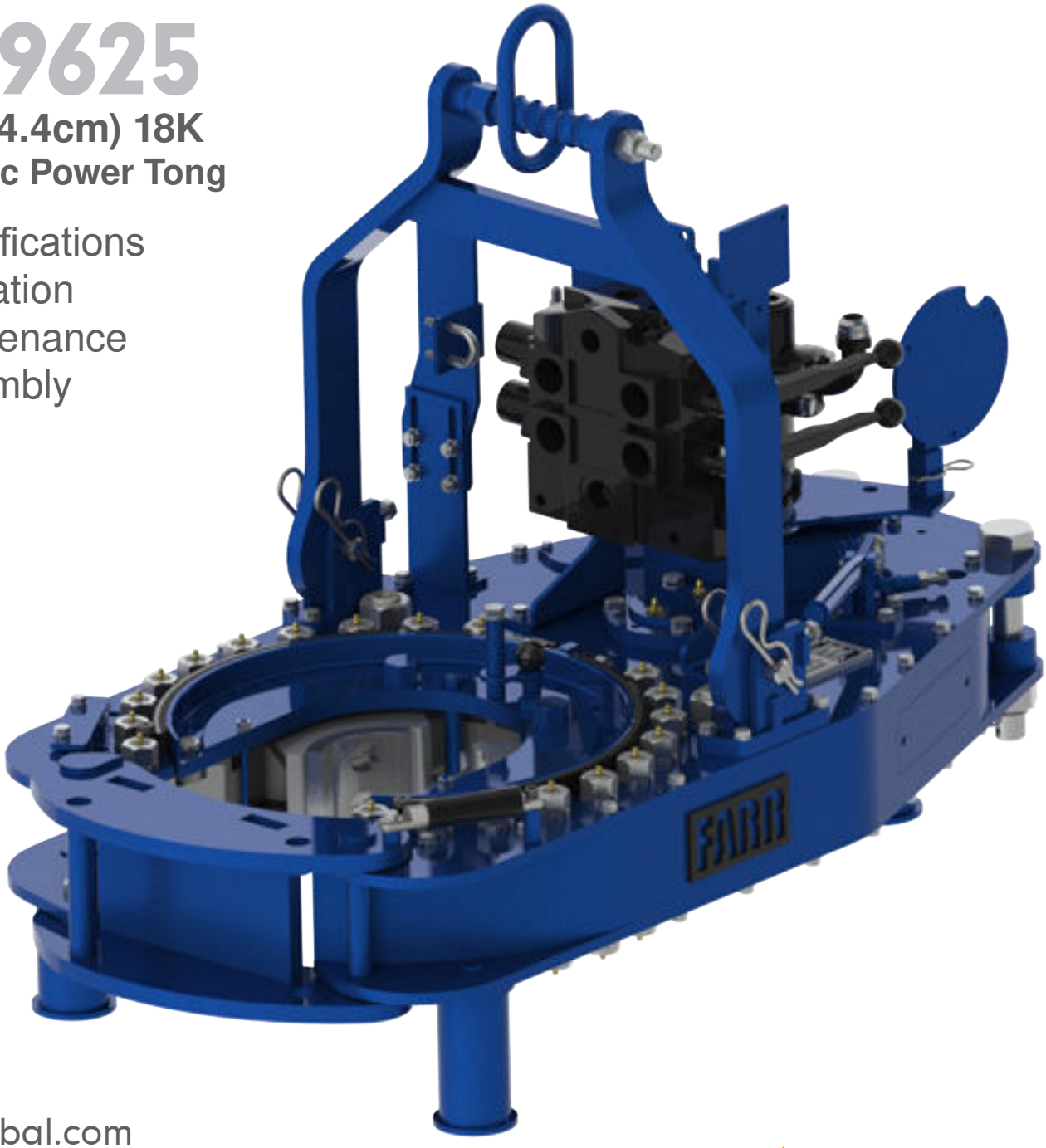
# FARR

TECHNICAL MANUAL

# KT-9625

## 9-5/8" (24.4cm) 18K
## Hydraulic Power Tong

- Specifications
- Operation
- Maintenance
- Assembly

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MCCOY
MOVING GLOBAL ENERGY FORWARD

## This manual covers the following models:

| TONG MODEL | REV | DESCRIPTION |
|---|---|---|
| 80-0830-1 | 3 | 9-5/8" tong with two-speed hydraulic motor, motor valve, lift cylinder valve & rigid sling |
| 80-0830-4 | 1 | 9-5/8" tong with two-speed hydraulic motor, motor valve, & rigid sling |

**NOTE:** ***Some illustrations used in this manual may not exactly match your model of tong.***

**PATENTED & PATENTS PENDING**

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# WARNINGS

***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 FARR CANADA CORP. IS DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL. FARR CANADA CORP. WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES. FARR CANADA CORP. 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 FARR CANADA CORP..***

***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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**Summary Of Revisions**

| Date | Section | Page | Description Of Revision |
|---|---|---|---|
| November 2010 | N/A | N/A | Intial Release |
| April 2011 | | iii | Added model 80-0830-4 |
| June 2011 | 3 | 3.12 - 3.20 | Revised assembly procedures to include new door latch and door components |
| | 3 | 3.21 | Moved maintenance checklists from appendices to maintenance section |
| | 5 | 5.24 | Revised door assembly and bill of materials |
| | 6 | All | Complete revision of torque measurement section. |

*The information presented in this document will provide setup, operating, and maintenance instructions for your KT-9625 tong. 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 Drilling & Completions 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. 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. Caution symbols are also used to identify the potential for making common errors 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.***

*Congratulations on the purchase of your **FARR®** KT-9625 9-5/8" tong. 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 Drilling & Completions | FARR in Edmonton, Alberta. Note that many parts are transferable between **FARR®** tongs and backups. Should you need replacement parts, or should you experience any difficulty not covered in this manual, please contact:*

***McCoy Drilling & Completions | FARR***

*14755 121A Avenue*
*Edmonton, Alberta*
*Canada T5L 2T2*
*Phone: 780.453.3277*
*Fax: 780.455.2432*

*Sales Fax: 780.481.9246*
*Email Engineering: engFarr@mccoyglobal.com*
*Email Sales: salesFarr@mccoyglobal.com*
*Customer Care: customerCareFarr@mccoyglobal.com*

*Website: http://www.mccoyglobal.com/index.php/drilling-completions*

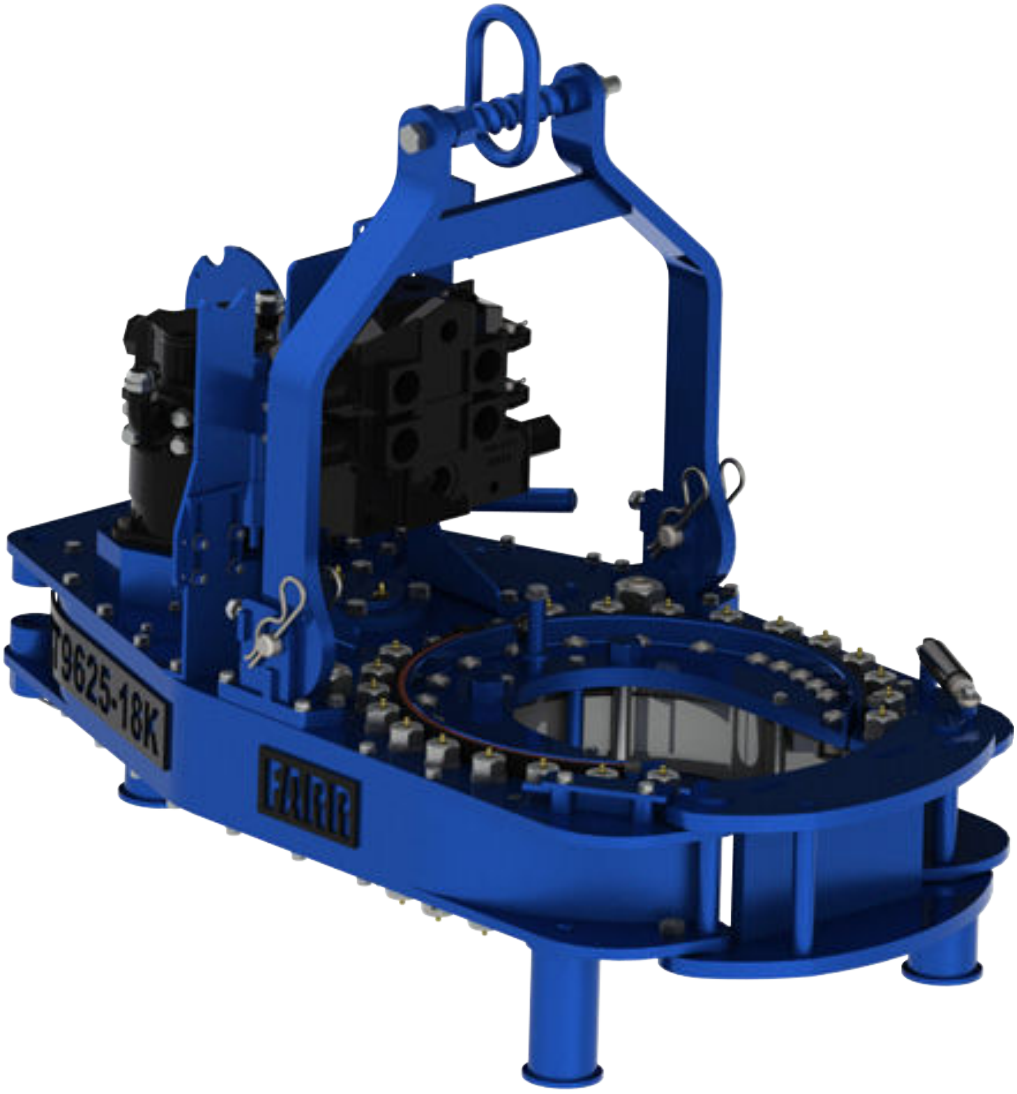



***ILLUSTRATION 1.A.1: KT-9625 POWER TONG***

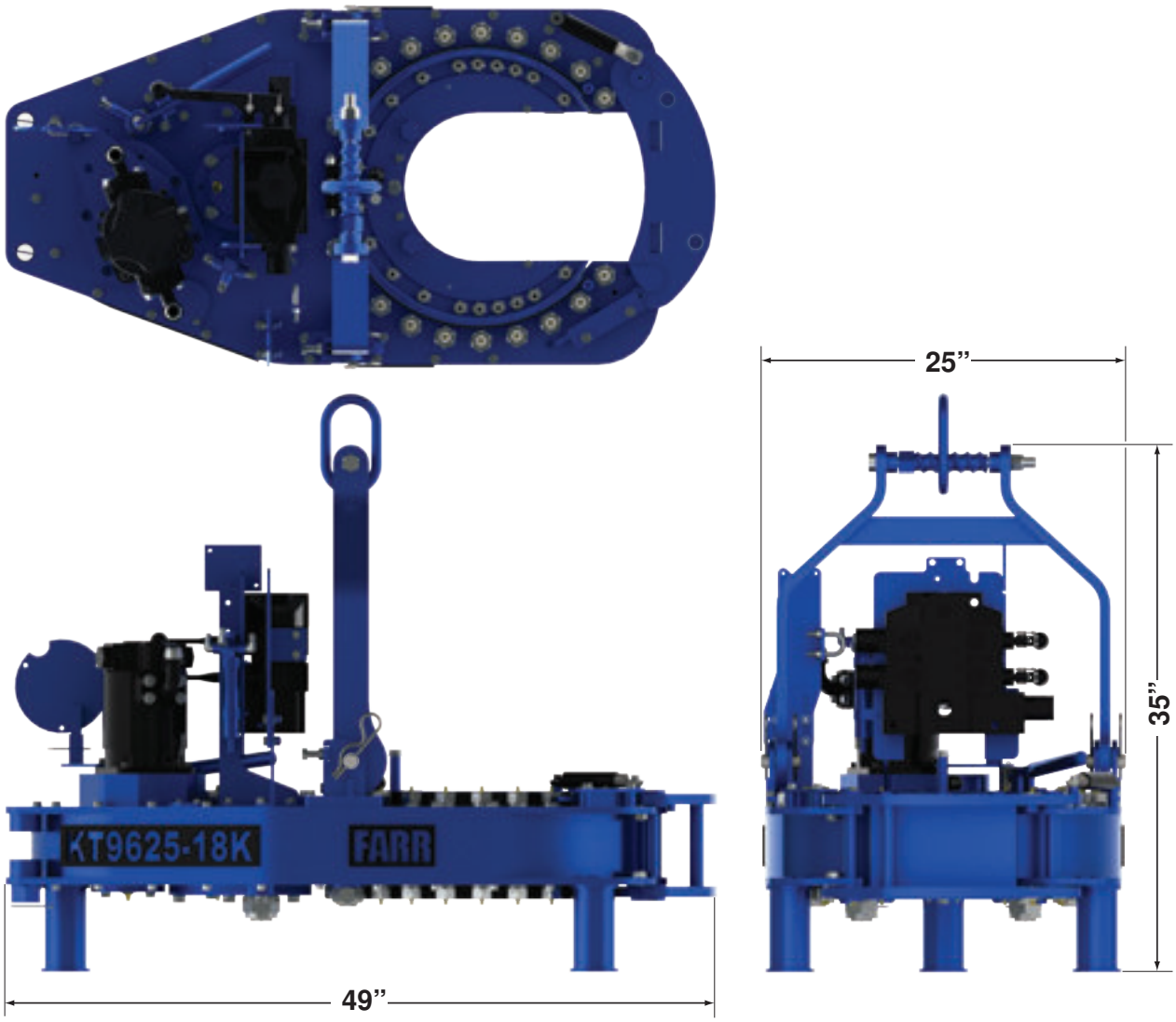



*ILLUSTRATION 1.A.2: KT-9625 POWER TONG DIMENSIONS*

| Torque Table ** | | | | |
|---|---|---|---|---|
| Pressure | High Gear/High Speed | | Low Gear/Low Speed | |
| PSI / MPa | Lbs.-ft. | Nm | Lbs.-ft. | Nm |
| 1000 / 6.89 | 1600 | 2169 | 8000 | 10847 |
| 1300 / 8.96 | 2200 | 2983 | 11000 | 14914 |
| 1600 / 11.03 | 2800 | 3796 | 13900 | 18846 |
| 2000 / 13.79 | 3500 | 4745 | 17900 | 24269 |
| MAXIMUM RATED TORQUE: 18000 LBS.-FT. / 24405 Nm | | | | |

| Speed Table | | | | |
|---|---|---|---|---|
| | Gear / Displacement | | | |
| Flow (GPM/LPM) | Low/Full | Low/Half | High/Full | High/Half |
| 10 / 37.9 | 2 | 5 | 12 | 24 |
| 20 / 75.7 | 5 | 9 | 24 | 47 |
| 30 / 113.6 | 7 | 14 | 36 | 71 |
| 40 / 151.4 | 9 | 18 | 47 | 95 |

** THESE ARE IDEAL VALUES. ACTUAL ACHIEVED TORQUE IS HIGHLY DEPENDANT UPON TONG EFFICIENCY AND FINAL POSITION OF ROTARY GEAR WHEN FULL TORQUE LOAD IS REACHED.

**Hydraulic Requirements:** 40 GPM @ 1000 psi / 151 LPM @ 6.9 MPa
20 GPM @ 2000 psi / 75.7 LPM @ 13.8 MPa

**Length:** 40 inches / 101.6 cm.

**Overall Width:** 25-1/2 inches / 64.8 cm.

**Space Required On Pipe:** 8 inches / 20.32 cm.

**Torque arm length:** 32 inches / 81.3 cm.
(Line of Pipe Centre Line of Anchor Handle)

**Weight (Approximate):** 1102 lb. / 500 kg.

**Recommended Spring Hanger:** Capacity 600 - 1100 lb (273 - 500 kg)
McCoy P/N 85-0106

**Jaws available (inches):** All standard sizes from 2-7/8" to 9-5/8"

**REPLACEMENT FASTENERS (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) MUST BE GRADE 8 OR EQUIVALENT**

***Use an EP synthetic grease that meets or exceeds the following specifications:***

| | |
|---|---|
| *Thickener* | *Lithium Complex* |
| *NLGI consistency grade* | *2* |
| *NLGI performance grade* | *GC-LB* |
| *Penetration - ASTM D 217 (25°C [77°F]* | *265-295 minimum* |
| *0.1 mm) worked 60 strokes* | |
| *Dropping point, °F[°C] - ASTM D2265* | *550 [288] minimum* |
| *High temperature life, hours - ASTM D 3527* | *160 minimum* |
| *Oxidation stability, psi - ASTM D 942* | *(100 hr/300 hr) 0/3* |
| *Water washout, percent - ASTM D 1264* | *1.8 max* |
| *Rust and corrosion - ASTM D 1743* | *pass* |
| *Oil separation, percent loss - ASTM D 1742* | *1.1 max* |
| *(24 hours, 25°C [77°F]* | |
| *Leakage, g lost - ASTM D 4290* | *1.0 max* |
| *Four ball wear test, mm scar - ASTM D 2266* | *0.40 max* |
| *Fretting wear, mg - ASTM D 4170* | *3.4 max* |
| *Four ball EP, kgf - ASTM D 2596* | |
| *Weld point* | *400 minimum* |
| *Load wear index* | *50 minimum* |
| *Timken OK load test, lbs - ASTM D 2509* | *50* |
| *Low temperature torque, N*m - ASTM D 4693* | *1.3 max* |
| *(-40°C [-40°F])* | |
| *LT-37 pumpability, g/min* | *360/7* |
| *(60°F/0°F [16°C/-18°C])* | |
| *Copper corrosion - ASTM D 4048* | *1B* |
| *Disc brake wheel bearing specifications* | |
| *Ford ESA-M1C 198A* | *Yes* |
| *Chrysler MS-3701* | *Yes* |
| *Oil viscosity: 40°C [104°F], cSt* | *151* |
| *100°C [212°F], cSt* | *19.2* |
| *Flash point, °F[°C] - ASTM 92* | *450[232]* |

***Use a premium quality hydraulic fluid that meets or exceeds the following specifications:***

| | |
|---|---|
| *Typical Density (kg/m$^3$)* | *878* |
| *Viscosity - cSt @ 40 °C* | *68.8* |
| *- cSt @ 100 °C* | *8.7* |
| *Viscosity Index* | *97* |
| *Pour Point °F [°C]* | *-22 [-30]* |
| *Flash Point °F [°C]* | *432 [222]* |
| *Colour, ASTM* | *1.5* |
| *Neutralization Number* | *0.40* |
| *Rust Protection - Distilled Water* | *No Rust* |
| *- Sea Water* | *No Rust* |
| *Hydrolytic Stability - Cu Mass Loss, mg/cm$^2$* | *0.04* |
| *Copper Corrosion Test* | *1A* |
| *Filterability: Denison - Wet & Dry* | *Pass* |
| *Afnor - Wet & Dry* | *Pass* |
| *Cincinnati Milacron Spec Approved* | *P69* |
| *Denison HF-0:* | *Approved* |
| *Denison P-46 Piston Pump:* | *Pass* |
| *Denison T6C Vane Pump:* | *Pass* |
| *Vickers 35VQ25 Vane Pump Test:* | *Pass* |
| *104/105C Vane Pump Test:* | *No Data Available* |
| *Vane pump test total ring and vane wear, mg.* | *<10* |
| *Oxidation Stability* | |
| *Turbine Oil Stability Test Life, hours* | *2500+* |
| *Rotary Bomb Oxidation Test, minutes* | *325* |
| *FZG Spur Gear Test, Failure Load Stage (FLS)* | *12* |

*Adequate setup and proper hydraulic connections are essential in ensuring reliable operation of your tong. For best results and long term reliability, read and obey the start-up instructions in this section.*

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

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

### A. SLING / LOAD BEARING DEVICE SAFETY

***THE SUPPLIED LOAD-BEARING DEVICE (CHAIN SLING, RIGID SLING, SPREADER BAR ASSEMBLY, FRAME, OR ANY OTHER DEVICE THAT BEARS THE PARTIAL OR TOTAL WEIGHT OF THE EQUIPMENT DESCRIBED IN THIS MANUAL) HAS BEEN SPECIFIED OR DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS DOCUMENT. FARR WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE 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 FARR CANADA CORP..***

***FARR CANADA CORP. DOES NOT GUARANTEE THE INTEGRITY OF MODIFIED OR DAMAGED LOAD-BEARING DEVICES, UNLESS THOSE MODIFICATIONS ARE PERFORMED BY FARR CANADA CORP..***

*Farr Canada Corp. 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.*

***THE MINIMUM SLING ANGLE (THE ANGLE OF THE LEG OF THE SLING MEASURED FROM THE HORIZONTAL) MUST NEVER FALL LOWER THAN THE ANGLE SPECIFIED FOR THE SLING IN USE***

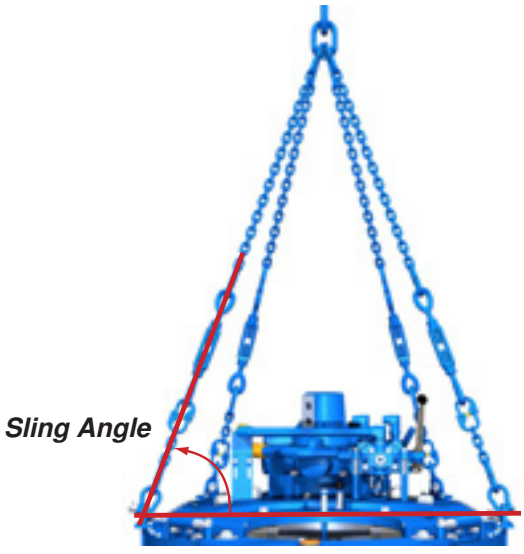



*ILLUSTRATION 2.A.1: SLING ANGLE*

1. ***Inspection Of Slings***

***Farr Canada Corp. 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*** | | | |

- *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 Farr / Superior | 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.

***IF MECHANICAL DAMAGE IS SEEN OR SUSPECTED ON A LOAD-BEARING DEVICE, OR IF THE LOAD-BEARING DEVICE HAS BEEN OVERLOADED, IT MUST BE REMOVED FROM SERVICE AND QUARANTINED UNTIL RECERTIFIED***

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

**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.*

**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. Farr 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.*
- *Farr 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.*

### B. MAJOR COMPONENT IDENTIFICATION

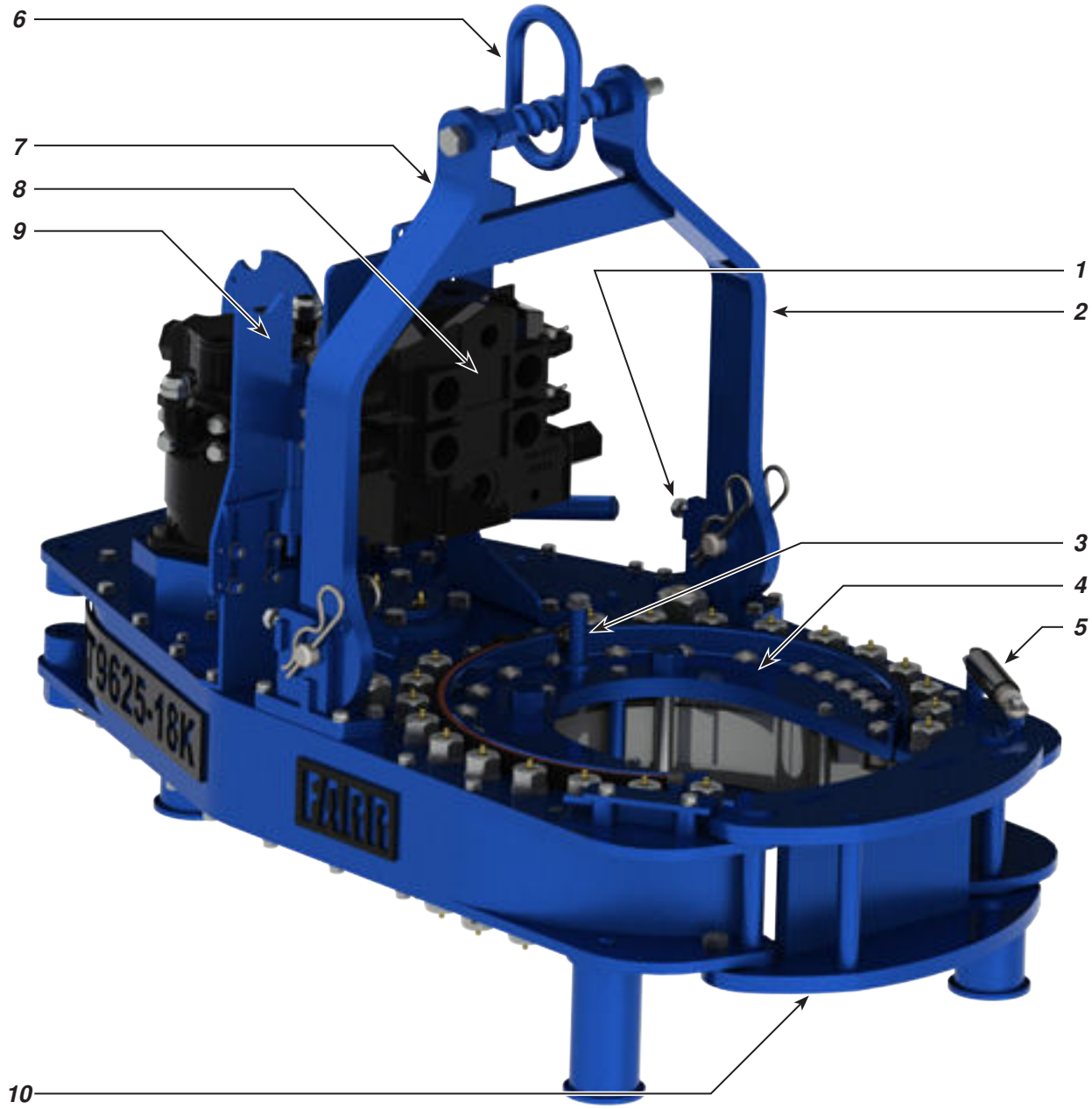



*ILLUSTRATION 2.B.1: MAJOR COMPONENT IDENTIFICATION 01*

| Item | Description |
|---|---|
| 1 | Tong Leveling Adjustment |
| 2 | Rigid Sling |
| 3 | Backing Pin Assembly |
| 4 | Cage Plate Assembly |
| 5 | Tong Door Cylinder |
| 6 | Master Link |
| 7 | Rigid Sling |
| 8 | Hydraulic Valve Assembly |
| 9 | Hydraulic Tubing Mount |
| 10 | Tong Door |

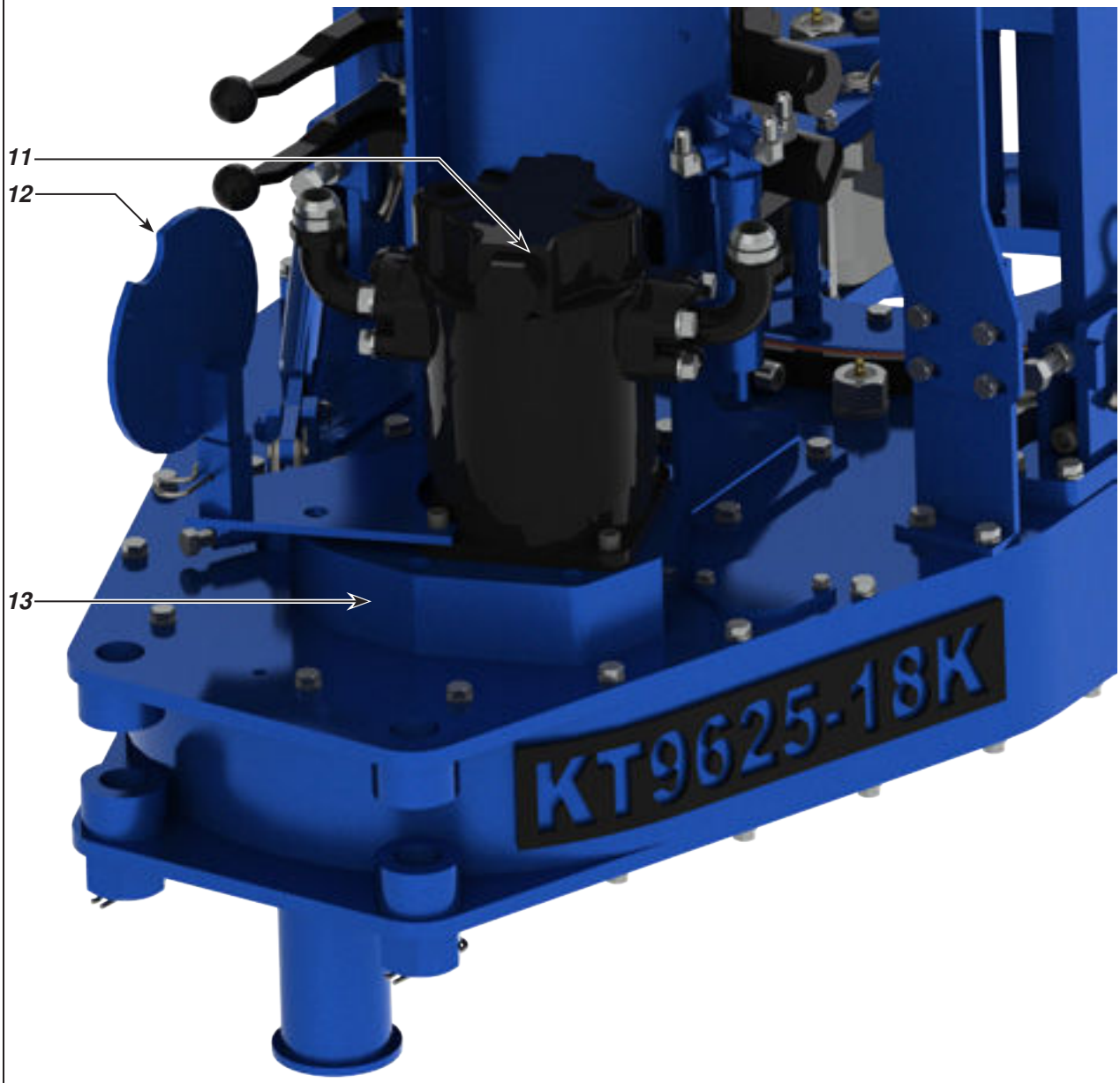



*ILLUSTRATION 2.B.2: MAJOR COMPONENT IDENTIFICATION 02*

| Item | Description |
|---|---|
| 11 | Hydraulic Motor |
| 12 | Torque Gauge Mount |
| 13 | Motor Mount |

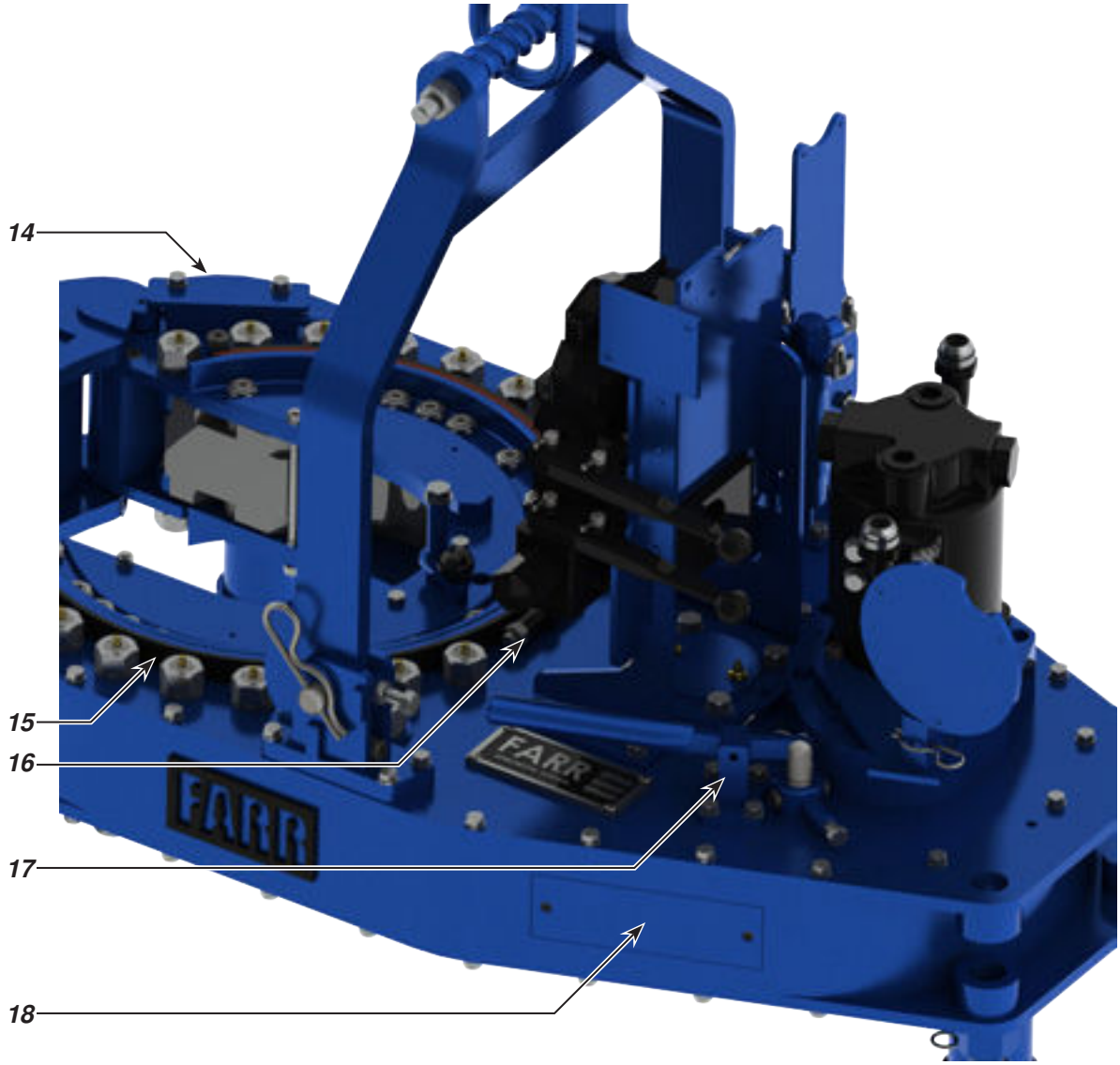



*ILLUSTRATION 2.B.3: MAJOR COMPONENT IDENTIFICATION 03*

| Item | Description |
|---|---|
| 14 | Safety Door Plunger Switch |
| 15 | Brake Band (top brake band shown - bottom brake band is identical) |
| 16 | Brake Band Adjustment (top adjustment shown - bottom adjustment is identical) |
| 17 | Manual Shift Assembly |
| 18 | Shifter / Gear Train Inspection Panel |

### C. HYDRAULIC SCHEMATIC / COMPONENT IDENTIFICATION

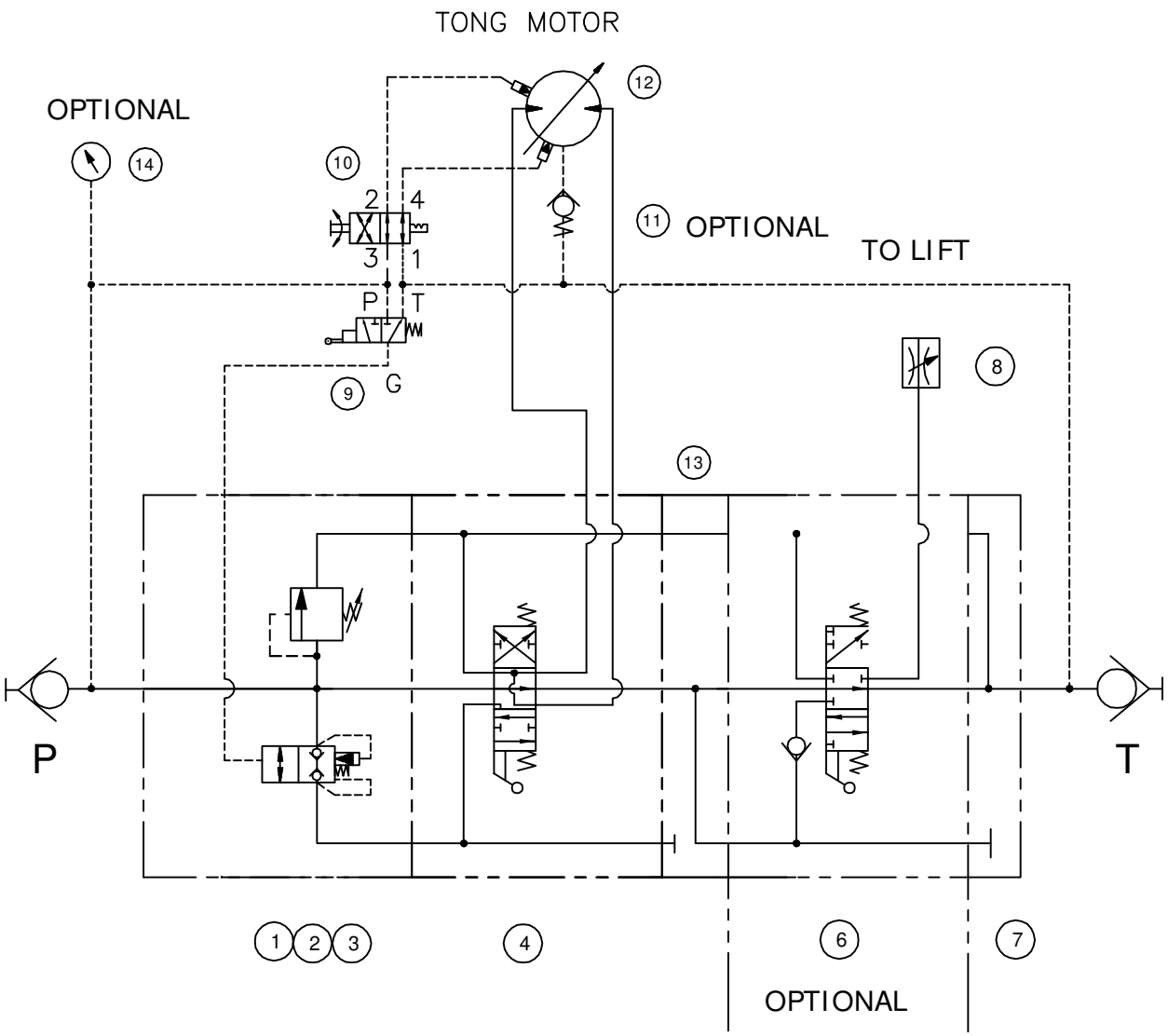



*ILLUSTRATION 2.C.1: HYDRAULIC SCHEMATIC*

| Item | Description | Part Number | Page |
|---|---|---|---|
| 1 | Inlet Valve c/w safety door cartridge | 101-3927A | 2.8 |
| 2 | Relief Valve, DVA35-MRV-1 | 10-0010R | 2.8 |
| 3 | Pilot-To-Open Valve, Sun LKHC-XDN | 08-1625 | 2.9 |
| 4 | Motor Section, DVA35-MA8, 4WAY SAE PORTS | 10-9014 | 2.8 |
| 6 | Lift Cylinder Section, DVA35-SA8, 1" ORB PORT (Optional) | 10-9015 | 2.8 |
| 7 | Outlet Section, DVA35-TR99, SAE PORT | 10-0086 | 2.8 |
| 8 | Flow Control Valve, Parker N800S | 08-9062 | Not Shown |
| 9 | Safety Door Switch | 08-0337 | 2.8 |
| 10 | Motor Shift Valve, Bailey ED Series 220-906 | 10-9035 | 2.8 |
| 11 | Check Valve (Optional) | 08-9022 | Not Shown |
| 12 | Rineer GA15-13/6.5 Hydraulic Motor | 87-0008 | 2.8 |
| 13 | DVA35 Transition Plate | 101-3935 | 2.8 |
| 14 | 3000 psig Pressure Gauge | 02-0246 | Not Shown |

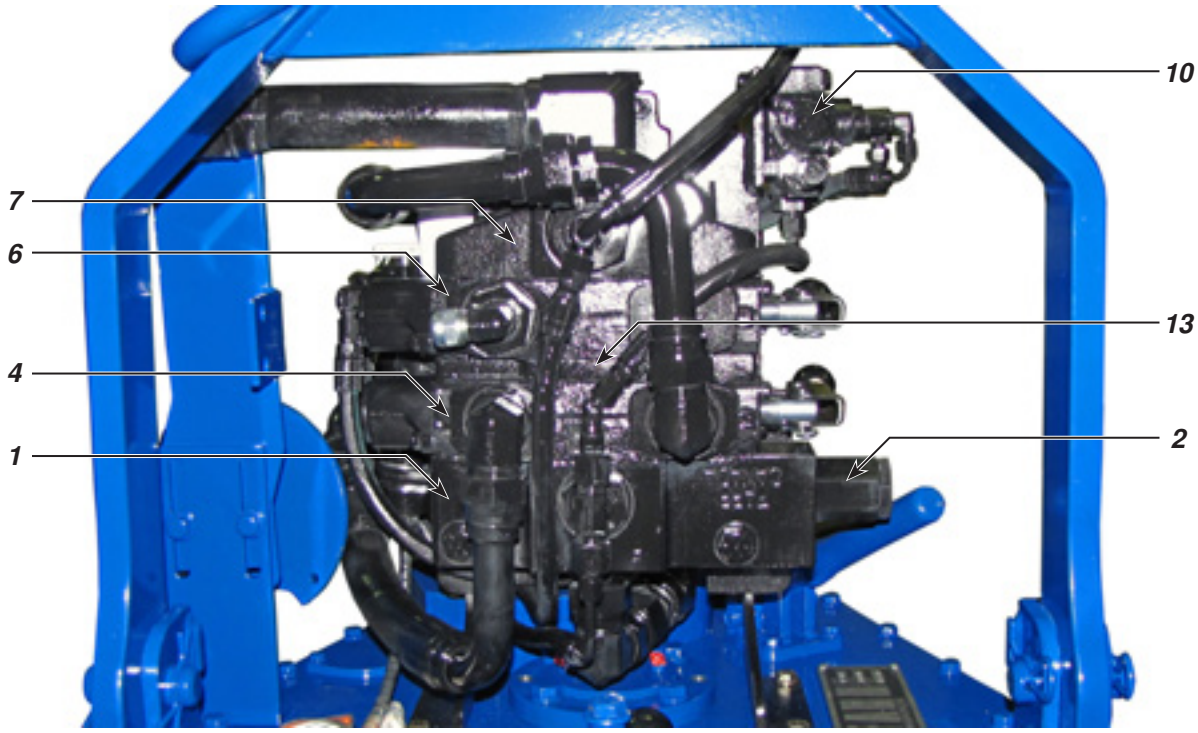



ILLUSTRATION 2.C.2: HYDRAULIC COMPONENT IDENTIFICATION 01

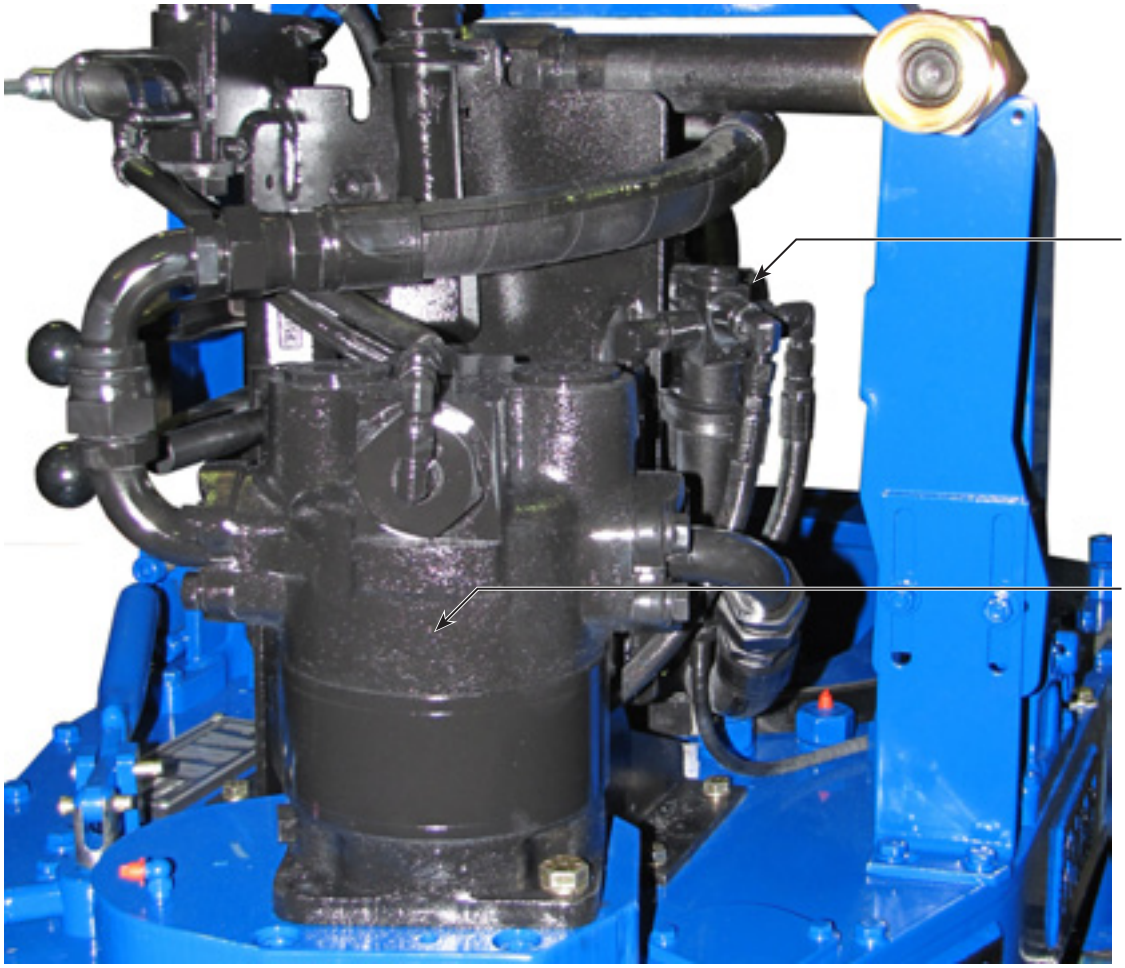



ILLUSTRATION 2.C.3: HYDRAULIC COMPONENT IDENTIFICATION 02

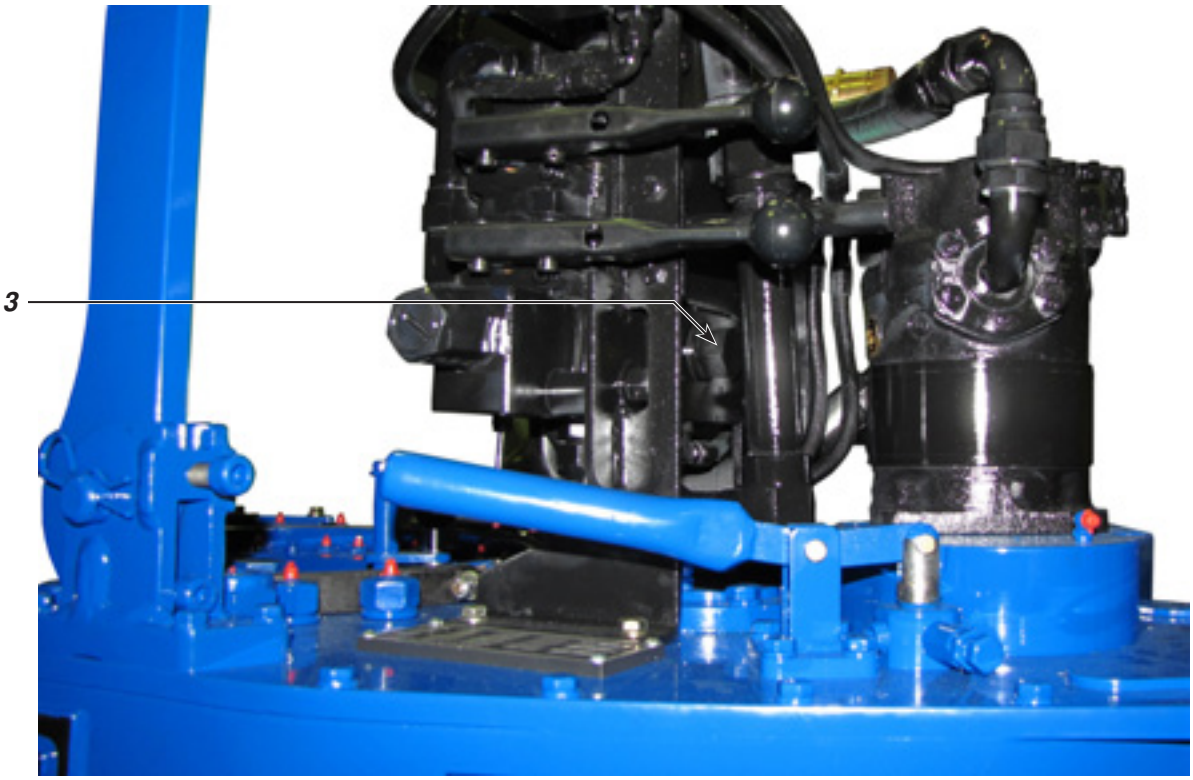



ILLUSTRATION 2.C.4: HYDRAULIC COMPONENT IDENTIFICATION 03

### D. HYDRAULIC CONNECTIONS

*A pair of hydraulic lines - a 1" supply line and a 1-1/4" return line - connect the tong to the power unit (see illustration below). The valve block provides hydraulic power to ancillary devices (hydraulic motors, hydraulic cylinders, etc.).*

*Perform any hydraulic connection when the power unit is not running, or when the hydraulic pump is disengaged. The possibility of error in inter-changing the high pressure supply hose and the low pressure return hose has been eliminated, because the supply side coupling is smaller than the return side.*

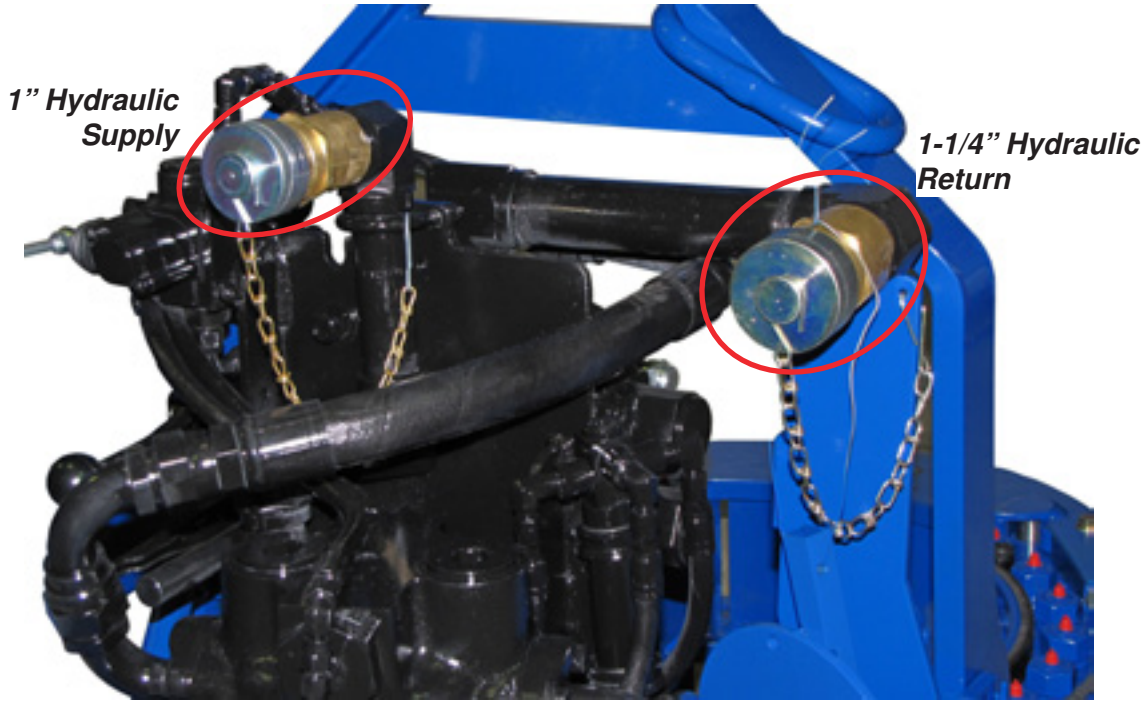



ILLUSTRATION 2.D.1: HYDRAULIC CONNECTIONS 01

*These hose couplings are self-sealing, and care should be taken to ensure complete engagement to prevent partial closure of the check valve in the coupling. Ensure that the nut (female) side is completely made up onto the male connector - there is a line on the male fitting that indicates complete make-up. Snug the female fitting right up to the line.*

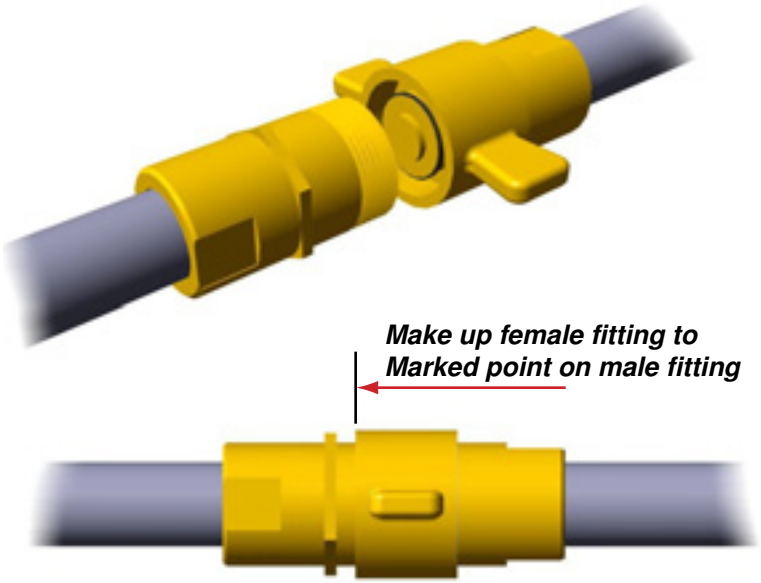



***ILLUSTRATION 2.D.2: HYDRAULIC CONNECTIONS 02***

### E. TONG / BACKUP JAW AVAILABILITY & INSTALLATION

*The following table lists all jaw die kits that are available as standard sizes for this model of tong. If your desired size is not listed, Farr can engineer custom jaw sizes - contact sales for further information.*

| Description | Part Number |
|---|---|
| 2-7/8" Jaw Die Kit [1] | AK21-JDK-2875 |
| 3-1/2" Jaw Die Kit [2] | AK21-JDK-3500 |
| 4" Jaw Die Kit | AK21-JDK-4000 |
| 4-1/2" Jaw Die Kit | AK21-JDK-4500 |
| 5" Jaw Die Kit | AK21-JDK-5000 |
| 5-1/2" Jaw Die Kit | AK21-JDK-5500 |
| 5-3/4" Jaw Die Kit | AK21-JDK-5750 |
| 6-5/8" Jaw Die Kit | AK21-JDK-6625 |
| 7" Jaw Die Kit | AK21-JDK-7000 |
| 7-5/8" Jaw Die Kit | AK21-JDK-7625 |
| 8-5/8" Jaw Die Kit | AK21-JDK-8625 |
| 9-5/8" Jaw Die Kit | AK21-JDK-9625 |
| | |

[1] Uses jaw die 12-0007
[2] Uses jaw die 12-0011
All remaining jaw die kits use flat die PN 12-1004

*If necessary the entire jaw may be removed. Support the jaw from the bottom and remove the jaw pivot bolt. The jaw may then be slid out of and away from the cage plate. Reverse this procedure to replace the jaw assemblies (see Illustration 2.E.1)*

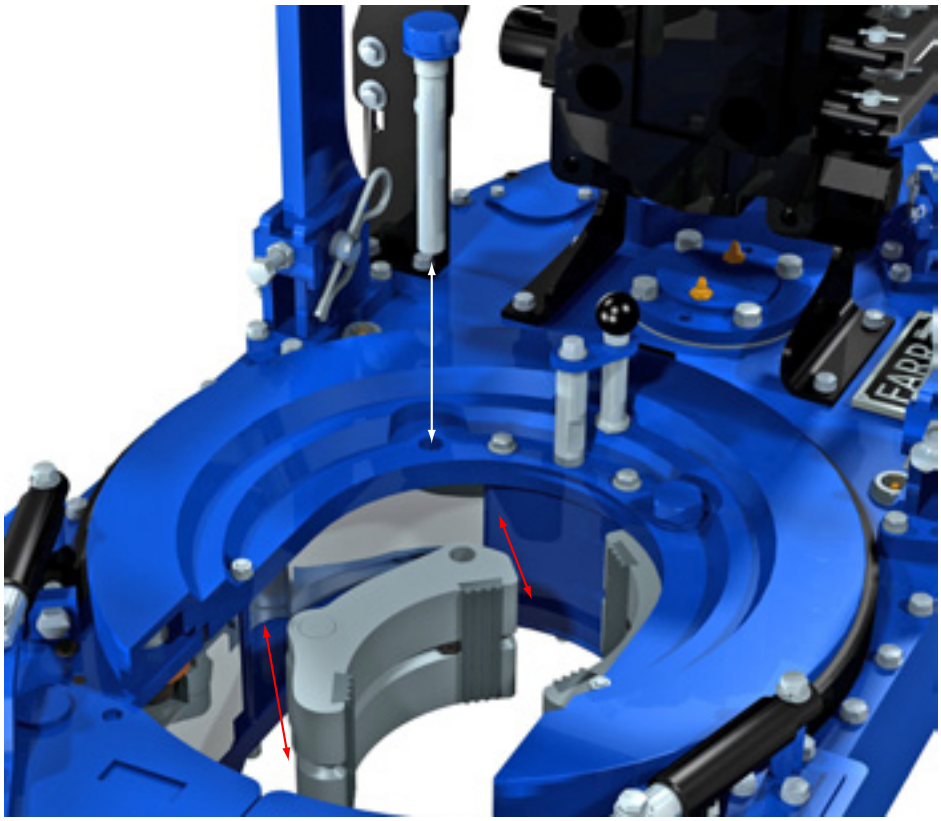


***ILLUSTRATION 2.E.1: JAW REPLACEMENT***

*Once the jaw has been removed the jaw dies may be replaced by removing the keeper screw above the die, and tap the die from jaw using a hammer. Replace the die, tapping it into place if necessary, and replace the keeper screws.*

### *F. TONG RIG-UP & LEVELING*

#### *1. Suspension & Restraint*

*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 Drilling & Completions 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 Drilling & Completions recommends using dual backup (snub) lines of sufficient strength to withstand the force imparted by the maximum rated torque of the tong in use. 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, an 18,000 lbs.-ft. tong with a 31 inch (2.583 ft.) torque arm will generate 6968.6 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.*

***Suspension & Restraint (Cont'd)***

*Snub lines must be securely connected to the rear of the tong, and tied off to a suitable anchor. One snub line must be secured to the load cell, which is then secured to the rear of the tong. The side of the tong the load cell connects to is dependant upon whether make-up or break-out activities are underway. To ensure accurate torque measurement, the torque measurement line must be connected perpendicular to the lengthwise axis of the tong, and perpendicular to the hang line (see illustrations 2.F.1 and 2.F.2). Connect the second snub line on the opposite side of the load cell, perpendicular to the lengthwise axis of the tong and perpendicular to the vertical.*

***FARR CANADA CORP. ACCEPTS NO RESPONSIBILITY FOR DESIGNING AND SELECTING AN ADEQUATE SUSPENSION AND RESTRAINT SYSTEM FOR YOUR DRILLING EQUIPMENT***

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

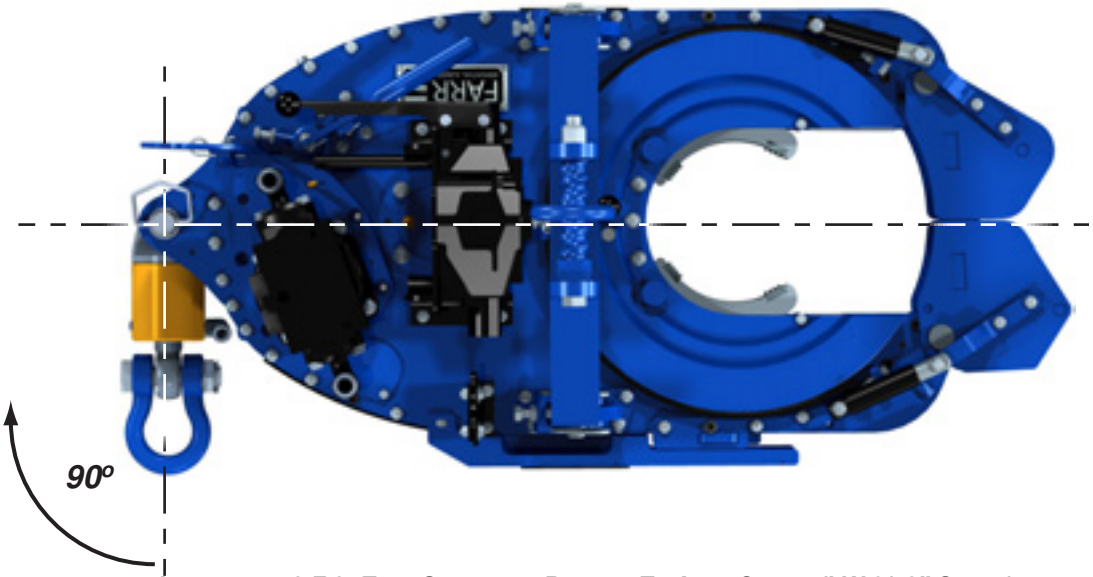



ILLUSTRATION 2.F.2: TONG SUSPENSION RELATIVE TO AXIAL CENTRE (LW 9/58" SHOWN)

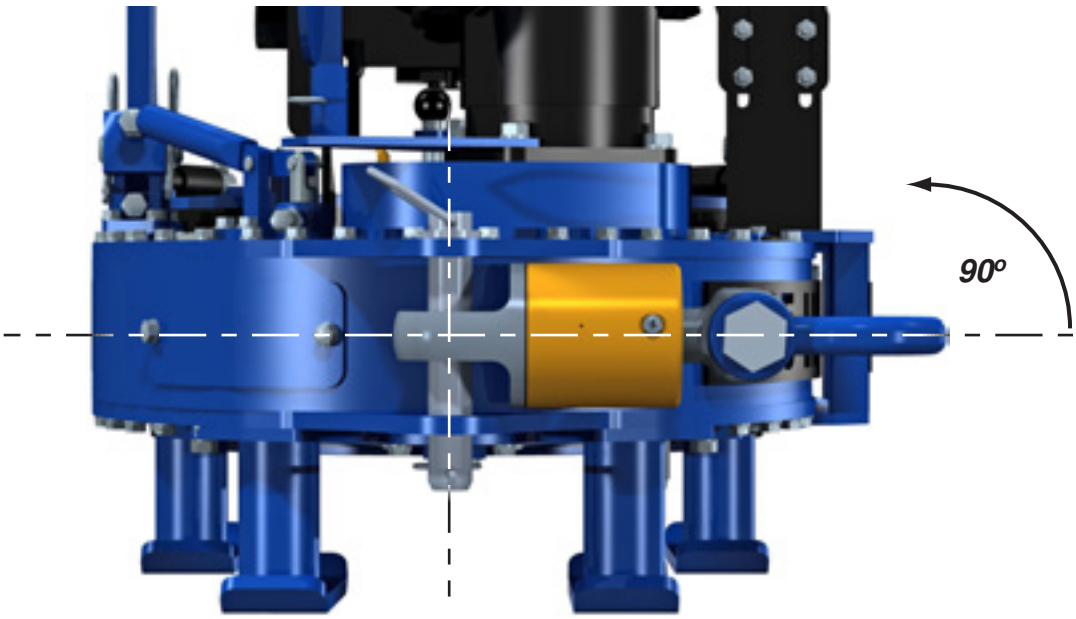



ILLUSTRATION 2.F.1: TONG SUSPENSION RELATIVE TO VERTICAL CENTRE (LW 9/58" SHOWN)

**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.*

*i. Place a level axially (side to side) across the tong, ensuring that it is parallel with the surface of the tong. Use a thin wrench on the flat of the adjusting helix to rotate the helix, forcing the lift link to move towards the outer supports of the sling. The 3/4" nylock nut on the pin may have to be slightly loosened to allow the helix to rotate. Adjust the helix until the level shows that the tong is level side-to-side.*

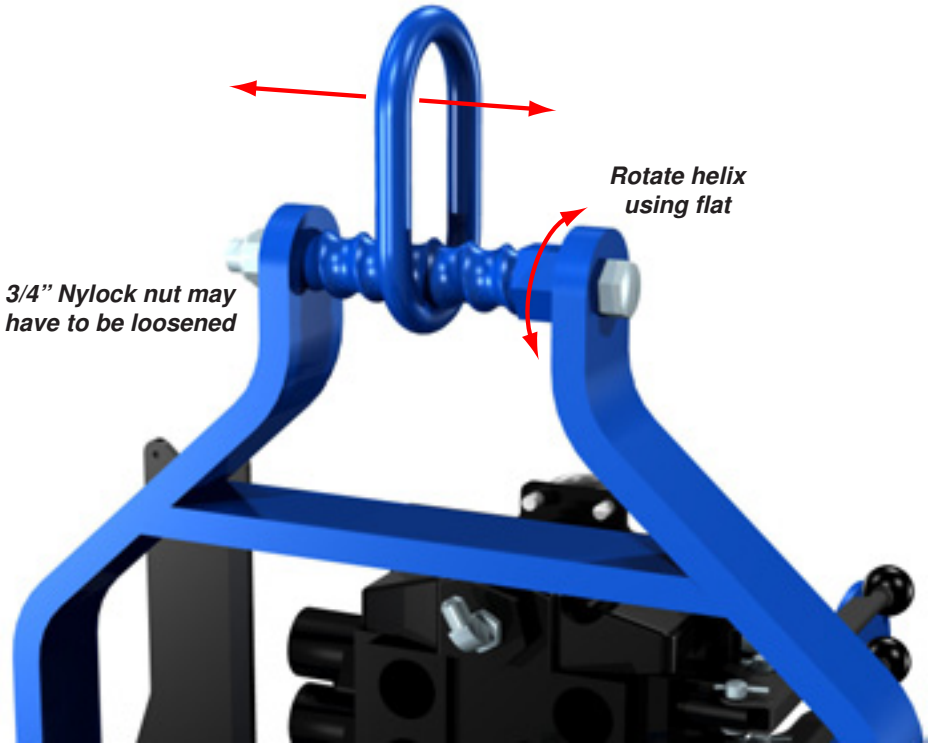



ILLUSTRATION 2.F.3: TONG LEVELING (SIDE-TO-SIDE)

*ii. Place a level lengthwise (front to back) along the tong, ensuring that it is parallel with the surface of the tong. Loosen the 1/2" jam nuts on the adjusting bolts on rigid sling brackets. Completely loosen the adjusting bolts. Turn each adjusting bolt equally until tong hangs level front-to-back. Lock adjusting bolts in place with the jam nuts.*

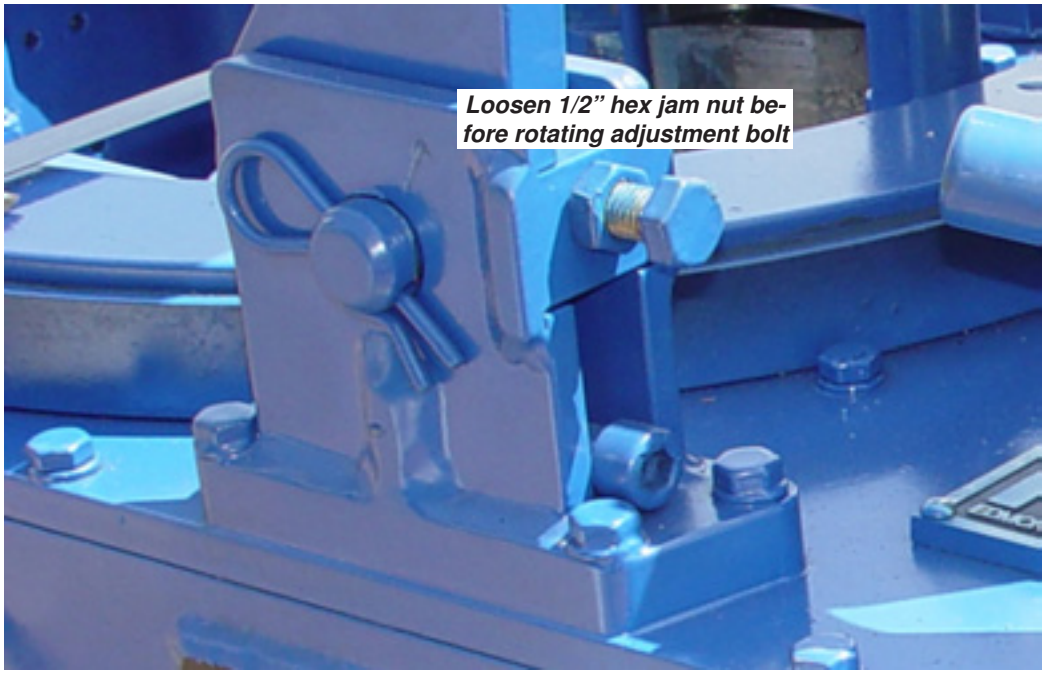



ILLUSTRATION 2.F.4: TONG LEVELING (FRONT-TO-REAR)

## G. TONG OPERATION

### 1. Initial Start-up and Break-in Procedure

***YOUR EQUIPMENT HAS BEEN THOROUGHLY TESTED AND INSPECTED AT THE FACTORY. HOWEVER, WE ADVISE INSPECTION AND TESTING OF YOUR NEW TONG AFTER TAKING POSSESSION IN ORDER TO ELIMINATE THE POSSIBILITY OF SHIPPING DAMAGE.***

*McCoy Completions & Drilling recommends that the following pre-operating tests be performed after receipt from the factory or after extended storage, prior to releasing the tong to operations:*

- *Perform a complete inspection of all fasteners to ensure none have loosened during transport.*
- *Connect the tong to the power unit, and apply full hydraulic pressure. Inspect and correct any leaks.*
- *Operate the tong at full speed and in high gear for a duration of one-half hour. Hot bearing caps may indicate impending bearing failure.*
- *Switch to low gear and operate for an additional one-half hour at full speed.*
- *Run the backup through several clamp/un-clamp sequences to ensure functionality.*
- *Inspect all components and hydraulic fittings for possible defects following completion of the tests. All FARR Tongs have been thoroughly tested at the factory prior to shipping, but shipping damage must be identified before running the tong in an operational environment.*
- *Carefully inspect the safety door components, and test to ensure that the safety device on each door is operating correctly before releasing the tong to the operating environment.*

***TONG DOOR MUST BE CLOSED AND SECURELY LATCHED BEFORE THE POWER UNIT IS STARTED IN ORDER TO ASSURE THE SAFETY OF OPERATING PERSONNEL***

*Ensure adequate lube oil and hydraulic oil levels before starting engine. Use start up procedures as recommended by the power unit engine operator's manual. Open the Bypass Valve on the hydraulic system, and inspect all pressure and return line hose connections to ensure correct and secure installation.*

***IMPROPERLY SECURED HYDRAULIC CONNECTIONS WILL INTERRUPT HYDRAULIC FLUID FLOW, AND COULD RESULT IN THE FOLLOWING FAILURES:***

- *A restriction in the pressure supply hose will result in high pressure within the power unit hydraulic system, which will activate the hydraulic governor and increase the engine speed to as high as maximum RPM.*
- *A restriction in the return line will result in high pressure within the power unit and the tong hydraulic system, causing engine speeds as high as maximum RPM, and possible failure of the motor seal.*

*Following inspection of the hoses, start the engine and allow it to idle until warm. Allow hydraulic fluid to circulate for approximately 10 minutes, then slowly close the Bypass Valve to allow hydraulic fluid to circulate through the hoses and to the tong (circulating pressure should not exceed 200 psi). Place the tong gear shifter in low gear and rotate the tong slowly forward and then reverse with the throttle valve control lever. Once this has been done and the proper size jaws have been installed, the tong is then ready to run pipe.*

### 2. Valve Operation

*4-way proportional 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. These 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.*

*The following illustration demonstrates 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.*

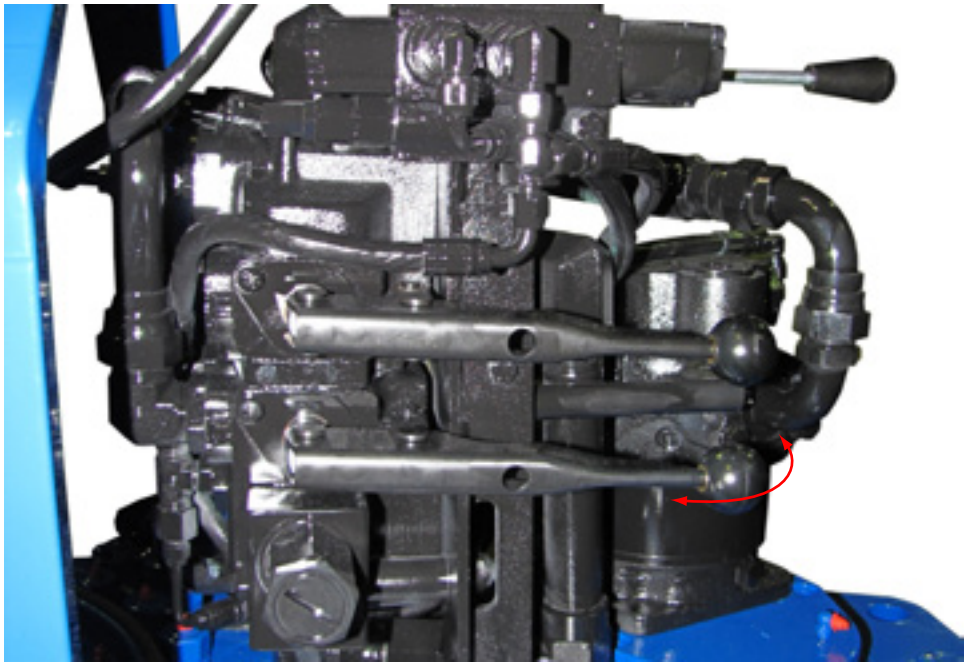


***ILLUSTRATION 2.G.1: TONG ROTATION CONTROL VALVE***

***LIFT CYLINDER***

*This is a direct-acting valve. Pushing the valve handle forward will cause the lift cylinder to lift the tong vertically. Pulling the valve handle in the opposite direction will cause the lift cylinder to lower the tong.*

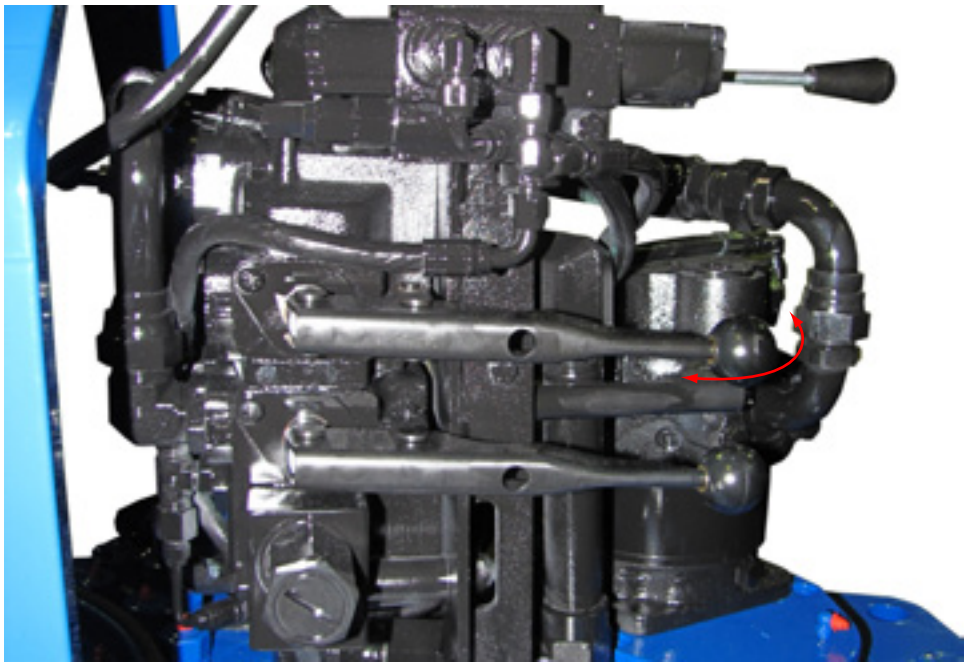


***ILLUSTRATION 2.G.2: TONG LIFT CYLINDER CONTROL VALVE***

*MOTOR SPEED*

*This valve sets the speed of the two-speed motor. Pulling the motor speed control all the way out sets the motor speed to LOW. Maximum torque is only available when the motor speed is set to LOW. Pushing the valve handle towards the centre of the tong sets the motor speed to HIGH, which is useful for rapidly un-threading broken connections.*

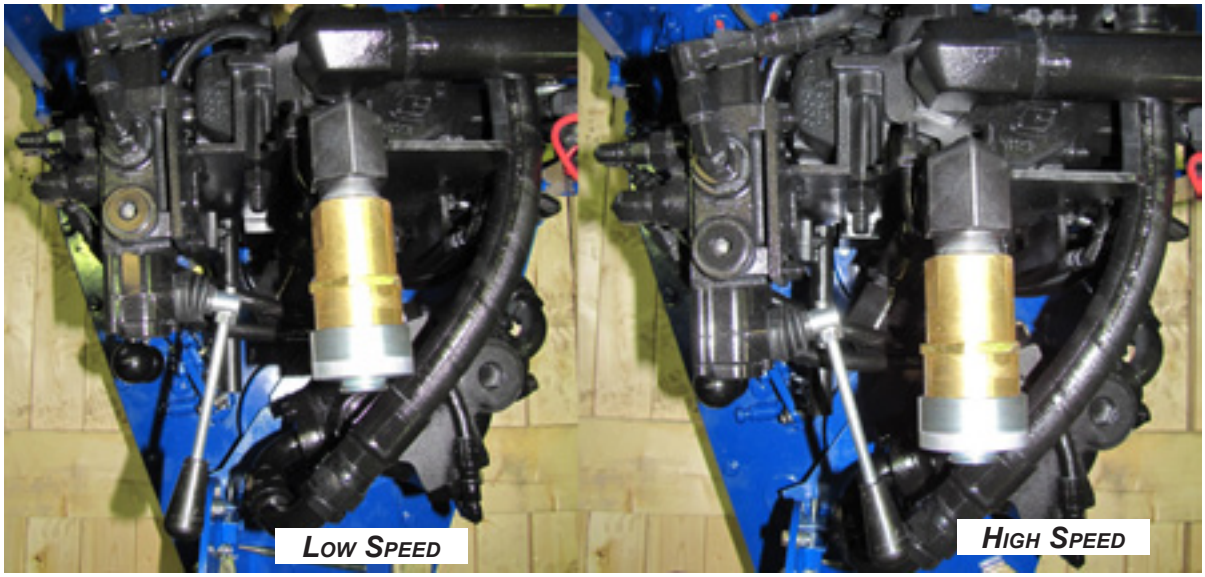



***ILLUSTRATION 2.G.3: TONG MOTOR SPEED CONTROL VALVE***

***3. Shifting Gears***

*The shifting shaft has three "detent" positions identifying the low speed/high torque position, the "neutral" or free-spinning position, and the high speed/low torque position. The detent strength may be adjusted by releasing the locknut on the detent tube and increasing or relaxing pressure on the detent spring. Ensure the locknut is tightened once the desired detent pressure has been set.*

*To shift to the high-speed gear, move the shifting handle upward from neutral position. To shift to the low-speed gear, move the shifting handle down through the neutral detent 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 (see Illustration 2.G.4 next page).*

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

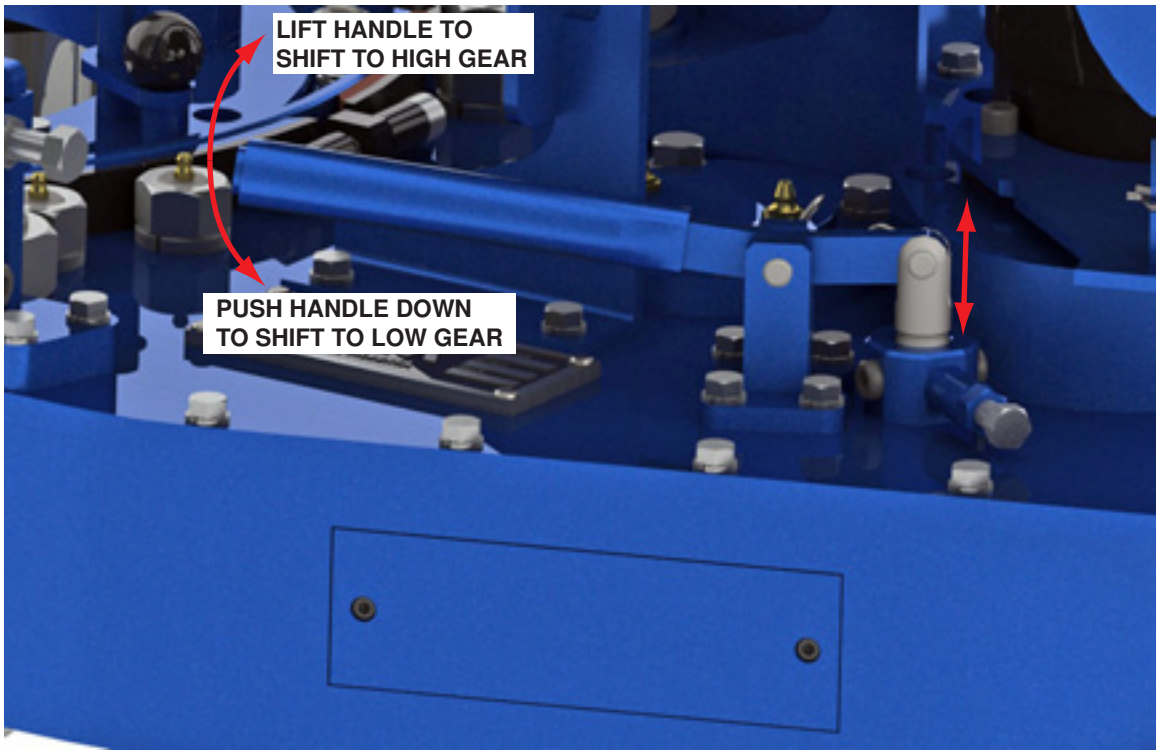



*ILLUSTRATION 2.G.4: TONG MANUAL SHIFT CONTROL*

**4. General Comments**

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

b) *When making-up integral (shouldered) joints, it is essential to make up the last turn of the threads in low gear. This reduces the tendency of an instant stop or a sudden increase in torque, which induces extremely high stresses on the gear train.*

c) *DO NOT employ the "snap break" method of breaking-out joints when pulling a string. By definition, the "snap break" method is a procedure used by some operators to break out connections, accomplished by leaving slack in the "jaw-pipe" engagement, and then quickly pulling the throttle valve control lever allowing the tong to snap into its loaded or high torque condition. Although this method is very effective in breaking out joints, the extremely high stress placed on the gear train frequently causes gear breakage.*

## H. MAKING AND BREAKING CONNECTIONS

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

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

- *2.D - Hydraulic Connections*
- *2.E - Tong Jaw Installation*
- *2.F.1 - Tong Rig-up and Leveling (Suspension)*
- *2.F.2 - Tong Rig-up and Leveling (Leveling)*

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

### 1. Making A Connection

a) *Ensure hydraulic power supply to the tong is energized. The master link on the rigid sling must be used to suspend the tong. Do not suspend the tong directly from the rigid sling.*

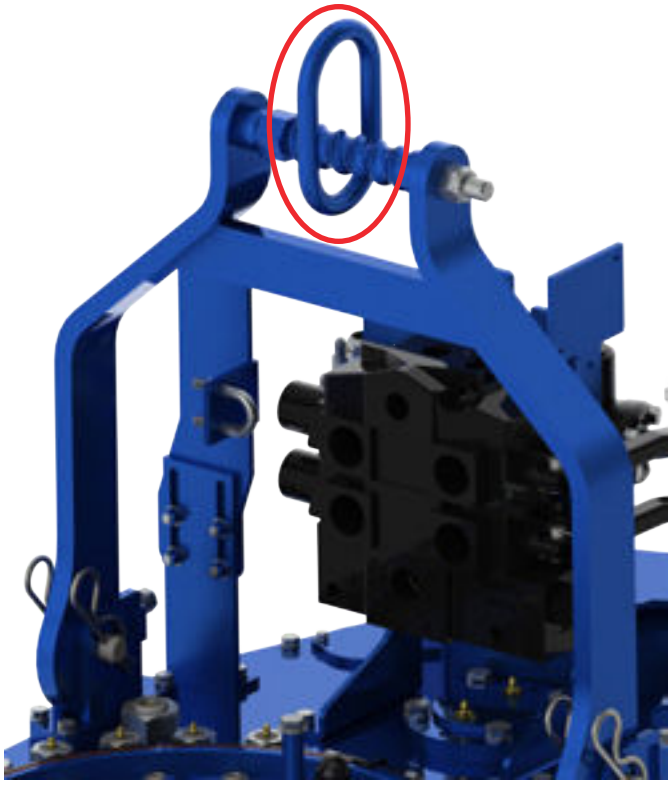


*ILLUSTRATION 2.H.1: MASTER LIFTING LINK*

**THE MASTER LINK MUST BE USED TO SUSPEND THE TONG ASSEMBLY**

b) *Ensure the backing pin is in the "makeup" position. From the front of the tong, the backing pin correctly configured for makeup will be in the 10 o'clock position (see Illustration 2.H.2 next page). If it is not, simply lift up and place in the correct position (see Illustration 2 next page). The cage plate opening must be aligned with the door opening when setting the backing pin position.*

*Making A Connection (Continued)*

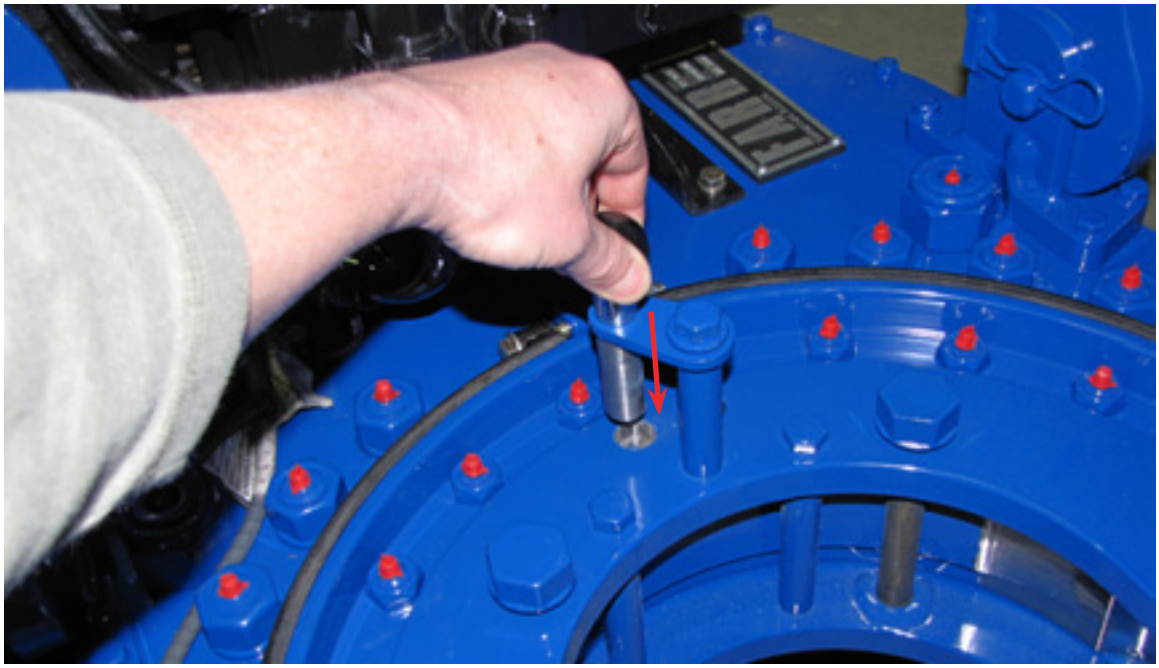


**ILLUSTRATION 2.H.2: SETTING BACKING PIN TO "MAKE-UP" POSITION**

c) *Ensure the load cell and snub line(s) are properly configured for making up connections. The "snub line" is a length of wire rope that connects the rear of the tong body to a sturdy anchor on the drill floor (see Section 2.F.1). The snub line prevents the tong body from spinning in the opposite direction of the cage plate when torque begins to build in the joint. The snub line must be rated for the applied torque plus whatever safety margins stated by your own operating policies. The snub line connection point on the drill floor must be sturdy enough to absorb all applied forces when making up the joints. When making up joints the snub line is attached to the driller's side of the tong, which is the left side of the tong as seen from the rear. For accurate torque measurement the snub line must be perpendicular to the vertical, and perpendicular to the centre-line of the tong.*

d) *Actuate the lift cylinder control valve to lift the assembly from the drill floor. Pushing the valve toward the center of the tong will retract the lift cylinder to lift the assembly (see Illustration 2.H.3 below). Note that rig personnel are required to stabilize the tong and backup as it is being lifted so it does not swing and collide with other rig equipment.*

***RIG PERSONNEL MUST STABILIZE THE TONG AS IT IS LIFTED FROM THE DRILL FLOOR***

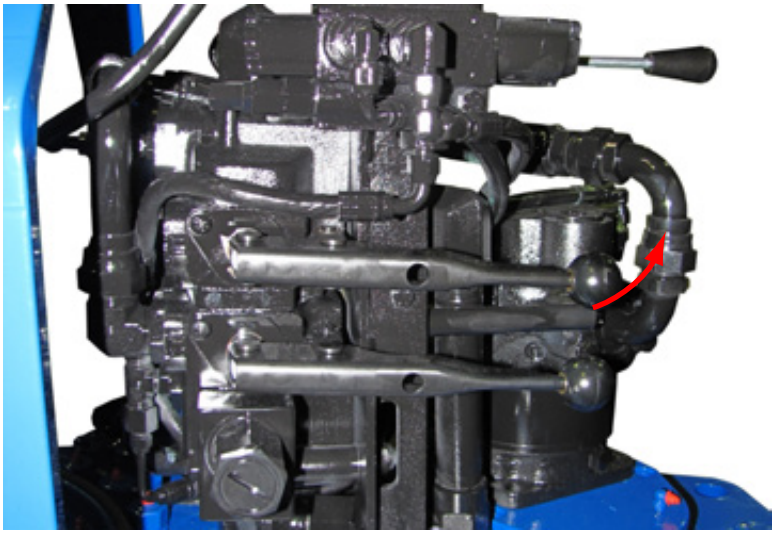


**ILLUSTRATION 2.H.3: LIFT CYLINDER CONTROL - RAISE**

***Making A Connection (Continued)***

*e) Grasp the tong door handle and pull the door to open (See Illustration 2.H.4 next page). Since your equipment is equipped with a safety door, opening the door will inhibit rotation of the cage plate.*

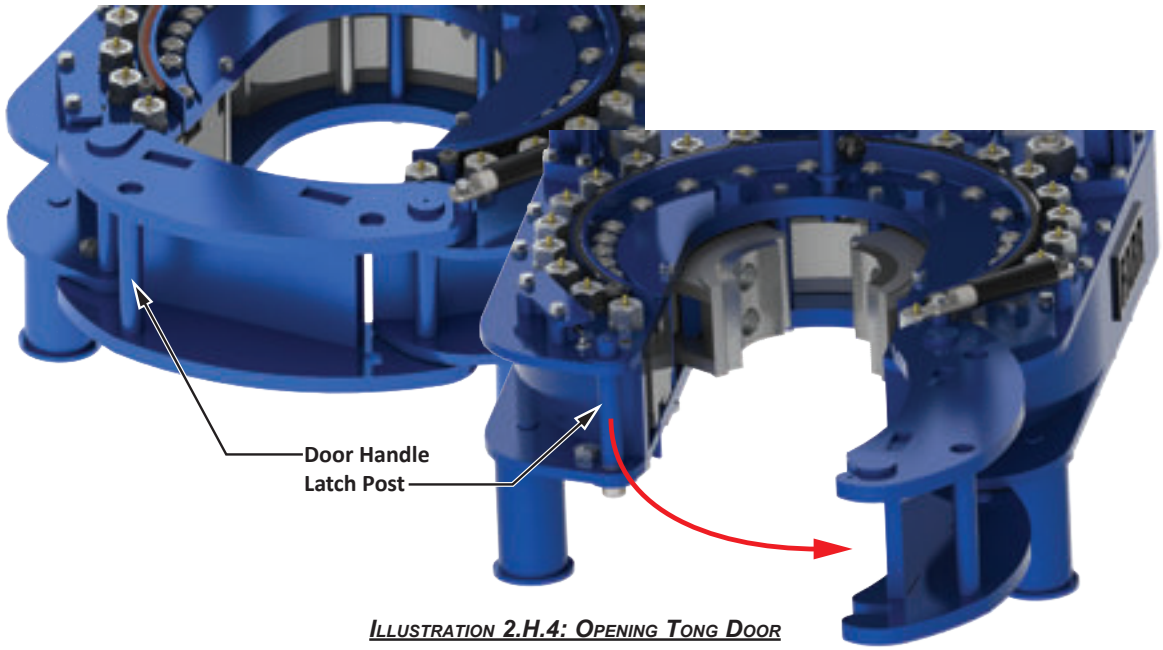



***ILLUSTRATION 2.H.4: OPENING TONG DOOR***

*f) Manually engage the threads of the tubing connection being made up. Ensure threads are not cross-threaded.*

*g) Move the tong on to the tubing joint. Use the lift cylinder to ensure the tong jaws are at the correct location above the connection joint.*

*h) Firmly close the tong door against the latch post.*

*i) Ensure tubing is roughly centered within the tong jaws - rig personnel are required to stabilize the tong above the connection until the jaws have made full contact with the pipe or casing.*

*j) Begin rotation with the tong in high gear and the tong motor set to high speed (high speed/low torque). See Section 2.G.2 to set the tong motor to high speed, and Section 2.G.3 to properly set the tong to high gear. Do not shift gears while the tong is rotating.*

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

*k) Push the motor control valve toward the tong to rotate the cage plate in the make-up direction.*

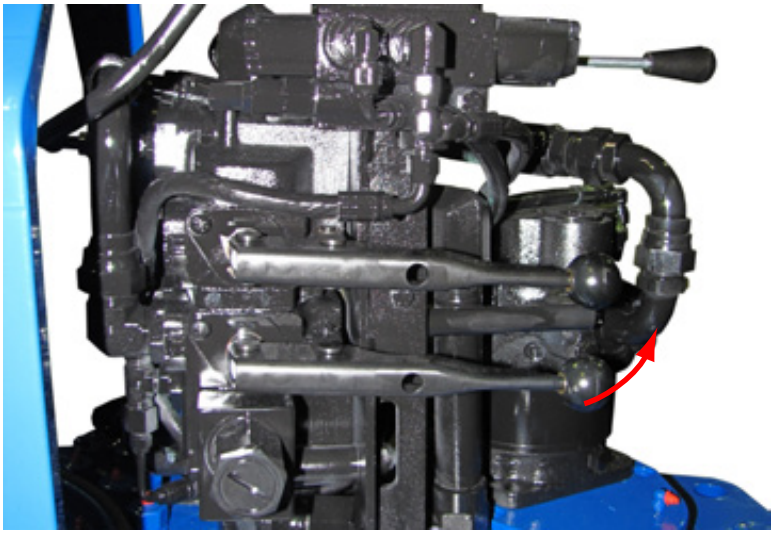


***ILLUSTRATION 2.H.5: MOTOR CONTROL - MAKE-UP***

***Making A Connection (Continued)***

*l) When the tong jaws cam on to the tubing push the rotation control handle all the way in to thread the connection together at high speed. As the joint becomes fully made up the increasing torque demand will stall the motor, and displayed torque will increase.*

*m) Stop rotation, and set motor to low speed and shift to low gear (low speed/high torque - See Section 2.G.2 for instructions for setting motor to low speed, and Section 2.G.3 for shifting to low gear). This will enable the tong to produce adequate torque for making up the joint to specification.*

*n) Push the rotation control handle all the way in to complete the connection at low speed/high torque. Observe the torque gauge - when the specified make-up torque is reached stop rotation. Reverse the rotation control valve to release the tong jaws from the tubing (see Illustration 2.H.6).*

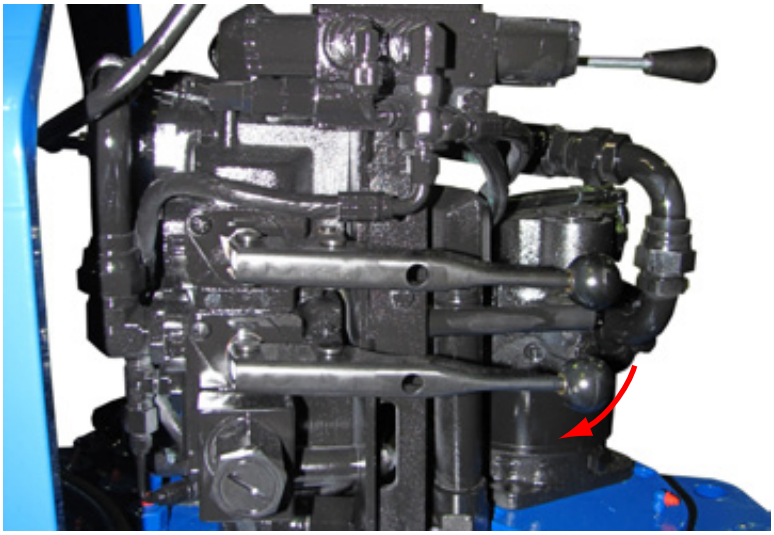


***ILLUSTRATION 2.H.6: MOTOR CONTROL - RELEASING JAWS***

*Making A Connection (Continued)*

*o) When tong jaws are free, align the opening in the rotary gear with the mouth of the tong, and open the tong door to free the tong from the drill string. Note that rig personnel may be required to stabilize the tong as it completely releases from the drill string. Guide the tong away from the string and use the lift cylinder control to lower it to the drill floor if desired.*

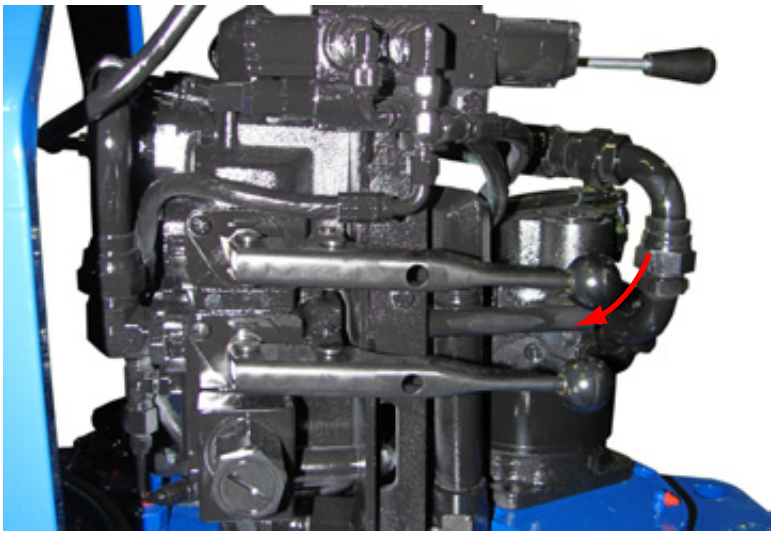


***ILLUSTRATION 2.H.7: LIFT CYLINDER CONTROL - LOWER***

*Making A Connection (Continued)*

p) *Repeat steps "f" through "o" until the desired number of connections are made up.*

**2. *Breaking A Connection***

***YOUR TONG SHOULD BE PROPERLY SUSPENDED, CONNECTED TO A HYDRAULIC POWER SOURCE, AND READY TO BREAK CONNECTIONS.***

a) *Ensure hydraulic power supply to the tong and backup is energized. The master link on the rigid sling must be used to suspend the tong. Do not suspend the tong directly from the rigid sling. See Illustration 2.H.1.*

b) *Set the backing pin for "breakout" operation. Lift up on the backing pin and rotate it to the "breakout" position, which is 2 o'clock as seen from the front of the tong. The opening in the rotary gear must be aligned with the tong door opening in order to properly set the backing pin (see Illustration 2.H.8).*

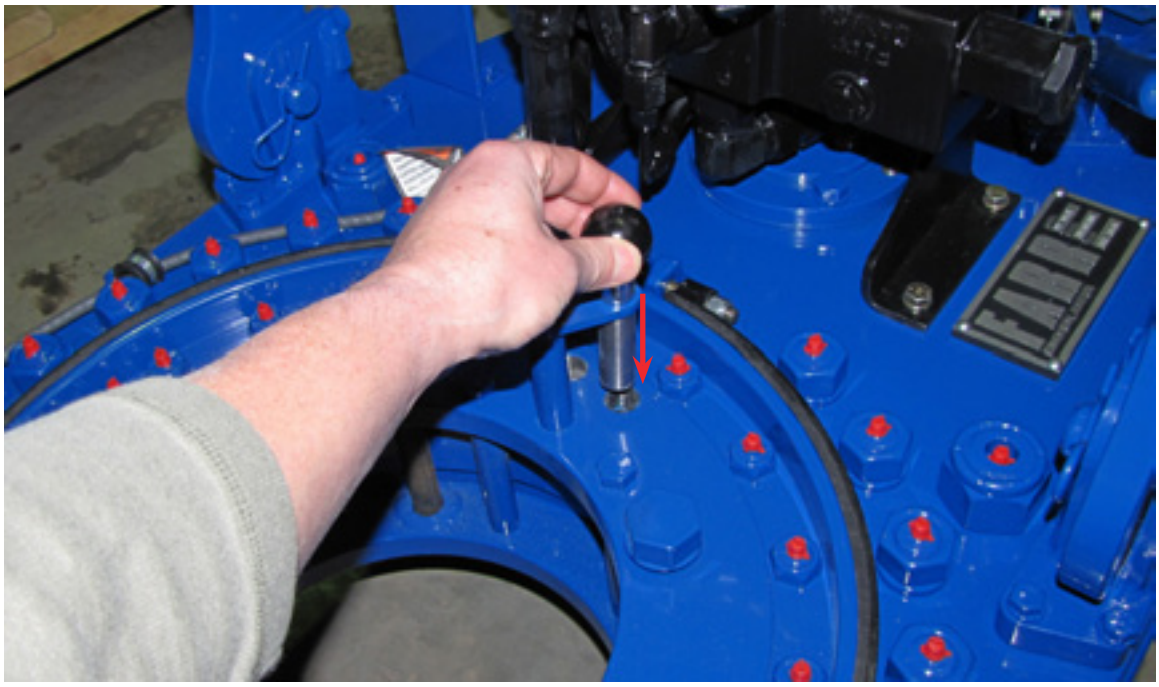


***ILLUSTRATION 2.H.8: SETTING BACKING PIN TO "BREAK-OUT" POSITION***

c) *Ensure the load cell and snub line is configured for break-out operation. The snub line and load cell must be transferred to the off-driller's side (the right hand side as seen from the rear of the tong) to perform break-out operations.*

d) *Open the tong door (see Illustration 2.H.4).*

e) *Actuate the lift cylinder control valve to lift the assembly from the drill floor if necessary. Pushing the valve toward the center of the tong will retract the lift cylinder to lift the assembly (see illustration 2.H.3). Note that rig personnel are required to stabilize the tong and backup as it is being lifted so it does not swing and collide with other rig equipment.*

***RIG PERSONNEL MUST STABILIZE THE TONG AS IT IS LIFTED FROM THE DRILL FLOOR***

f) *Move the tong on to the tubing joint. Use the lift cylinder to ensure the tong jaws are at the correct location above the connection joint.*

g) *Firmly close the tong door against the latch post.*

h) *Ensure tubing is roughly centered within the tong jaws - rig personnel are required to stabilize the tong above the connection until the jaws have made full contact with the pipe or casing.*

i) *Breakout torque is only available when tong motor speed is set to low speed and tong is in low gear. See Section 2.G.2 to set tong to low speed and Section 2.G.3 to shift to low gear. Do not shift gears while the tong is rotating.*

***Breaking A Connection (Continued)***

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

*j) Pull the motor control valve toward the operator to rotate the cage plate in the break-out direction.*

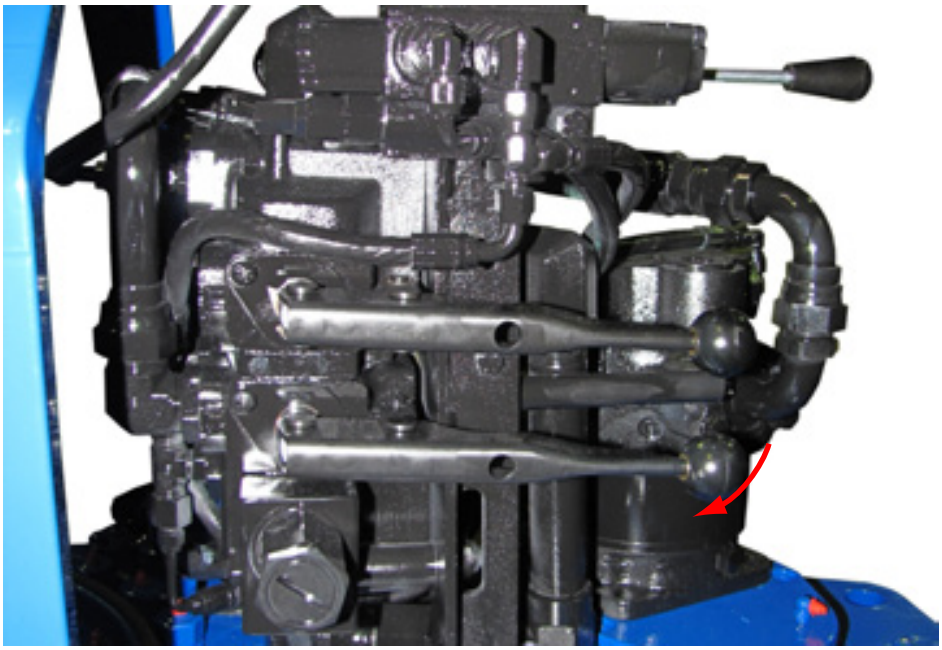


***ILLUSTRATION 2.H.9: ROTATION CONTROL - BREAK-OUT***

*l) When the tong jaws cam on to the tubing pull the rotation control handle all the way out to break the connection.*

*m) When the connection breaks stop rotation, set tong motor to high speed and shift to high gear (see Section 2.G.2 to set motor speed and 2.G.3 to shift to high gear). This will enable the tong to completely un-thread the connection at high speed.*

*n) Pull the rotation control handle all the way out to completely un-thread the connection. Reverse the rotation control handle (push toward tong) to release the tong jaws from the tubing (see Illustration 2.H.10 next page).*

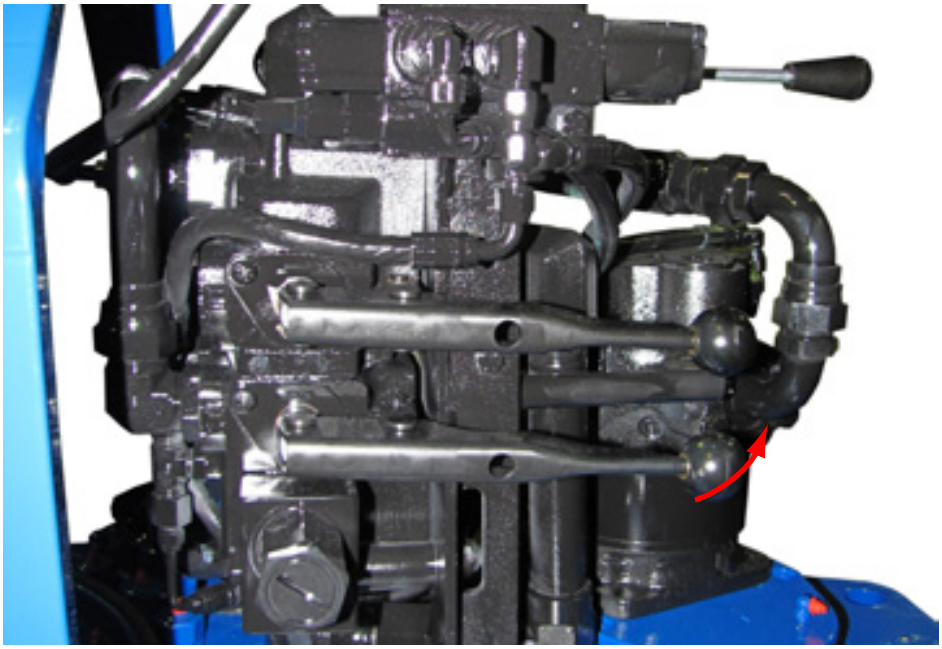


***ILLUSTRATION 2.H.10: RELEASING TONG JAWS FOLLOWING BREAK-OUT & UN-THREADING***

***Breaking A Connection (Continued)***

*o) When the tong jaws disengage align the opening in the rotary gear with the mouth of the tong, and open the tong door to free the tong from the drill string. Unlatch and open the tong door to free the assembly from the tubing. Note that rig personnel may be required to stabilize the equipment as it completely releases from the tubing. Guide the assembly away from the string and use the lift cylinder control to lower it to the drill floor if desired.*

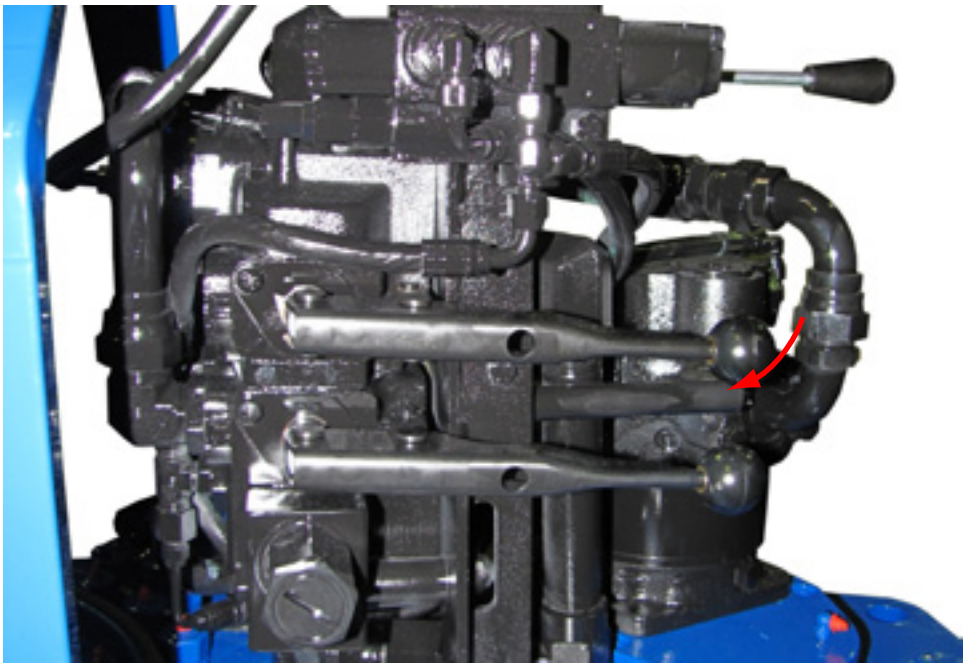


***ILLUSTRATION 2.H.11: LOWERING TONG USING LIFT CYLINDER CONTROL***

*p) Use your rig's standard pipe handling procedures to remove and rack the freed tubing stand.*

*q) Repeat steps "e" through "p" as many times as necessary to break out and un-thread the desired number of connections.*

## H. EXTREME COLD WEATHER OPERATION PROCEDURES

*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.*

*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.*

### 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 foot wear, 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 signs 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*

*McCoy recommends that disconnection of hydraulic connectors be performed with the power unit off and the hydraulic circuit depressurized.*

*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.*

### B. CLEANING

*Clean tong thoroughly cleaned with a good petroleum-based cleaning agent after each job, prior to storage. Farr 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.*

### C. PREVENTIVE MAINTENANCE

*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.*

*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.*

*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 Completions & Drilling recommends tracking all maintenance activity including the lubrication schedule. 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.*

## D. LUBRICATION

*Use a quality multipurpose bearing lubricant that will remain within its viscosity range at expected operating temperatures. In addition, Farr recommends the following lubrication procedure at the completion of each job prior to storage.*

### 1. Cage Plate Cam Followers

*Lubricate cam followers mounted in the cage plate and in the body plates surrounding the rotary gear through the grease fittings in the ends of the cam followers (40 locations - see illustration below).*

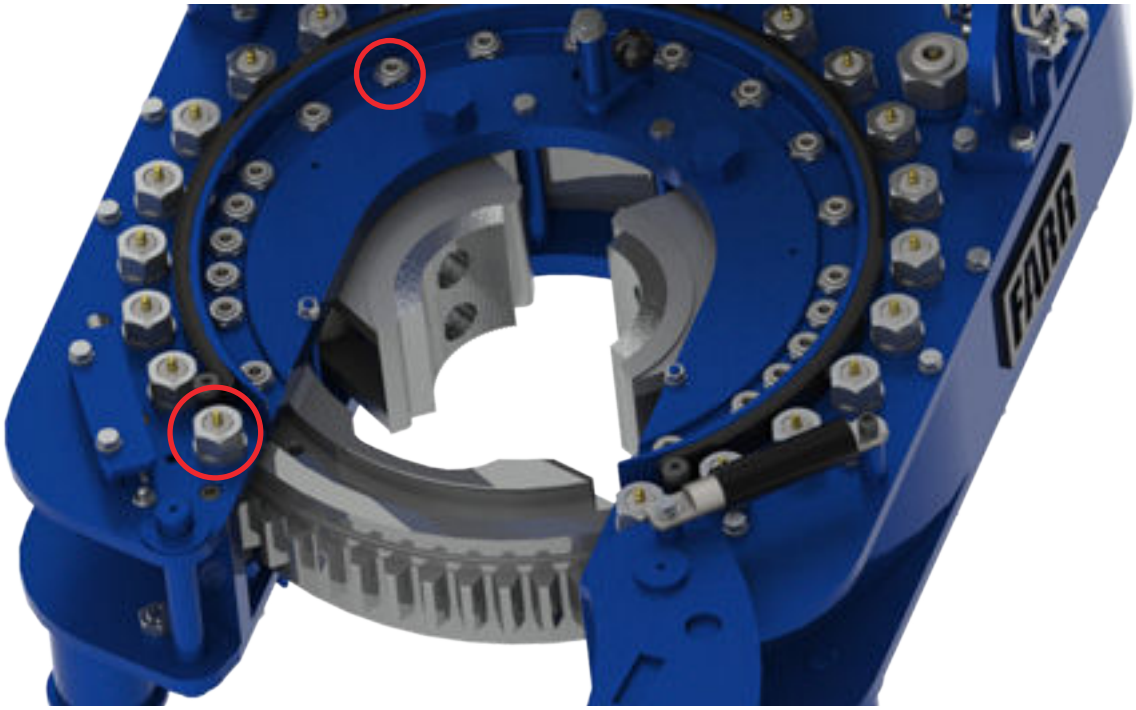



ILLUSTRATION 3.D.1: CAM FOLLOWER LUBRICATION

### 2. Rotary Idler Bearings

*Apply grease to these bearings through the grease fittings in the ends of the rotary idler shafts, located on the top of the tong to the inside of each rigid sling weldment (2 locations total).*

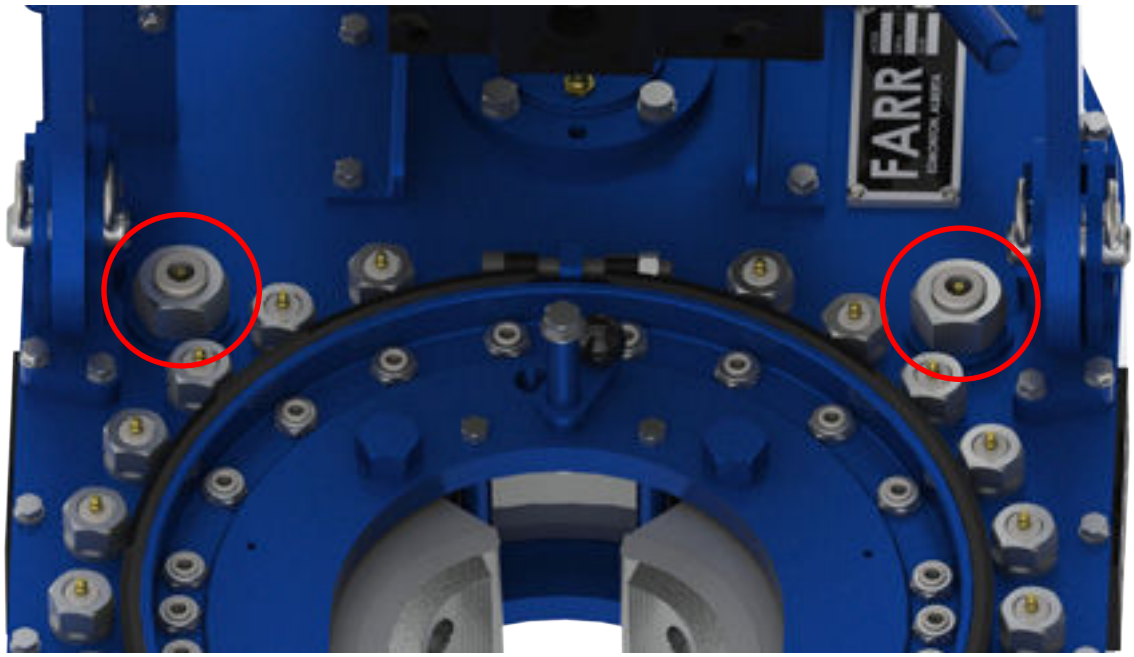



ILLUSTRATION 3.D.2: ROTARY IDLER LUBRICATION

3. **Pinion Idler Bearings**

*Apply grease to these bearings through the grease fittings in the ends of the pinion idler shafts, located on the bottom of the tong on each side of the stiffener plate, just behind the brake band (2 locations total).*

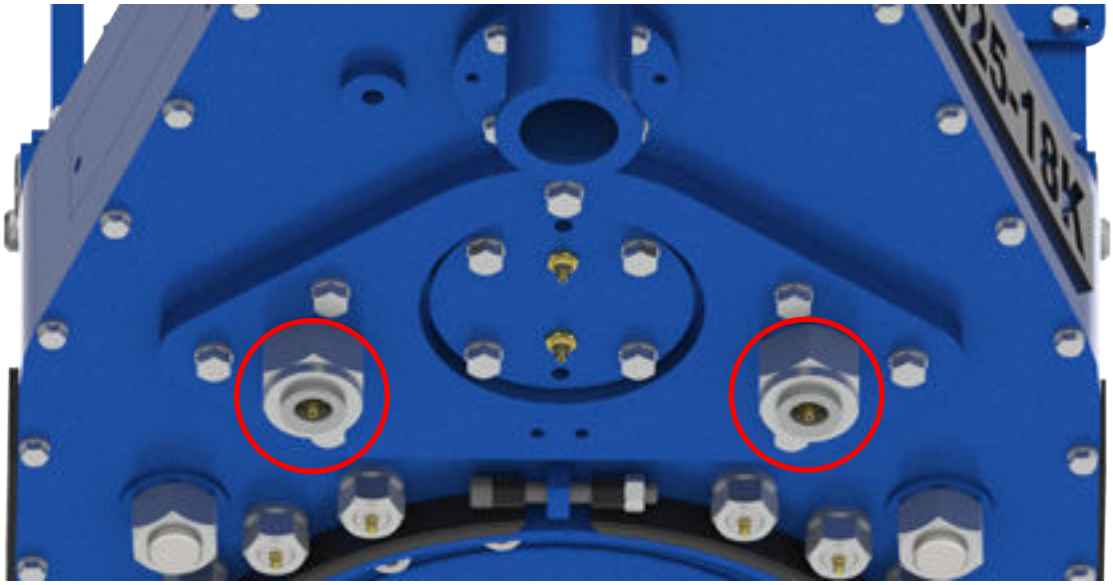


*ILLUSTRATION 3.D.3: PINION IDLER LUBRICATION*

4. **Pinion Bearings**

*Apply grease to these bearings through the grease fittings in the pinion bearing caps located on the top of the tong directly beneath the valve bank, and on bottom of the tong in the center of the stiffener plate (total of four locations).*

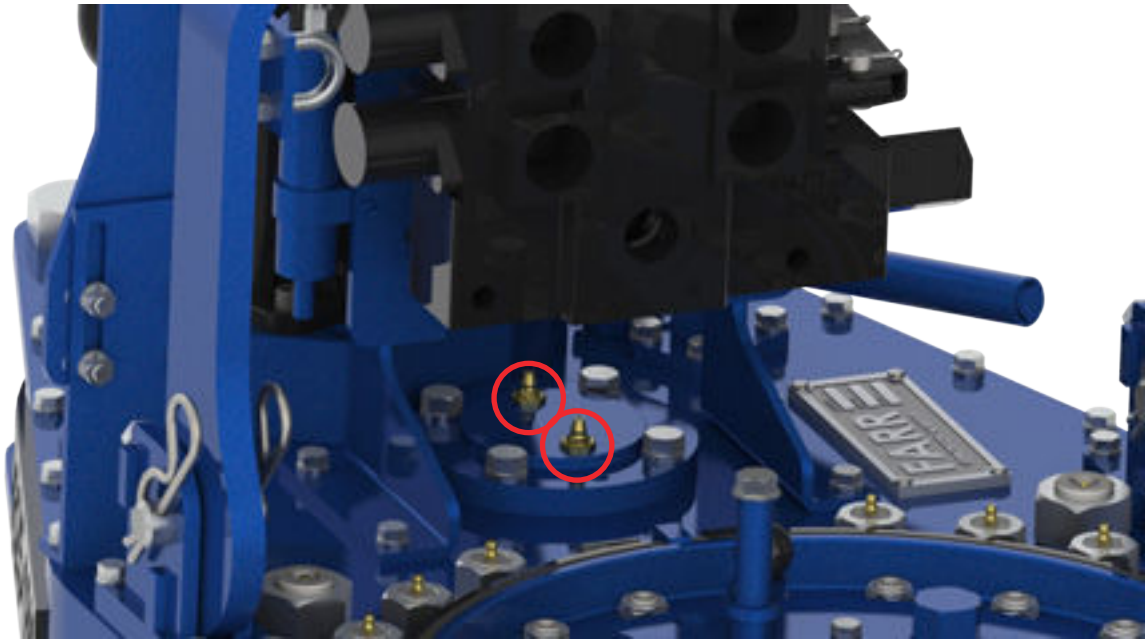



*ILLUSTRATION 3.D.4: PINION LUBRICATION (TOP PLATE)*

***Pinion Bearing** Lubrication (cont'd)*

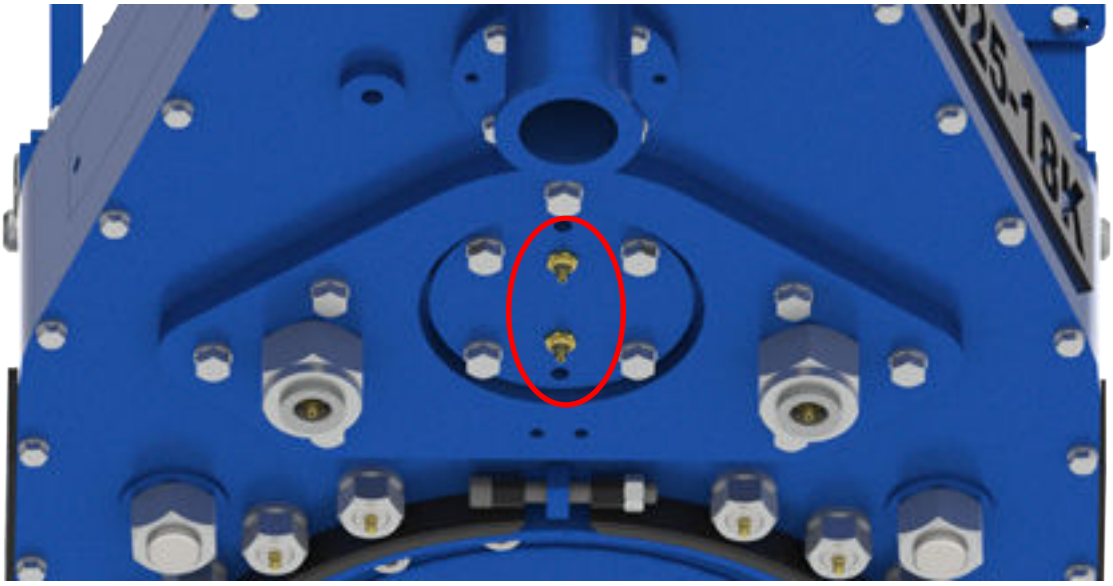


*ILLUSTRATION 3.D.5: PINION LUBRICATION (BOTTOM PLATE)*

**5. Clutch Shaft Bearings**

*Apply grease to these bearings through three grease fittings in the clutch bearing cap, which is located on the bottom plate. Note that the centre grease fitting is recessed into the end of the clutch shaft.*

*ILLUSTRATION 3.D.6: CLUTCH LUBRICATION*

**6. Motor Mount Housing**

*Apply grease to the gears in this housing through the two grease fittings on the bearing cap on top of the motor mount, in the area indicated by the red circle.*

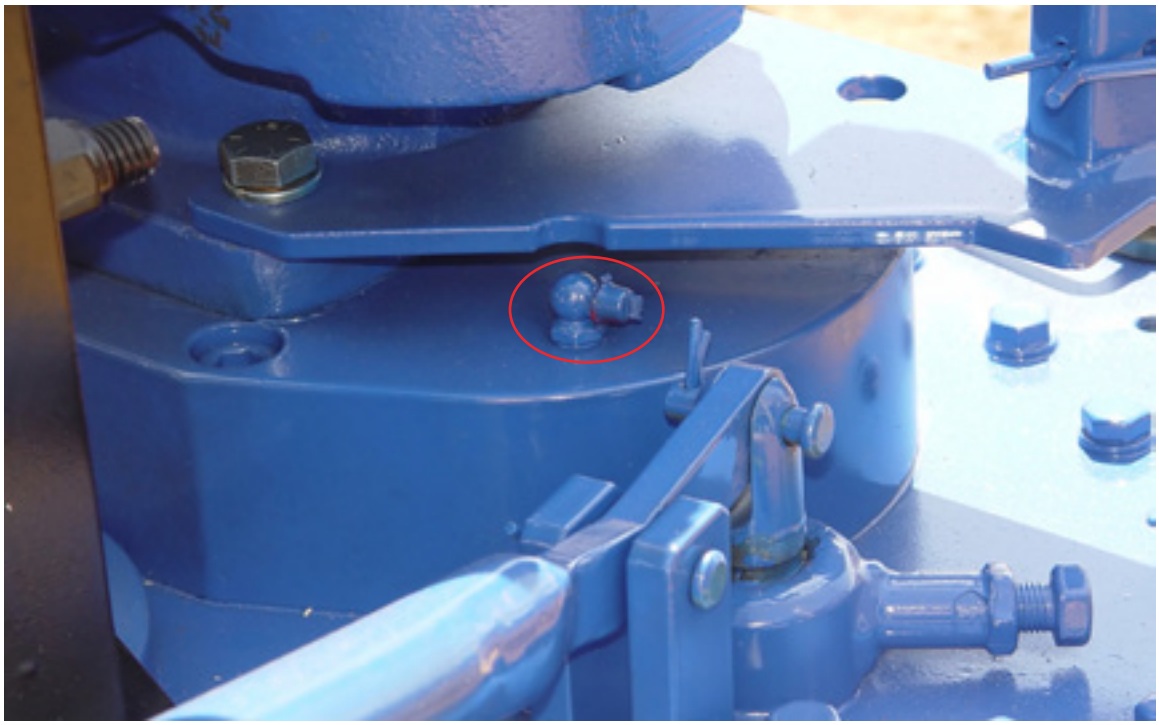


ILLUSTRATION 3.D.7: MOTOR MOUNT LUBRICATION

**7. Shifting Shaft**

*Apply grease to the shifting shaft and shifting shaft bushings. These can be accessed through the cover plate on the side of the tong, near the rear.*

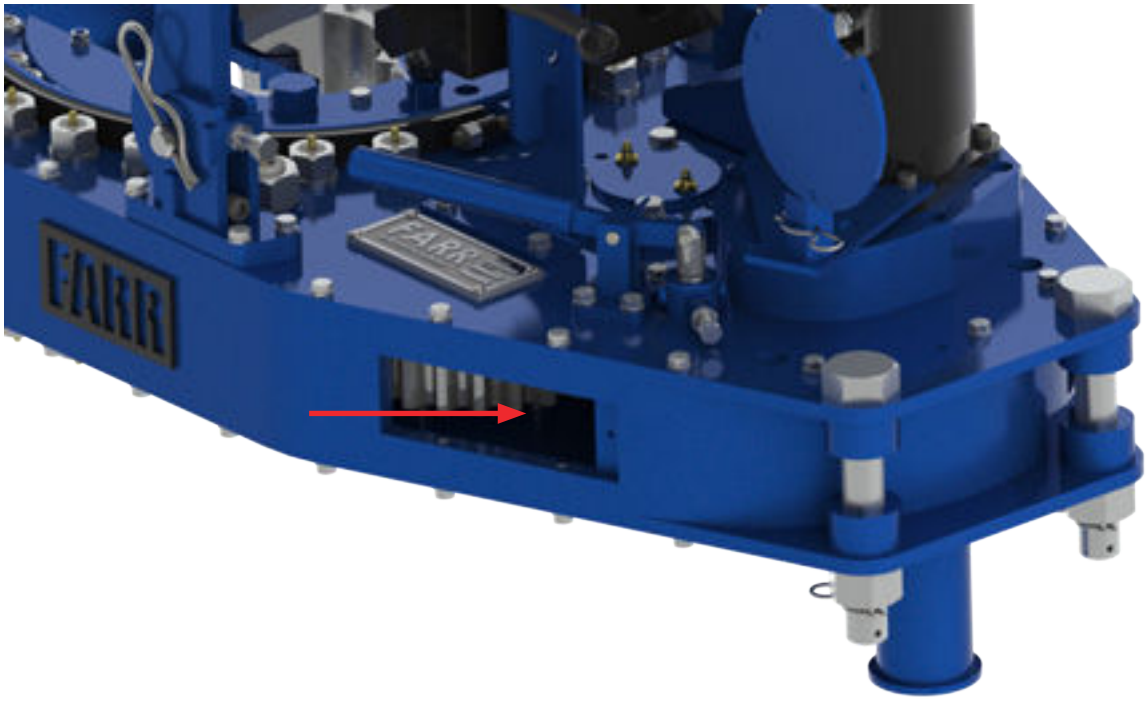



ILLUSTRATION 3.D.8: SHIFTER SHAFT LUBRICATION

**9. Door Latch Lubrication**

*Apply a small amount of grease to the door latch shaft and the door latch hook as necessary in order to maintain smooth operation.*

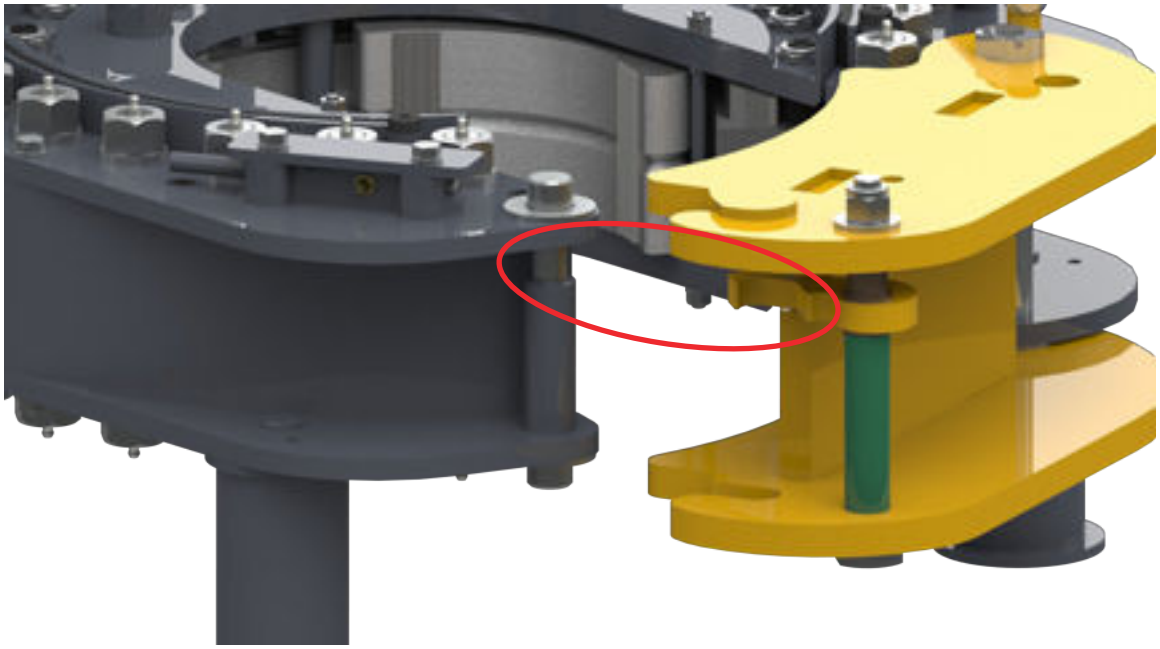


*ILLUSTRATION 3.D.9: DOOR LATCH LUBRICATION*

**10. Safety Door Switch Lubrication**

*Apply grease to the safety door switch through the grease fitting on the cable guide. Also lightly grease the safety door switch plunger (circled in red in the following illustration) in order to ensure it will allow the rounded corner of the door weldment to smoothly slide across it.*

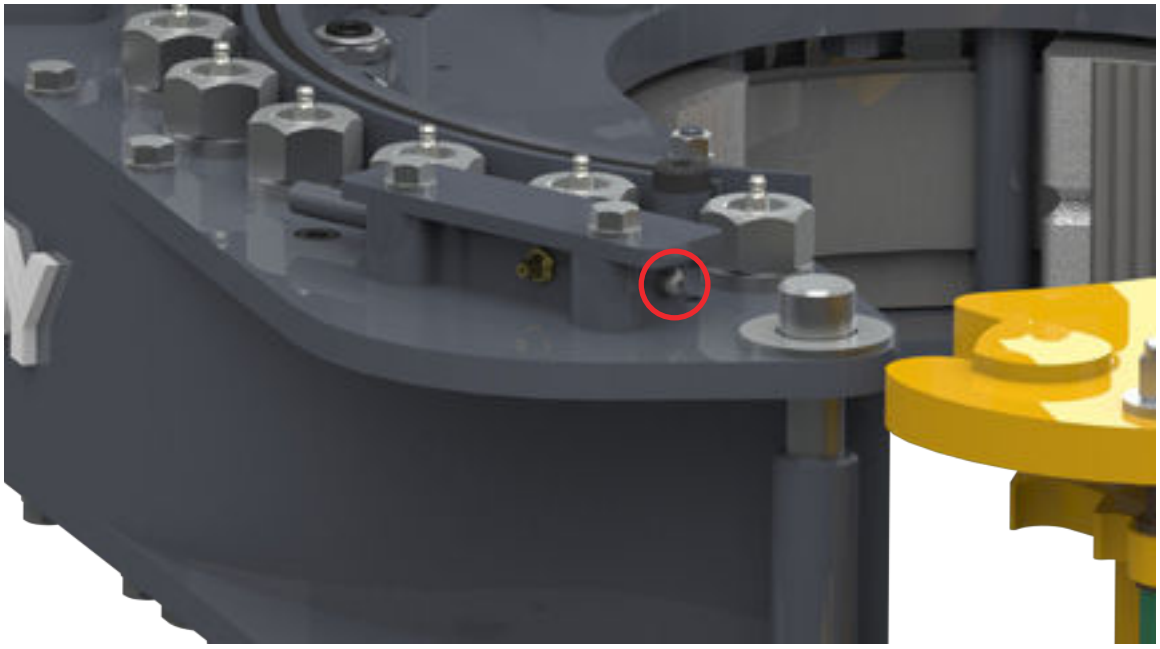


*ILLUSTRATION 3.D.10: SAFETY DOOR SWITCH LUBRICATION*

**11. Door Spring Cylinder**

*Periodically disassemble the door stop cylinders and coat the spring and cylinder with a general purpose lubricating oil.*

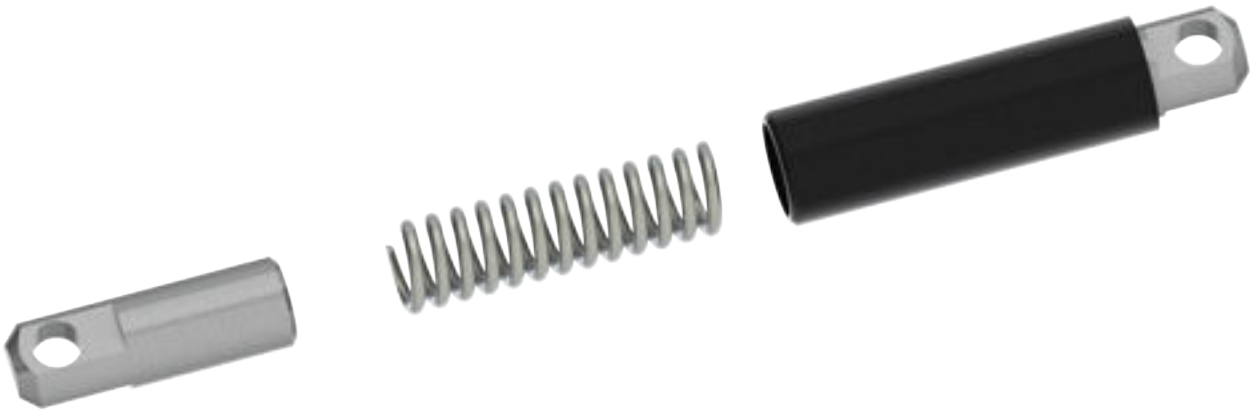


ILLUSTRATION 3.D.11: DOOR SPRING CYLINDER

## E. ADJUSTMENTS

**1. Brake Band Adjustment**

*The top and bottom brake bands must be periodically adjusted to continue to provide smooth and efficient jaw cam action. If the cage plate turns with the rotary gear, the jaws will not cam properly and, therefore, will not bite on the tubing or casing. 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. Use caution, as over-tightening will cause excessive wear to the brake bands.*

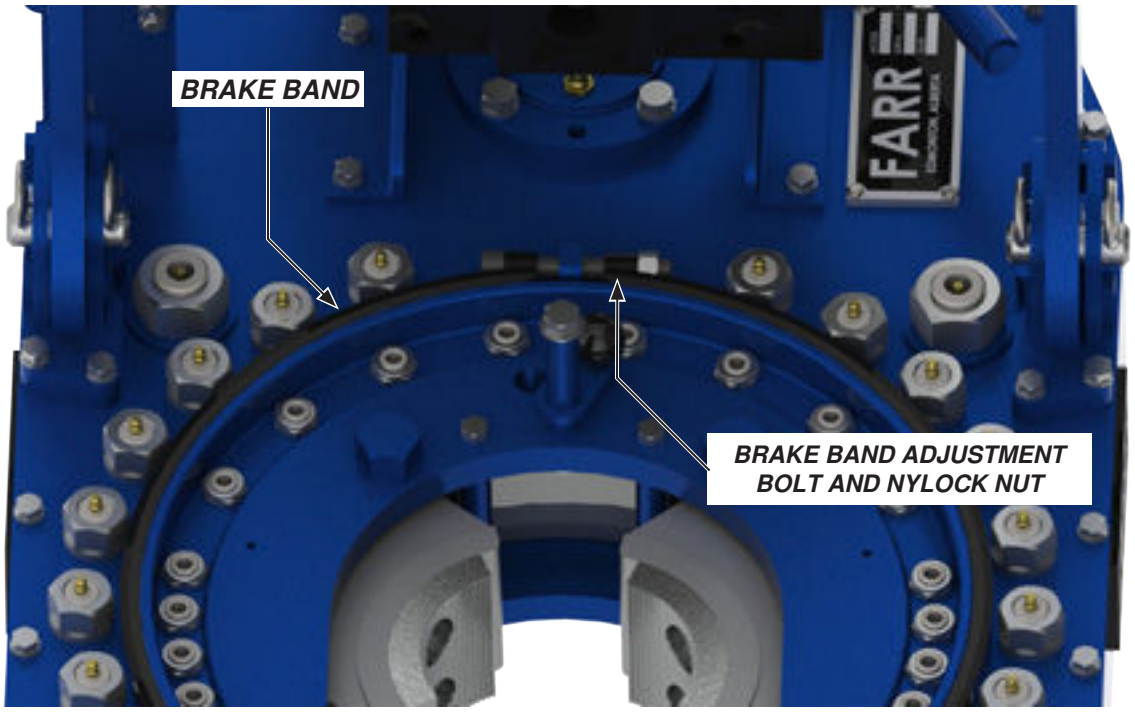



ILLUSTRATION 3.E.1: BRAKEBAND ADJUSTMENT

**2. Shifter Detent Adjustment**

*Over time wear to the shifting shaft, wear to the detent ball, and loss of spring tension in the detent spring may result in a loose or "sloppy" fit within the top shifter bushing. The detent pressure may be increased or otherwise adjusted by loosening the 7/16" UNF locking jam nut, and turning the 7/16" UNF detent bolt. Should adequate detent action not be achieved, the shifting shaft, detent ball, or detent spring (or possibly all three) may need to be replaced (see Pp. 5.12 - 5.13).*

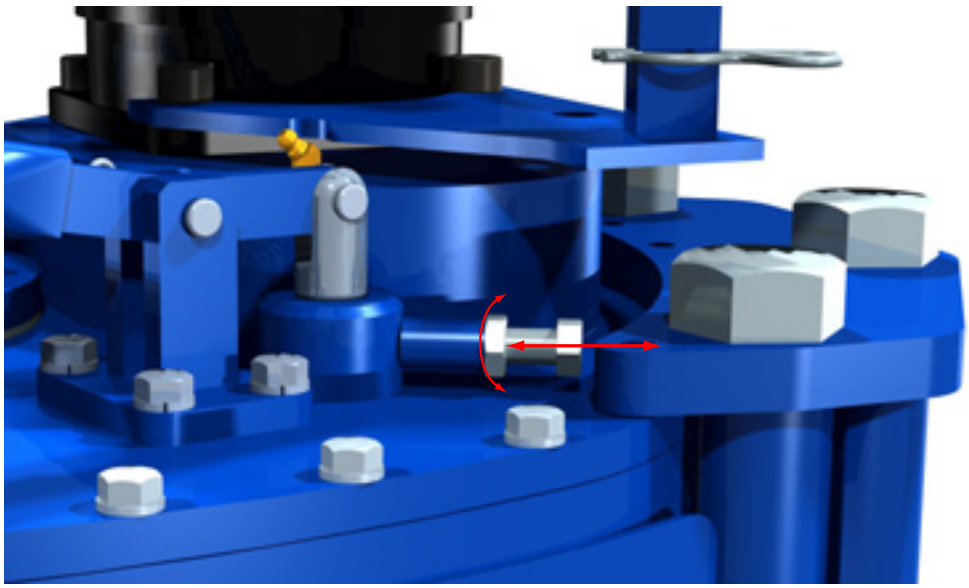


***ILLUSTRATION 3.E.2: SHIFTER DETENT ADJUSTMENT***

**3. Safety Door Switch Adjustment**

*The safety door switch should interrupt hydraulic power to the motor when the tong door is opened, or even slightly ajar. This is a critical safety system, and proper adjustment is necessary to maintain the intended function. If the rotary gear does not stop immediately and completely stop rotating when the door is opened, remove the tong from service and perform the following adjustments:*

1. *Set the tong up in a controlled testing environment without connecting hydraulic power.*
2. *Open the tong door and check operation of the safety door switch plunger. Depress and allow it spring back several times to ensure smooth operation. If the plunger binds or jams, remove the control cable guide mount at the door end, remove the control cable and plunger, and thoroughly clean and lubricate the plunger and control cable before reinstalling.*
3. *Test the control cable after cleaning and reinstallation. The cable end should spring back when depressed. If the cable does not smoothly spring back, replace the control cable.*
4. *Following reinstallation the plunger should extend 3/4 of an inch from the end of the control cable guide mount.*

***ILLUSTRATION 3.E.3: SAFETY DOOR PLUNGER ADJUSTMENT 01***

***Safety Door Switch Adjustment Cont'd:***

*Adjust plunger position using the positioning nut and locking nut on the control cable before proceeding. Loosen the locking nut, and adjust the positioning nut until the plunger extension measures approximately 3/4". When position of the plunger is set, tighten the locking nut. Note that although the following illustration shows the tong door closed, the plunger extension must be performed with the door open.*

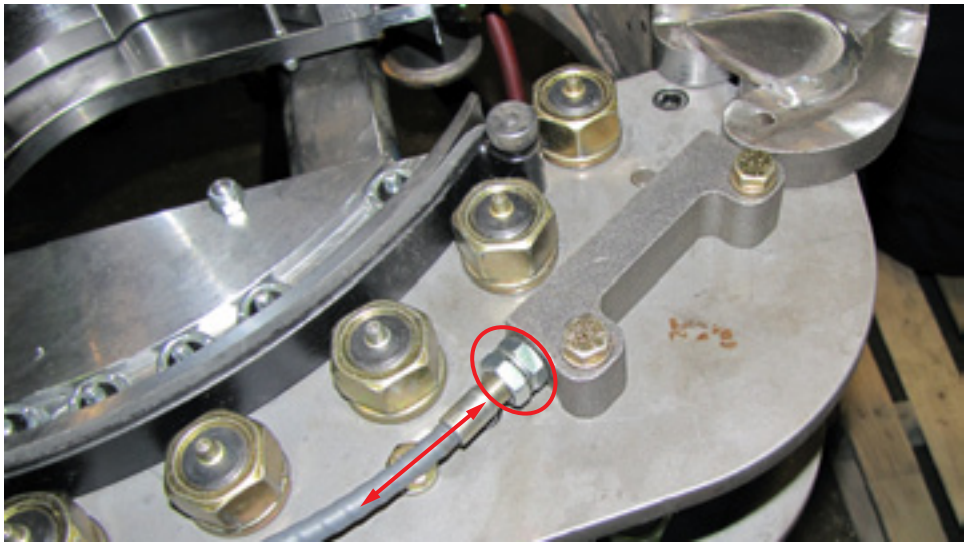


***ILLUSTRATION 3.E.4: SAFETY DOOR PLUNGER ADJUSTMENT 02***

5. *Connect hydraulic power to the tong.*
6. *Ensure the door is closed and all personnel are clear. Begin rotating the cage plate. Open the tong door - the cage plate should immediately and completely stop.*
7. *Release all controls, and close the tong door again. Ensure the cage plate rotates with the door closed.*
8. *If cage plate continues to rotate with the door open, further adjustment of the safety door switch is necessary. Remove hydraulic power from the tong.*
9. *Adjust the guide block first. Slightly loosen the two mounting bolts, and use a hammer to lightly tap the guide block toward the front of the tong. Adjust the block approximately 1/8" of an inch, and retighten the mounting bolts.*

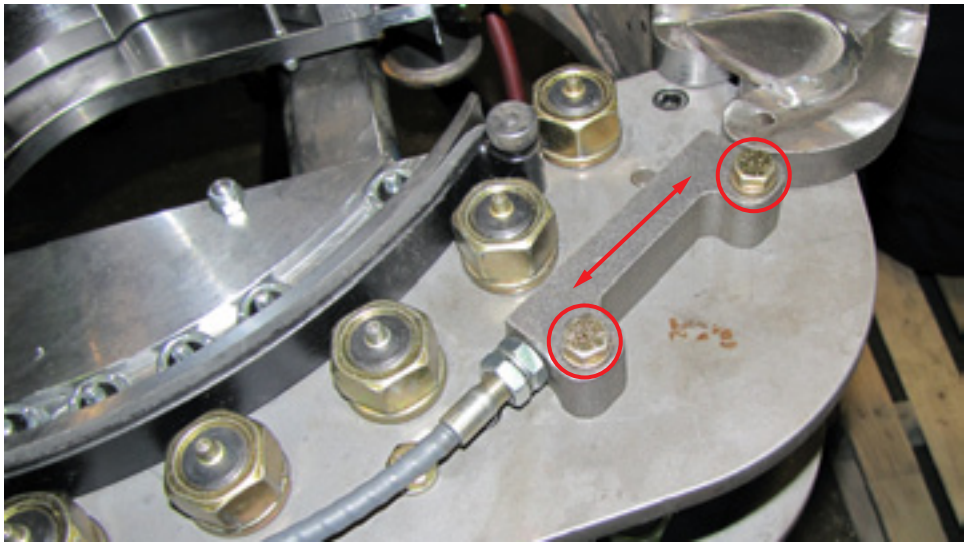


***ILLUSTRATION 3.E.5: SAFETY DOOR PLUNGER ADJUSTMENT 03***

10. *Repeat steps 5 through 8.*
11. *Make another adjustment of the guide block. Once the adjustment block can no longer be adjusted, further adjustment must be made using the cable positioning nuts (see Step 4).*
12. *Repeat steps 5 through 11 as many times as necessary to properly adjust the safety door switch. Once the switch has been satisfactorily adjusted the tong my be returned to service.*

### F. RECOMMENDED PERIODIC CHECKS

**1. Door Stop Spring**

*The spring inside the actuator cylinder must be of sufficient strength to enable the door latch mechanism to snap closed properly, and to hold the door in the open position when opened. Door stop spring fatigue will result in sluggish latch operation. Replace the latch spring inside the cylinder when this occurs.*

**2. 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 either pin is bent.*

**3. Shifting Shaft**

*The shifting yoke is secured to the shifting shaft by one hex jam nut above the shifting yoke, and one locknut on the bottom of the yoke. Check these nuts after each job. Do this by removing the clutch inspection plate and ensuring a snug fit prior to lubrication.*

**4. Torque Gauge**

*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. Farr recommends that the torque gauge assembly be calibrated yearly. Periodically check to ensure the load cell is filled with oil (see Section 6).*

### G. OVERHAUL PROCEDURES

*The tong may be overhauled following the disassembly instructions in the following procedure. Access to the gear train is possible by removing the top plate of the tong.*

***ALL MAINTENANCE AND OVERHAUL SHOULD BE PERFORMED FROM THE TOP. THE BOTTOM PLATE OF THE TONG IS TYPICALLY WELDED TO THE SIDE BODY AND CANNOT BE REMOVED.***

***REPLACEMENT FASTENERS (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) USED DURING MAINTENANCE OR OVERHAUL MUST BE GRADE 8 OR EQUIVALENT.***

**REMOVAL OF TOP PLATE**

1. *Place the tong on a suitable surface that will support the entire weight of the tong and allow access to the bottom plate.*
2. *Support the rigid sling with a crane. Remove the two hitch pins from each rigid sling pin, and remove the rid sling pins. The rigid sling may now be lifted away from the tong. Remove both rigid sling hanger bracket weldments.*
3. *Disconnect the hydraulic connections from the motor. Remove the bolts securing the safety door plunger block to the top plate near the door. Undo the restraints securing the inlet and outlet lines from their supports, and the four 3/8" x 1" bolts securing the valve mount weldment to the top plate. Lift the entire hydraulic valve section away from the tong. Remove the inlet and outlet support pieces.*
4. *Remove the adjustable outlet support from the top plate.*
5. *Remove the tong door cylinder.*
6. *Remove the door assembly by removing the door pin. Remove the 1" outside snap ring from the shaft just inside the top and bottom door weldment plate and slide the shaft out the bottom. Support the door assembly as the door pin is removed - a soft alloy material (e.g. brass rod, etc.) may be required to lightly tap the shaft through the door assembly until it comes free at the bottom.*
7. *Remove the two socket head cap screws securing the torque gauge mount to the motor mount, and lift the gauge mount out of place.*
8. *Remove the remaining two socket head cap screws securing the motor, and lift the motor off the motor mount. Inspect the motor gear, located at the bottom of the motor shaft, for gear clashing or tooth damage. Also, ensure that the motor gear is securely attached to the motor shaft.*
9. *Remove the motor mount by removing the four socket head cap screws. The motor mount can be lifted out of place. Take care not to lose the two position dowels - one, or both, may come off with the mount.*
10. *Remove the snap ring that secures the clutch drive gear. Remove the clutch drive gear and top clutch spacer. Remove the six #10 x 3/4" socket head cap screws securing the bearing retainer to the top plate, and slide the bearing and bearing retainer up and off the clutch shaft.*
11. *Remove the clevis pin connecting the shifting shaft handle to the shifting shaft. Back off the shifter position detent spring and ball assembly as much as possible without removing the adjustment bolt.*

***REMOVAL OF TOP PLATE Continued:***

12. *Remove the access panel on the body side adjacent to shifter assembly. Remove the 5/8" fine thread nut, and 5/8" fine thread jam nut from the shifting shaft to release the shifting fork from the shaft. The shifting shaft may now be carefully rotated and pulled out of the top shifter bushing. Use caution that the shifter detent ball is not dislodged and lost when the shifter shaft is removed.*
13. *Remove the four 3/8" x 1" hex bolts and 3/8" lock-washers securing the shifter lug weldment to the top plate, and remove the shifter lug and the shifter handle.*
14. *Remove the top brake band by removing the adjustment socket head cap screw and locking nut from the rear brake band lug, and the shoulder bolts from the front pivot points.*
15. *Remove the bottom brake band by removing the the adjustment socket head cap screw and locking nut from the rear brake band lug, and the shoulder bolts from the front pivot points.*
16. *If not already done, remove the jaw pivot bolts and the jaw assemblies.*
17. *Remove the backing pin assembly.*

***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***

18. *Remove the upper and lower nuts and washers from the front cage plate spacers, Remove the rear cage plate bolts, washers, and nuts, and the rear cage plate spacer. The cage plates may now be removed.*
19. *Pull the top bearing cap and spacer for the pinion drive gear by removing the four 1/2" bolts which secure the bearing cap to the top plate. Thread two of the removed bolts into the extra holes on top of the bearing cap, and use them as lifting lugs to lift the bearing cap out of place.*

***IF THE BEARING REMAINS ATTACHED TO THE GEAR SHAFT AFTER THE BEARING CAP IS PULLED, FARR SERVICE PERSONNEL RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.***

20. *Remove the hex head bolts and recessed socket head cap screws around the perimeter of the tong which secure the top plate to the gear case housing.*
21. *With all the above steps taken, the top tong plate can be lifted off providing access to the inside of the gear case. Note that the top cam follower array remains attached to the top plate - these cam followers should all be inspected, and replaced if necessary.*

## H. ASSEMBLY PROCEDURES

*Assembly of Farr Hydraulic Power Tongs is simple, and can be accomplished without the use of special tools. The instructions on this page are presented as a guide only, and are similar to the assembly sequence our technician would use while assembling the tong in our plant.*

**REFER TO THE FOLLOWING TABLE FOR TORQUE SPECS WHEN TIGHTENING HEX BOLTS AND HEX HEAD CAP SCREWS.**

| TIGHTENING TORQUE GUIDE | | | |
|---|---|---|---|
| SAE GRADE 8 - FINE THREAD | | | |
| SIZE | CLAMP LOAD | PLAIN | PLATED |
| 1/4 - 28 (.250) | 3,263 | 14 ft. lbs. | 10 ft. lbs. |
| 5/16- 24 (.3125) | 5,113 | 27 ft. lbs. | 20 ft. lbs. |
| 3/8 - 24 (.375) | 7,875 | 49 ft. lbs. | 37 ft. lbs. |
| 7/16 - 20 (.4375) | 10,650 | 78 ft. lbs. | 58 ft. lbs. |
| 1/2 - 20 (.500) | 14,400 | 120 ft. lbs. | 90 ft. lbs. |
| 9/16 - 18 (.5625) | 18,300 | 172 ft. lbs. | 129 ft. lbs. |
| 5/8" - 18 (.625) | 23,025 | 240 ft. lbs. | 180 ft. lbs. |
| 3/4 - 16 (.750) | 33,600 | 420 ft. lbs. | 315 ft. lbs. |
| 7/8" - 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 1/8 - 12 (1.125) | 77,025 | 1444 ft. lbs. | 1083 ft. lbs. |
| 1 1/4 - 12 (1.125) | 96,600 | 2012 ft. lbs. | 1509 ft. lbs. |
| 1 3/8 - 12 (1.375) | 118,350 | 2712 ft. lbs. | 2034 ft. lbs. |
| 1 1/2 - 12 (1.500) | 142,275 | 3557 ft. lbs. | 2668 ft. lbs. |
| SAE GRADE 8 - COARSE THREAD | | | |
| SIZE | CLAMP LOAD | PLAIN | PLATED |
| 1/4 - 20 (.250) | 2,850 | 12 ft. lbs. | 9 ft. lbs. |
| 5/16- 18 (.3125) | 4,725 | 25 ft. lbs. | 18 ft. lbs. |
| 3/8 - 16 (.375) | 6,975 | 44 ft. lbs. | 33 ft. lbs. |
| 7/16 - 14 (.4375) | 9,600 | 70 ft. lbs. | 52 ft. lbs. |
| 1/2 - 13 (.500) | 12,750 | 106 ft. lbs. | 80 ft. lbs. |
| 9/16 - 12 (.5625) | 16,350 | 153 ft. lbs. | 115 ft. lbs. |
| 5/8" - 11 (.625) | 20,325 | 212 ft. lbs. | 159 ft. lbs. |
| 3/4 - 10 (.750) | 30,075 | 376 ft. lbs. | 282 ft. lbs. |
| 7/8" - 9 (.875) | 41,550 | 606 ft. lbs. | 454 ft. lbs. |
| 1 - 8 (1.000) | 54,525 | 909 ft. lbs. | 682 ft. lbs. |
| 1 1/8 - 7 (1.125) | 68,700 | 1288 ft. lbs. | 966 ft. lbs. |
| 1 1/4 - 7 (1.125) | 87,225 | 1817 ft. lbs. | 1363 ft. lbs. |
| 1 3/8 - 6 (1.375) | 103,950 | 2382 ft. lbs. | 1787 ft. lbs. |
| 1 1/2 - 6 (1.500) | 126,450 | 3161 ft. lbs. | 2371 ft. lbs. |

***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™.***

1. *Position the tong body gear case weldment on a suitable stationary support such that the bottom body plate is accessible.*
2. *Install twenty cam followers (PN SSCF1500) onto the bottom plate as shown in the following illustration. Secure each cam follower with a 7/8" lock-washer and 7/8" NC hex nut.*

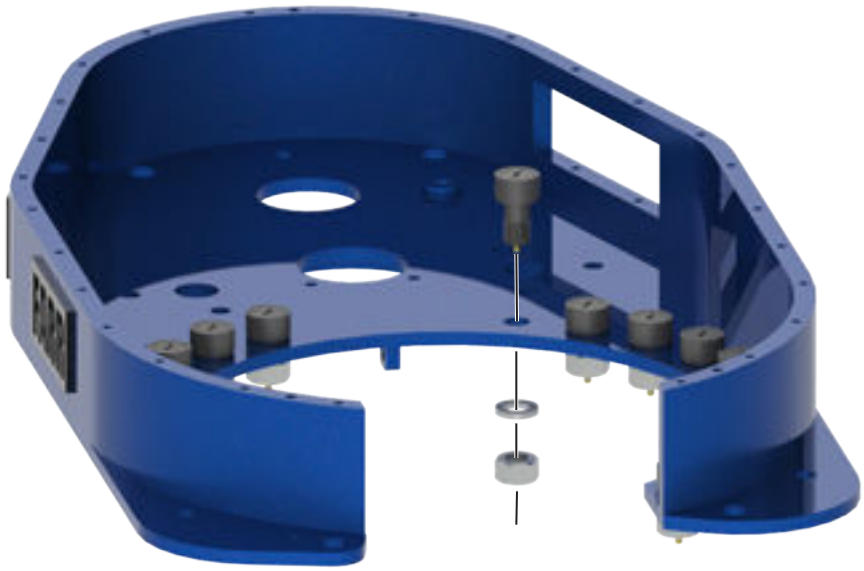


***ILLUSTRATION 3.H.1: CAM FOLLOWER INSTALLATION - BOTTOM PLATE***

3. *Install rotary gear, ensuring the backing pin slots face up. The outside of the rotary gear rides on top of the cam followers installed in the step 2.*
4. *Press pinion bearing (PN 1234-08-01B) into bottom pinion bearing cap (PN AK01-151), and install bearing cap into bottom plate of tong using four 1/2" NC x 1-1/4" hex bolts and 1/2" lock-washers.*
5. *Press lower clutch bearing (PN 02-0076) into clutch bearing cap (PN AK01-201), and install bearing cap into bottom plate of tong using four 3/8" NC x 1-1/4" hex bolts and 3/8" lock-washers.*
6. *Press two idler bearings (PN 02-E0104) into each rotary idler gear (PN AK01-102). Ensure the bearings are pressed tight to the inner flange on the idler gears. Insert a bearing retainer ring (PN 02-E105) into each idler gear to secure the bearings.*
7. *Lightly grease each rotary idler shaft (PN 101-5005) and insert into the gear and bearing assemblies. For reference, if the rotary idler shaft is inserted through the gear and bearing assembly correctly the snap ring in the gear assembly will be oriented toward the bottom of the idler shaft. The bottom of the shaft in not drilled and tapped for a grease fitting. Centre the gear and bearing assembly on each rotary idler shaft (see Illustration 3.H.2 nex page).*

***ASSEMBLY PROCEDURE (continued...):***

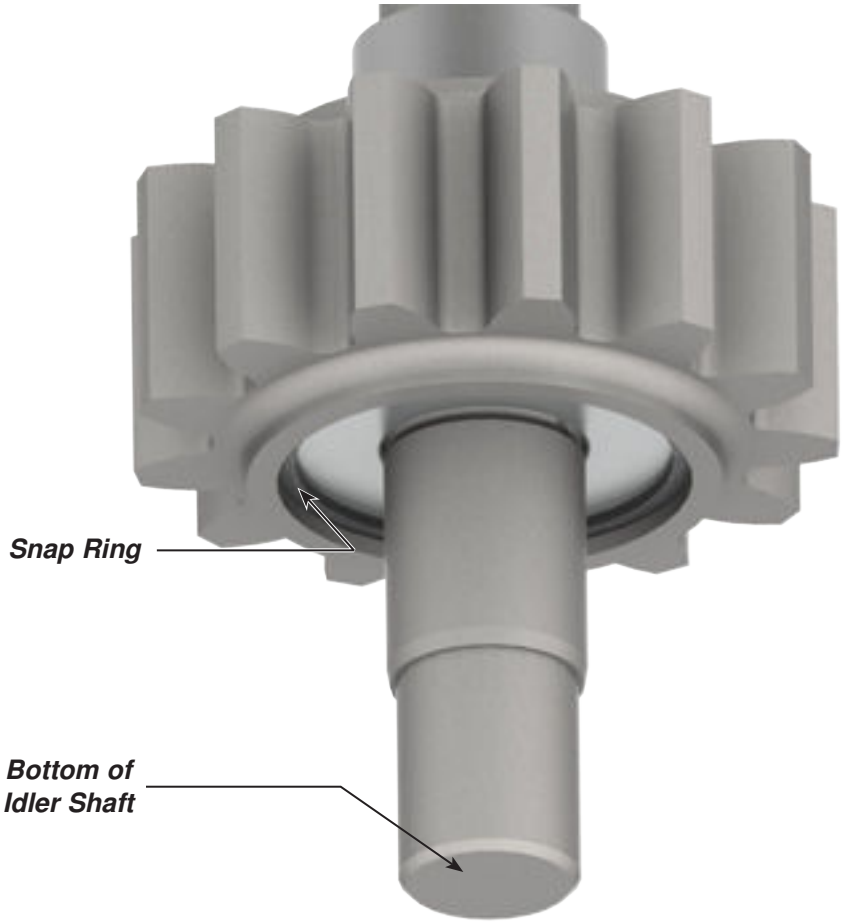



***ILLUSTRATION 3.H.2: ROTARY IDLER GEAR ORIENTATION***

8. *Slide a rotary idler spacer over each end of the rotary idler*
9. *Install each rotary idler assembly, ensuring bottom of the shafts are inserted through the bottom plate.*
10. *Slide the high pinion gear (PN 997-A4-87B) over the end of the pinion gear shaft (PN 997-A7-86B). Ensure the pinion gear is oriented correctly when installing the high pinion gear - see Pp. 5.8 - 5.9 for an exploded view. Place the end of the pinion shaft with the high pinion gear into the lower pinion bearing installed in Step 4.*
11. *Install one retainer clip (PN 02-0009) into each pinion idler gear (PN AK01-122). Lightly grease the inside of the gears, and press a rotary idler bearing (PN 02-0075) into each gear, tight to the previously installed retainer. Secure each bearing with another retainer clip (PN 02-0009).*
12. *Insert each pinion idler half-shaft through the pinion idler gear assemblies. Place a bearing seal (PN 02-0010) over the end of each pinion idler shaft, and secure shafts and seals to the gear assemblies using a small retainer ring (PN 02-0008).*
13. *Place the ends of each pinion idler through the bottom plate, ensuring the pinion idler gears mesh smoothly with the rotary idler gears and the pinion gear shaft.*
14. *Place the tong body stiffener plate (PN AK00-001) onto the bottom of the tong, and secure the stiffener plate in place with the 1/2" NC x 2-1/2" hex bolts,1/2" lock-washers, and 1-1/2" UNF nylock nuts used to secure the pinion idler half-shafts to the bottom plate. Secure the rear of the stiffener plate with a 1/2" NC x 1-1/4" hex bolt and 1/2" lock-washer, next to the clutch bearing cap (see Illustration 3.H.3 next page).*

***ASSEMBLY PROCEDURE (continued...):***

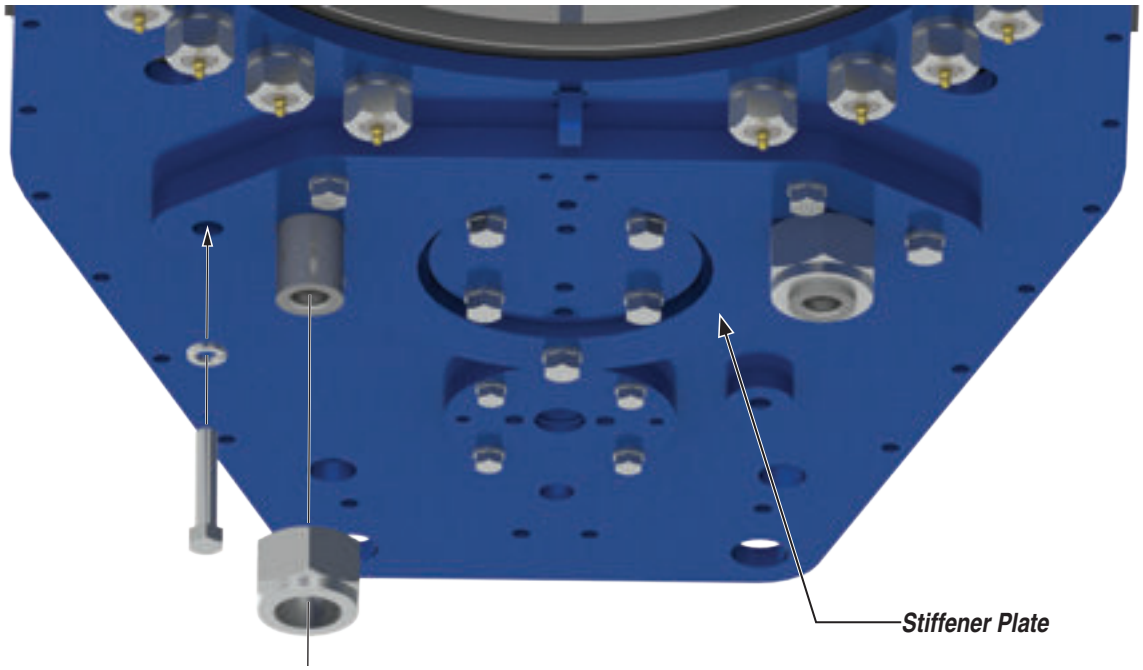



***ILLUSTRATION 3.H.3: STIFFENER PLATE INSTALLATION***

15. *Lightly grease clutch o-ring (PN 08-1240) and insert into the o-ring groove in the clutch bearing cap.*

***ILLUSTRATION 3.H.4: CLUTCH O-RING INSTALLATION***

16. *Lightly grease all four needle bearings (PN 02-1404), and slide two bearings over each end of the clutch shaft and press tight to the center gear in the clutch shaft.*
17. *Slide the high clutch gear (PN 997-HT-51B) over the bottom end of the clutch shaft (the bottom end of the clutch shaft can be identified by the threaded 1/8" NPT port for a grease fitting) and press on to the two needle bearings on that side of the center gear on the clutch shaft. Ensure the gear is properly oriented on the shaft - the smaller diameter portion of the gear must be oriented toward the center clutch shaft gear.*
18. *Slide the lower clutch spacer (PN 997-99) over the bottom end of the clutch shaft - the side of the spacer with the small shoulder should be oriented toward the lower clutch bearing and the flat side against the high clutch gear. 19. Insert the bottom end of the clutch shaft into the clutch bearing cap, ensuring that the o-ring does not become dislodged - the o-ring should slide over the outside circumference of the clutch shaft. Mesh the high clutch gear with the high pinion gear.*

***ASSEMBLY PROCEDURE (continued...):***

20. *Slide the shifting collar (PN 997-HT-62) over the top of the clutch shaft and mesh with the center clutch shaft gear.*
21. *Slide the low clutch gear (PN 997-HT-52) over the top of the clutch shaft and press onto the remaining two needle bearings - press tight to clutch shaft shaft center gear.*
22. *Slide clutch gear spacer (PN AK01-204) over the top of the clutch shaft and press tight to the low clutch gear.*
23. *Slide the low pinion gear (PN 997-A5-88) on to the pinion gear shaft, ensuring that the smaller diameter shoulder on the low pinion gear is facing up.*
24. *Insert two positioning dowel pins (PN 09-0092) into the two un-threaded holes in the side body weldment on either side of the door opening.*
25. *Install door latch post (PN 101-5108) into the machined hole in the front of the bottom plate next to the opening (see Illustration 3.H.5).*

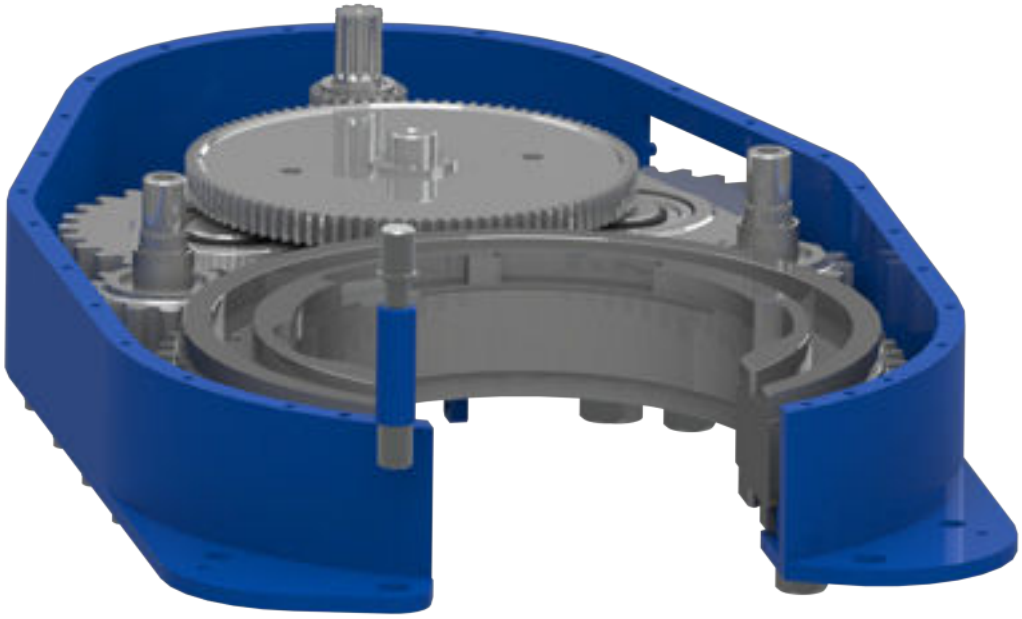


***ILLUSTRATION 3.H.5: DOOR LATCH POST INSTALLATION***

***ASSEMBLY PROCEDURE (continued...):***

26. *Install twenty cam followers (PN SSCF1500) onto the top plate as shown in the following illustration. Secure each cam follower with a 7/8" lock-washer and 7/8" NC hex nut.*

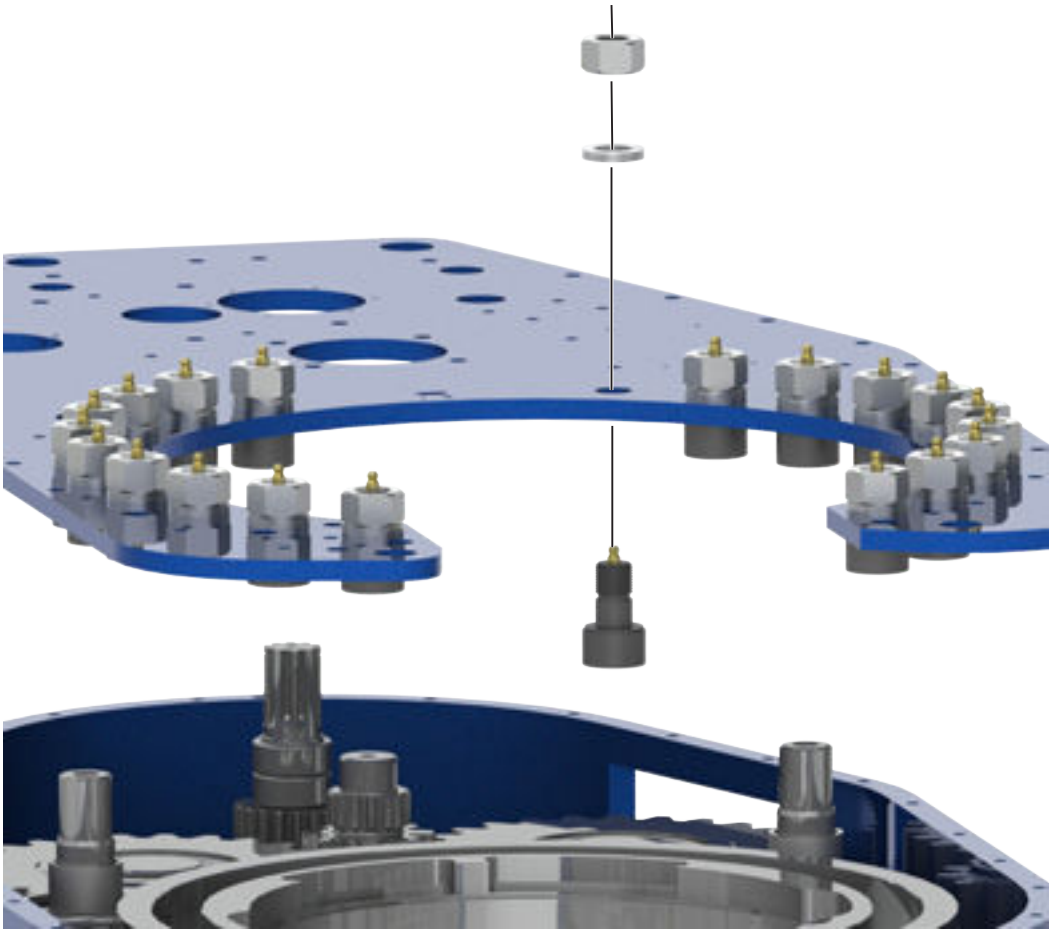


***ILLUSTRATION 3.H.6: CAM FOLLOWER INSTALLATION - TOP PLATE***

27. *Install top plate onto side body assembly, ensuring the door latch post fits into the machined hole in the top plate. Secure plate with 3/8" NC x 1-1/2" hex bolts and 3/8" lock-washers, and 3/8" NC x 1-1/4" hex socket head cap screws. Do not install fasteners in the rigid sling bracket or hydraulic support locations as shown in Figure 3.H.7.*

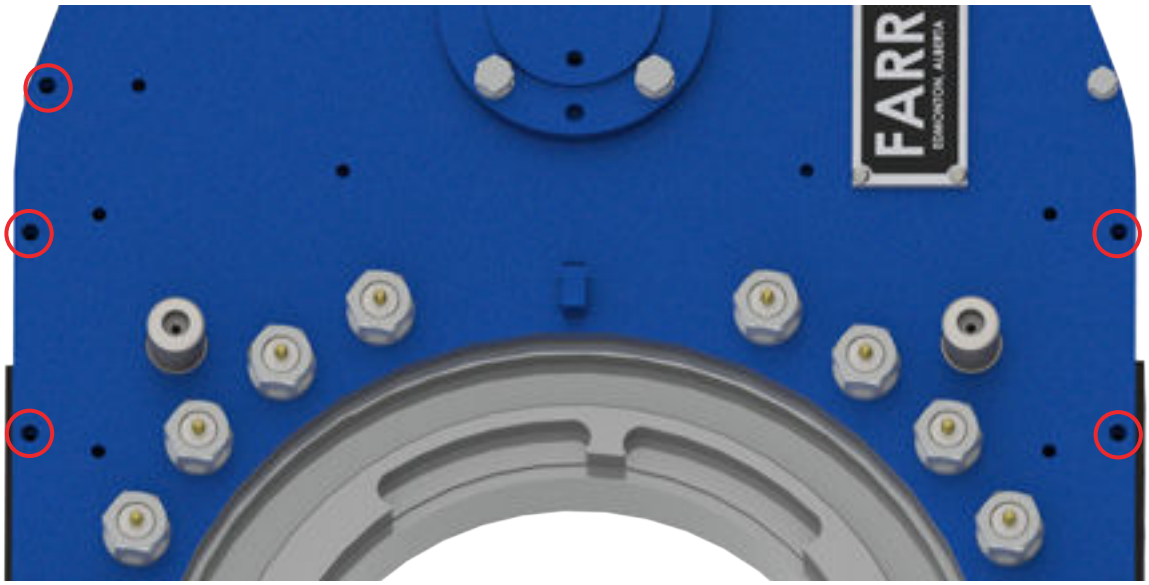



***ILLUSTRATION 3.H.7: TOP PLATE FASTENERS***

**ASSEMBLY PROCEDURE (continued...):**

28. Press top clutch bearing (PN 02-0077) into the top clutch bearing retainer (PN AK01-203), and install top clutch bearing/ bearing retainer on to the top plate using six 10-24 x 3/4" hex socket head cap screws.
29. Slide the bearing spacer (PN AK01-205) over the end of the clutch shaft.
30. Install clutch drive gear (PN 997-HT-61) on to the end of the clutch shaft, ensuring the "cut out" on the drive gear faces up. Secure with an external snap ring (PN 1234-00-04).
31. Press the remaining pinion bearing (PN 1234-08-01B) into the top pinion bearing cap (PN 997-D15-89), and install on to the top plate of the tong over the pinion shaft, ensuring that the pinion bearing spacer (PN 1400-89A) is placed between the bearing cap and the top plate. Secure with four 1/2" NC x 1-1/4" hex bolts and 1/2" lock-washers.
32. If not already done thread three 5/8" UNC hex socket set screws into the top shifter bushing (PN 101-0020). Thread the top shifter bushing into the top plate, ensuring the unplugged hole in the bushing faces toward the left rear of the tong at roughly a 45° angle. Thread the shifter detent tube (PN 101-0019) into the shifter bushing.

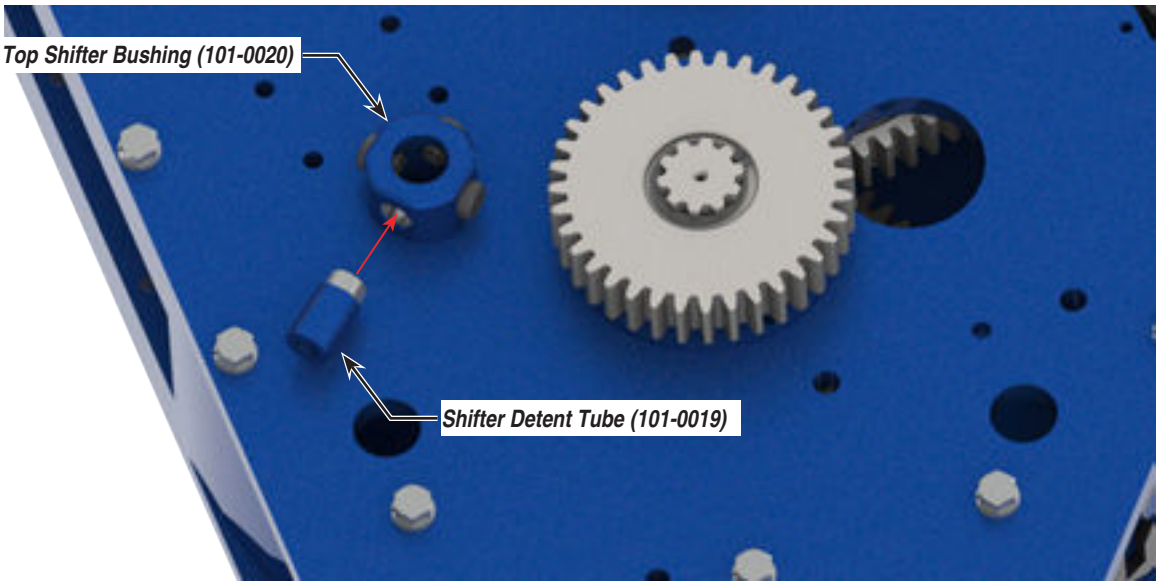



ILLUSTRATION 3.H.8: TOP SHIFTER BUSHING INSTALLATION

33. Position the shifting fork (PN 997-HT-72) in its proper position, engaged with the shifting collar. Lightly grease the shifting shaft (PN 1400-71) and insert through the top shifter bushing, which is typically welded to the top plate. Continue to insert the shaft through the shifting fork, and secure the shaft to the fork with a 5/8" UNF hex nut, and a 5/8" UNF hex jam nut.
34. Insert the shifter detent ball (PN 02-0018) into the detent tube on the top shifter bushing. Insert the shifter detent spring (PN 997-0-64) into the detent tube. Thread a 7/16" UNF jam nut on to the 7/16" UNF x 1-1/4" hex bolt, and then thread the bolt into the end of the detent tube. Lock the bolt to the detent tube with the hex nut. See Pg. 3.7 for information about adjusting the shifter detent tension.
35. Place two 5/16" motor mount positioning dowel pins (PN 09-0170) in to their locations in the un-threaded holes adjacent to the the clutch drive gear. Install the motor mount (PN-C8-150) on to the top plate and secure with four 1/2" NC x 2" hex socket head cap screws.
36. Install 5/16" x 5/16" x 2" square key into the key slot on hydraulic motor shaft. Install motor gear (PN 997-A10-149) on to the hydraulic motor shaft over the key, and secure with two 3/8" NC x 3/8" flat point hex socket set screws.
37. Install motor on to motor mount. Secure the RH side of the motor (as seen from the back of the tong) with two 1/2" NC x 1-1/2" hex socket head cap screws and 1/2" lock-washers. The torque gauge holder weldment (PN 1500-09-04A) is secured by the two LH motor screws - position the torque gauge holder weldment in place, and secure it and the LH side of the motor with two 1/2" NC x 1-1/4" hex socket head cap screws and 1/2" lock-washers.

***ASSEMBLY PROCEDURE (continued...):***

38. *Install twenty cam followers (PN 02-0016) into the bottom cage plate weldment (PN AK20-20W-KT), and secure the cam followers with 5/8" UNF thin nylock nuts. Install 20 cam followers into the top cage plate (PN AK20-10W-KT). Assemble the top and bottom cage plates around the body plates and rotary gear using two rear cage plate tubular spacers (101-4992), two threaded front cage plate spacers (PN AK20-031), two 1/2" NC x 6-1/4" bolts, two 1/2" narrow flat-washers, two 1/2" NC thin nylock nuts, four 5/16" NC hex nuts, and four 5/16" lock-washers.*

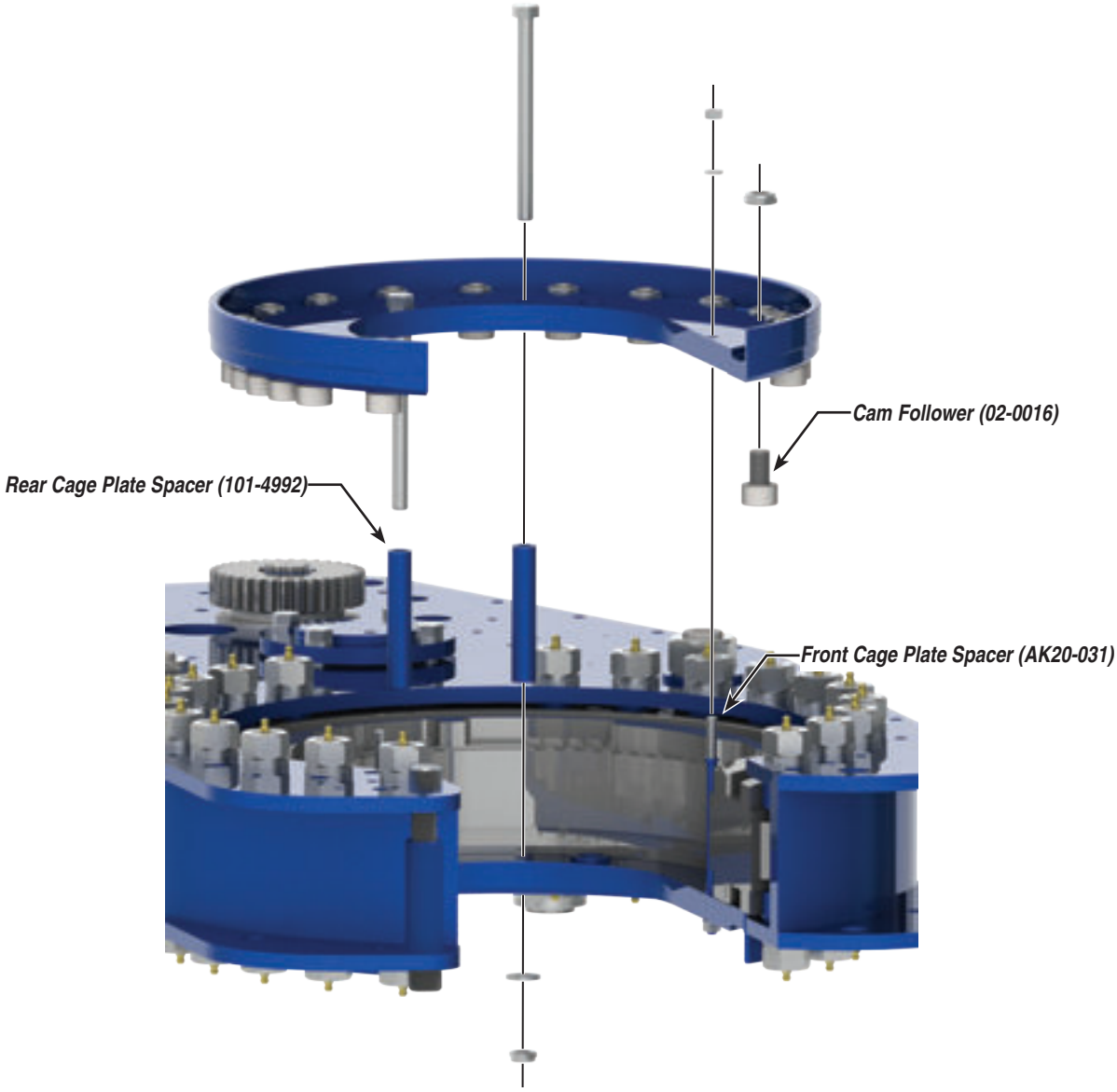



***ILLUSTRATION 3.H.9: CAGE PLATE ASSEMBLY***

39. *If not already done, thread 1-1/4" UNF nylock nuts on to each end of the rotary idler shafts.*
40. *If not already done, thread 1-1/2" UNF nylock nuts on to the ends of the pinion idler shafts.*
41. *Attach the shifter lug weldment (PN 101-0016) to the top plate of the tong next to the top shifter bushing weldment using four 3/8" NC x 1" hex bolts and 3/8" lock-washers.*
42. *Connect the shifter handle weldment's (PN AK00-092) pivot point to the pivot point of the shifter lug weldment using a 5/16" x 1-1/2" clevis pin. Connect the end of the shifter handle weldment to the top of the shifter shaft using a 5/16" x 1" clevis pin. Secure the clevis pins with .093" X 1.125" hitch pins.*
43. *Slide the backing pin retainer (PN 101-4040) over the backing pin spacer tube (PN 101-4995). Mount the spacer tube to the top cage plate using a 1/2" NC x 4-1/2" hex bolt, 1/2" narrow flat-washer, and a 1/2" NC thin nylock nut.*
44. *Ensure a 3/8" threaded stud (PN 101-4058) has been threaded into the backing pin (PN 101-4994). Insert the backing pin/threaded rod assembly through the backing pin retainer, and secure with the backing pin knob (see Pp 5.14 - 5.15 for a detailed assembly drawing).*

***ASSEMBLY PROCEDURE (continued...):***

45. *Install upper and lower lined brake band weldments (PN 101-4999). Secure the rear of the top brake band to the brake band retainer studs on the top and bottom plates with a 1/2" NC x 3-3/4" hex socket head cap screw and 1/2" NC thin nylock nut each, and secure the front of the weldments to the top and bottom plates with 1/2" x 1-1/2" hex socket shoulder screws.*
46. *Assemble the door latch (see Pp. 5.24-5.25 for an exploded view):*
    - i. *Insert the door latch shaft (PN 101-5249) through the bottom door plate until it is about halfway to the top door plate.*
    - ii. *Slide a door latch bushing (PN 02-E124) shoulder-down over the shaft until it is tight to the shoulder on the pivot shaft.*
    - iii. *Slide the door latch on to the bushing installed in the last step. ASSEMBLY NOTE: Ensure the latch is oriented toward the latch post installed in Step 25.*
    - iv. *Slide a second door latch bushing over the shaft, shoulder-down,*
    - v. *Install the latch handle weldment on to the second latch bushing, with the handle part of the weldment pointing toward the bottom plate of the door weldment.*
    - vi. *Slide a thrust washer (PN 02-E0125) over the top of the latch shaft..*
    - vii. *Slide the end of the latch shaft through the top door plate and secure with a 5/8" UNC nylock nut and 5/8" narrow flat washer.*
    - vi. *Insert the door latch spring (PN 997-13D) into the round receptacle in the door weldment (PN AK12-702B-KT-SINGLE).*

    ***ASSEMBLY NOTE:*** *See Illustration 3.H.10 for a view of the assembled latch.*

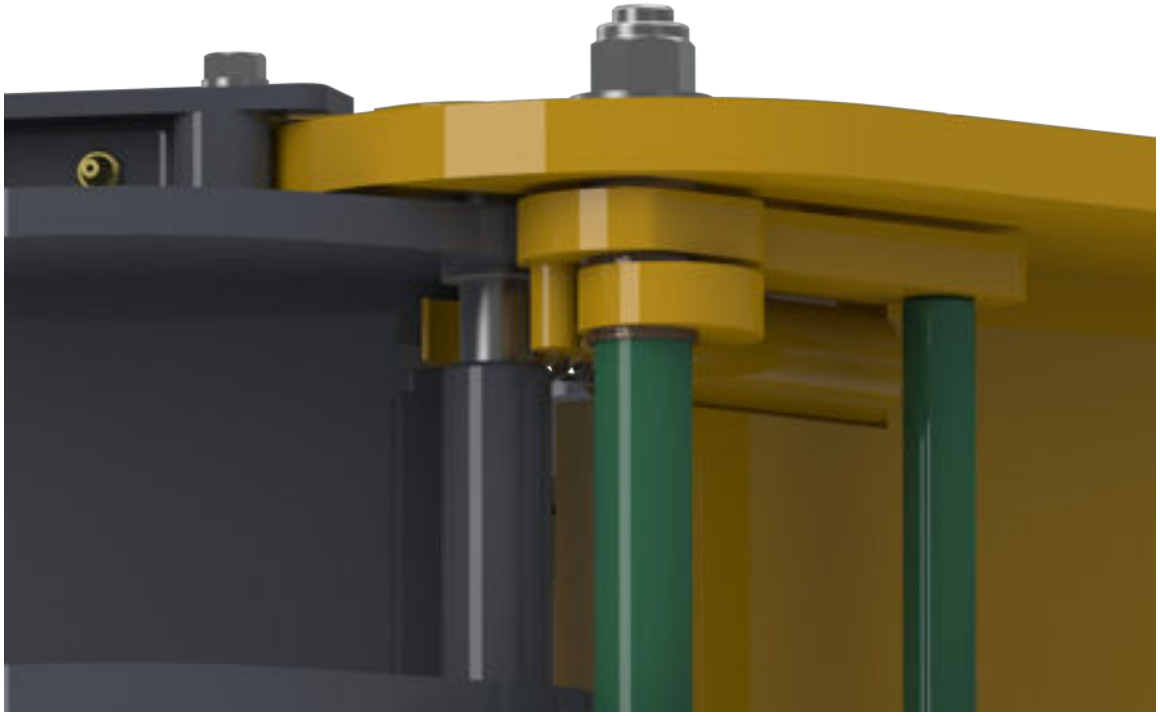


***ILLUSTRATION 3.H.10: TONG DOOR LATCH (ASSEMBLED)***

47. *Insert door bushings (PN 02-E0126) in to the top and bottom plates of the door weldment (PN AK12-702B-KT-SINGLE).*
48. *Position the door weldment over the top and bottom plates so the post holes in the door weldment align with the post holes in the body plates. Insert the door pivot shaft (PN 101-5034) from the top through the body plates and door weldment. Secure the shaft with a 3/4" UNC thin nylock nut and a 3/4 narrow flat washer.* ***ASSEMBLY NOTE:*** *Ensure a 1" regular flat washer is inserted between the bottom of the top door plate and the top of the top body plate, and the top of the bottom door plate and the bottom of the bottom plate.*
49. *Install the door cylinder (PN 101-0069) onto the lugs on the door weldment and body (typically welded to the top plates). Secure the rear of the cylinder with a 1/2" x 2" UNC hex socket head shoulder bolt, and the front of the cylinder with a 1/2" x 1" UNC hex socket head shoulder bolt.*
50. *Install the RH rigid sling bracket (PN 101-1244) and the LH rigid sling bracket (PN 101-1245). Secure each bracket to the top plate with two 3/8" x 2" hex bolts and lock-washers.*

***ASSEMBLY PROCEDURE (continued...):***

51. *Use a crane to position the rigid sling weldment, and connect to the two rigid sling brackets using one rigid sling pin (PN AK00-056) per side. Secure each rigid sling pin with two 0.243" x 5.125" hitch pins.*
52. *Pre-mount the main hydraulic inlet line to the inlet section on the valve bank. Mount the main valve bank to the valve mount weldment (PN AK00-070B-KT) using four 1/2" NC x 4-1/2" hex bolts, two 1/2" narrow flat-washers per bolt, and four 1/2" NC nylock nuts. Secure the hydraulic line to the top of the valve mount weldment using a 3/8" NC threaded U-bolt (PN 101-2075) and two 3/8" NC nylock nuts.*
53. *Install the valve mount weldment on the top plate, directly over the top pinion bearing cap. Secure with four 3/8" NC x 1" hex bolts and 3/8" lock-washers.*
54. *Attach the inlet coupling support weldment (PN 101-1138) to the top plate directly behind the RH rigid sling bracket. Secure with two 3/8" NC x 1" hex bolts and 3/8" lock-washers. Attach the adjustment plate (PN 101-5075) to the support weldment using four 3/8" NC x 1" hex bolts, two 3/8" narrow flat-washers per bolt, and four 3/8" NC nylock nuts.*
55. *Attach the two #20 (1-1/4") x JIC 1" flange elbows (PN 02-9216) to the motor ports using two #20 split flange kits (PN 02-9217).*
56. *Attach the valve mount handle weldment (PN AK00-076) to the top LH side of the valve mount weldment (as seen from the rear of the tong) using two 5/16" NC x 1" hex bolts, two 5/16" narrow flat-washers per bolt, and two 5/16" NC nylock nuts.*
57. *Thread the safety door plunger (PN 101-4360) on to one of the threaded ends of the push/pull control cable (PN 02-E0026). If this is final assembly use red or blue Loctite™ to secure the plunger to the control cable. Insert the end of the push-pull control cable with the plunger into the door-side cable guide holder (PN 101-4235) and adjust the positioning nut so that approximately 5/8" (1.5 cm) protrudes out the other end.*
58. *Thread a 10-32 x 1" coupling nut approximately halfway on to the other end of the control cable. This coupling serves as a contact spot with the control valve in the valve-side cable holder. If this is final assembly use red or blue Loctite™ to secure the coupling nut to the control cable.*
59. *Thread the modified Deltrol isolator valve (PN 08-0337M) into the cable guide holder (PN 101-4236). Install a 1/4" NPT x 1/4" JIC 90º elbow into each open port on the Deltrol valve.*
60. *Insert the end of the control cable with the coupling nut into the cable guide holder/Deltrol valve assembly. Ensure the coupling nut on the end of the cable contacts the actuator on the Deltrol valve, and secure the cable to the cable guide with the locking nuts.*
61. *Secure the cable guide holder to the top plate using the cable guide cover plate (PN 101-4237) and two 3/8" NC x 1-3/4" hex bolts and 3/8" lock-washers.*
62. *Use the 1-1/4" pipe clamp (PN 02-E0025), and a 3/16" NC x 3/4" hex bolt and 3/16" lock-washer to attach the cable guide holder to the valve mount weldment. See Section 3.E.3 for instructions for properly adjusting the safety door switch assembly.*
63. *Install grease fittings as follows:*

i. *Install a 1/4" UNF straight thread grease fitting (PN 02-0097) in the end of each rotary idler shaft, located on the top side of the tong.*

ii. *Install a 1/8" NPT grease fitting (PN 02-0005) in the end of each pinion idler half-shaft, located on the the bottom side of the tong.*

iii. *Install two 1/8" NPT 90 degree grease fittings (PN 02-0093) in each pinion bearing cap*

iv. *Install two 1/8" NPT 90 degree grease fittings (PN 02-0093) in the clutch bearing cap on either side of the center hole, and one 1/8" NPT grease fitting (PN 02-0005) in the end of the clutch shaft, accessed through the center hole in the clutch bearing cap.*

v. *Install a 1/8" NPT 90 degree grease fitting (PN 02-0093) in the threaded port on top of the motor mount.*

***ALL CAM FOLLOWERS ARE FACTORY-EQUIPPED WITH GREASE FITTINGS***

## I. DAILY INSPECTION & MAINTENANCE CHECKLIST (POWER TONG)

*Farr 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. 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..***

***DEPRESSURIZE HYDRAULIC SYSTEM IN PREPARATION FOR MAINTENANCE:***

2. ☐
   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***

3. ☐ *Perform an initial wash of the tong 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.*

4. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*

5. ☐ *Use a flashlight to perform a visual inspection of the gear train through the access panel and 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. Replace access panel when inspection is complete.*

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. Farr recommends that damaged or missing body parts be repaired or replaced as soon as possible.*

7. ☐ *Inspect the jaws and dies. 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 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.*

14. ☐ *Perform a complete greasing of the tong - refer to Maintenance section of the technical manual*

15. ☐ *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.*

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

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

18. ☐ *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.*

19. ☐ *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. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*

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

21. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*

22. ☐ *Test safety door feature (if equipped). Open the tong door(s), and attempt to rotate the cage plate at low speed (low gear) in both directions (makeup and breakout). If cage plate begins rotating, the safety door mechanism is not functional, and the tong must be removed from service until the safety door mechanism can be repaired. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

***NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR***

23. ☐ *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.*

### J. MONTHLY MAINTENANCE CHECKLIST - POWER TONG

*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. Farr 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. 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..***

***DEPRESSURIZE HYDRAULIC SYSTEM IN PREPARATION FOR MAINTENANCE:***

2. ☐
   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***

3. ☐ *Clean the exterior of the tool thoroughly, using either water (if using a pressure washer ensure a low-pressure wash wand is used), 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. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*

5. ☐ *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.*

6. ☐ *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.*

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

8. ☐ *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. Farr recommends that damaged or missing body parts be repaired or replaced as soon as possible.*

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 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 - "Farr Blue" is paint number RAL5005 (contact Farr sales for paint number for custom paint applications). Allow sufficient time for paint to dry before proceeding.*

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

12. ☐ *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 2A of the technical manual (Sling/Load Bearing Device Safety) for information on recommended testing and recertification. Please note that turnbuckles with part number 101-3086 (short turnbuckles) use a high-strength pin which must be supplied by Farr.*

***"SHORT" TURNBUCKLES HAVING PART NUMBER 101-3086 EMPLOY HIGH-STRENGTH PINS WHICH MUST BE SUPPLIED BY FARR.***

13. ☐ *Rotate the gear train by hand, and use a flashlight to perform a visual inspection of the gear train through the access panel and the opening of the rotary gear while the gear train is being rotated. If gear damage or chips of metal are seen, the tong should be removed from service and overhauled to avoid further damage. Replace access panel when inspection is complete.*

14. ☐ *Inspect all jaws and dies in use for the maintenance interval. Inspect the jaw roller pins for signs of damage - replace pins if necessary. If the 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.*

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

16. ☐ *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.*

17. ☐ *Inspect door springs. Ensure the springs retain sufficient strength to be able to assist the opening of the door, and to keep the door open. The springs should also help to "snap" the door shut.*

18. ☐ *Inspect backup springs (if applicable). The rear extension springs should be equally extended, and the front leg springs should be equally compressed. Ensure that neither of the rear backup springs have been over-extended and lack sufficient tension to adequately support the backup. Ensure that neither of the front leg springs have been over-compressed, and still retain enough spring strength to support the front of the backup.*

19. ☐ *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.*

20. ☐ *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.*

21. ☐ *Generously fill the gear train housing with grease through the access panel, and also through the opening in the rotary gear. Perform a full lubrication - refer to Maintenance section of manual to determine lubrication points.*

22. ☐ *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.*

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

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

25. ☐ *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.*

26. ☐ *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.*

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

28. ☐ *Re-energize power unit and extend all hydraulic cylinders. Inspect cylinder rods for signs of mechanical damage, flaking, or rust. Farr recommends that damaged cylinders be replaced.*

29. ☐ *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.*

30. ☐ *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 Maintenance Manual for all bearing locations).*

31. ☐ *Install load cell. If using a tension load cell, perform a visual inspection and replace any cracked, broken, or distorted components including links and chains. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*

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

33. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*

34. ☐ *Inspect load cell for damage or signs of stress. Check oil level in load cell and fill if necessary (refer to technical manual Section 7 or Section 8).*

35. ☐ *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 maintenance section of the manual for instructions on properly adjusting brake bands.*

36. ☐ *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.*

37. ☐ *Test safety door feature (if equipped). Begin rotating the tong at low speed, and open the tong door(s). If rotation does not immediately stop, this is an indication that the safety door mechanism is not operating correctly and the tong must be removed from service until the mechanism is repaired. Repeat the test while operating the tong in the opposite direction. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

***NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR***

38. ☐ *Farr 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.***

### K. DAILY INSPECTION & MAINTENANCE CHECKLIST (POWER UNIT)

*Farr recommends that the following inspections and maintenance procedures be performed before each use, and at least once per day when the equipment is in steady use, in the sequence in which they are listed. Rigorous inspection and maintenance, especially lubrication, is essential in order to ensure that your equipment always meets specifications, and to prevent catastrophic failures that can severely damage your equipment and cause worker injury.*

*If using a stand-alone power unit, perform the following inspection and maintenance procedures before each use, and at least once per day when the power unit is in steady use:*

*Do not perform any maintenance while the power unit is energized (electric) or if the engine is running (diesel). Ensure the electrical supply is locked out, or, if using a diesel power supply, ensure that the engine is locked out or the starting mechanism otherwise disabled.*

**DIESEL ONLY**

1. ☐ *Check engine oil levels - add if necessary*
2. ☐ *Check diesel fuel tank - fill if necessary.*
3. ☐ *Visually inspect all fan belts.*
4. ☐ *Activate mechanical shut-off device - ensure that shut-off switch on engine is engaging when manual shut-off switch is actuated.*

**ELECTRIC ONLY**

1. ☐ *Visually inspect all electrical lines and visible connections. If your unit is NOT explosion proof, open the electrical enclosure and VISUALLY inspect contacts and connections for signs of corrosion or arcing. Do not open explosion-proof enclosures.*

***NEVER PLACE HANDS INSIDE AN ELECTRICAL ENCLOSURE UNLESS YOU HAVE CONFIRMED THAT THE POWER HAS BEEN DISCONNECTED AND LOCKED OUT***

2. ☐ *Visually inspect main electrical line between main power source and power unit.*

**ALL UNITS**

5. ☐ *Perform a visual inspection of all parts. Check to ensure there are no loose or missing fasteners.*
6. ☐ *Check hydraulic fluid level - ensure level is approximately half-way up the sight glass on the hydraulic fluid reservoir.*
7. ☐ *Perform a visual inspection to ensure there are no hydraulic fluid leaks - correct if necessary.*
8. ☐ *Check that the main supply and return lines on the hydraulic fluid reservoir are both fully open.*
9. ☐ *Apply grease to any grease fittings that your power unit may have. Apply grease to each fitting until grease is visibly displaced from bearing, or as recommended by your power unit manual.*
10. ☐ *Ensure supply and return connections at the power unit and at the equipment in use are fully made up.*

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

11. ☐ *Check hydraulic fluid filter back pressure (must be done while fluid is circulating). If needle on indicator gauge is in the red zone, the filter should be changed the next time the unit is shut down*

## L. TUBULAR CONNECTION EQUIPMENT DE-COMMISSIONING PROCEDURE

*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..***

***DEPRESSURIZATION 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 (if equipped) are closed. Fully extend the lift cylinder (if equipped). If mounted in a frame, retract the float cylinders (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***

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. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
3. ☐ *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.*
4. ☐ *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.*
5. ☐ *Inspect all fasteners and fastener safety wires. Replace any missing fasteners - use Grade 8 bolts only. Re-torque all external fasteners to SAE specifications.*
6. ☐ *Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.*
7. ☐ *Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.*
8. ☐ *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 - "Farr Blue" is paint number RAL.5005. Allow sufficient time for paint to dry before proceeding.*
9. ☐ *Perform a liberal lubrication of the equipment - refer to Maintenance section of manual to determine lubrication points. Generously fill the gear train housing with grease through the access panel, and also through the opening in the rotary gear.*
10. ☐ *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.*
11. ☐ *Energize power unit.*
12. ☐ *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.*

13. ☐ *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.*

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

15. ☐ *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.*

16. ☐ *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.*

17. ☐ *If you are using a frame-mounted tool, the tong must be lowered onto the backup in order to remove the risk of sudden and catastrophic movement when pressure is removed from the float cylinders. Cover the top of the backup with protective cloth to protect the paint on the backup. Place two wooden beams across the top of the tong, ensuring that the beams have a minimum size of 4" x 4" x the width of the tong. Cover the tops of the wooden beams with more protective cloth to prevent paint damage to the tong. When lowering the tong onto the beams, ensure that the beams come into flat contact with the bottom of the tong, away from bearing caps, brake bands, or other protrusions on the bottom of the tong. Ensure that the tong hanger chains are loose, but not dangling into contact with the hangers or top plate of the tong.*

***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 (if equipped), retract and extend the remote backing pin ramp (if equipped), retract and extend the float cylinders. Leave 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 remaining hoses such as case drains, or lines connected to the turns counter.*

18. ☐ *If any hydraulic fittings or hoses are leaking they must be repaired or replaced before proceeding.*

19. ☐ *Wipe all excess grease from outside of equipment. Replace the access door panel. 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.*

20. ☐ *Farr recommends that chain slings be removed and stored separately. Rigid slings and other rigid suspension devices may remain in place.*

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

22. ☐ *Farr 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.*

### 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 external dimensions of a KT20000 20" power tong are 80.25" x 50.5" x 28", which calculates to an approximate volume of 113500 $in^3$, or 66 $ft^3$ (1.87 $m^3$).*

2) *Multiply the calculated air volume, in cubic feet, by the recommended amount of desiccant per cubic foot. Carrying forth the example used in the previous step, the required desiccant charge would be 3.5 g. x 66 $ft^3$, equaling 231 g. Several manufacturers offer silica gel desiccant in packaged quantities of 125 grams per bag, so two packages of desiccant 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.*

### 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 Farr have been strictly observed.*

1. ☐ *Remove all protective plastic wrapping. If there are desiccant packs with the assembly, they may be disposed of with the regular garbage.*
2. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
3. ☐ *Wipe excess grease or heavy oil from exposed cylinder rods.*
4. ☐ *If applicable, re-connect chain sling to lifting lugs. 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. 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.*
5. ☐ *Perform a liberal lubrication of the equipment - refer to Maintenance section of manual to determine lubrication points. Generously fill the gear train housing with grease through the access panel, and also 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 tong'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. Any leaking hydraulic fluid lines or fittings must be replaced before the equipment is returned to service.*
10. ☐ *Perform a thorough inspection of all seals. Any seal that is leaking or "weeping" must be replaced before the equipment is returned to service.*
11. ☐ *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. 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 access panel, and 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. If using a tension load cell, perform a visual inspection and replace any cracked, broken, or distorted components including links and chains. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*
17. ☐ *If applicable, inspect the load cell anchor pins (tension load cell only). Replace the anchor pins if cracking or metal distortion is seen.*
18. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*
19. ☐ *Re-energize power unit.*

20. ☐ *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.*

21. ☐ *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.*

22. ☐ *Test safety door feature (if equipped). Open the tong door(s), and attempt to rotate the cage plate at low speed (low gear) in both directions (makeup and breakout). If cage plate begins rotating, the safety door mechanism is not functional, and the tong must be removed from service until the safety door mechanism can be repaired. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

***NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR***

23. ☐ *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.*

24. ☐ *When all of the previous steps are completed, you may return your re-commissioned equipment to service.*

*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.*

### A. TONG WILL NOT DEVELOP SUFFICIENT TORQUE

1. *Malfunctioning relief valve on tong hydraulic circuit.*
   a. *POSSIBLE PROBLEM: Relief pressure set too low.*

      *SOLUTION: Increase setting. To check, block the oil line beyond the relief valve and determine pressure with a gauge.*

   b. *POSSIBLE PROBLEM: Relief valve is stuck.*

      *SOLUTION: Check for contamination of oil that may inhibit the way the valve actuates. Remove valve and clean, ensuring that the valve spring operates smoothly.*

   c. *POSSIBLE PROBLEM: Relief valve is leaking.*

      *SOLUTION: Check valve seat for scouring. Check oil seals. Check for particles stuck under the valve system.*

2. *POSSIBLE PROBLEM: Directional valve is leaking.*

   *SOLUTION: Check directional valve. Neutral position should return fluid directly to the reservoir. Replace or repair valve to ensure correct operation.*

3. *POSSIBLE PROBLEM: Power unit is not producing adequate pressure.*

   *SOLUTION: Troubleshoot power unit (see user's manual for your particular unit).*

4. *POSSIBLE PROBLEM: Poor hydraulic pressure at the tong despite adequate pressure at the power unit, or excessive back pressure in the return line.*

   *SOLUTION: 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. *POSSIBLE PROBLEM: Fluid viscosity is not appropriate (too high or too low).*

   *SOLUTION: Ensure hydraulic fluid being used is the viscosity recommended by McCoy Drilling & Completions. 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.*

   *SOLUTION: 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. *POSSIBLE PROBLEM: Worn or damaged tong motor causing slippage.*

   *SOLUTION: Replace or repair worn or damaged motor.*

7. *POSSIBLE PROBLEM: Damaged bearings or gears causing excessive drag.*

   *SOLUTION: Replace or repair worn or damaged gears or bearings.*

8. *POSSIBLE PROBLEM: Jaws slipping on pipe.*

   *SOLUTION: Ensure jaw dies are not worn to the point that they cannot grip. Ensure the correct sized jaws are in use.*

9. *POSSIBLE PROBLEM: Torque gauge is indicating incorrectly*

   *SOLUTION: 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.*

   *SOLUTION: Gauge has been damaged. Check gauge operation and calibration on independent system.*

***TONG WILL NOT DEVELOP SUFFICIENT TORQUE Cont'd:***

10. *POSSIBLE PROBLEM: Load cell is measuring incorrectly.*

    *SOLUTION: Incorrect load cell is being used.*

    *SOLUTION: Air is trapped in torque measuring circuit (load cell, hydraulic line, or gauge. Refer to torque measurement troubleshooting in Section 6 of this manual.*

    *SOLUTION: Load cell has been damaged. Replace load cell, or return to McCoy for repair and re-calibration.*

11. *POSSIBLE PROBLEM: Incorrect motor speed selected.*

    *SOLUTION: Maximum torque can only be developed when motor is in the lowest speed. Ensure motor is in low speed.*

12. *POSSIBLE PROBLEM: Incorrect tong gear selected.*

    *SOLUTION: Maximum torque can only be developed when tong is in low gear. Ensure tong is in low gear.*

***FARR CANADA CORP. GUARANTEES CALIBRATION OF A LOAD CELL/TORQUE GAUGE ASSEMBLY FOR A PERIOD OF ONE YEAR. FARR CANADA CORP. RECOMMENDS THAT THE LOAD CELL/TORQUE GAUGE ASSEMBLY BE RETURNED TO THE FACTORY FOR RE-CALIBRATION ONCE PER YEAR.***

**B. FAILURE OF JAWS TO GRIP PIPE**

1. *POSSIBLE PROBLEM: Dies have become too dull to provide adequate grip.*
   *SOLUTION: Replace dies.*

2. *POSSIBLE PROBLEM: Incorrect jaws are being used.*
   *SOLUTION: Double-check jaw size to ensure they are rated for the diameter of pipe or casing being run.*

3. *POSSIBLE PROBLEM: Incorrect dies are being used*
   *SOLUTION: Ensure dies loaded in the jaws are appropriate for the type of pipe or casing being run.*

4. *POSSIBLE PROBLEM: Brake bands are insufficiently adjusted, not allowing jaws to cam properly.*
   *SOLUTION: Adjust brake bands to give proper resistance to cage plates.*

5. *POSSIBLE PROBLEM: Jaw roller broken or worn.*
   *SOLUTION: Remove jaw assembly and inspect. Replace rollers that are visibly "flat-spotted" or otherwise damaged.*

### C. TONG RUNNING TOO SLOWLY

1. *POSSIBLE PROBLEM: Obstruction in tong hydraulic circuit preventing adequate flow.*
   *SOLUTION: Inspect self-sealing couplings to ensure they are properly engaged.*
   *SOLUTION: The main hydraulic lines (supply and discharge) to the tong are obstructed. Remove and clean if required.*

2. *POSSIBLE PROBLEM: Power unit is not producing adequate flow or pressure.*
   *SOLUTION: Troubleshoot power unit (see user's manual for your particular unit).*

3. *POSSIBLE PROBLEM: Tong motor is excessively worn and is leaking hydraulic fluid past the vanes.*
   *SOLUTION: Replace motor, or rebuild as per Section 7 of this manual.*

4. *POSSIBLE PROBLEM: Bearings in gear train and rotary section are excessively worn.*
   *SOLUTION: Overhaul tong. See Section 3 of this manual for tong overhaul procedures.*

5. *POSSIBLE PROBLEM: Shifter has malfunctioned and the tong is not shifting to high gear.*
   *SOLUTION: Inspect and repair shift mechanism as necessary.*

6. *POSSIBLE PROBLEM: Two-speed hydraulic motor (if equipped) is not set to correct speed.*
   *SOLUTION: Check motor, and set to the correct speed if required.*

7. *POSSIBLE PROBLEM: Safety door system is not properly adjusted - hydraulic fluid leak past Deltrol valve.*
   *SOLUTION: Check and adjust safety door system.*

8. *POSSIBLE PROBLEM: Hydraulic fluid viscosity too high.*
   *SOLUTION: Ensure hydraulic fluid meets McCoy Drilling & Completions specifications.*
   *SOLUTION: Ensure hydraulic fluid is appropriate for climatic conditions, especially during cold-weather operation..*

9. *POSSIBLE PROBLEM: By-pass valve not functioning.*
   *SOLUTION: Check and repair.*

### D. FAILURE OR DIFFICULTY OF TONG TO SHIFT

1. *POSSIBLE PROBLEM: Bent or broken shifter handle.*
   *SOLUTION: Replace shifter handle.*

2. *POSSIBLE PROBLEM: Bent or broken shifter yoke.*
   *SOLUTION: Inspect and replace shifter yoke.*

3. *POSSIBLE PROBLEM: "Frozen" or hard-to-move shifter handle.*
   *SOLUTION: Grease shifter shaft.*

4. *POSSIBLE PROBLEM: Bent or broken shifter shaft.*
   *SOLUTION: Replace.*

5. *POSSIBLE PROBLEM: Locking nuts on shifting shaft have loosened and position of yoke has changed.*
   *SOLUTION: Reposition yoke and re-tighten locking nuts.*

6. *POSSIBLE PROBLEM: Shifting yoke has come loose from shifting shaft*
   *SOLUTION: Inspect yoke and inspect for damage. If free of damage, replace on shaft and tighten locking nuts.*

7. *POSSIBLE PROBLEM: Tong pops out of gear*
   *SOLUTION: Ensure that detent ball & spring assembly has been correctly set.*

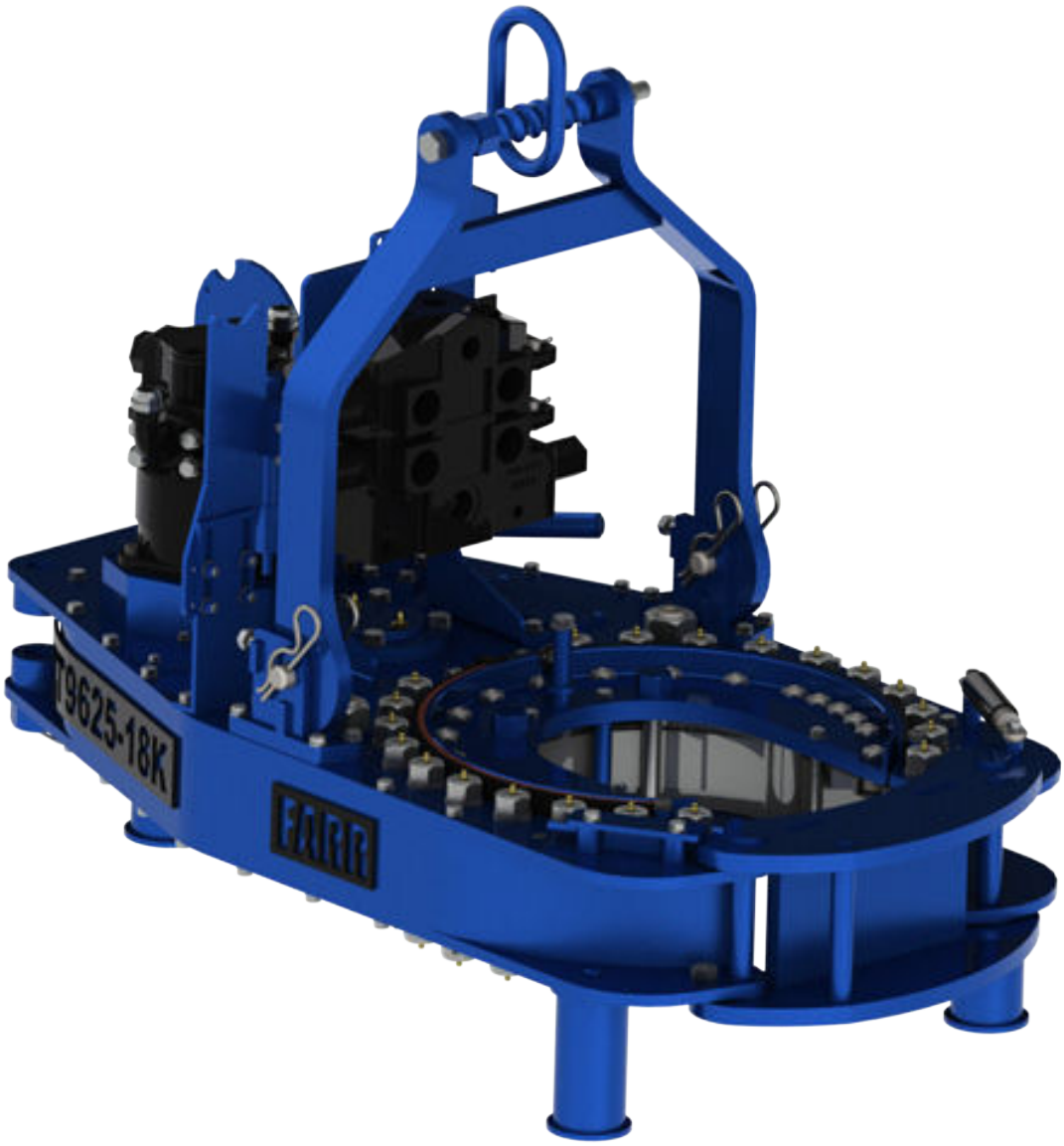
### H. GENERAL COMMENTS

*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.*

# KT-9625 9 5/8" 18K Tong




# Parts and Assemblies

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DRILLING & COMPLETIONS
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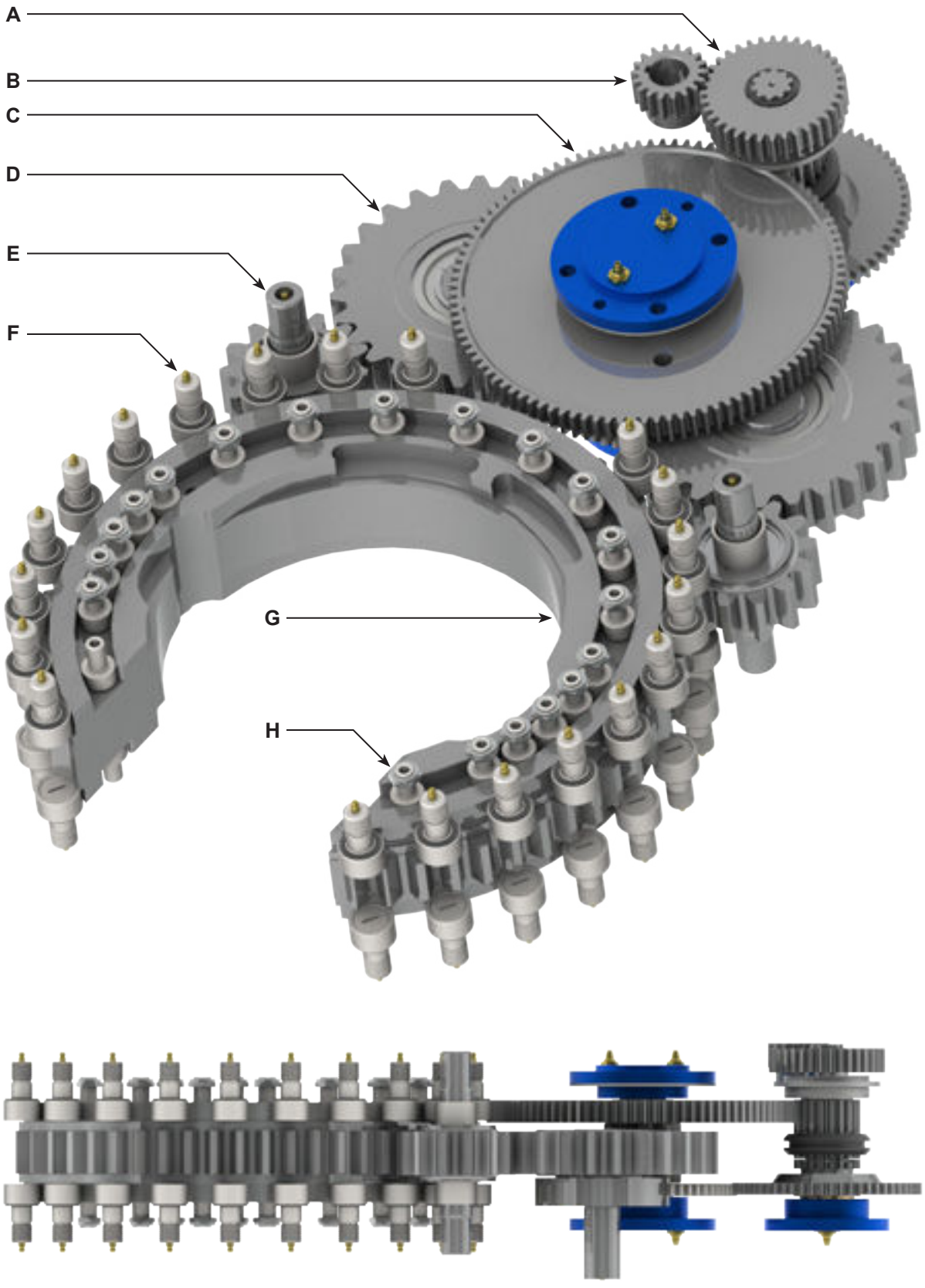
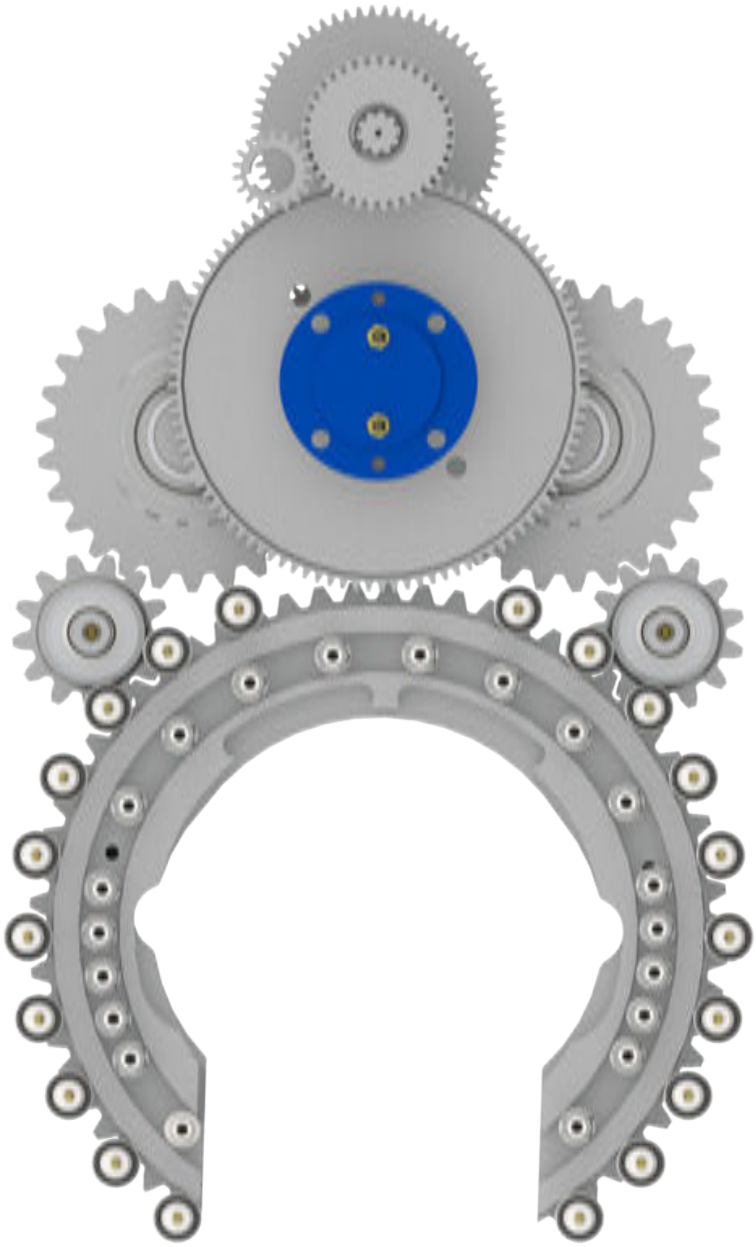
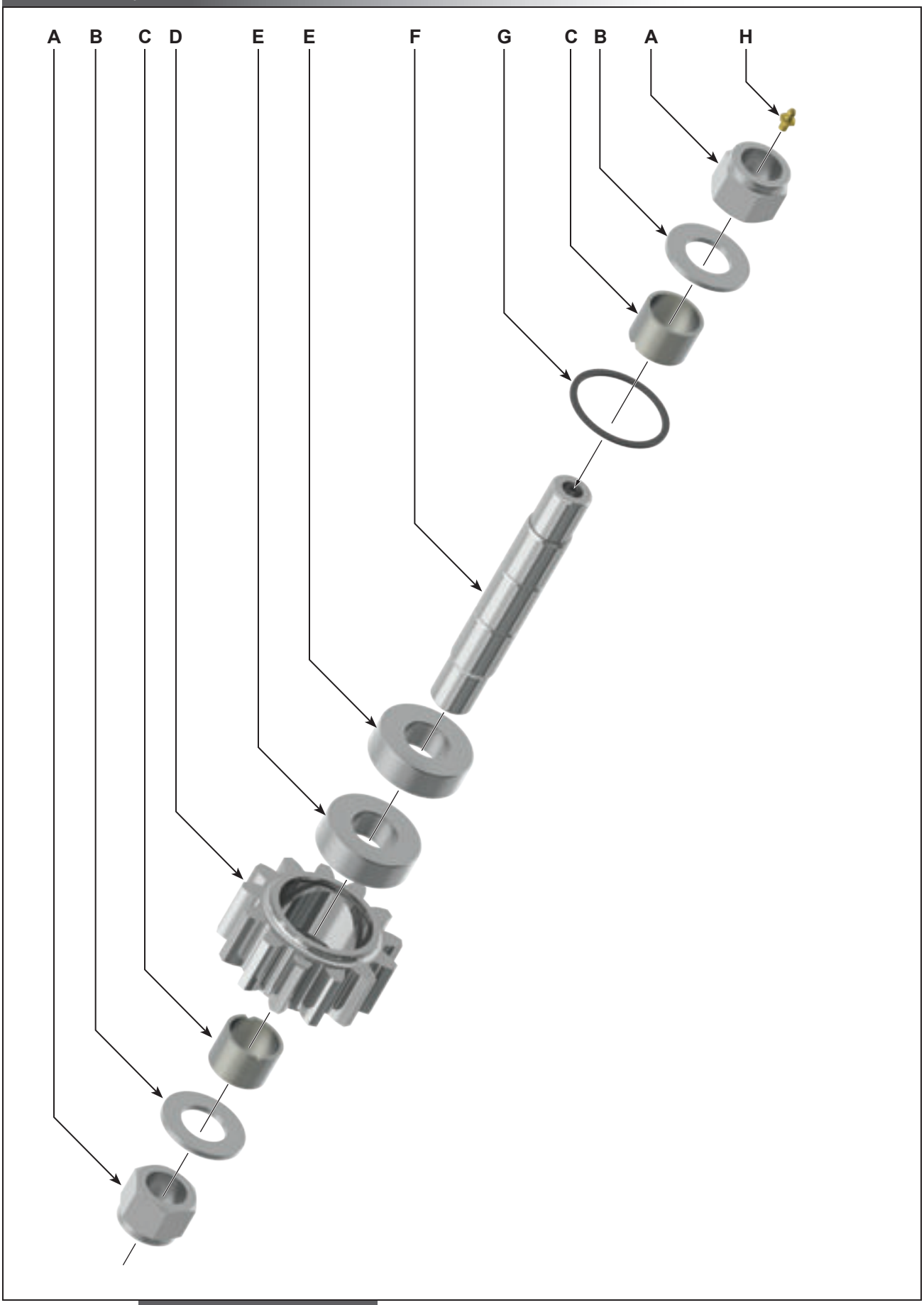
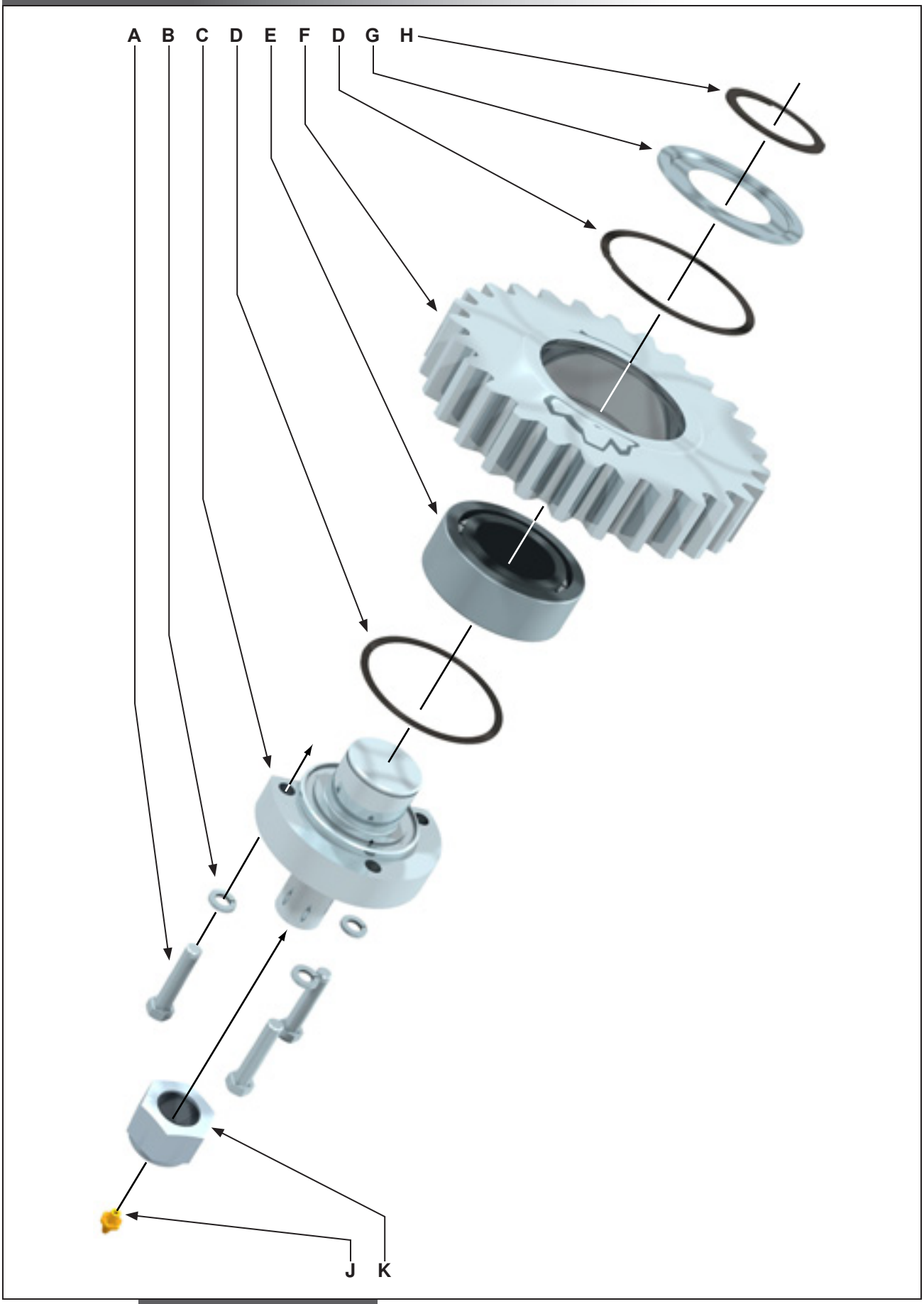


| ITEM | TYPE | DESCRIPTION | QTY | PART NUMBER |
|---|---|---|---|---|
| A | Assembly | Clutch Assembly (See Pp. 5.10 - 5.11) | 1 | CA-LW-9625 |
| B | Part | Motor Gear | 1 | 997-A10-149 |
| C | Assembly | Pinion Gear Assembly (See Pp. 5.8 - 5.9) | 1 | PA-LW-9625 |
| D | Assembly | Pinion Idler Assembly (See Pp. 5.6 - 5.7) | 2 | PIA-LW-9625 |
| E | Assembly | Rotary Idler Assembly (See Pp. 5.4 - 5.5) | 2 | RIA-KT9625 |
| F | Part | Cam Follower | 40 | SSCF1500 |
| G | Part | Rotary Gear | 1 | AK01-001-KT |
| H | Part | Cam Follower | 40 | 02-0016 |

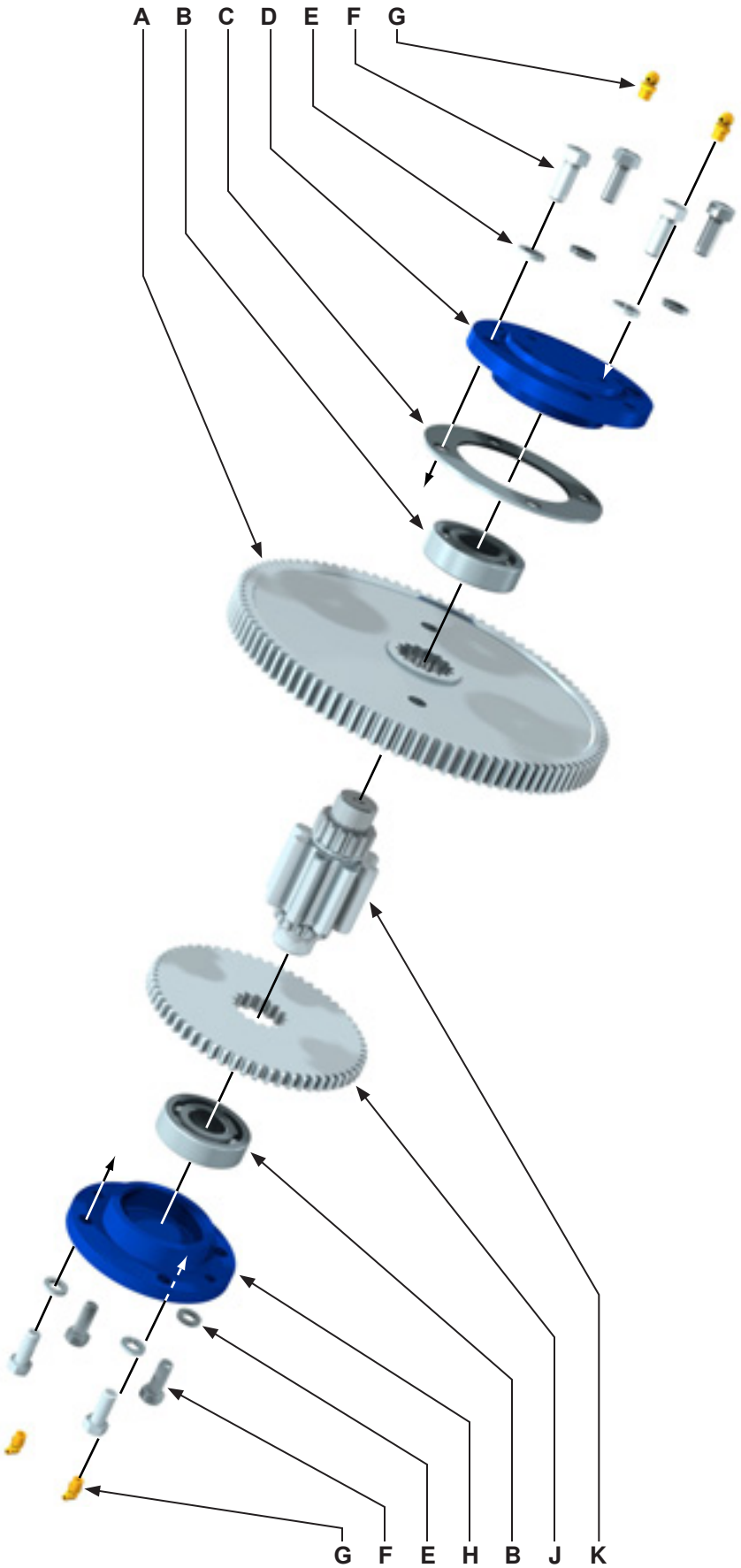


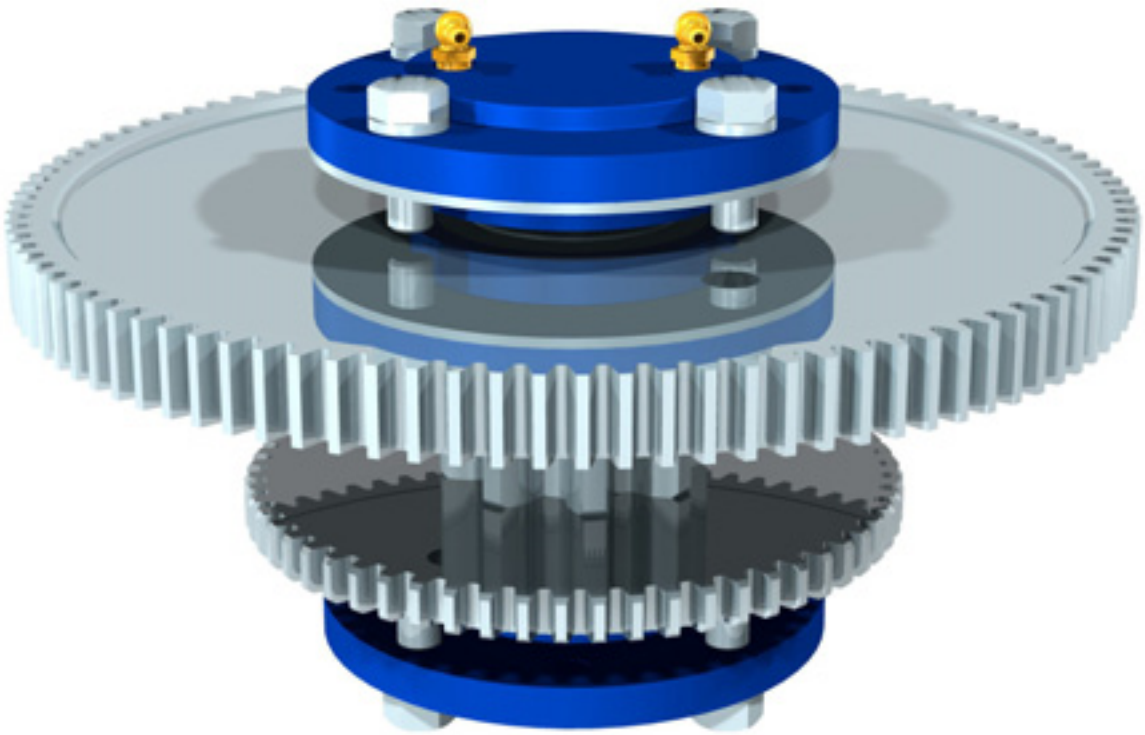


| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1-1/4" UNF Hex Nylock Nut | 2 | 09-5702 |
| B | Part | 1-1/4" Narrow Flat Washer | 2 | |
| C | Part | Rotary Idler Spacer | 2 | 101-5006 |
| D | Part | Rotary Idler Gear | 1 | AK01-102 |
| E | Part | Cylindrical Roller Bearing | 2 | 02-E0104 |
| F | Part | Rotary Idler Shaft | 1 | 101-5005 |
| G | Part | Internal Retaining Ring | 1 | 02-E0105 |
| H | Part | Grease Fitting, 1/4" straight thread | 1 | 02-0097 |

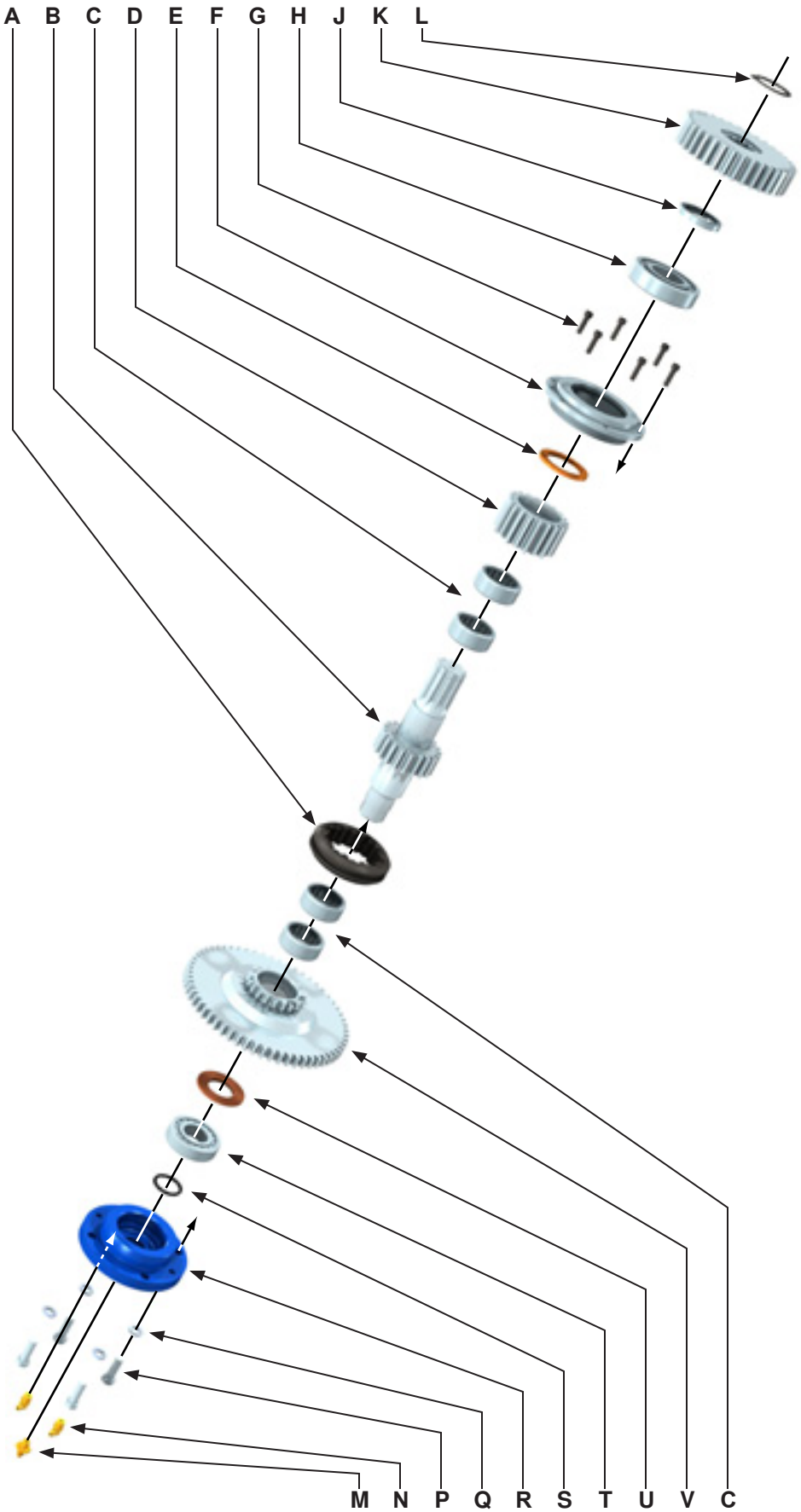


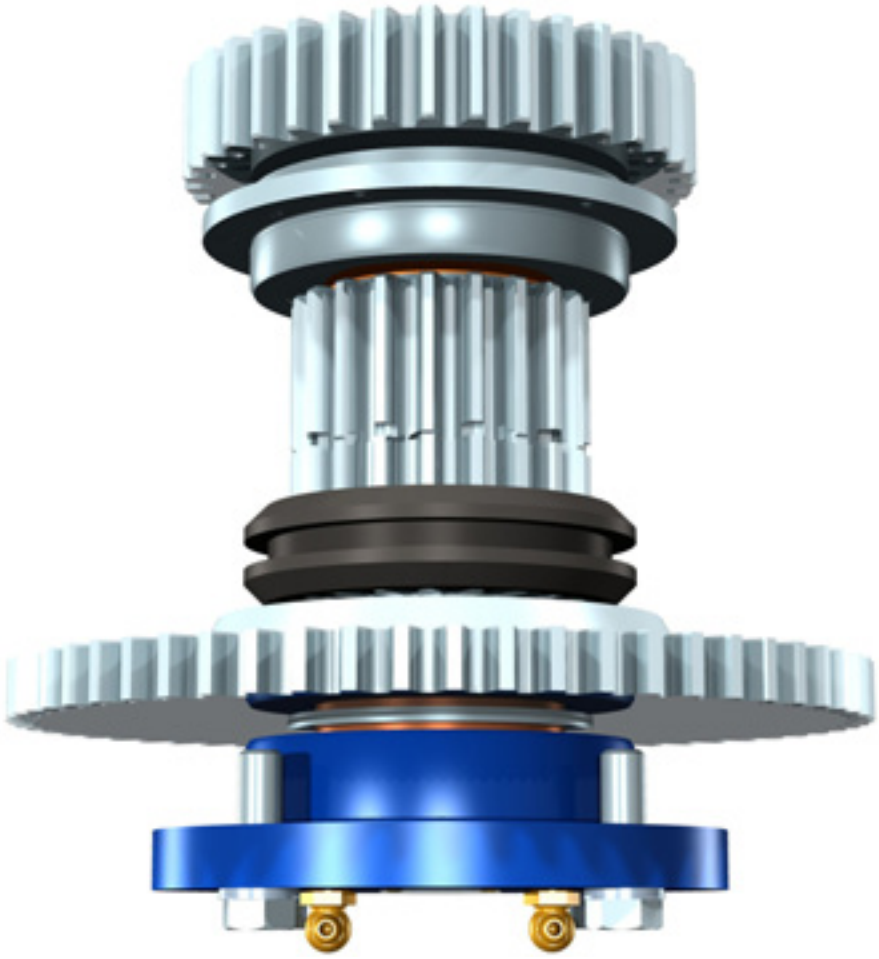
| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1/2" NC x 2-1/2" Hex Bolt | 3 | 09-1176 |
| B | Part | 1/2" Lock Washer | 3 | 09-5110 |
| C | Part | Pinion Idler Half Shaft | 1 | AK01-121 |
| D | Part | Gear Retainer | 2 | 02-0009 |
| E | Part | Bearing MU5212TM | 1 | 02-0075 |
| F | Part | Pinion Idler Gear | 1 | AK01-122 |
| G | Part | Bearing Seal | 1 | 02-0010 |
| H | Part | Bearing Retainer | 1 | 02-0008 |
| J | Part | Grease Fitting, 1/8" NPT | 1 | 02-0005 |
| K | Part | 1-1/2" Nylock Nut | 1 | 09-5740 |



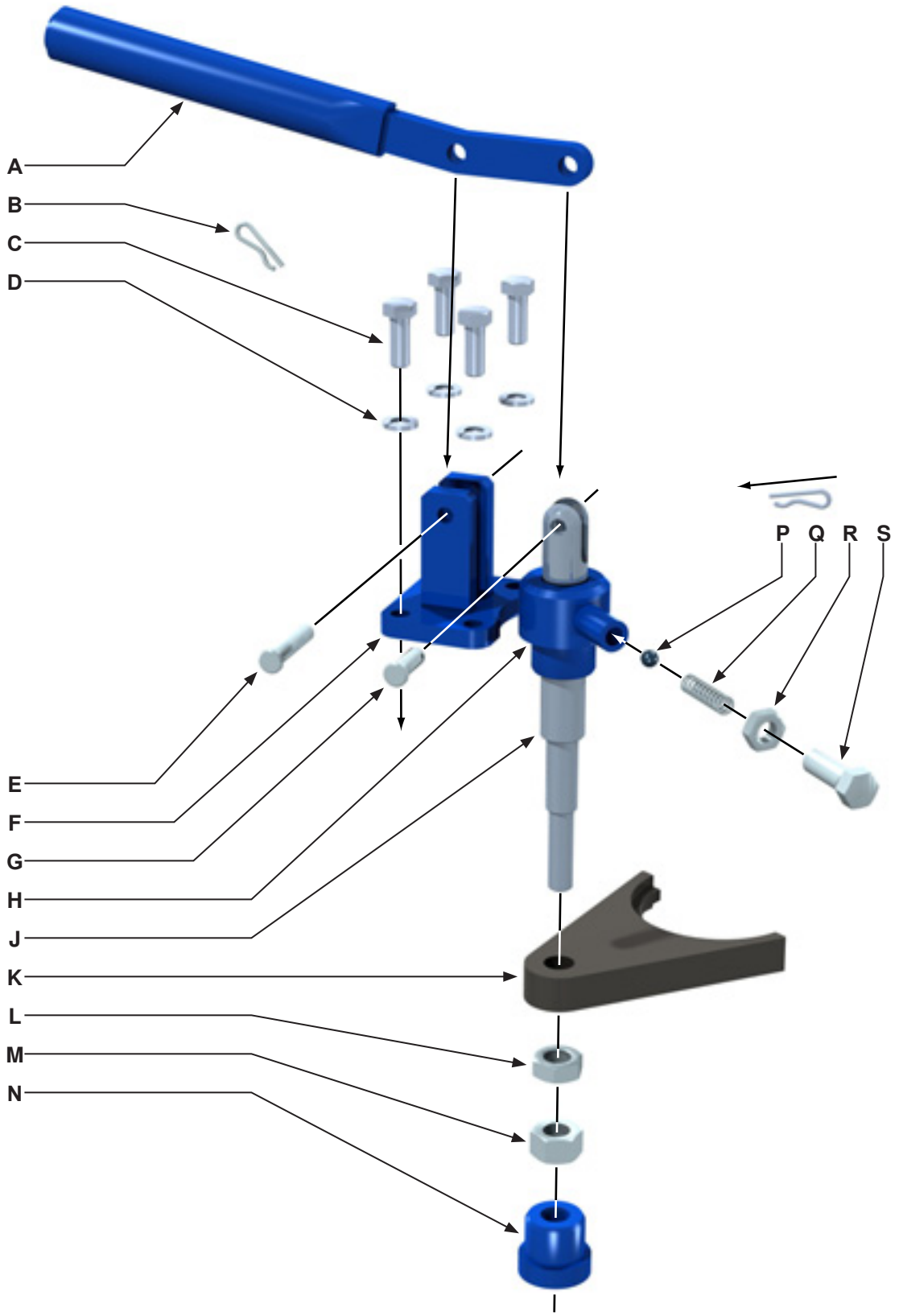


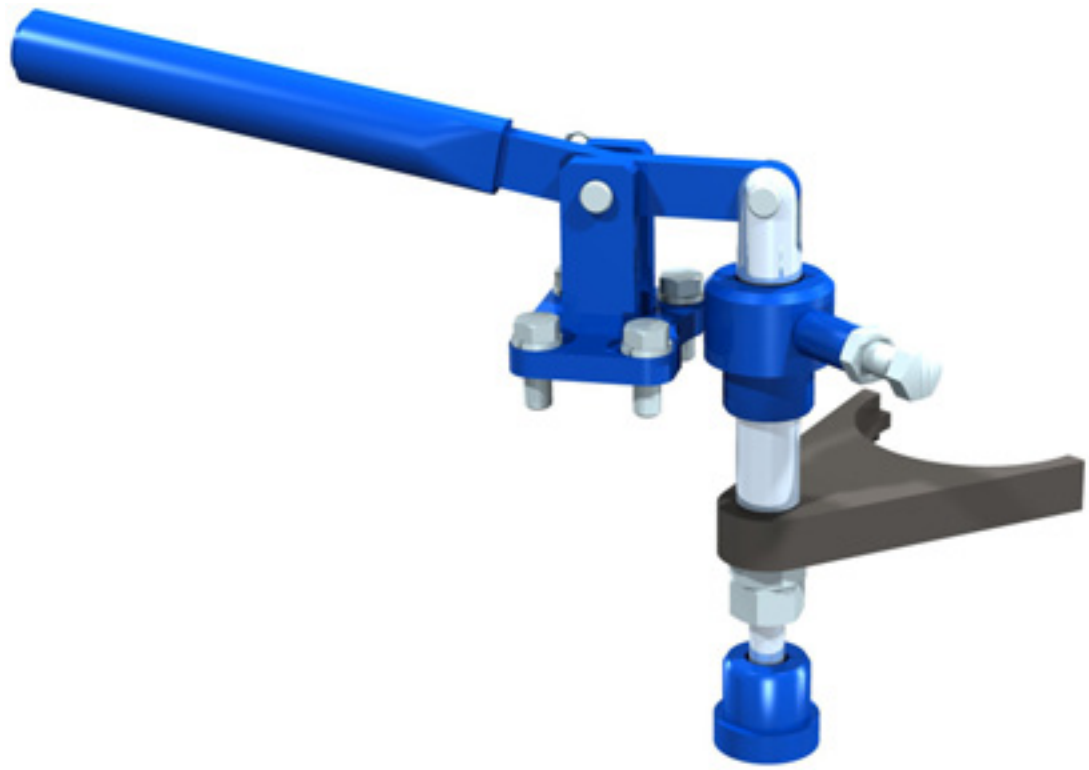
| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | Low Pinion Gear | 1 | 997-A5-88 |
| B | Part | Cylindrical Roller Bearing | 2 | 1234-08-01B |
| C | Part | Pinion Bearing Spacer | 1 | 1400-89A |
| D | Part | Top Pinion Bearing Cap | 1 | 997-D15-89 |
| E | Part | 1/2" Lock Washers | 8 | 09-5110 |
| F | Part | 1/2" NC x 1-1/4" Hex Bolts | 8 | 09-1168 |
| G | Part | 1/8" NPT 90 DEG Grease Fitting | 4 | 02-0093 |
| H | Part | Bottom Pinion Bearing Cap | 1 | AK01-151 |
| J | Part | High Pinion Gear | 1 | 997-A4-87B |
| K | Part | Pinion Gear Shaft | 1 | 997-A7-86B |



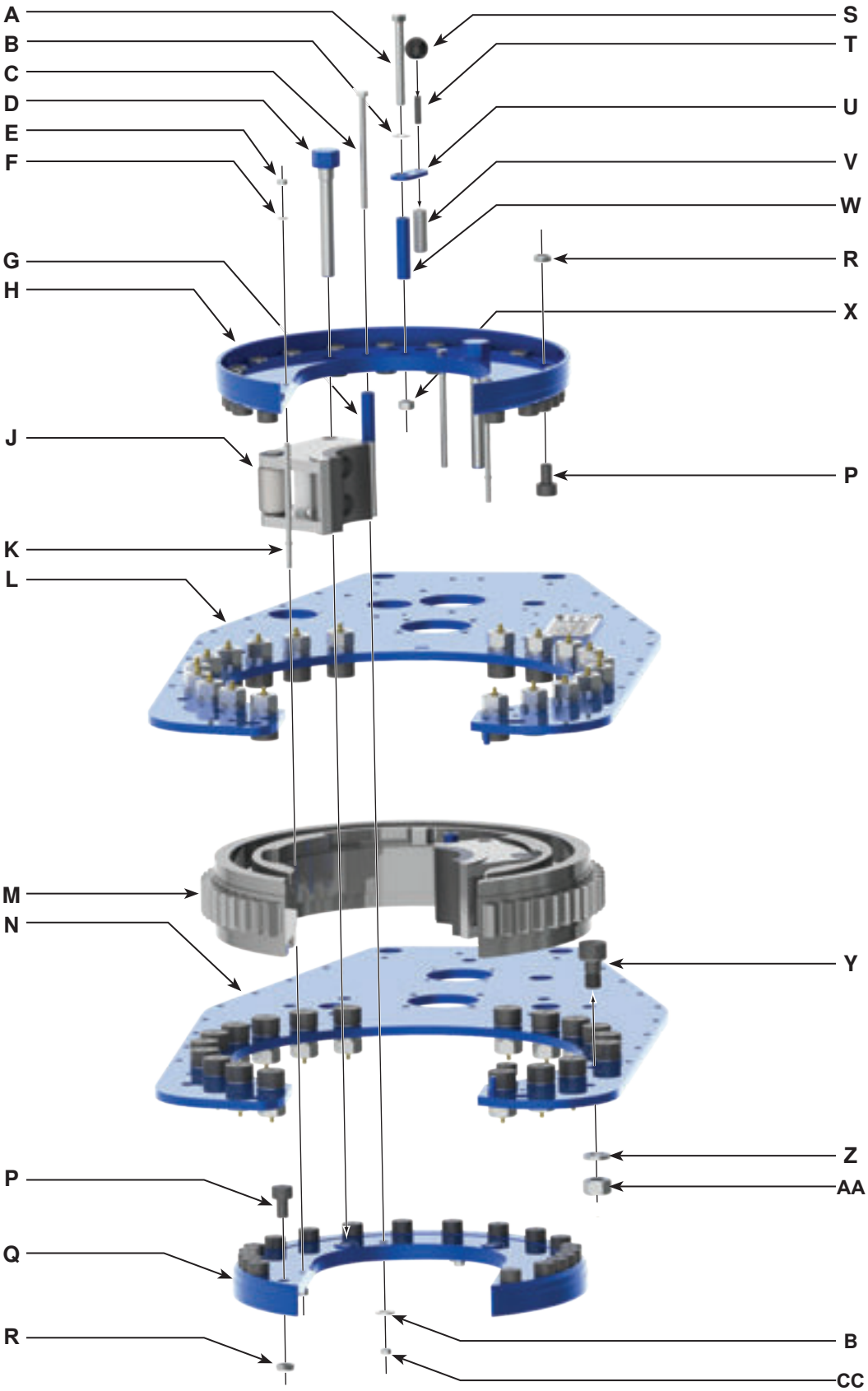


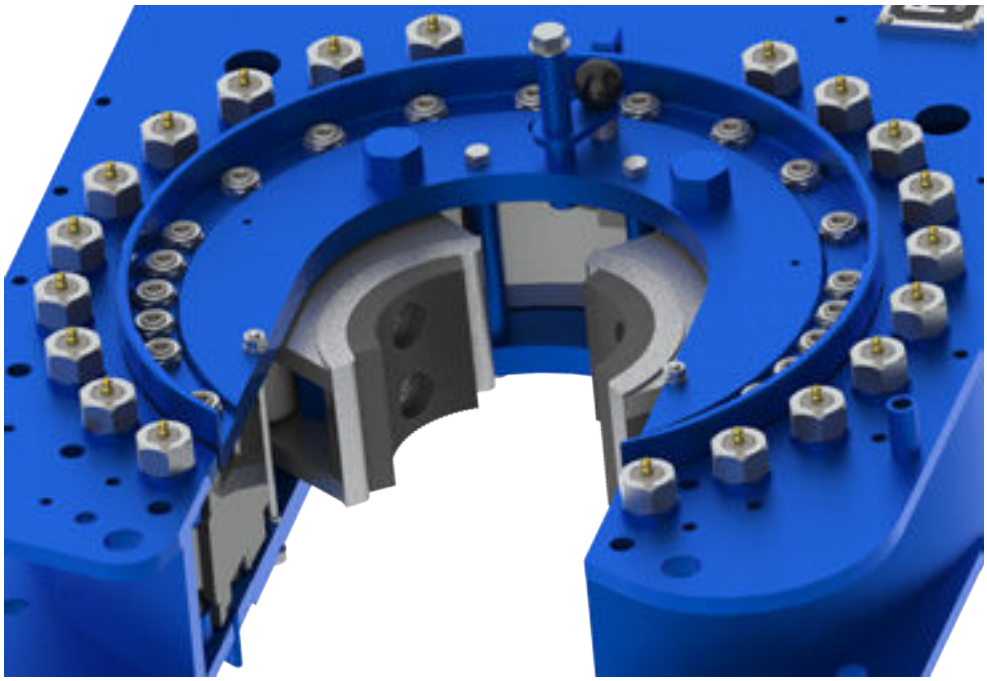
| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | Shifting Collar | 1 | 997-HT-62 |
| B | Part | Splined Clutch Shaft | 1 | AK01-202 |
| C | Part | Needle Roller Bearing | 4 | 02-1404 |
| D | Part | Low Clutch Gear | 1 | 997-HT-52 |
| E | Part | Top Clutch Bearing Spacer | 1 | AK01-204 |
| F | Part | Top Bearing Retainer | 1 | AK01-203 |
| G | Part | #10 x 3/4" Hex SHCS | 6 | 09-0001 |
| H | Part | Top Clutch Bearing | 1 | 02-0077 |
| J | Part | Top Clutch Spacer | 1 | AK01-205 |
| K | Part | Drive Gear | 1 | 997-HT-61 |
| L | Part | Outside Snap Ring | 1 | 1234-00-04 |
| M | Part | 1/8" NPT Grease Fitting | 1 | 02-0005 |
| N | Part | 1/8" NPT 90 Deg. Grease Fitting | 2 | 02-0093 |
| P | Part | 3/8" NC x 1-1/4" Hex Bolt | 4 | 09-1048 |
| Q | Part | 3/8" Lock Washer | 4 | 09-5106 |
| R | Part | Clutch Bearing Cap | 1 | AK01-201 |
| S | Part | Clutch O-Ring | 1 | 08-1240 |
| T | Part | Bottom Clutch Bearing | 1 | 02-0076 |
| U | Part | Bottom Clutch Spacer | 1 | 997-99 |
| V | Part | High Clutch Gear | 1 | 997-HT-51B |



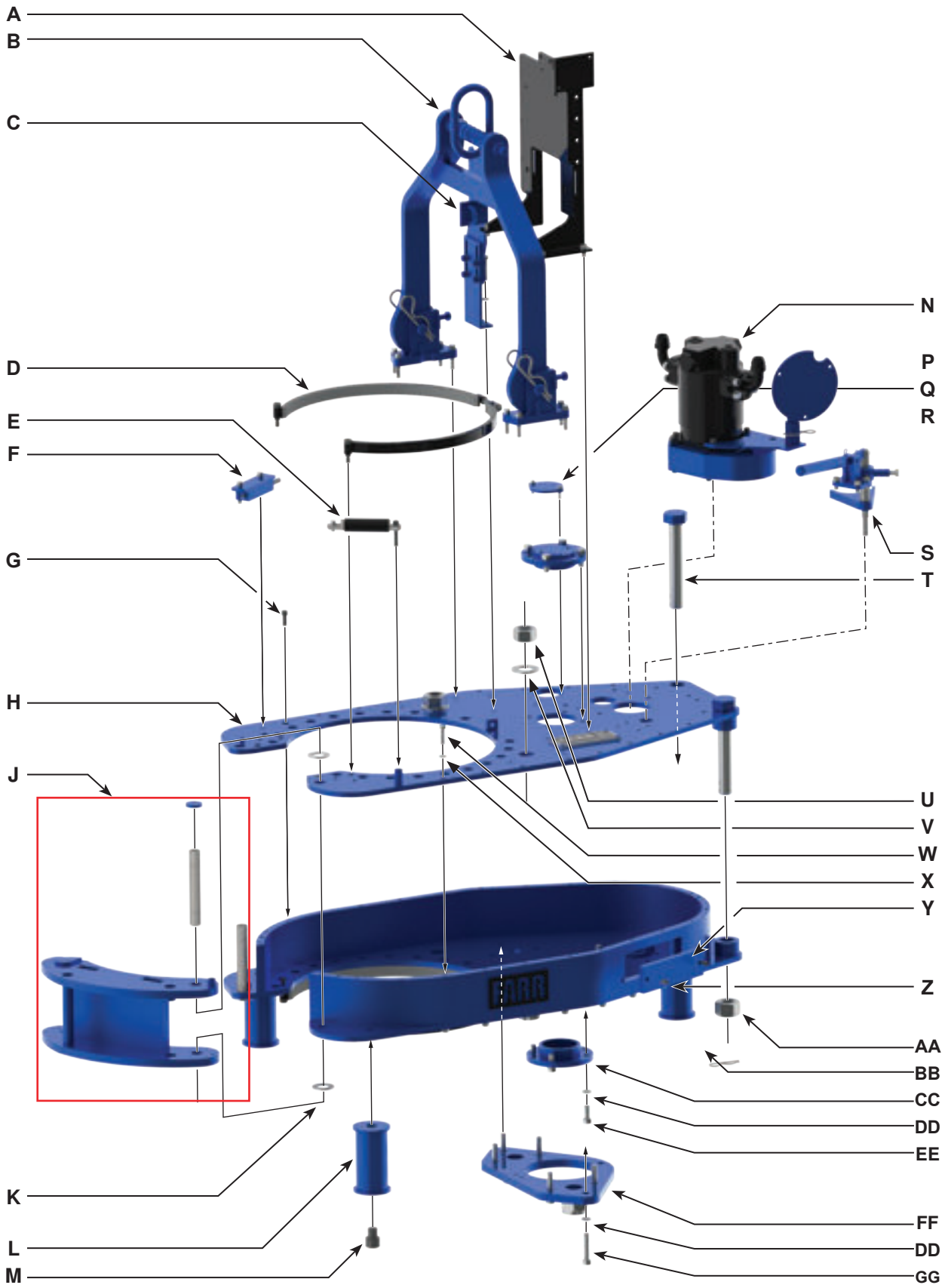


| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Weldment | Shifting Handle Weldment | 1 | AK00-092 |
| B | Part | HITCH PIN .0930 X 1.125, Spaenaur CP-83H | 2 | 02-0274 |
| C | Part | 3/8" NC x 1" Hex Bolt | 4 | 09-1046 |
| D | Part | 3/8" Lock Washer | 8 | 09-5106 |
| E | Part | 5/16" x 1-1/2" Clevis Pin | 1 | 09-0256 |
| F | Weldment | Shifter Lug Weldment (Bolted) | 1 | 101-0016 |
| G | Part | 5/16" x 1" Clevis Pin | 1 | 02-0020 |
| H | Part | Top Shifter Bushing (threaded) | 1 | 101-0020 |
| J | Part | Shifting Shaft | 1 | 1400-71 |
| K | Part | Shifting Fork | 1 | 997-HT-72 |
| L | Part | 5/8" UNF Hex Jam Nut | 1 | 09-5915 |
| M | Part | 5/8" UNF Hex Nut | 1 | 09-5914 |
| N | Part | Lower Shifter Bushing (typically welded to bottom plate) | 1 | AK00-091 |
| P | Part | Detent Ball | 1 | 02-0018 |
| Q | Part | Detent Spring | 1 | 997-0-64 |
| R | Part | 7/16" UNF Hex Jam Nut | 1 | 09-5508 |
| S | Part | 7/16" UNF x 1-1/4" Hex Bolt | 1 | 09-1608 |

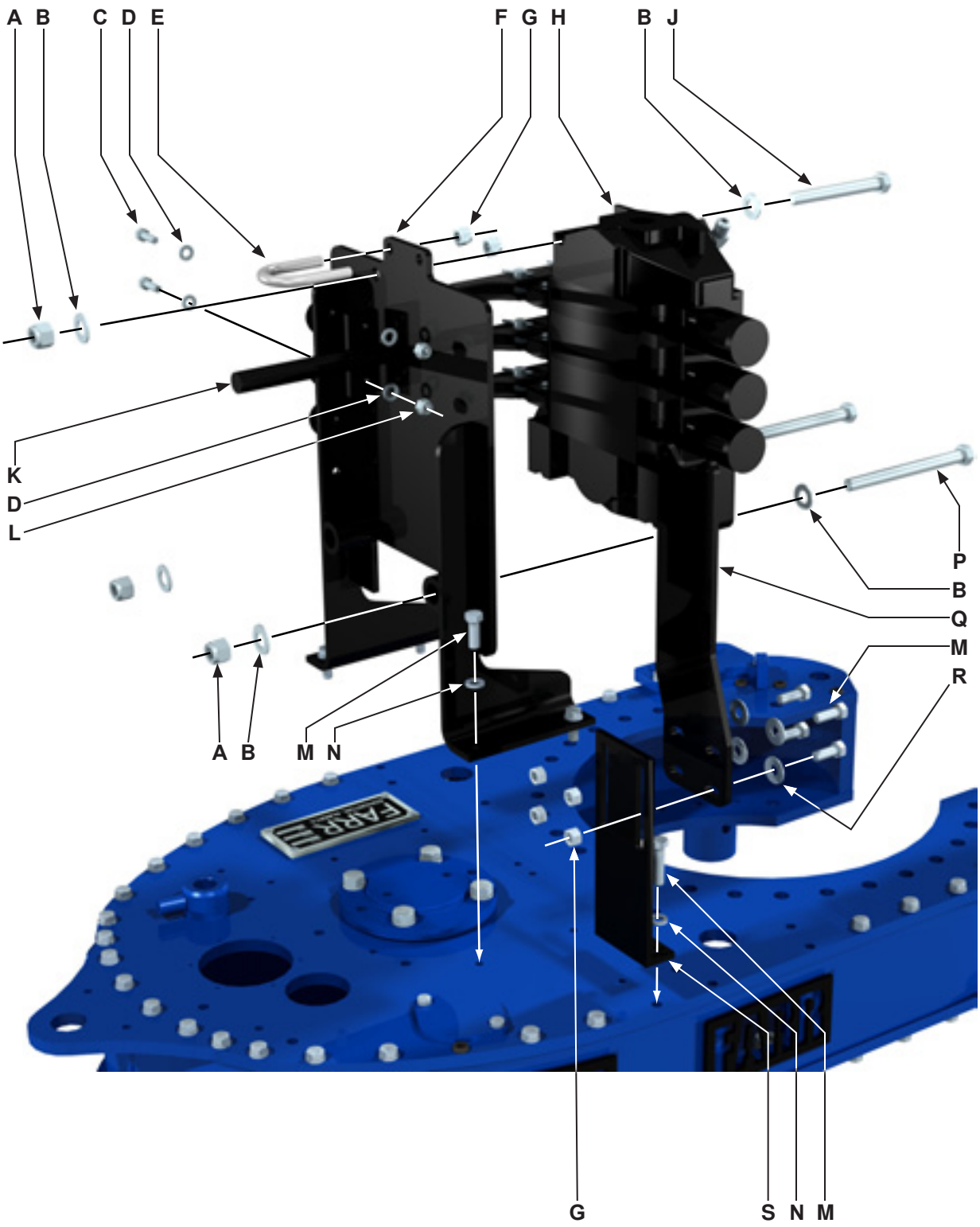


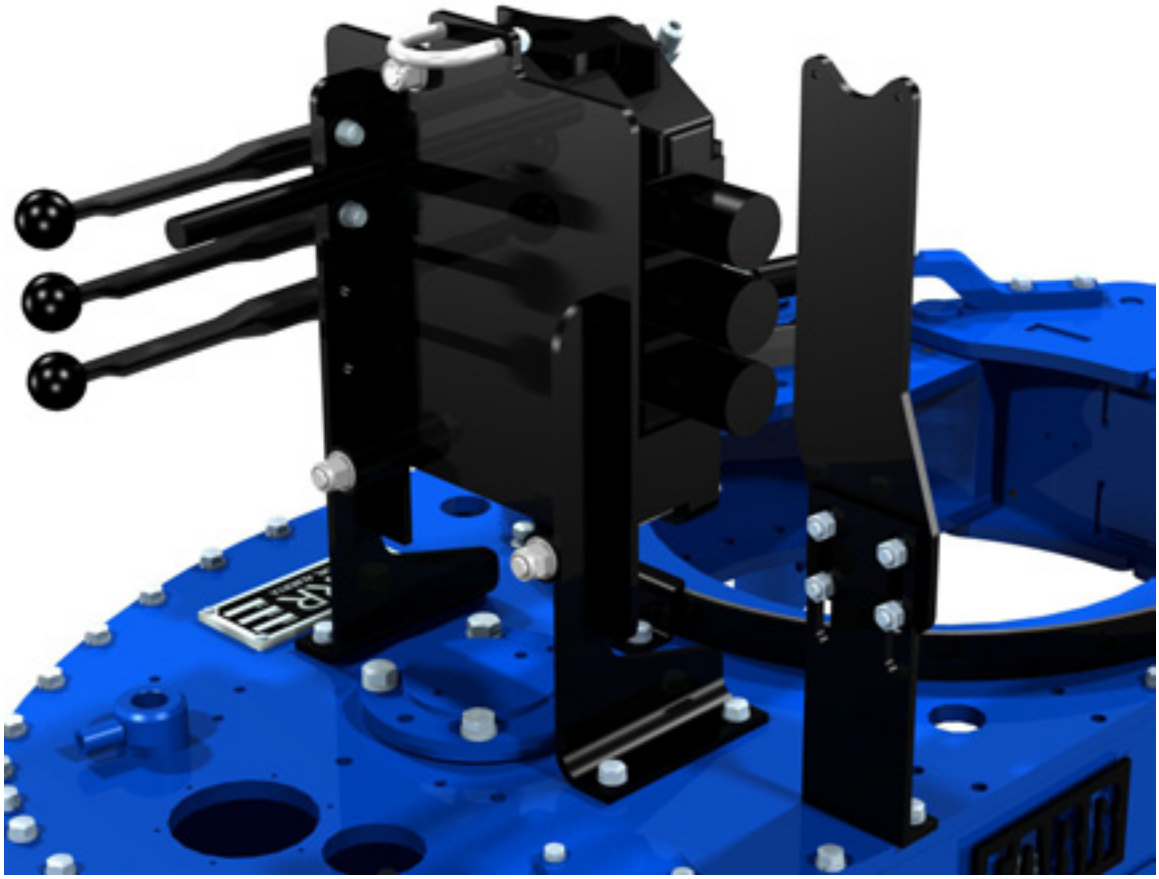


| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1/2" UNC x 4-1/2" Hex Bolt | 1 | 09-1184 |
| B | Part | 1/2" Narrow Flat Washer | 3 | 09-5119 |
| C | Part | 3/8" UNC x 6-1/2" Hex Bolt | 2 | 09-1071 |
| D | Part | Jaw Pivot Bolt | 2 | AK10-056 |
| E | Part | 5/16" Nylock Nut | 4 | 09-5703 |
| F | Part | 5/16" Flat Washer | 4 | 09-5004 |
| G | Part | Cage Plate Spacer | 2 | 101-4992 |
| H | Part | Cage Plate - TOP | 1 | AK20-010-KT |
| J | Assembly | Jaw Die Kit (5-1/2" shown - see Pg. 2.8) | 2 | |
| K | Part | Front Cage Plate Spacer | 2 | AK20-031 |
| L | Part | Top Plate (shown for illustration purposes only) | 1 | AK07-001M-KT_TOP |
| M | Part | Rotary Gear | 1 | AK01-001-KT |
| N | Part | Bottom Plate (shown for illustration purposes only) | 1 | AK07-001M-KT_BOT |
| P | Part | Cam Follower | 40 | 02-0015 |
| Q | Weldment | Bottom Cage Plate Weldment | 1 | AK20-20W-KT |
| R | Part | 5/8" UNF Hex Jam Nut | 40 | 09-1405 |
| S | Part | Backing Pin Knob | 1 | 02-0017 |
| T | Part | 3/8" UNC Threaded Stud | 1 | 101-4058 |
| U | Part | Backing Pin Retainer | 1 | 101-4040 |
| V | Part | Backing Pin | 1 | 101-4994 |
| W | Part | Backing Pin Spacer | 1 | 101-4995 |
| X | Part | 1/2" UNC Nylock Nut | 1 | 09-5610 |
| Y | Part | Cam Follower | 40 | SSCF-1500 |
| Z | Part | 7/8" Narrow Flat Washer | 40 | 09-5123 |
| AA | Part | 7/8" UNF Nylock Jam Nut | 40 | 09-5722 |
| BB | Part | 1/2" UNC Nylock Jam Nut | 2 | 09-5610S |

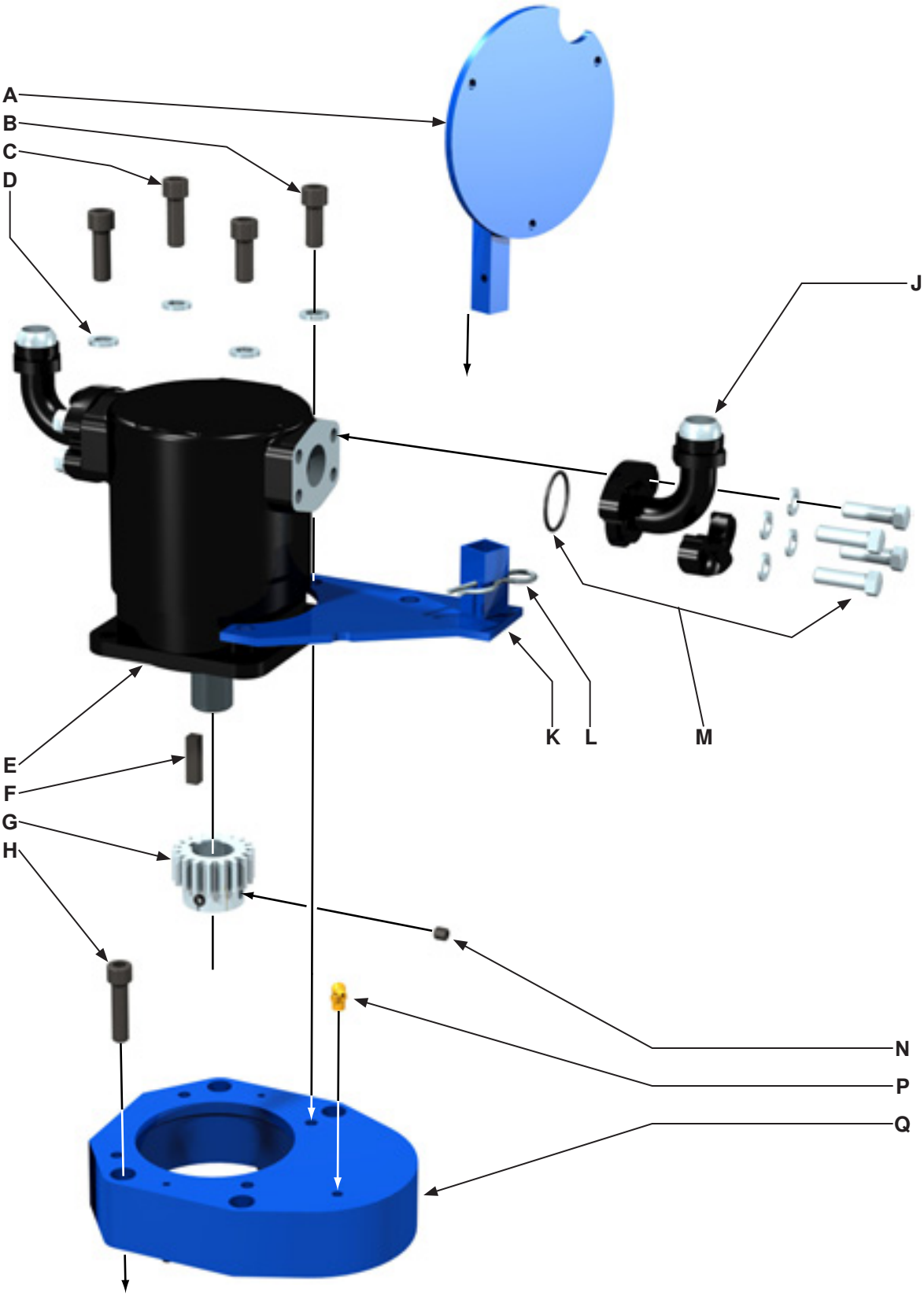


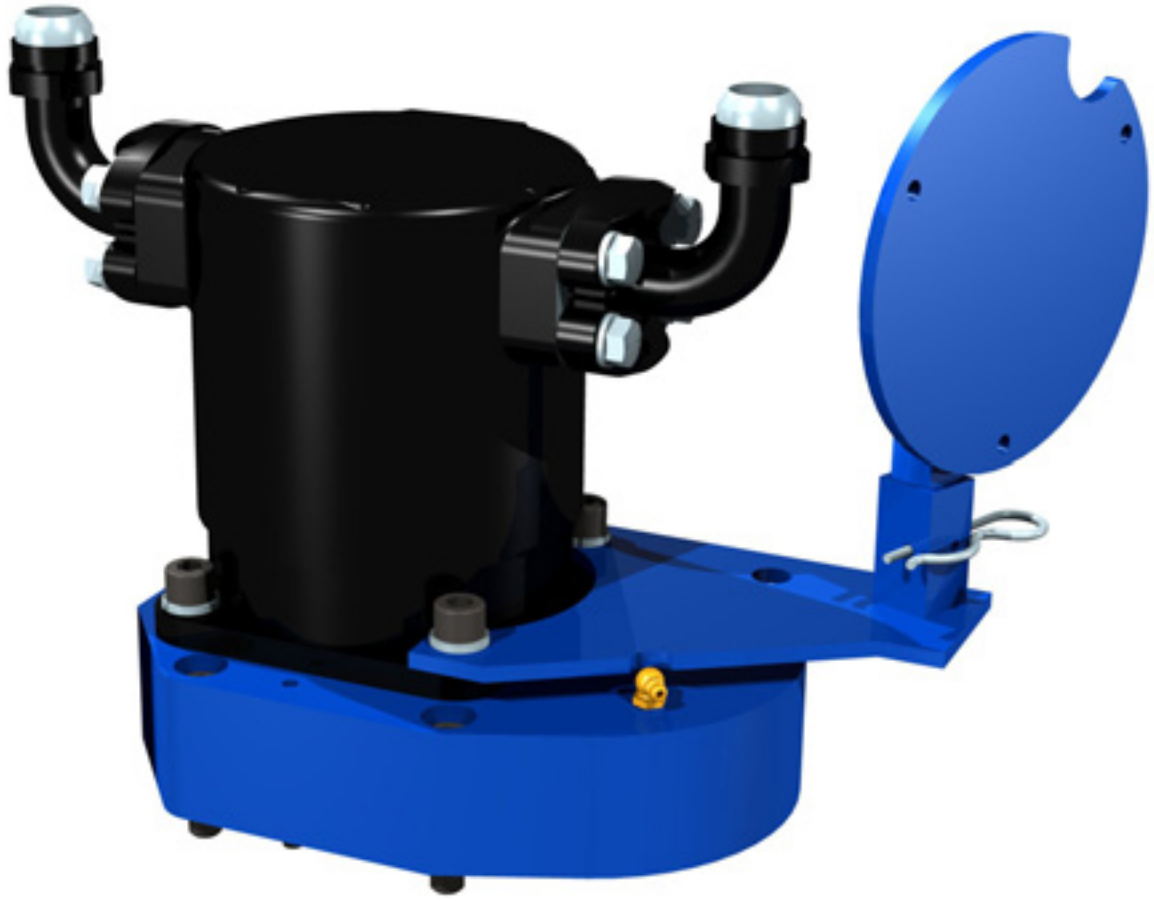

| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Assembly | Hydraulic Valve Support Assembly (See Pp. 5.18 - 5.19) | 1 | |
| B | Assembly | Rigid Sling Assembly (See Pp. 5.28 - 5.29) | 1 | |
| C | Assembly | Hydraulic Tubing Support Assembly (See Pp. 5.18 - 5.19) | 1 | |
| D | Weldment | Lined Brake Band Weldment (See Pp. 5.22 - 5.23) | 2 | 101-4999 |
| E | Assembly | Door Stop Cylinder Assembly | 1 | 101-0069 |
| F | Assembly | Safety Door Plunger Assembly (See Pp. 5.24 - 5.25) | 1 | |
| G | Part | 3/8" UNC x 1" Hex Socket Head Cap Screw | 9 | 09-1738 |
| H | Part | Body Plate - TOP | 1 | AK07-001M-KT |
| J | Assembly | Door Assembly (See Pp. 5.24 - 5.25) | 1 | |
| K | Part | 1" Narrow Flat Washer | 4 | 09-5120 |
| L | Weldment | Leg Weldment | 3 | 997-D8-160A |
| M | Part | 7/8" UNC x 1" Hex Socket Head Cap Screw | 3 | |
| N | Assembly | Motor & Motor Mount Assembly (See Pp. 5.20 - 5.21) | 1 | |
| P | Part | Cover Plate | 1 | 101-1246 |
| Q | Part | 1/4" NC x 1" Hex Bolt | 2 | 09-1007 |
| R | Part | 1/4" Lock Washer | 2 | 09-5102 |
| S | Assembly | Shifter Assembly (See Pp. 5.12 - 5.13) | 1 | |
| T | Part | Load Cell Anchor Bolt | 2 | 101-0040 |
| U | Part | 1-1/4" UNF Hex Nylock Nut (See Rotary Idler Ass'y Pp. 5.4 - 5.5) | 2 | 09-5702 |
| V | Part | 1-1/4" Narrow Flat-washer (See Rotary Idler Ass'y Pp. 5.4 - 5.5) | 2 | 09-5120 |
| W | Part | 3/8" NC x 1-1/2" Hex Bolt | 40 | 09-1553 |
| X | Part | 3/8" Lock Washer | 40 | 09-5106 |
| Y | Part | Clutch Access Plate | 1 | 997-D13-161 |
| Z | Part | 1/4" UNC x 1" Hex Socket Head Cap Screw | 2 | 09-2007 |
| AA | Part | 1-1/4" UNC Heavy Hex Nut | 2 | 09-5832 |
| BB | Part | 0.148 x 2.938" Hitch Pin | 2 | 09-0090 |
| CC | Part | Pinion Bearing Cap (See Pp. 5.8 - 5.9) | 2 | |
| DD | Part | 1/2" Lock Washer | 14 | 09-5110 |
| EE | Part | 1/2" NC x 1-1/2" Hex Bolt (For Pinion Bearing Caps) | 8 | 09-1170 |
| FF | Part | Stiffener Plate | 1 | AK00-001 |
| GG | Part | 1/2" NC x 2-1/2" Hex Bolt | 6 | 09-1176 |



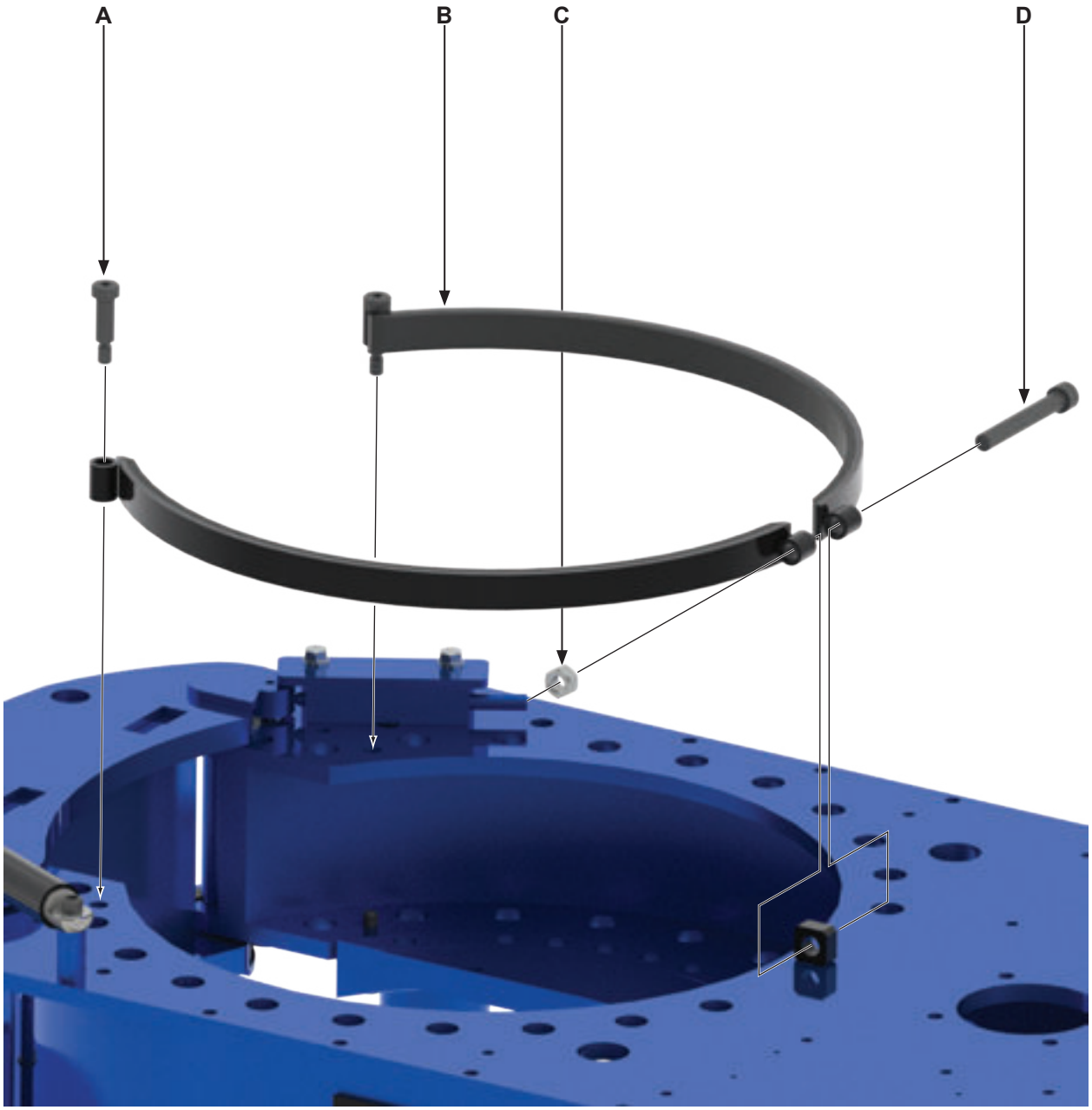


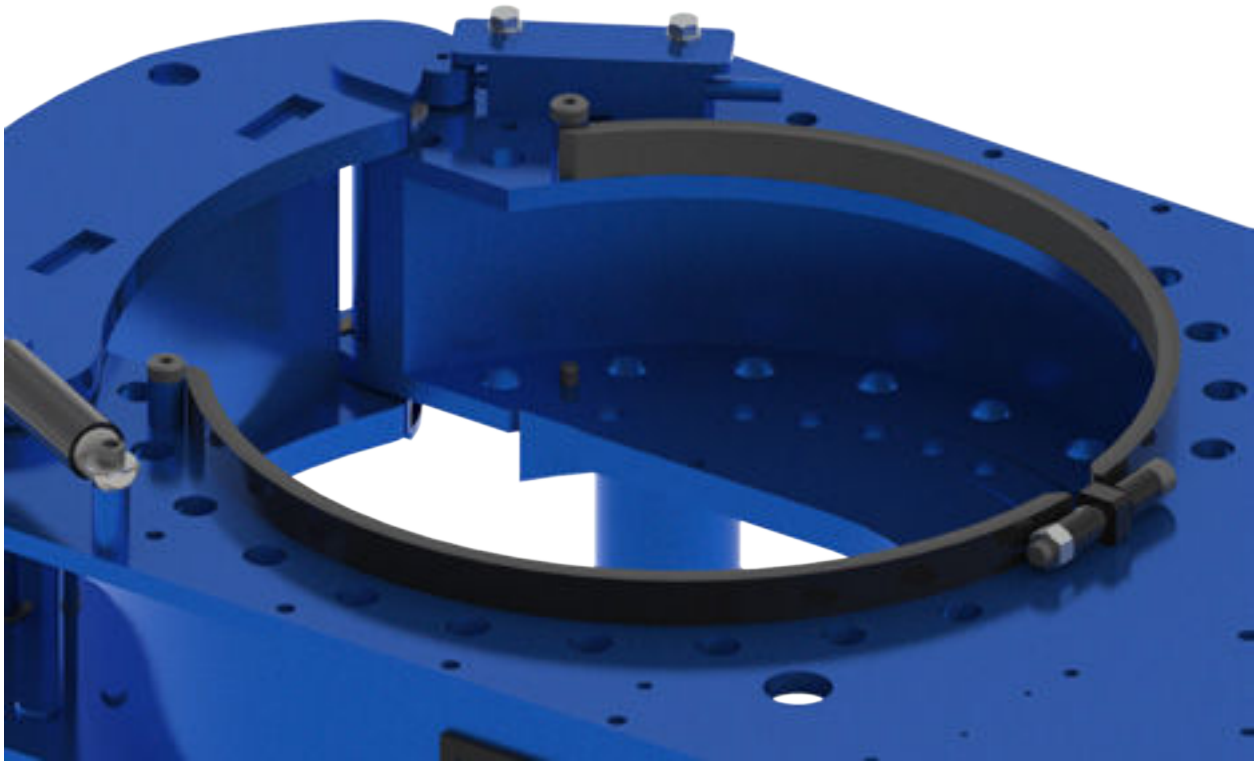
| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1/2" NC Nylock Nut | 3 | 09-5610 |
| B | Part | 1/2" Narrow Flat Washer | 6 | 09-5119 |
| C | Part | 5/16 NC x 1" Hex Bolt | 2 | 09-1026 |
| D | Part | 5/16" Flat Washer | 4 | 09-5004 |
| E | Part | 3/8" NC Threaded U-Bolt | 1 | 101-2075 |
| F | Weldment | Valve Mount Weldment | 1 | AK00-070B-KT |
| G | Part | 3/8" NC Nylock Nut | 6 | 09-5607 |
| H | Assembly | Hydraulic Valve Assembly - DVA35 (2 Valve + motor speed) | 1 | |
| J | Part | 1/2" NC x 4-1/2" Hex Bolt | 2 | 09-1184 |
| K | Weldment | Handle Weldment | 1 | AK00-076 |
| L | Part | 5/16" NC Nylock Nut | 2 | 09-5703 |
| M | Part | 3/8" NC x 1" Hex Bolt | 10 | 09-1046 |
| N | Part | 3/8" Helical Lock Washer | 6 | 09-5106 |
| P | Part | 1/2" NC x 6" Hex Bolt | 2 | 09-1190 |
| Q | Part | Hydraulic Support Plate | 1 | 101-3947 |
| R | Part | 3/8" Flat Washer | 4 | 09-5006 |
| S | Weldment | inlet Coupling Support Weldment | 1 | 101-1138 |



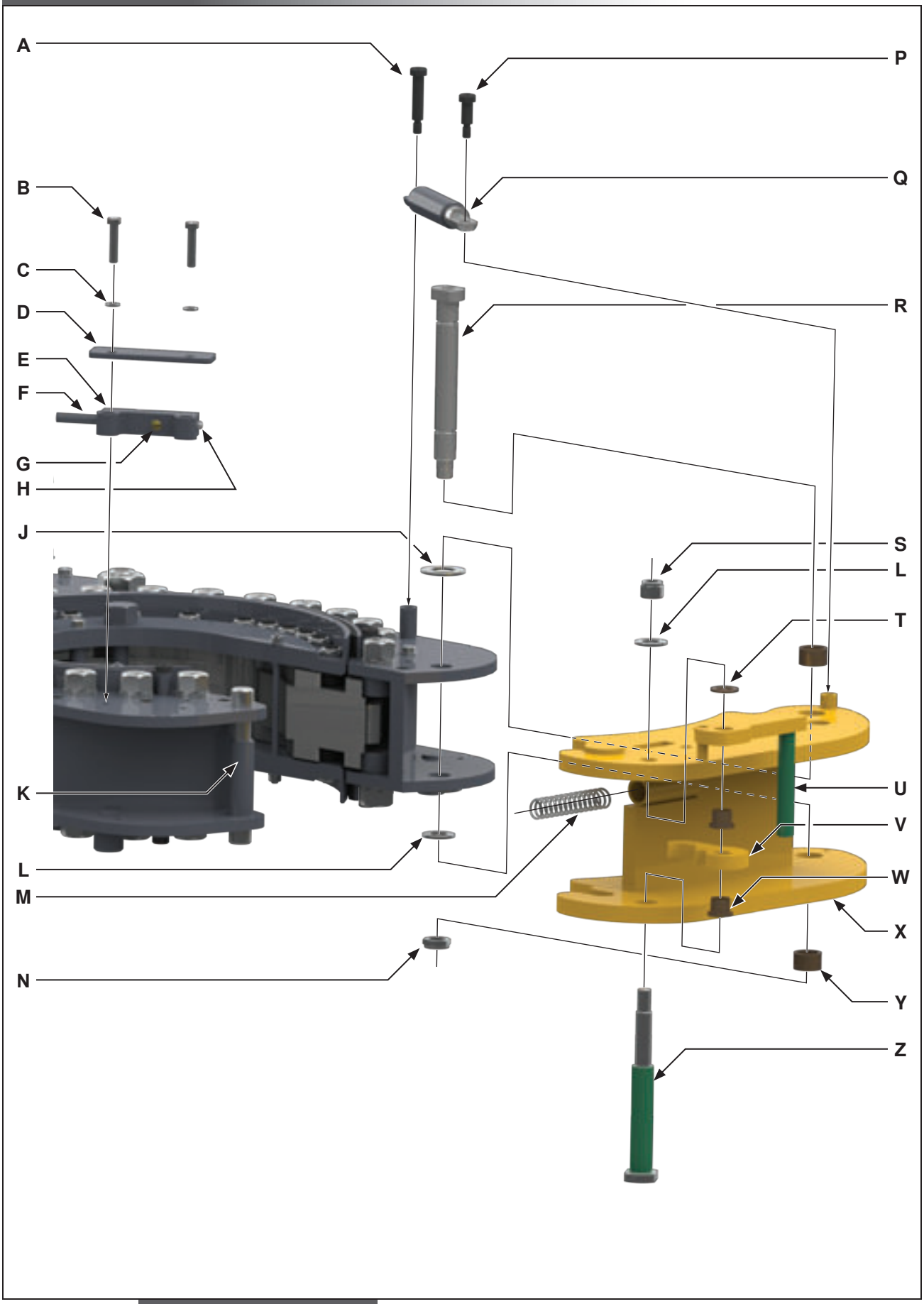


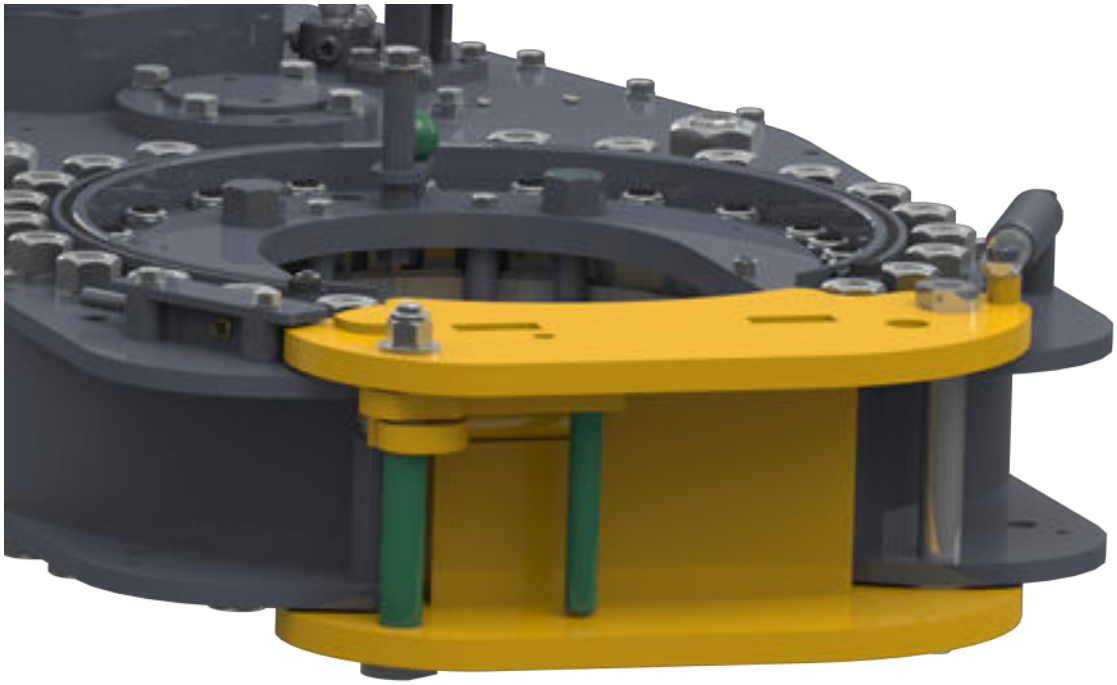
| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Weldment | Torque Gauge Mount Weldment | 1 | 1500-09-03A |
| B | Part | 1/2" NC x 1-1/4" Hex Socket Head Cap Screw | 2 | 09-2168 |
| C | Part | 1/2" NC x 1-1/2" Hex Socket Head Cap Screw | 2 | 09-2170 |
| D | Part | 1/2" Lock-washer | 4 | 09-5110 |
| E | Part | Rineer GA15-13/6.5 Hydraulic Motor | 1 | 87-0008 |
| F | Part | 5/16" x 5/16" x 2" Square Gear Key | 1 | |
| G | Part | Motor Gear | 1 | 997-A10-149 |
| H | Part | 1/2" NC x 2" Hex Socket Head Cap Screw | 4 | 09-0234 |
| J | Part | #20 (1-1/4")/JIC 1" Flange Elbow | 2 | 02-9216 |
| K | Weldment | Torque Gauge Holder Weldment | 1 | 1500-09-04A |
| L | Part | 0.148" x 2.938" Hitch Pin | 1 | |
| M | Part | #20 (1-1/4") Split Flange Kit | 2 | 02-9217 |
| | Part | O-Ring | 1 | |
| | Part | #20 (1-1/4") Split Flange | 2 | |
| | Part | 7/16" Lock-washer | 4 | |
| | Part | 7/16" NC x 1-1/2" Hex Bolt | 4 | |
| N | Part | 3/8" NC x 3/8" Hex Socket Set Screw | 2 | 09-0106 |
| P | Part | 1/8" NPT 90 DEG Grease Fitting | 1 | 02-0093 |
| Q | Part | Motor Mount | 1 | 1064-C8-150 |



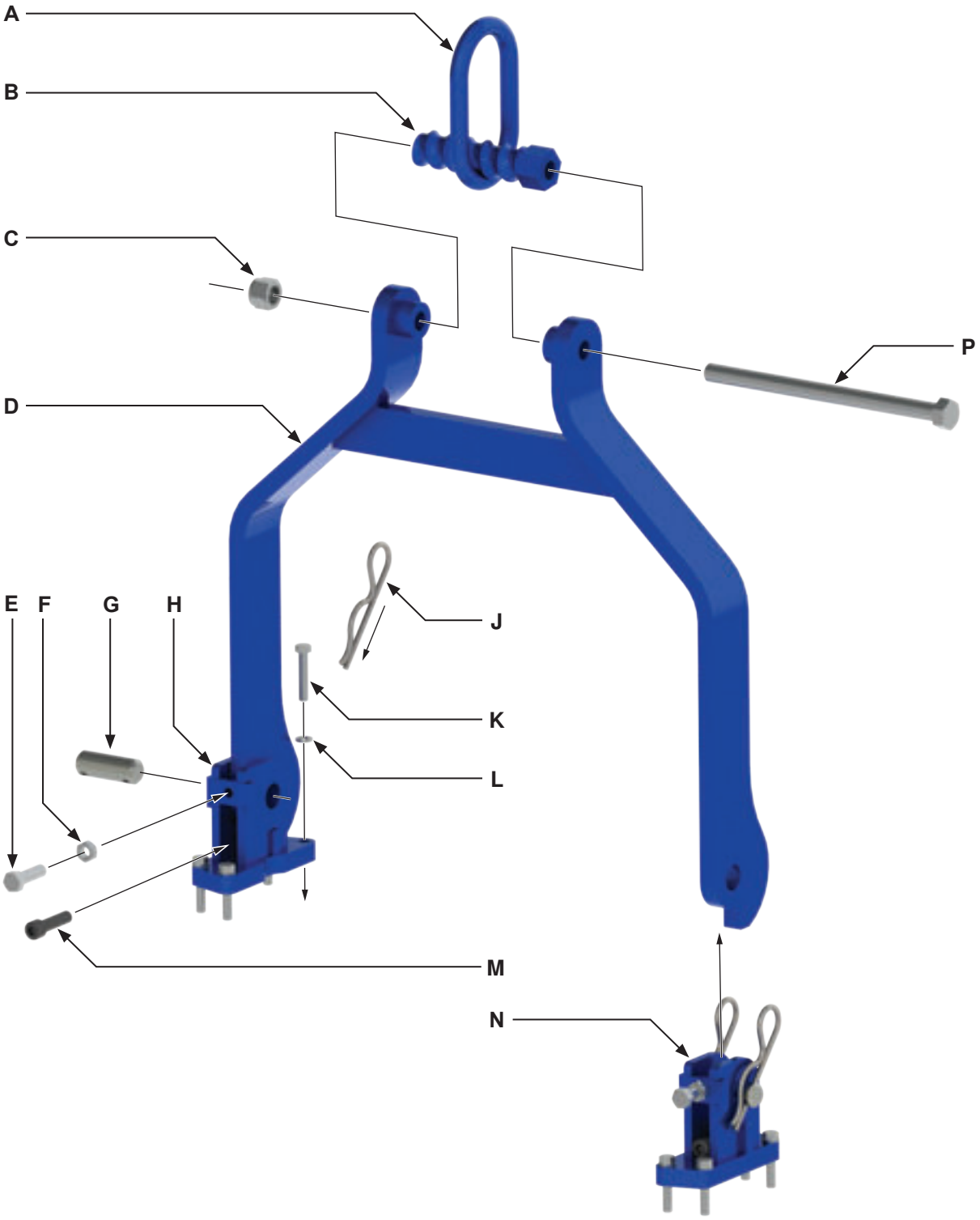


| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1/2" x 1-1/2" Hex Socket Head Shoulder Screw | 4 | 09-1113 |
| B | Weldment | Lined Brake Band Weldment | 2 | 101-4999 |
| C | Part | 1/2" NC Nylock Nut | 2 | 09-5610 |
| D | Part | 1/2" NC x 3-3/4" Hex Socket Head Cap Screw | 2 | 25-6001 |





| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | 1/2" X 2" UNC Hex Socket Head Cap Screw | 1 | 09-0234 |
| B | Part | 3/8" NC x 1-3/4" Hex Bolt | 2 | 09-1557 |
| C | Part | 3/8" Lock Washer | 2 | 09-5106 |
| D | Part | Cable Guide Guard | 1 | 101-4237 |
| E | Part | Control Cable Guide | 1 | 101-4235 |
| F | Part | Push-Pull Control Cable | 1 | 02-E0026 |
| G | Part | Grease Fitting, 1/4" Straight Thread | 1 | 02-0097 |
| H | Part | Safety Door Plunger | 1 | 101-4360 |
| J | Part | 1" Narrow Flat Washer | 1 | 09-5120 |
| K | Part | Door Latch Post (Single Door) | 2 | 101-5108 |
| L | Part | 3/4" Narrow Flat Washer | 1 | 09-5013 |
| M | Part | Door Latch Spring | 1 | 997-13D |
| N | Part | 3/4" UNF Thin Nylock Nut | 1 | 09-5718 |
| P | Part | 1/2" X 1" UNC Hex Socket Head Cap Screw | 1 | 09-0154 |
| Q | Assembly | Door Spring Cylinder | 1 | 101-0069 |
| | Weldment | Door Cylinder Barrel Weldment | 1 | 997-12-01 |
| | Part | Door Cylinder Piston | 1 | 997-12-02 |
| | Part | Door Cylinder Spring | 1 | 997-13 |
| R | Part | Door Pivot Post (Single Door) | 1 | 101-5034 |
| S | Part | 5/8" UNC Hex Nylock Nut | 1 | 09-5614 |
| T | Part | Door Latch Thrust Washer | 1 | 02-E0125 |
| U | Weldment | Door Latch Handle Weldment | 1 | 101-5250 |
| V | Part | Door Latch | 1 | 101-5246 |
| W | Part | Door Latch Bushing | 2 | 02-E0124 |
| X | Weldment | Door Weldment | 1 | AK12-702B-KT-SINGLE |
| Y | Part | Door Bushing | 2 | 02-E0126 |
| Z | Part | Door Lock Shaft | 1 | 101-5249 |



| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| A | Part | Lifting Link | 1 | 02-0516 |
| B | Part | Rigid Sling Adjustment Helix | 1 | 1053-1-H |
| C | Part | 3/4" NC Nylock Nut | 1 | 1429-39-02 |
| D | Weldment | Rigid Sling Weldment | 1 | AK06-000B-KT |
| E | Part | 1/2" NC x 1-3/4" Hex Bolt | 2 | 09-1172 |
| F | Part | 1/2" NC Hex Jam Nut | 2 | 09-5810 |
| G | Part | Rigid Sling Pin | 2 | AK00-056 |
| H | Weldment | LH Rigid Sling Bracket | 1 | 101-1244 |
| J | Part | 3/16" Hitch Pin | 2 | 02-0028 |
| K | Part | 3/8" NC x 2" Hex Bolt | 8 | 09-1046 |
| L | Part | 3/8" Helical Lock-washer | 8 | 09-5106 |
| M | Part | 1/2" NC x 2" Hex Socket Head Cap Screw | 2 | 09-0234 |
| N | Weldment | RH Rigid Sling Bracket | 1 | 101-1245 |
| P | Part | 3/4" NC x 9" Hex Bolt | 1 | 09-1322 |

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### 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 6.A.1: TORQUE GAUGE (FOR ILLUSTRATION PURPOSES ONLY)***

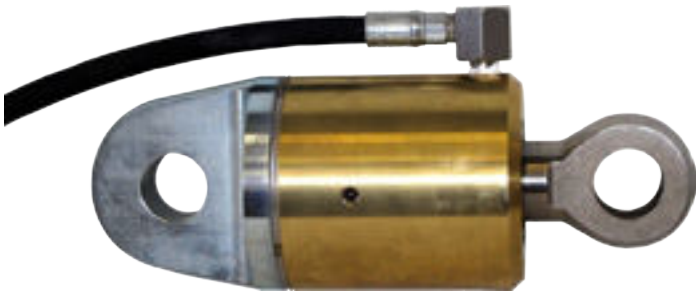


***ILLUSTRATION 6.A.2: TENSION LOAD CELL***

***ILLUSTRATION 6.A.3: COMPRESSION 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.***

**BASIC TORQUE MEASUREMENT (Continued:)**

*The images on the preceding 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.*

***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 | 32" Arm - 20K Torque Gauge / Tension Load Cell Assembly | 1 | 10-0029T |
| 1 | Part | 32" Arm 20,000 Lbs.-Ft Torque Gauge | 1 | 10-0212G |
| 2 | Part | 4.08" Tension Load Cell | 1 | 10-0008T |
| 3 | Part | Hydraulic Hose | 1 | 02-0069 |
| 4 | Part | Torque Gauge Flange | 1 | 997-D7-5 |
| 5 | Part | Tension Load Cell Shackle | 1 | 02-0078 |

| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| | Assembly | Tension Load Cell, 4.08 $in^2$ | 1 | 10-0008T |
| A | Part | O-Ring | 1 | 02-0800 |
| B | Part | Load Cell Body | 1 | LC99-104 |
| C | Part | 1/4" NC x 1/2" Binding Head Machine Screw | 1 | 09-0045A |
| D | Part | Stat-O-Seal | 1 | 02-0307 |
| E | Part | O-Ring | 1 | 02-0350 |
| F | Part | O-Ring | 1 | 08-0596 |
| G | Part | Load Cell Piston | 1 | LC99-101 |
| H | Part | Load Cell End | 1 | LC99-003 |
| J | Part | Flange Gasket | 1 | 02-0073 |
| K | Part | Load Cell Rod | 1 | LC99-002 |
| L | Part | Wiper | 1 | 08-1558 |
| M | Part | 3/8" NC x 3/8" Cup Point Hex Set Screw | 2 | 09-0106 |
| Seal Kit | | Replacement Seal Kit 4.08 $in^2$ Tension Load Cell | | 02-4578 |

***This is the standard tension load cell supplied by McCoy Drilling & Completions | Farr. Contact our sales department for information about optional application-specific tension load cells.***

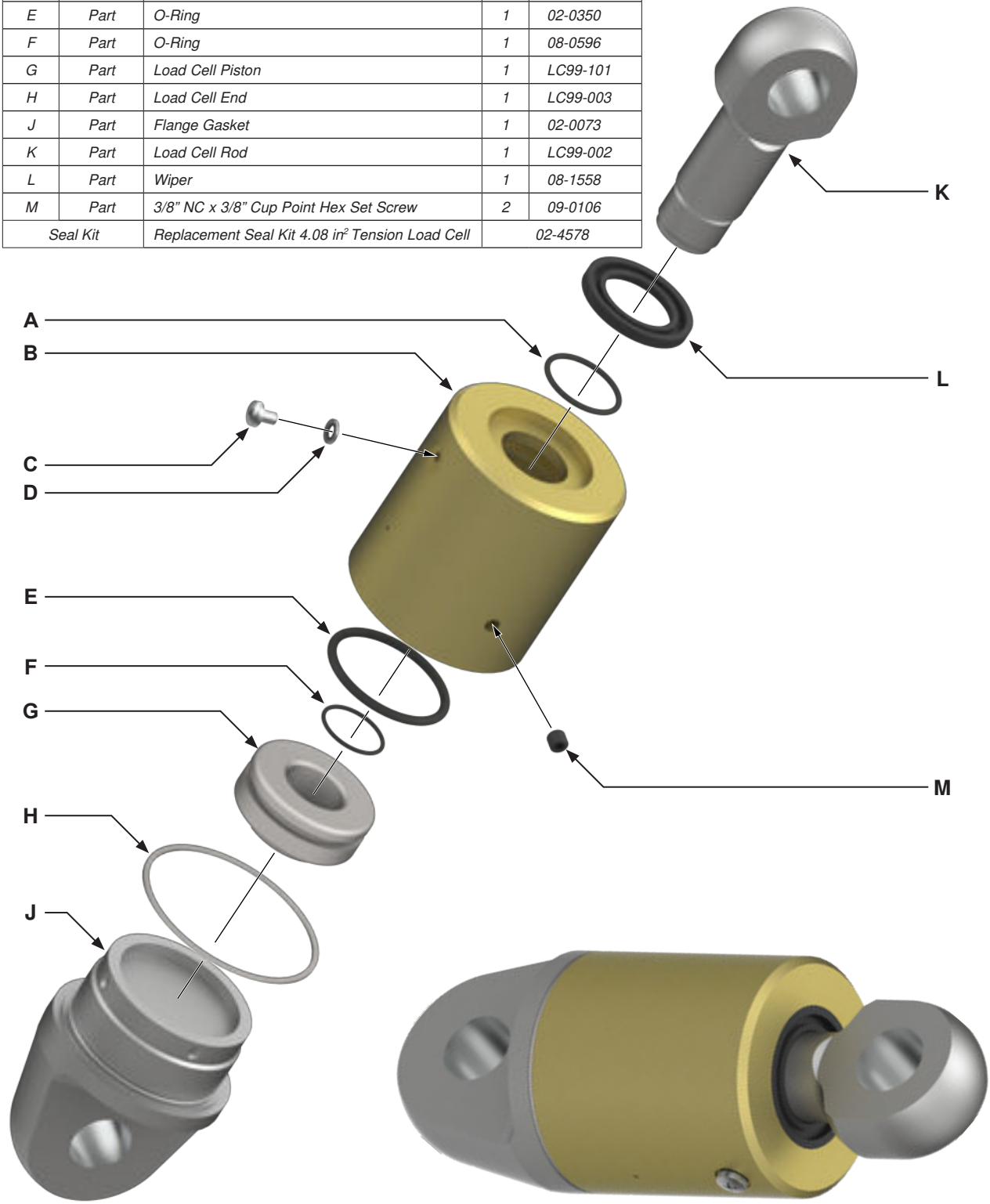



*ILLUSTRATION 6.A.4: TENSION LOAD CELL EXPLODED*

| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| | Assembly | Compression Load Cell, 8 $in^2$ | 1 | 10-0008C |
| A | Part | 5/16" UNC x 1" Hex Socket Head Cap Screw | 1 | 09-2026 |
| B | Part | Load Plate | 1 | E360-A |
| C | Part | 5/16" UNC x 3/4" Hex Socket Head Cap Screw | 6 | 09-2024 |
| D | Part | Retainer Ring | 1 | E360-8 |
| E | Part | Diaphragm | 1 | E358-2 |
| F | Part | Diaphragm Casing | 1 | E360-C |
| G | Part | Street Elbow | 1 | |
| H | Part | 1/4" NPT Brass Plug | 1 | |

***This is the standard hydraulic compression load cell supplied by McCoy Drilling & Completions | Farr. Contact our sales department for information about optional application-specific compression load cells.***

***Electronic compression load cells are used for some WinCatt™ applications.***

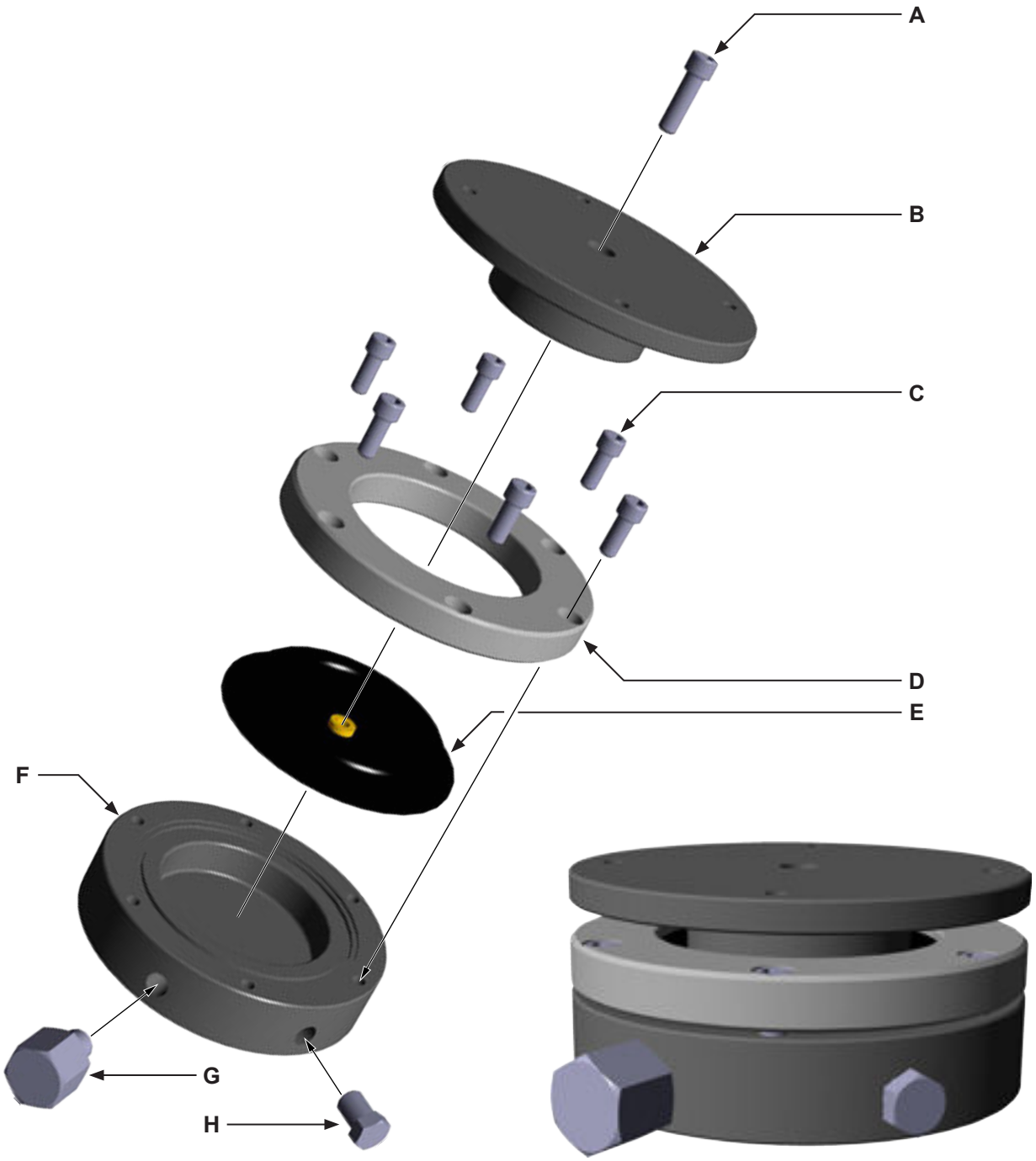
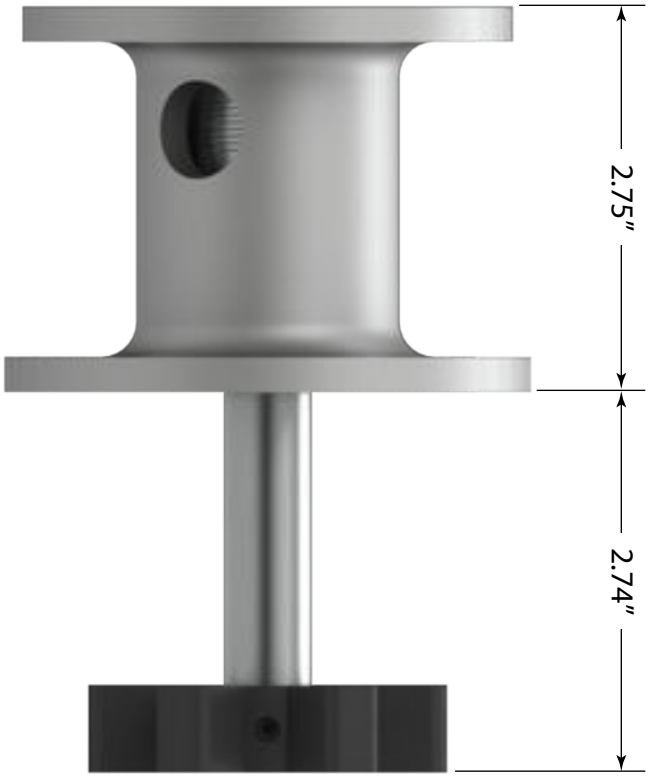
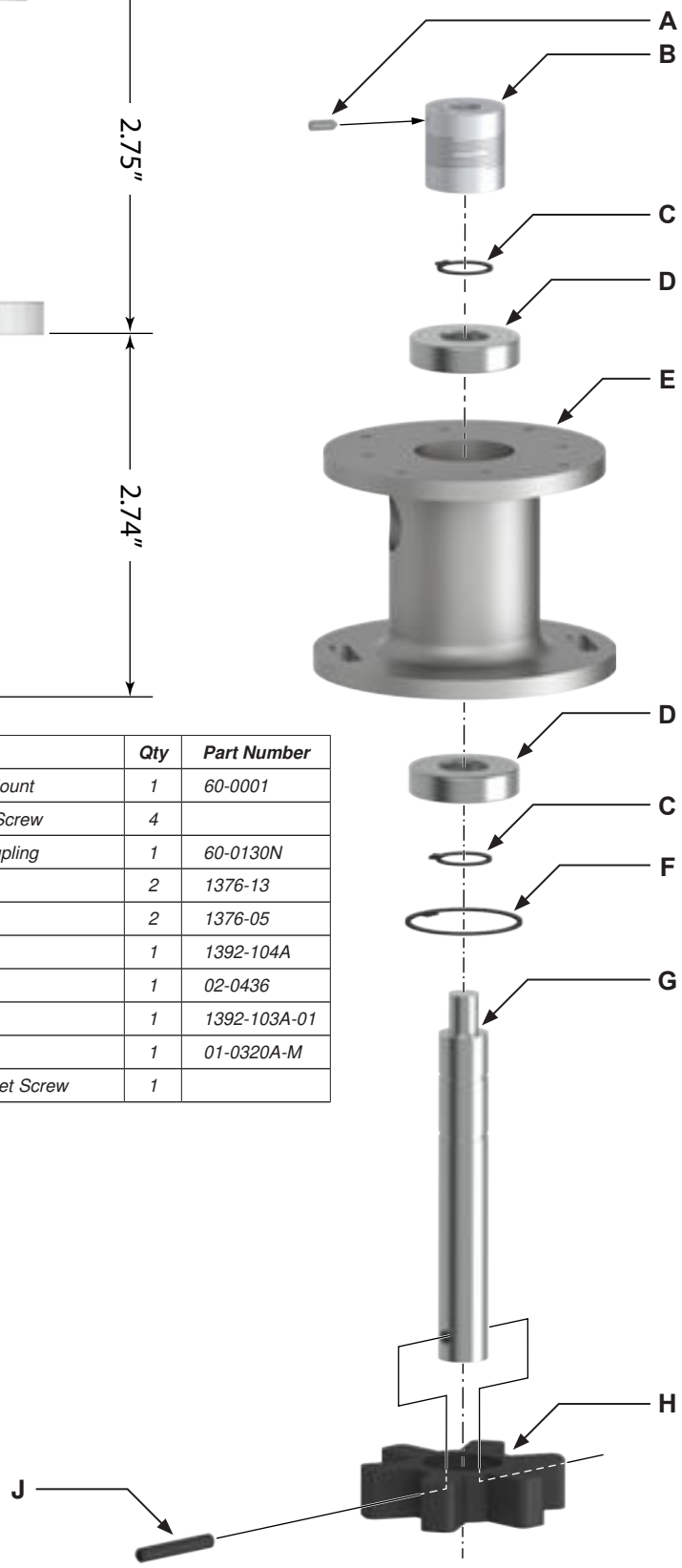



*ILLUSTRATION 6.A.5: COMPRESSION LOAD CELL EXPLODED*




| Item | Type | Description | Qty | Part Number |
|---|---|---|---|---|
| | Assembly | Standard Turn Counter Encoder Mount | 1 | 60-0001 |
| A | Part | 6-32 x 3/8" Hex Socket Head Set Screw | 4 | |
| B | Part | Helical Flexible Encoder Shaft Coupling | 1 | 60-0130N |
| C | Part | Internal Retainer Ring | 2 | 1376-13 |
| D | Part | Bearing | 2 | 1376-05 |
| E | Part | Encoder Housing | 1 | 1392-104A |
| F | Part | Internal Retainer Ring | 1 | 02-0436 |
| G | Part | Encoder Shaft | 1 | 1392-103A-01 |
| H | Part | Encoder Gear | 1 | 01-0320A-M |
| J | Part | 10-24 x 1-1/4" Hex Socket Head Set Screw | 1 | |

*ILLUSTRATION 6.A.6: TURN COUNTER ENCODER MOUNT EXPLODED*

## 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 gauge.**

*Possible Problem:* Obstruction in hydraulic hose.
*Solutions:* Check hydraulic hose for kinks.
Replace hydraulic hose.

*Possible Problem:* Loss of hydraulic fluid.
*Solution:* 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.

*Possible Problem:* Internal mechanism of torque gauge is damaged.
*Solution:* Replace gauge.

**2. Symptom: Gauge indication unexpectedly high.**

*Possible Problem:* Excessive hydraulic fluid.
*Solutions:* Completely drain hydraulic fluid from torque gauge/load cell system. Recharge following the procedure in Section 6.C.

*Possible Problem:* Internal mechanism of gauge is damaged.
*Solution:* Replace gauge.

*Possible Problem:* Incorrect torque gauge in use (not part of the original torque gauge/load cell pair).
*Solution:* Replace gauge with gauge properly calibrated for the load cell in service.

**3. Symptom: Gauge indication unexpectedly low**

*Possible Problem:* Insufficient hydraulic fluid.
*Solution:* 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.

*Possible Problem:* Obstruction in hydraulic hose.
*Solutions:* Check hydraulic hose for kinks.
Replace hydraulic hose.

*Possible Problem:* Snub line not at right-angle to tong handle.
*Solution:* Check angle of snub line and correct if necessary.

*Possible Problem:* Internal mechanism of gauge is damaged.
*Solution:* Replace gauge.

*Possible Problem:* Incorrect torque gauge in use (not part of the original torque gauge/load cell pair).
*Solution:* Replace gauge with gauge properly calibrated for the load cell in service.

**4. Symptom: Gauge indication is erratic or sluggish**

*Possible Problem:* Insufficient hydraulic fluid in torque measurement section.
*Solution:* 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.

*Possible Problem:* Loss of damping fluid in torque gauge.
*Solution:* Top up or refill damping fluid (NOTE: Ensure leakage points in gauge are identified and repaired to prevent further loss of damping fluid).

*Possible Problem:* Air bubbles in hydraulic fluid in the torque measurement system.
*Solution:* Bleed air from load cell and torque gauge and top up fluid (if necessary) as per Section 6.C.

*Possible Problem:* Internal mechanism of gauge is damaged.
*Solution:* Replace gauge.

### C. PERIODIC INSPECTION AND MAINTENANCE

#### 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.*

#### 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.*

***UN-CONTAINED 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.*

#### 3. Repair And Calibration

*Load cell and indicator gauge should be returned to authorized repair facility for any repairs or calibration required.*

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MANUFACTURER OF HYDRAULIC MOTORS
RINEER HYDRAULICS, INC.

15 series

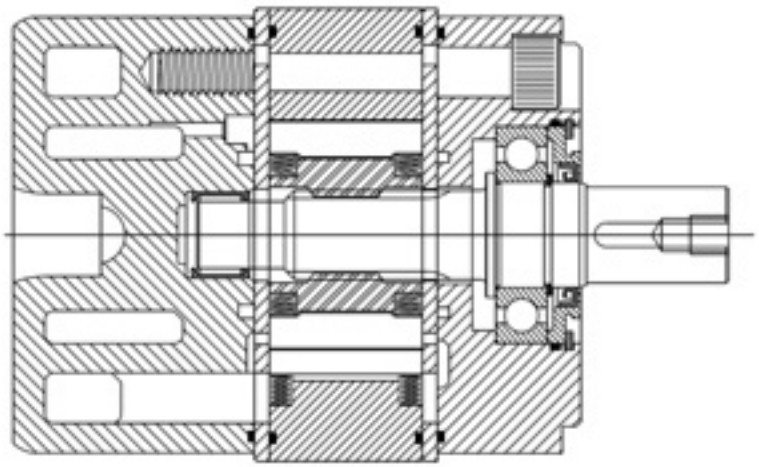
POWER to be the Best!

MOTOR SELECTION GUIDE

## Features of the 15 Series Standard Motor:
## Standard Motor - 3000 PSI (Code 61)

- Eight fixed displacement motors ranging from 6 $in^3$ to 15 $in^3$.
- Starting and stall torques equal to 90-94% of theoretical torque.
- Speed to 2,000 RPM continuous.
- Up to 75 HP continuous.
- Conforms to SAE 'C' mounting specification.
- Weighs 43 lbs.

CROSS SECTION



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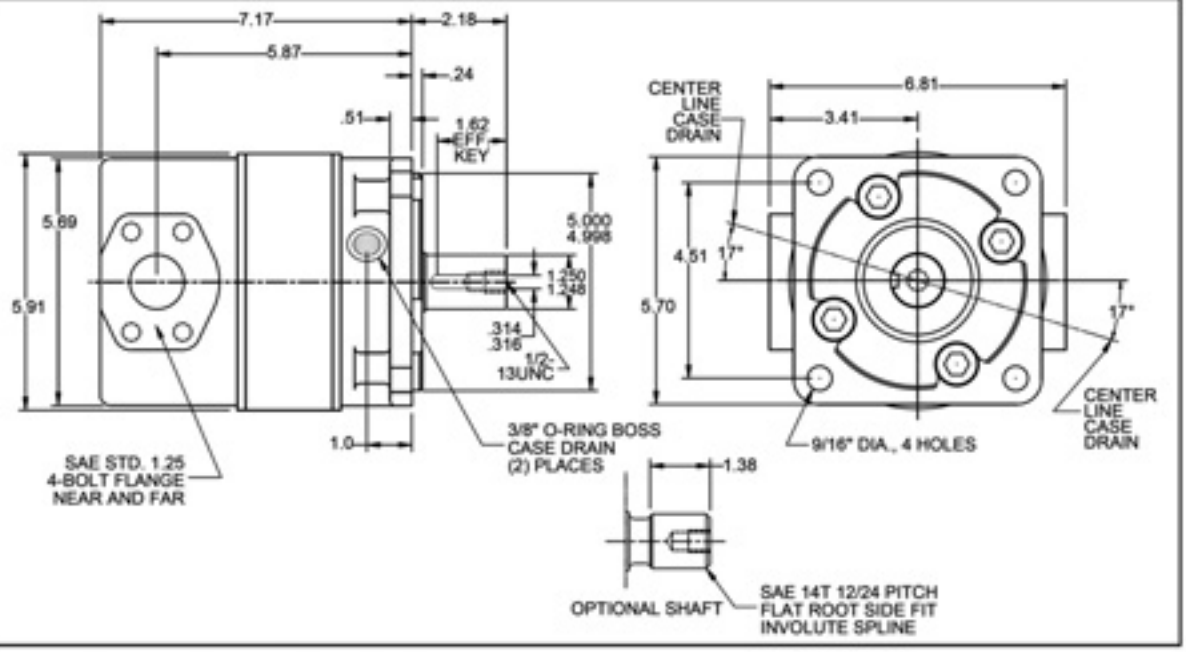
PUBLICATION DS151005 8/03

## 15 Series Standard Motor Envelope




## Technical Information - All Styles

### VANE CROSSING VANE
The Rineer patented vane crossing vane design produces much higher volumetric and mechanical efficiencies than is possible with a standard vane type design. This design provides a sealing vane between cavities to improve mechanical and volumetric efficiencies.

### STARTING AND STALL TORQUE
The Rineer motor produces torque curves which are virtually flat, with starting and stall torque equal to approximately 90-94% of theoretical torque.

### MORE POWER STROKES PER REVOLUTION
The 15 Series has four stator cavities and 10 rotor vanes. Each rotor vane works in each stator cavity once per revolution, which results in 40 power strokes per revolution. This helps produce higher mechanical efficiency and flatter torque curves.

### BEARING LOADING
The bearings in the 15 Series can accept radial load per the radial capacity chart. Thrust load is not recommended under most conditions. Consult with a Rineer Application Engineer for optional bearing configurations to match your application.

### SEALS
Buna N seals are supplied as standard on the Rineer 15 series motors. Viton seals may be ordered as an option.

### ROTATING GROUP - 1S or 1H
Under most operating conditions, 1S (standard rotating group parts) should be used. Under some high speed conditons 1H can be specified.

### ROTATION
The 15 Series Motor rotates equally well in either direction and smoothly throughout its entire pressure and speed range. Looking into the end of the shaft, rotation is clockwise when oil is supplied to port "A".

### HORSEPOWER LIMITATION
Maximum horsepower limitations may vary with different applications. ***When using the 15 Series Motor above 75 HP, consult a Rineer Application Engineer.***

### FILTRATION
25 micron minimum.

### FLUID
We suggest premium grade fluids containing high quality rust, oxidation and foam inhibitors, along with anti-wear additives. For best performance, minimum viscosity should be maintained at 100 SSU or higher. Fluid temperature should not exceed 180° F. Elevated fluid temperature will adversely affect seal life while accelerating oxidation and fluid breakdown. Fire resistant fluids may be used with certain limitations. Contact Rineer for additional information.

### CASE DRAIN
The 15 Series Motor is designed for either internal or external case drain. Two case drain ports are supplied. When using internal case drain, simply plug the two ports. When using external case drain, use the port at the highest elevation. We recommend case drain pressure of 35 PSI or less when using the standard seals.

### CASE DRAIN CIRCULATION
Fluid should be circulated through the case when a temperature differential exists between the motor and the system in excess of 50° F. ***Should this occur, contact a Rineer Application Engineer.***

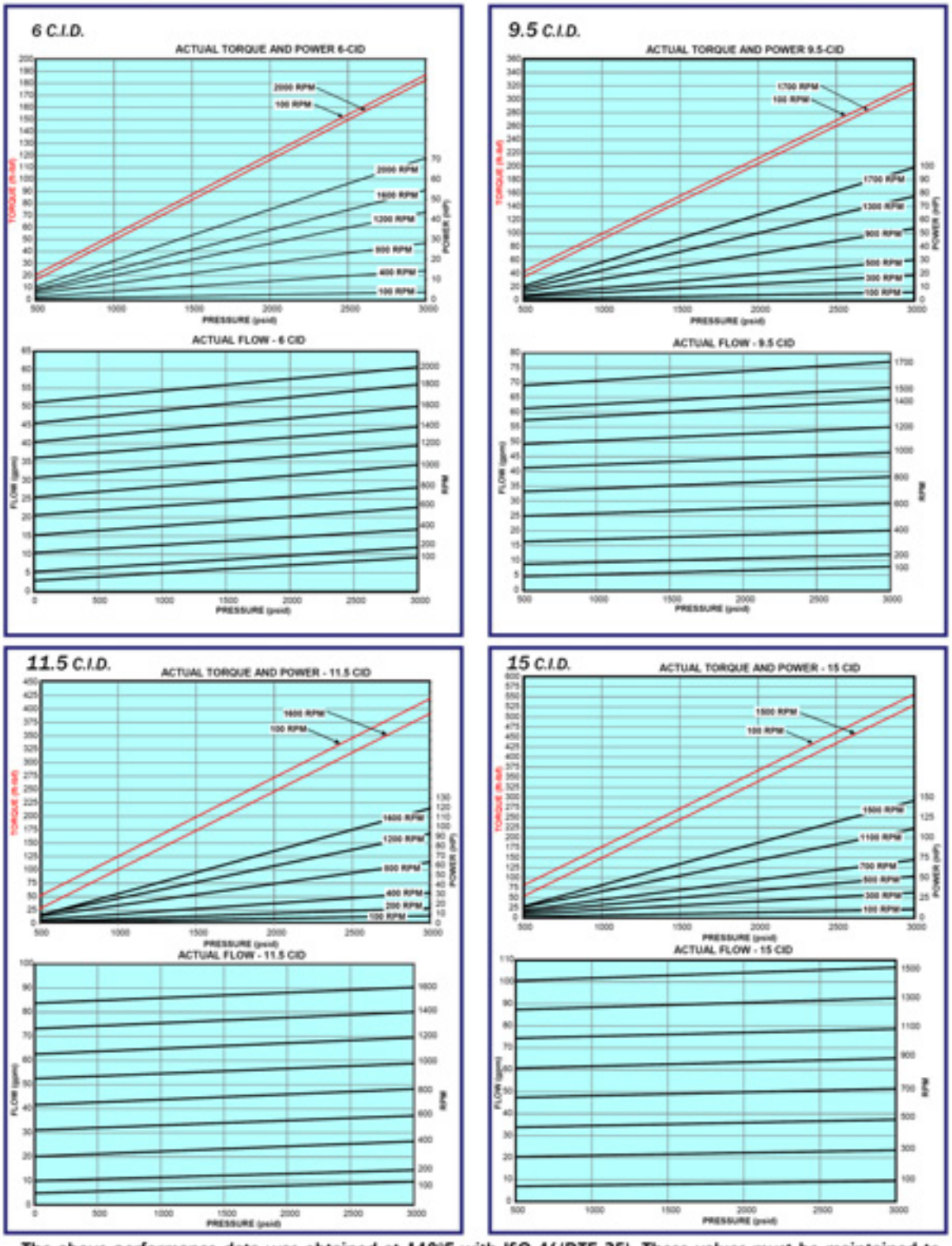
### MOUNTING
The mounting position is unrestricted. The shafts, pilots, and mounting faces should be within .002 TIR.

### INTERMITTENT CONDITIONS
Intermittent conditions are to be less than 10% of every minute.

### OTHER AVAILABLE MOTORS
For information on additional Rineer Motors, request one of the following publications:

| | |
|---|---|
| 37 Series | Publication DS371003 |
| 57 Series | Publication DS571003 |
| 125 Series | Publication DS1251003 |

## Performance Data - Selected Displacements




The above performance data was obtained at 140°F with ISO 46(DTE 25). These values must be maintained to obtain the performance indicated. Contact Rineer Hydraulics, Inc. for additional displacements.

## Model Code

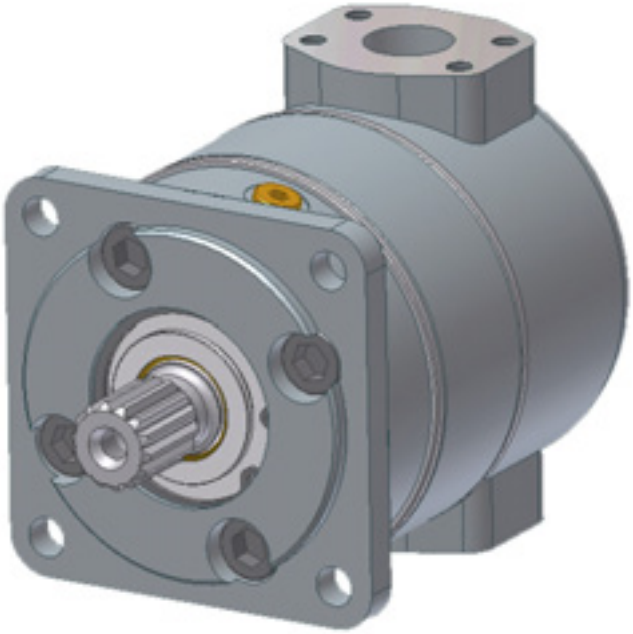
**M015 - 61/62** | **-1S** | **-015** | **-31** | **-B1** | **-TV** | **-000**

- **M015 - 61/62**
  - M015 - 61 = 015 Single Speed
  - M015 - 62 = 015 Two Speed
  - Options:
    - 62 = Two Speed Single Pilot Open During Crossover
    - 63 = Two Speed Single Pilot Closed During Crossover
    - 65 = Two Speed Double Pilot Open During Crossover
    - 67 = Two Speed Double Pilot Closed During Crossover
- **-1S**
  - 1S = Std.
  - 1H = High Speed
- **-015**
  - 006 = 6 in³ (98cc)/rev.
  - 007 = 7 in³ (115cc)/rev.
  - 008 = 8 in³ (131cc)/rev.
  - 009 = 9.5 in³ (156cc)/rev.
  - 010 = 10.5 in³ (172cc)/rev.
  - 011 = 11.5 in³ (189cc)/rev.
  - 013 = 13 in³ (213cc)/rev.
  - 015 = 15 in³ (246cc)/rev.
- **-31**
  - 30 = Keyed Shaft
  - 31 = Splined Shaft
  - 32 = Wheel Motor
  - 34 = Double Key
  - 50 = Retractable
  - 53 = API Thread
- **-B1** = Bearing Package Selection
- **-TV** = Seal - Package Selection
- **-000** = Special Code Designator

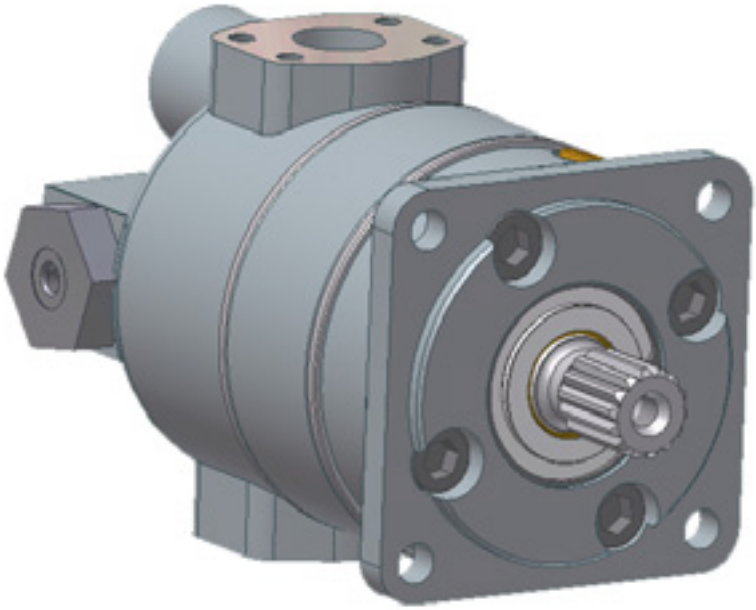
## Applications

# Repair Manual

## 15 Series



Standard Motor



Two Speed Motor

SERIES 15 STD. TWO SPEED EXP. VIEW

| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 0150111 | SEAL PLATE SNAP RING | 1 |
| 2 | 0150135 | SEAL PLATE | 1 |
| 3 | 1250161 | SEAL, SHAFT, TCN | 1 |
| 4 | | NOT USED | |
| 5 | 0150114 | SEAL PLATE O-RING | 1 |
| 6 | 0150730 | SNAP RING, BEARING | 1 |
| 7 | 0150710 | BALL BEARING | 1 |
| | 0150701 | SHAFT, KEYED | 1 |
| 8 | 0150702 | SHAFT, SPLINED | 1 |
| 9 | 0150901 | BOLT | 4 |
| 10 | 0150102 | FRONT HOUSING-INTERNAL | 1 |
| 11 | 0150428 | DOWEL PINS - FRONT | 2 |
| 12 | 0150610 | O-RING | 4 |
| 13 | 0150902 | BALL CHECKS | 4 |
| 14 | 0150620 | PLATE SCREW | 4 |
| 15 | 0150609 | PLATE, TWO SPEED | 2 |
| 16 | 0150401 | STATOR GA 15 | 1 |
| | 0150402 | STATOR GA 13 | 1 |
| | 0150403 | STATOR GA 9.5 | 1 |
| | 0150404 | STATOR GA 8.0 | 1 |
| | 0150407 | STATOR GA 6 | 1 |
| | 0150408 | STATOR GA 10.5-2S | 1 |
| | 0150414 | STATOR GA 11.5-2S | 1 |
| | 0150419 | STATOR GA 5 | 1 |
| 17 | 0150300 | ROTOR | 1 |
| 18 | 0150313 | ROTOR VANE | 10 |
| 19 | 0150320 | ROTOR VANE SPRING OUTER | 20 |
| 20 | 0150321 | ROTOR VANE SPRING INNER | 20 |
| 21 | 0150410 | STATOR VANE | 4 |
| 22 | 0150420 | STATOR VANE SPRING | 8 |
| 23 | 0150429 | DOWEL PINS - REAR | 2 |
| 24 | 0150720 | NEEDLE BEARING | 1 |
| 25 | 0150841 | REAR HOUSING, TS, #62 | 1 |
| | 0150842 | REAR HOUSING, TS, #63 | 1 |
| | 0150843 | REAR HOUSING, TS, #64 | 1 |

WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION

## REMOVAL OF SHAFT SEAL

1

1) Remove snap ring

WARNING: Use caution when removing snap ring. If released accidentally it can become an airborne hazard.

2

1) Pry out shaft seal plate with two screw drivers.
2) Remove seal plate o-ring from groove in bearing bore.

## REMOVAL OF WHEEL MOTOR SEAL PLATE AND BEARING BOX

3

1) Loosen and remove 8 each 10-32 bolts.
2) Pry off seal plate with screw driver.

4

Loosen and remove 8 each 3/8" bolts with 5/16" socket head wrench.

5

1) Two of the 3/8" bolt holes are provided with jack screw threads.
2) Insert a piece of 1/4" round stock by 2-1/2" long into each jack screw hole
3) Screw two 7/16-14 bolts into the jack screw threads until the bearing box is free of the motor.

6

Lift up on the bearing box to remove from motor.

## DISASSEMBLY OF WHEEL MOTOR BEARING BOX

7

1) Loosen clamp screw in lock nut.
2) Unscrew lock nut and remove.

8

1) Press shaft out of bearing box.
2) Proceed to step 9, disregarding steps 11 & 12

WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

## DISASSEMBLY OF FRONT HOUSING AND SHAFT

**9**

1) Mark one side of the motor for proper assembly, paying careful attention that the cartridge will not be installed upside down.
2) Secure the motor prior to loosening the 5/8-11 bolts.

**10**

1) Remove front housing
2) Note: Two 5/16" ball checks and one main body o-ring may be dislodged and fall free.

**11**

With the seal plate removed, press shaft and ball bearing out of front housing.

**12**

1) Remove snap ring from shaft.
2) Press shaft out of bearing.

## DISASSEMBLY OF ROTOR/STATOR CARTRIDGE

**13**

Lift up rotor/stator cartridge and remove from the rear housing.

**14**

1) Place cartridge on any object which will hold it off the table.
2) Remove two each 10-32 place screws.
3) Remove timing plate.

**15**

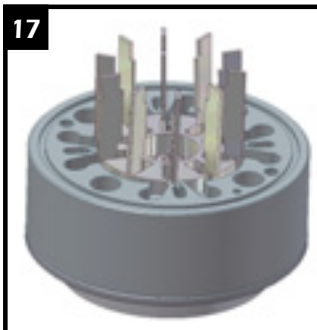
1) Remove o-ring and springs with a small screwdriver.
2) Remove dowels pins.

**16**

1) Replace plate on rotor/stator cartridge.
2) Turn rotor/stator cartridge over.
3) Repeat steps 14 & 15.

WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

17



1) Remove the rotor.
2) Remove both the rotor and stator vanes.
3) Note: On motors manufactured prior to 1987, rotor vane slots and rotor vanes should be numbered so that vanes can be reassembled in the same vane slot.

## INSPECTION AND REPLACEMENT OF PARTS

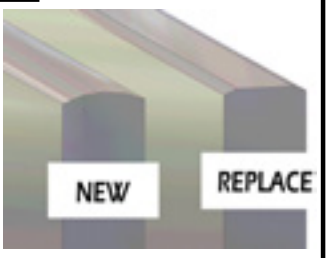
18

Inspect all springs and seals. We recommend replacement of all seals and springs whenever the motor has been disassembled.

19

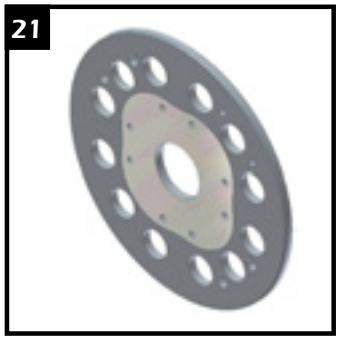
Inspect all parts and replace any parts which obviously show excessive wear or damage.

20




**VANES:** Normal wear results in slight flattening of vane tips which does not impair motor performance. Replace vane if radius is reduced by 50%. Clearance between the rotor vane and rotor vane slot varies with the vane selection. The design allows the vane to "lean" slightly in the slot, providing the required mechanical seal.

21

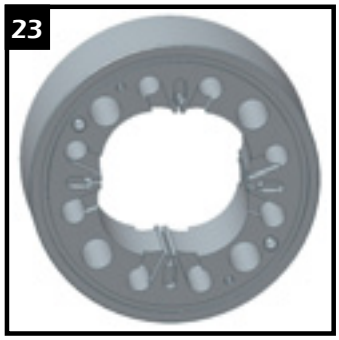


**PLATES:** Normal wear results in marking of timing plates which does not impair motor performance. Replacement of the timing plate is required if any smearing, galling, or heat cracks are present.

22

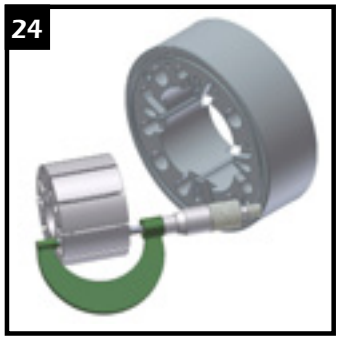
**ROTOR:** Normal wear results in polishing of rotor faces which does not impair motor performance. Examine the rotor vane slots closely. Polishing down in the slots is normal, but if there is any indication of a "pocket" forming in the wall of the slot, the rotor should be replaced.

23



**STATOR:** Normal wear results in polishing of cam form which does not impair motor performances. Noticeable wear may be apparent along the corner of one side of the staor vane slot. This does not necessarily require replacement of the stator, but may slightly affect volumetric efficiency.

24



Note: Measure the rotor and stator length to the fourth decimal point and supply measurement when ordering rotor, stator, or vanes.

WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

## ASSEMBLY OF ROTOR/STATOR CARTRIDGE

25

1) Reverse the procedures in steps 17, 16, 15, and 14
2) NOTE: Make sure that the radiused edge of each stator vane points to the rotor and the radiused edge of each rotor vane points to the stator.
3) NOTE: Make sure springs are seated in the bottom of the spring pocket in both the rotor and stator.

## ASSEMBLY OF FRONT HOUSING

26

1) Press bearing onto shaft.
2) Install snap ring.

27

Press shaft and bearing assembly into front housing by pressing on the outer race of bearing.

28

1) Place seal in seal plate.
2) Place seal plate o-ring into groove in the front housing.
3) Press seal plate into front housing.
4) Install snap ring.
5) Proceed to step 30.

## ASSEMBLY OF WHEEL MOTOR FRONT HOUSING

29

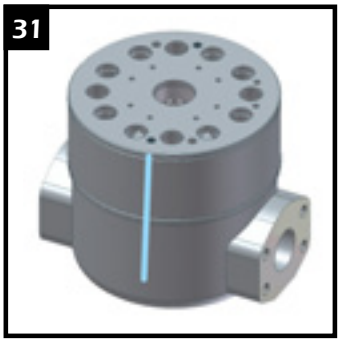
1) Reverse the procedures in steps 8 thru 3.
2) Screw lock nut onto shaft until all threads are engaged.
3) Tighten clamp screw until lock nut turns with a slight drag.
4) Tighten lock nut until desired rolling drag of bearing is obtained - see procedure Page 9.
5) Tighten clamp screw
6) Tighten all seal plate bolts.

## ASSEMBLY OF MOTOR

30

1) Install dowel pins into rear housing.
2) Install ballchecks into rear housings.
3) Install main body o-ring.

31



1) Place rotor/stator cartridge onto rear housing.
2) NOTE: Make sure assembly marks from step 3 are lined up.

32

1) Install main body o-ring into front housing.
2) Install ball checks into front housing.
3) Place a small amount of grease over ball checks and o-ring.
4) Wipe off excess grease.

WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

**33**

1) Install dowel pins into rotor/stator cartridge.
2) Pour a small amount of clean oil into the cartridge.
3) Install front housing onto rotor/stator cartridge.
4) Make sure alignment marks are lined up.

**34**

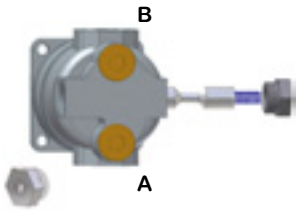
1) Install 5/8-11 bolts.
2) Torque bolts to 50 ft./lbs.

**35**

1) Rotate shaft in both directions to assure that the shaft turns smoothly.
2) Torque motor to 190 ft./lbs.
3) Rotate shaft again in both directions to assure that the shaft turns smoothly.

**SPOOL ASSEMBLY FOR THE TWO SPEED MOTOR**

**36**

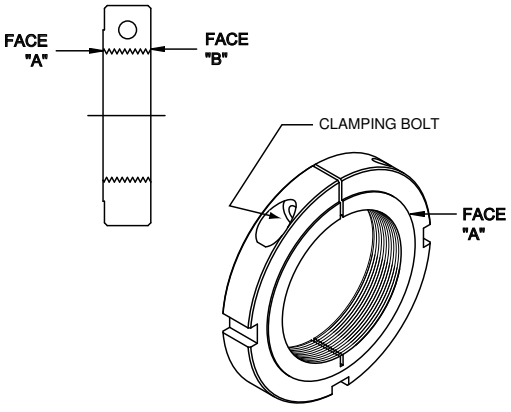



NOTE: Spool should be oriented as shown for two speed motors with model codes 62, 63, 68, & 69.

NOTE: Slight design variations may exist in motors manufactured either before or after the printing of this manual.

## WHEEL MOTOR SHAFT AND BEARING ASSEMBLY PROCEDURE

1) Clean ALL assembly parts w/ lacquer thinner.
2) Dip clampnut and clamping bolt separately in lacquer thinner.
3) (Steps 3 thru 10 must be conducted to completion ONE assembly at a time.)
4) Press bearing cups into bearing housing. Make sure they are pressed completely against bearing shoulders.
5) Coat inner race of large cone with #609 (green) Loctite and press cone onto the shaft. Make sure the cone is completely against the shoulder of the shaft.
6) Insert shaft and large cone into bearing housing.
7) Coat inner race of small cone with #609 (green) Loctite and press small cone onto shaft.
8) Apply #272 (red) Loctite to the clampnut threads of the shaft. Apply #242 (blue) Loctite to the threads of the clamping bolt and install in the clampnut.
9) Spin clampnut onto shaft with the "B" face towards bearings. After the nut threads are fully engaged, but prior to the nut contacting the bearings, tighten the clamping bolt until there is drag on the clamping nut (see note Fig. 1). Tighten the nut until a 20 to 30 inch pound rolling torque is achieved.
10) Tighten clamping bolt on clampnut to 70 inch pounds and recheck rolling torque. Apply inspectors lacquer to head of the bolt.
11) Allow a minimum of 24 hrs. to dry.



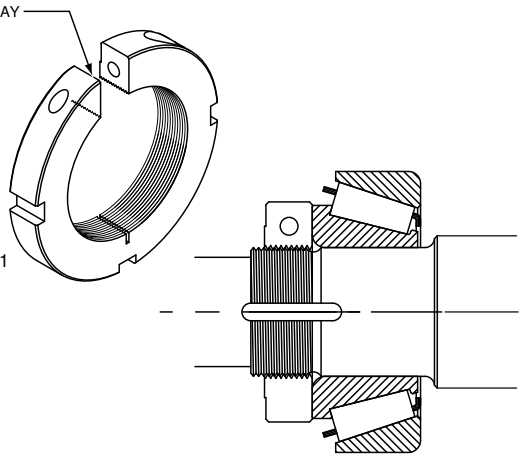
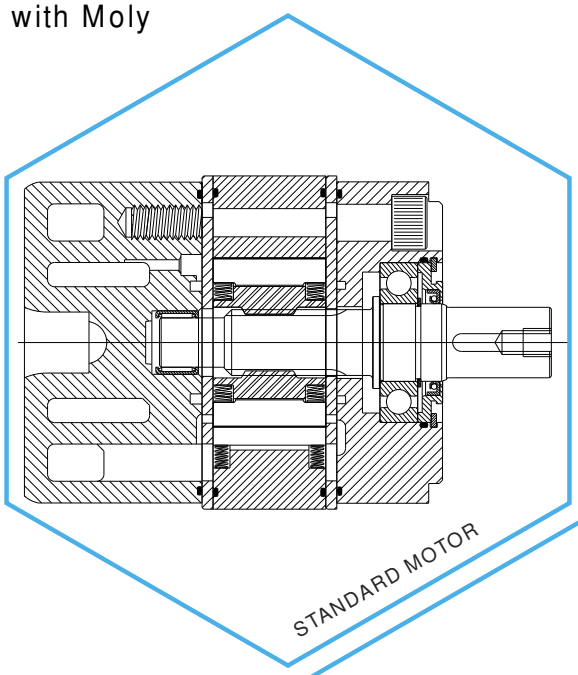



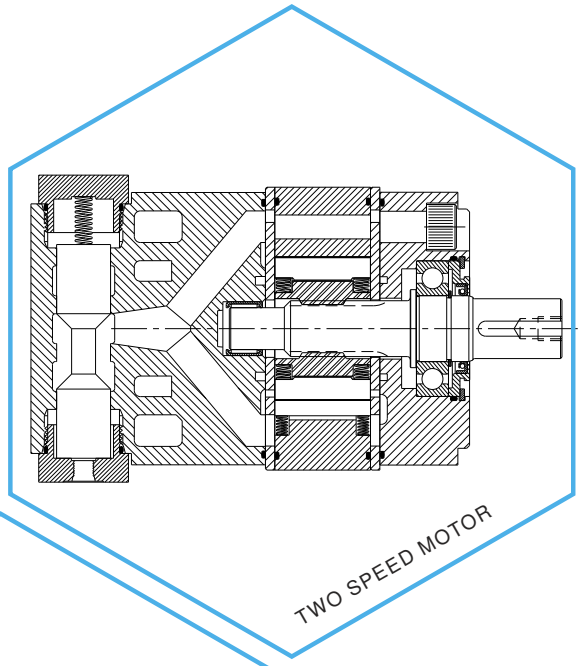

Figure 1

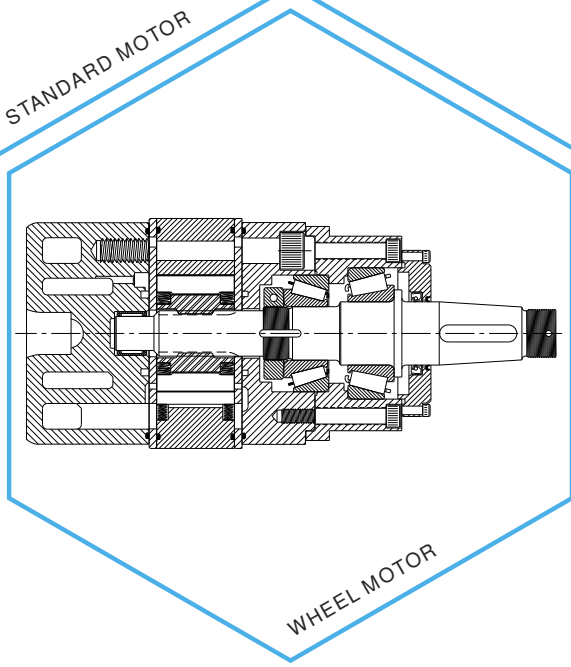
## Information:

Bolt Torque -
Main Bolts (5/8-11): 190 ft. lbs.
Seal Plate (3/8-16)
(Wheel Motor only): 45 ft. lbs.
Grease used for bolt threads
and o-ring retention:
Pennzoil 707L RED
Shaft seal assembly lube:
Mobilgrease special
with Moly

Seal Kits:
Standard 15 series seal kit
#0150940
Standard 15 two speed seal kit
#0150940
Standard 15 wheel motor seal kit
#0150936


STANDARD MOTOR


TWO SPEED MOTOR

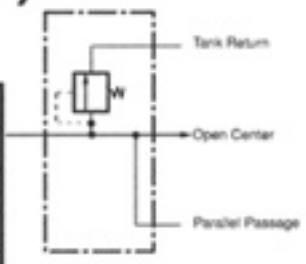

WHEEL MOTOR

331 Breesport San Antonio, Texas 78216
210-341-6333 Fax: 210-341-1231 e-mail: sales@rineer.com

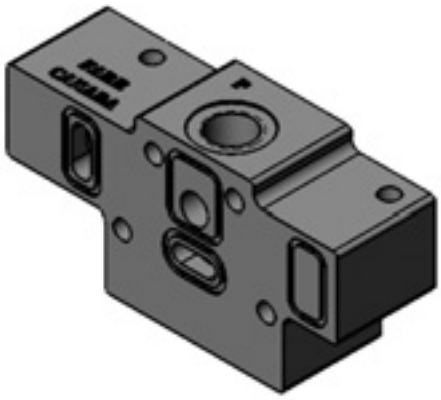
# Inlets (2500 psi)

## End Inlet

| End Port | Top Port |
|---|---|
| 1" NPT | 1" NPT |
| SAE-16 | SAE-16 |
| SAE-20 | SAE-16 |
| NON-PORTED HOUSING | |



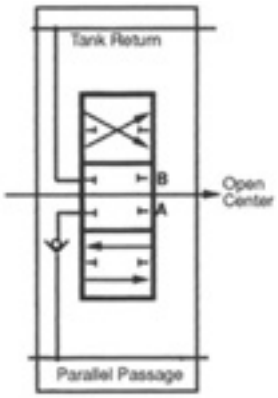

Schematic shown with main R/V



# Adjustable Relief Valve Cartridges

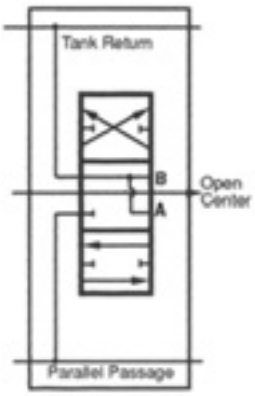
## For Inlets and Mid-section Inlets

| Code | Description |
|---|---|
| DVA35-MRV-1 | Main R/V pressure range 800-2000 psi. Factory set @ 1500 psi @ 50 gpm |
| DVA35-MRV-2 | Main R/V pressure range 2001-2500 psi. Factory set @2500 psi @ 50 gpm. |
| DVA35-MRVP | Main relief valve plug |



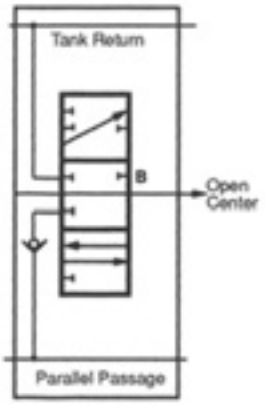

## DA8

Double-Acting Section
4-Way, 3-Position, Hold in Neutral
Cylinder Spool




## MA8

Double-Acting Section
4-Way, 3-Position, Float in Neutral
Motor Spool




# SA8

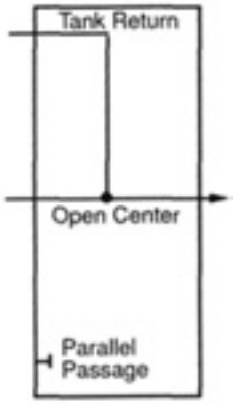
Single-Acting Section
3-Way, 3-Position, Hold in Neutral
Cylinder Spool

## Outlets

### Tank Return Type

| Code | End Port | Top Port |
|---|---|---|
| DVA35-TR55 | 1 1/4" NPT | 1 1/4" NPT |
| DVA35-TR99 | SAE-20 | SAE-20 |
| DVA35-TR00 | NON-PORTED HOUSING | |

NOTE: See Section G, Page 32 for Port Plugs



# Brief Circuit Descriptions

## Series Circuit

Available in DVA20 sections only.

If a machine's work cycle requires simultaneous as well as separate operation of individual hydraulic work functions, a series circuit is right for the job.

As with the other circuits, the oil flows through the open center when all spools are in neutral. There is no parallel passage in standard series sections because they feed directly from the open center passage. If more than one spool is operated, pump flow goes first to the section closest to the inlet. Return flow from the first section is fed back into the open center for use by downstream sections.

Downstream sections can be series, parallel or tandem and will operate in series with the upstream section.

In series circuits, operating pressure is cumulative. Therefore, the sum of the pressures in the circuits can not exceed the circuit or main relief valve setting.

## Parallel Circuits

Parallel circuits are the most common on mobile equipment because more than one function can be operated simultaneously and at random. If two or more functions are fully operated at the same time, the one with the lightest load will assert priority because the fluid will take the path of least resistance. However, the operater can divide the flow between functions by metering the spools.

Movement of the spool meters or shuts off the flow of oil thru the open center passage and pressurizes the parallel passage. Oil is then available, at the operator's discretion, to all work ports connected to the parallel passage.

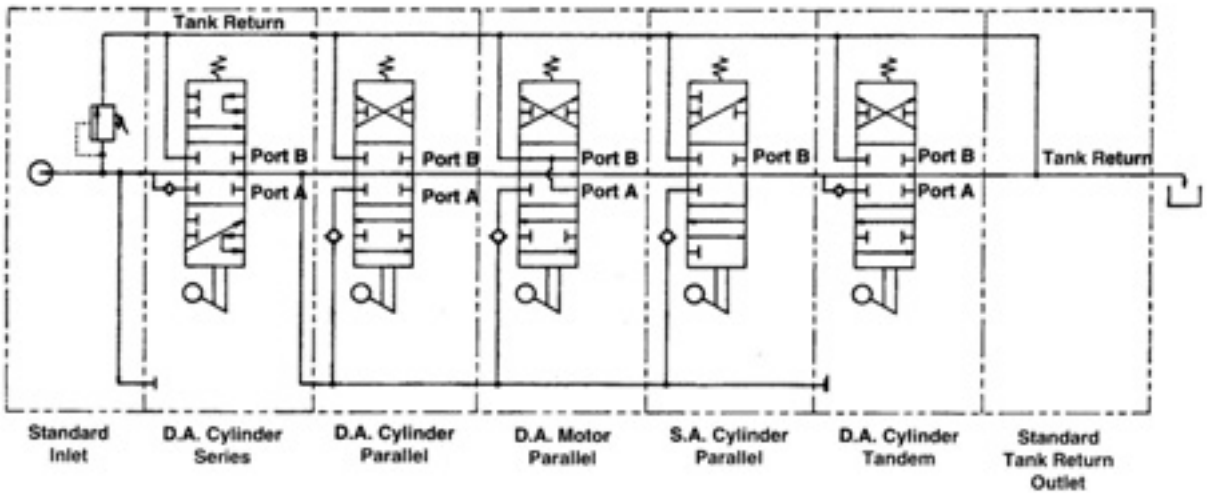
## Tandem Circuits

(Not available in the program)

Tandem circuits are sometimes called priority or standard circuits by other manufacturers. Tandem sections feed from the open center passage like series sections but the return flow is directed to the tank return passage and is not available downstream.

If a tandem section is followed by a series or tandem section, operating the tandem section nearest the inlet will assert priority and downstream sections will not function.

# Typical Work Section Schematics



# VA™/VG™ Valve Service Instructions

## INTRODUCTION

This manual has been prepared to assist you in the proper maintenance of the VA20™/VA35™ and VG20™/VG35™/VG80™ directional control valves. Before any work is done, we suggest that you read the assembly and disassembly instructions completely.

The first rule of good maintenance is cleanliness, which includes a clean environment. MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA. Dirt is the natural enemy of any hydraulic system.

## GENERAL INFORMATION

The VA and VG model valves are updated versions of our proven A20™ and A35™ units. The VG models are cast from compacted graphite, a high strength iron alloy, which allows the valve to be rated to 3500 psi. VA models are cast from gray iron and are rated at 2500 psi. These open-center, directional-control valves are available in parallel, tandem, and series circuitry. As needed, the sectional, stack-type construction provides flexibility for the addition of subtraction of work sections to an existing valve bank. This design also permits the combination of parallel, tandem, and series circuitry in a single bank. The internal coring of each valve section determines its circuitry and the number of gasket seals required.

All sections with optional features, such as port relief valves, crossover relief valves, and anti-cavitation checks, are dimensionally larger when measured from the top of the port to the bottom of the housing. These are referred to as "hi-boy" sections. Those without work-port options can use the low-profile castings, which are called "lo-boy" sections.

## REPLACEMENT PARTS

The illustrations and instructions in this manual apply only to the VA/VG series assemblies, subassemblies, and components. All valve components, except for spools and housings, are available as replacement parts or subassemblies. Spools are hone-fitted to their individual housings, so damage to either of these components means the entire section must be replaced.

We recommend that you use only genuine VA/VG series replacement parts in your service program. Manufactured to the same exacting tolerances and quality controls as the original equipment, genuine VA/VG replacement parts may help prevent premature, component failure and costly downtime. Service parts and assemblies are available through your original equipment dealer or any authorized distributor.

## MAINTENANCE

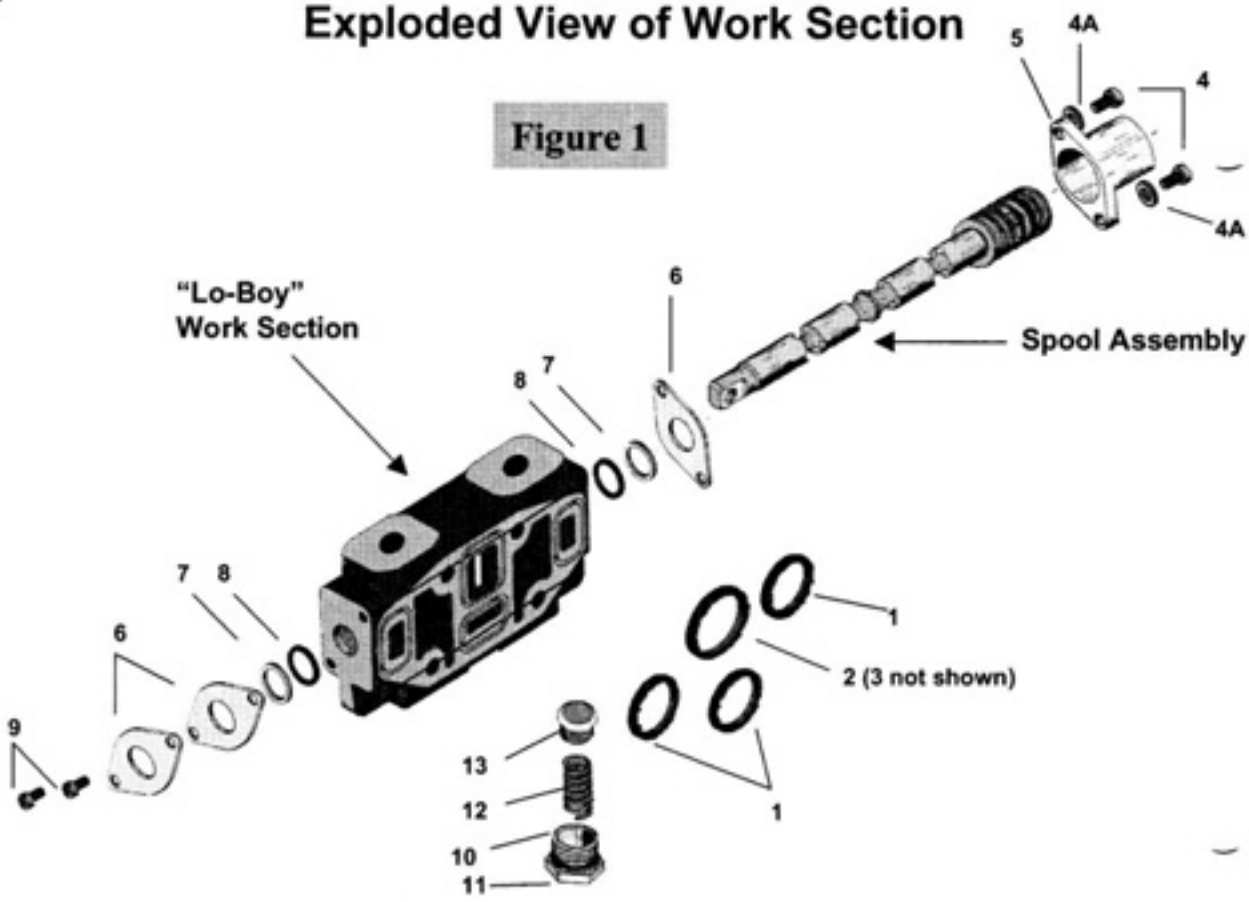
Valves are often used in hazardous environments. Inspect them frequently for damage due to improper use, corrosion or normal wear. If needed, repairs should be made immediately.

**Always refer to the machine manual for the proper procedure to remove the valve from the machine.**

Remove the valve bank from the equipment, disconnecting all hoses, fittings, control handles and linkage connectors that might be attached to the valve. Plug all ports and thoroughly clean the exterior of the valve bank, then the port plugs can be removed.

## Exploded View of Work Section

Figure 1



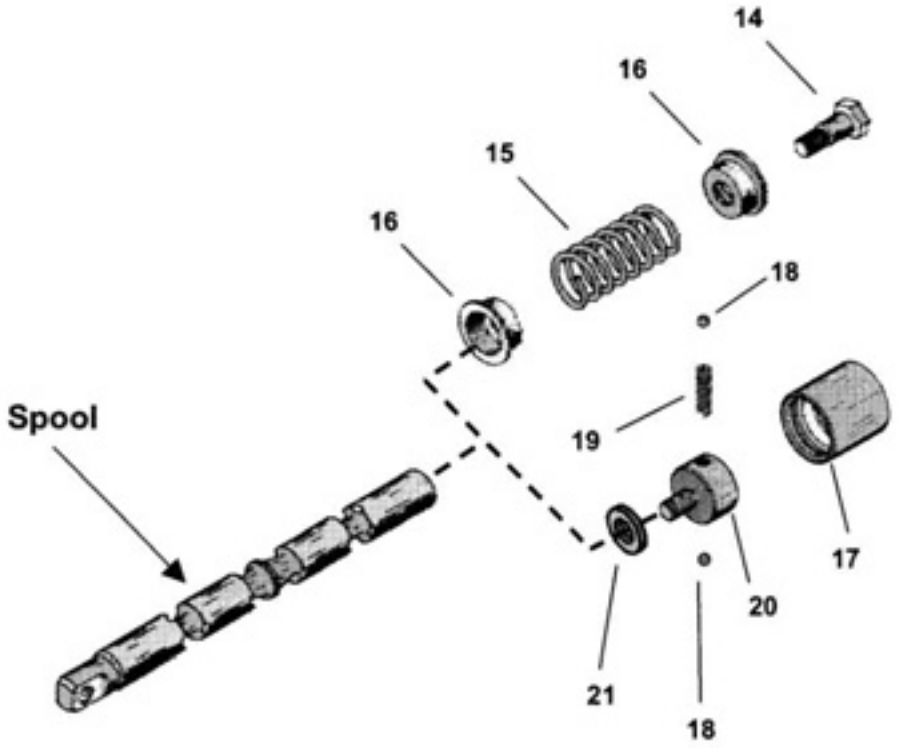

## Parts List For Work Section

| Item | Description | Qty. | VA/VG20 Part No. | VA/VG35 Part No. | VG80 Part No. |
|---|---|---|---|---|---|
| **Parallel Section Seals* See Figure 1** | | | | | |
| 1. | Square Seals | 3 | 391-2881-206 | 391-2881-200 | 391-2881-433 |
| 2. | Square Seal | 1 | 391-2881-200 | 391-2881-403 | 391-2881-670 |
| **Series Section Seals** | | | | | |
| 1. | Square Seals | 2 | 391-2881-206 | 391-2881-200 | ..... |
| 3. | Square Seal | 1 | 391-2881-627 | 391-2881-628 | ..... |
| **Parallel and Series Section Component Parts. See Figure 1** | | | | | |
| 4. | Back Cap Screws | 2 | 391-1433-020 | 391-1433-009 | (4) 391-1402-068 |
| 4A. | Lock washers | 8 | ..... | ..... | 391-3783-039 |
| 5. | Back Cap | 1 | 341-6000-100 | 342-6000-100 | 341-0585-099 |
| 6. | Retainer Plates | 3 | 391-2183-001 | 391-2183-005 | 391-2183-157 |
| 7. | Back up Rings | 2 | 391-2681-378 | 391-2681-426 | 391-2681-285 |
| 8. | Spool Seals | 2 | 391-1985-014 | 391-2887-212 | 391-2881-096 |
| 9. | Retainer Plate Screws | 2 | 391-1433-015 | 391-1433-002 | (4) 391-1402-015 |
| 10. | Check Valve Cap | 1 | 391-0581-044 | 391-0581-044 | 391-0585-099 |
| | Or Valve Cap (F.I.N.) | 1 | 391-2281-015 | 391-2281-015 | ..... |
| 11. | O Ring Seal ** | 1 | 391-2881-204 | 391-2881-204 | 391-2881-249 |
| 12. | Check Spring ** | 1 | 391-3581-713 | 391-3581-713 | 391-3581-778 |
| 13. | Check Valve Poppet ** | 1 | 391-2481-069 | 391-2481-069 | 391-2383-091 |

*Parallel Sealing Face includes inlets and mid-inlets.

**Not required in Float-in-neutral Sections.

## Figure 2




**Spring Centered and Detent Spool Operators. See Figure 2**

| | | | | |
|---|---|---|---|---|
| 14.Stripper Bolt | 1 | 391-1432-022 | 391-1432-021 | 391-1402-452 |
| 15.Centering Spring | 1 | 391-3581-608 | 391-3581-633 | 391-3581-330 |
| 16.Spring Guides | 2 | 391-1642-045 | 391-1642-013 | 391-1642-161 |
| 17.Detent Sleeve | 1 | 391-3283-015 | 391-3283-008 | 391-3384-310 |
| 18.Detent Balls | 2 | 391-0282-010 | 391-0282-009 | 391-0282-011 |
| 19.Detent Spring | 1 | 391-3581-130 | 391-3581-015 | 391-3581-316 |
| 20.Detent Poppet Retainer | 1 | 391-2583-008 | 391-2583-006 | 391-3384-311 |
| 21.Detent Spacer | 1 | ..... | ..... | 391-3782-208 |

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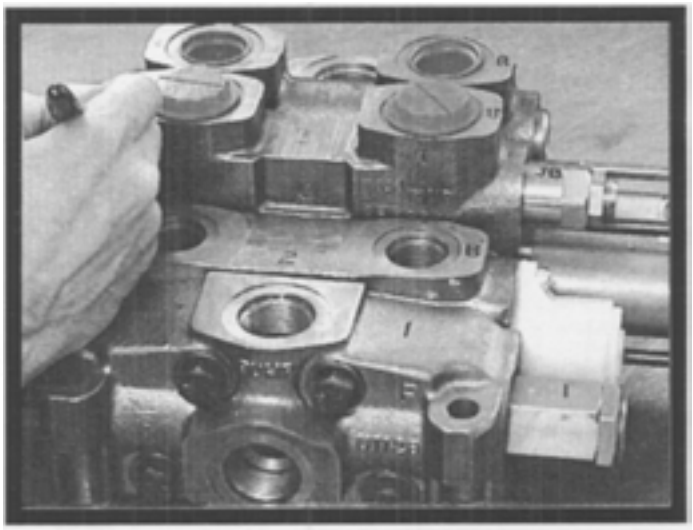
# Valve Disassembly Instructions

**Reference exploded view and parts list on page 2 and 3 for work section detail.**



## Step 1 - Valve Bank

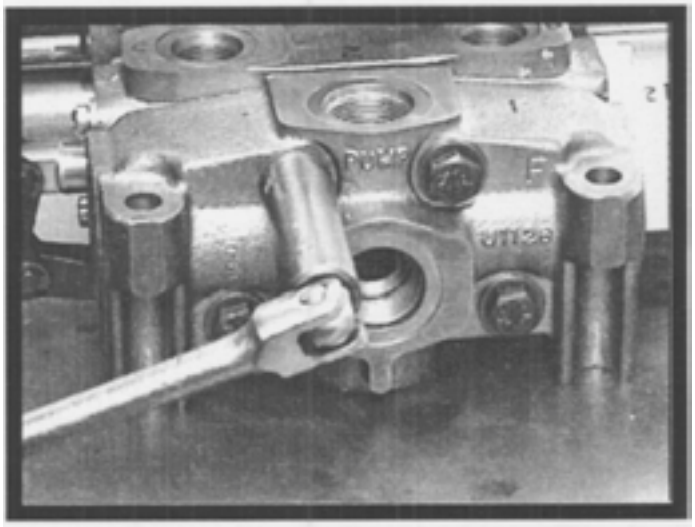
This step is the most critical in the disassembly procedure. It should be followed closely to ensure that the valve bank is properly reassembled after repairs have been made.

With a waterproof, quick-drying marker, mark each casting with a sequential number. Start by marking the inlet casting with the #1 and finish by marking the outlet with the highest number.

Next, mark the port boss closest to the back cap on each work section with a "B" (for back cap end).

Then, mark the port boss closest to the spool clevis on each work section with a "C" (for clevis end).

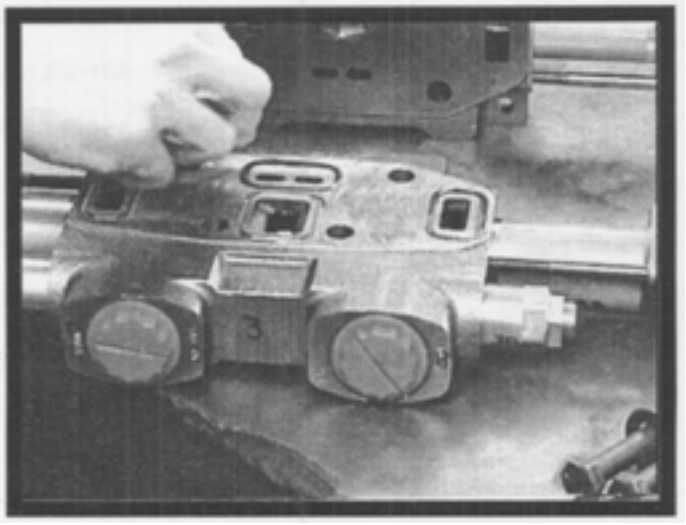
Finally, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they were removed. Inlet and mid-inlet relief valves are marked with a casting number only.



## Step 2 - Tie Bolts

Remove the four, tie bolts that hold the bank together and separate the sections.

**NOTE: VA valve tie bolts thread into the outlet casting. VG valve tie bolts pass through the entire bank, requiring washers and hex nuts to be fastened at both ends of the bolt.**



## Step 3 - Section Seals

The inlet, mid-inlet and each parallel work section have four, section seals, (Fig. 1, items 1 & 2) on the downstream, mating face. Series work sections and the VA/VG35 split flow mid inlets have three section seals on the downstream mating face, (Fig. 1, items 1 & 3.) These section seals should be removed and discarded.

**REMINDER: ALL WORK MUST BE PERFORMED IN A CLEAN AREA.**

# Valve Disassembly Instructions

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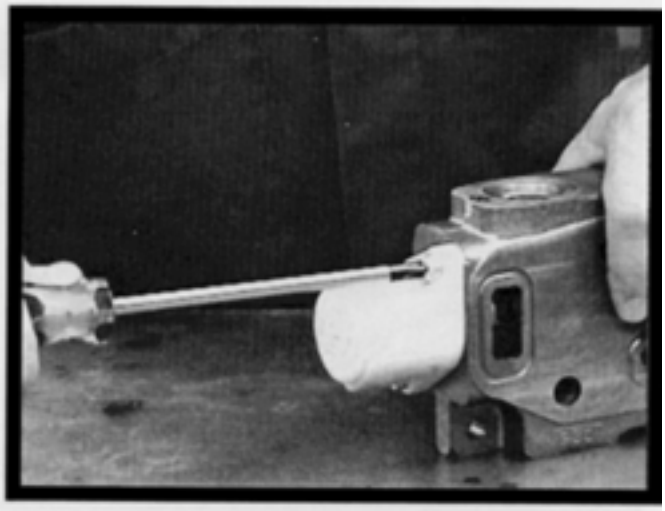


## Step 4 - Valve Back Cap

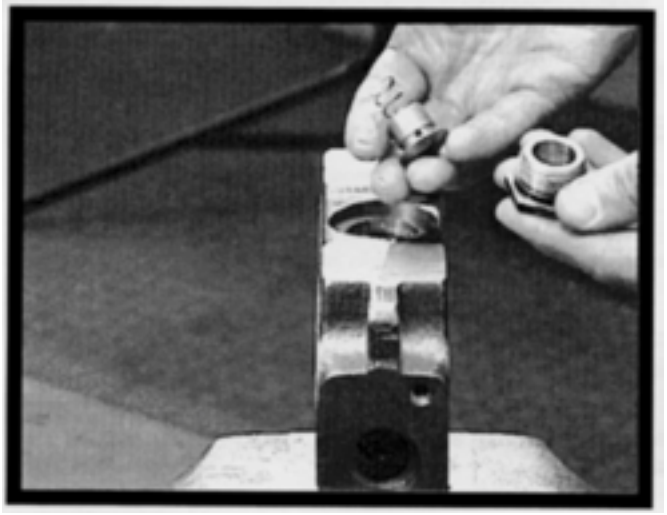
Using a large, Phillips-head screwdriver, remove the two, cap screws (Fig. 1, item 4) which fasten the back cap to the work section. Lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (Fig. 1, item 5).

## Step 5 - Control Spool and Seals

Grasp the spring end of the spool with a clean, lint-free cloth and pull the spool out of the housing using a twisting motion. Generally, the rear, retainer plate (Fig. 1, item 6 ) back-up ring (Fig. 1, item 7) and spool seal (Fig. 1, item 8) will come out with the spool.

**CAUTION: For detented spool models, be careful not to remove the detent poppet sleeve (Fig. 2, item 17) unless it is to be serviced.**

Using a large, Phillips-head screwdriver, remove the two, retainer-plate screws (Fig. 1, item 9) from the spool clevis end of the work section. Lightly tap the end of the screwdriver handle with a hammer to break the adhesive. Remove the two, retainer plates (Fig. 1, item 6) the back-up ring (Fig. 1, item 7) and the spool seal (Fig. 1, item 8). Tag or mark with the appropriate, work section identification number. (See Step 1.) Spool seals (Fig. 1, item 8) and back-up rings (Fig. 1, item 7) should be discarded.



## Step 6 - Transition Check

The transition check is located in the bottom center of the work section housing. Carefully clamp the work section in a vise with ports down. Do not clamp on the machined surface. Remove the check-valve cap (Fig. 1, item 10) and its O-ring seal (Fig. 1, item 11). Discard the seal. Remove the check spring (Fig. 1, item 12,) and the check-valve poppet (Fig. 1, item 13).

**NOTE: Only cylinder work sections (ports blocked in neutral) have a transition check. Motor sections have only a cap plug.**

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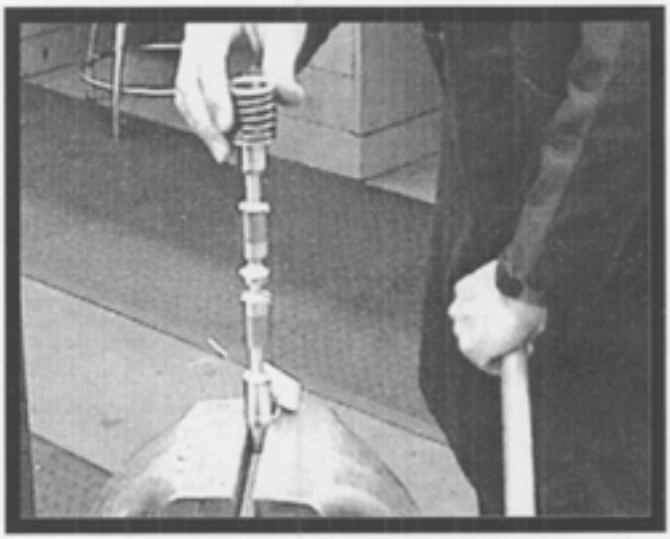
# Valve Disassembly Instructions

## Spool Disassembly

### Spring Centered Spool

The spring assembly should not be removed from the spool unless these parts need to be replaced. Once the spool is free of the work section housing, it must be handled carefully to avoid damage. Place the spool vertically in a soft-jawed vise, clamping on the flat, spool clevis, and remove the stripper bolt (Fig. 1, item 14) with a wrench.



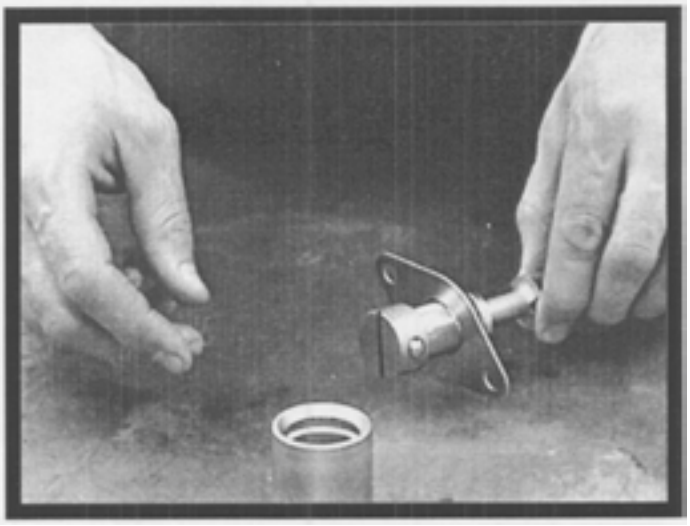
Lightly tap the stripper bolt with a hammer and a punch to help break the adhesive. Cautious application of heat may be required to free the stripper bolt, since an anaerobic thread adhesive was used during its assembly.

**CAUTION: Too much heat may distort the spool.**

As the stripper-bolt threads disengage, the spring (Fig. 2, item 15) and spring guides (Fig. 2, item 16) will release abruptly from the spool.

### Detent Spool

The detent assembly should not be removed from the spool unless these parts need to be replaced. Wrap the detent sleeve (Fig. 2, item 17) with a clean, lint-free cloth. Grip the cloth-covered sleeve and pull firmly. As the sleeve moves backwards, the detent balls (Fig. 2, item 18) and the detent spring (Fig. 2, item 19) will release abruptly. The cloth should capture these parts and prevent their loss.



Next, clamp the spool in a soft-jawed vise and remove the detent poppet retainer (Fig. 2, item 20). Place an undersized bar through the detent ball bore to serve as a wrench. Lightly tap the detent poppet retainer with a hammer and a punch to help break the adhesive. Cautious application of heat may be required again, since an anaerobic adhesive was also used in the detent retainer assembly.

**CAUTION: Too much heat may distort the spool!**

## CLEANING, INSPECTION, AND REPAIR

1. Inspect the spool bore, transition check seat and spool from each section for deep scratches, gouges or excessive wear. If any of these conditions exist, replace the section. Minor, surface damage on the control spool and check poppet can be carefully polished away with a very fine, crocus cloth.

2. Examine the machined surfaces of the valve housing for nicks and burrs that could cause leakage between sections. Lightly stone these surfaces to remove any rough spots.

**CAUTION: A shallow-milled relief area extends across the O-ring face of the valve housing. This should not be stoned or ground off!**

3. Wash all parts thoroughly in a cleaning solvent and blow dry before beginning reassembly. Pay special attention to the number and letters marked on the parts in Step 1. If any marks are removed during cleaning, re-mark immediately.

4. Clean adhesive from threads of spool, stripper bolt, housing, cap screws and hex nut with Loctite™ Chisel Gasket Remover.

# Valve Assembly Instructions

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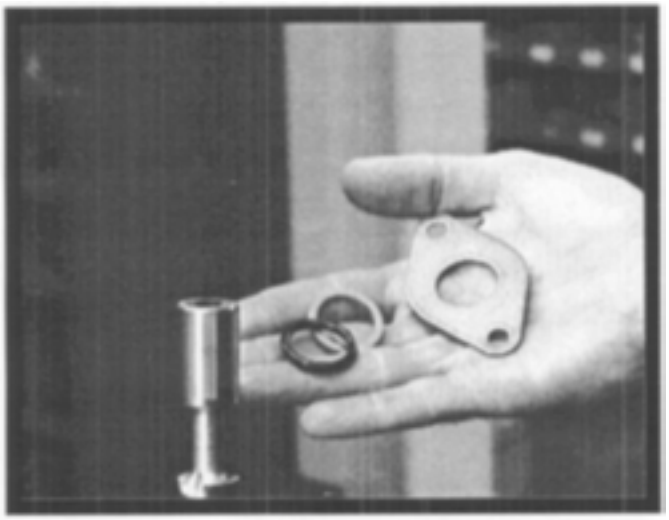
## Preparation of Parts

Spray the threads of the new stripper bolt (Fig. 2, item 14) tapped-threaded spool end, all screws and screw holes on both ends of the housing with LOCQUIC Primer Grade NF™ and let dry.

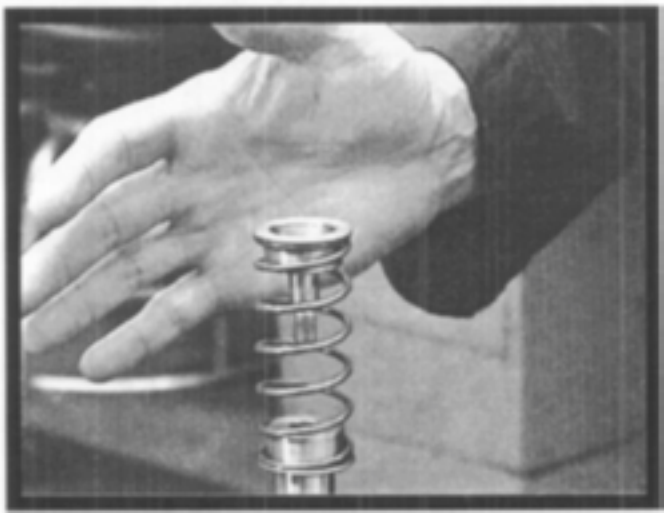
**CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or product malfunction. Product should be thoroughly tested to ensure proper operation before the valve is placed back into service.**

## Spring Center Spool Assembly



### Step 1 - Spool Assembly-Spring Centered

Clamp the flat, clevis end of the control spool in a soft jawed vise. Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8 ) and slide it onto the end of the spool away from the clevis. Slide on the back-up ring (Fig. 1, item 7) and retainer plate (Fig. 1, item 6). Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



### Step 2 - Attach Spring Guides and Spring

Apply 2 - 3 drops of Loctite 262™ or equivalent anaerobic adhesive near the middle of the female threads in the spool. Assemble the spring guides (Fig. 2, item 16) centering spring (Fig. 2, item 15 ) and stripper bolt (Fig.2, item 14, ) onto the spool (Reverse of Step 7). Torque the stripper bolt to 175 in. lbs. +/-4 in. lbs.

**CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding. Check for binding by compressing the spring and guides or by rotating the spring guide nearest the housing.**

**CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure!**

Lightly coat the centering spring with high- temperature grease to prevent rusting. Set the spool assembly aside and let it cure for a minimum of 1 hour. After curing, test the stripper bolt to make certain it can withstand 125 in. lbs. of breakaway torque.

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# Valve Assembly Instructions

## Detent Spool Assembly

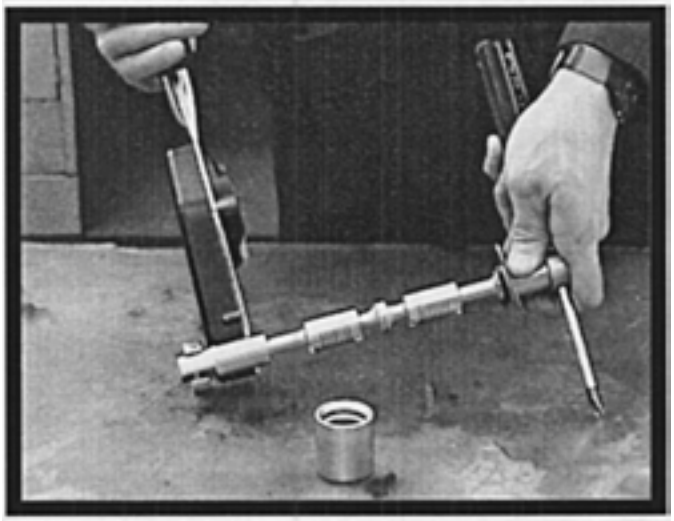
### Step 1 - Spool Assembly-Detent

Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide the back-up ring (Fig. 1, item 7) and one, retainer plate (Fig. 1 item 6) onto the spool. Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches. Apply 2 - 3 drops of Loctite 262™ or an equivalent, anaerobic adhesive near the middle of the female threads in the spool.

**CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure.**

### Step 2 - Spool Assembly-Detent

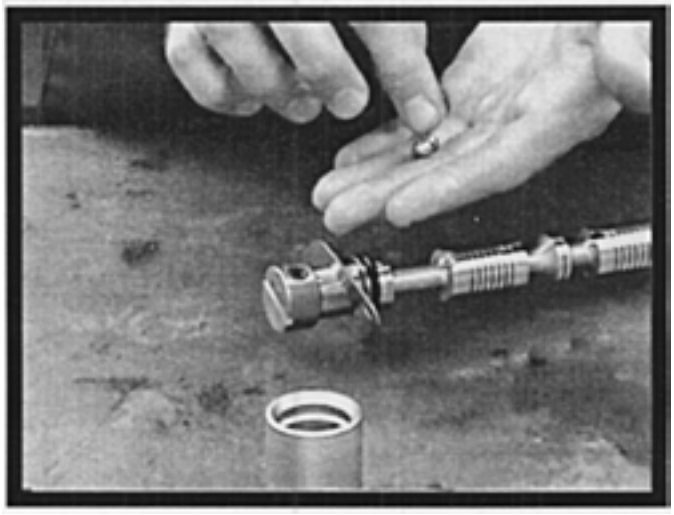
Thread the detent ball retainer (Fig. 2, item 20) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs.. This can be accomplished by using a crows-foot socket on the flats of the clevis, and holding the spool by inserting a round, steel rod or screwdriver through the hole in the ball retainer.



### Step 3 - Detent Balls and Spring

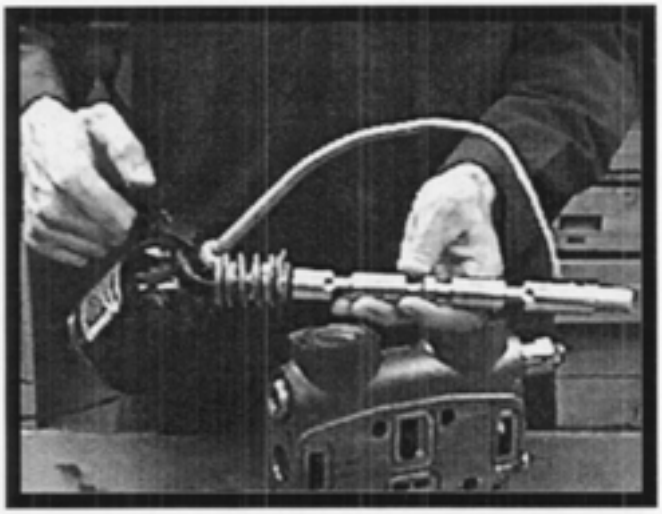
Next, lightly coat the detent balls (Fig. 2, item 18) detent spring (Fig. 2, item 19) and entire inside diameter of the detent sleeve (Fig. 2, item 17) with high-temperature grease.

Insert the detent spring into the through hole in the detent ball retainer. Place the steel balls on the ends of the spring. Compress the balls and spring, then slip on the detent sleeve. (Note: The detent sleeve is not symmetrical; one end of the sleeve has a lead-in chamfer. This chamfer must face the spool clevis when assembled.) Move the detent sleeve to the neutral or middle position to prevent the subassembly from separating during subsequent steps.



# Valve Assembly Instructions

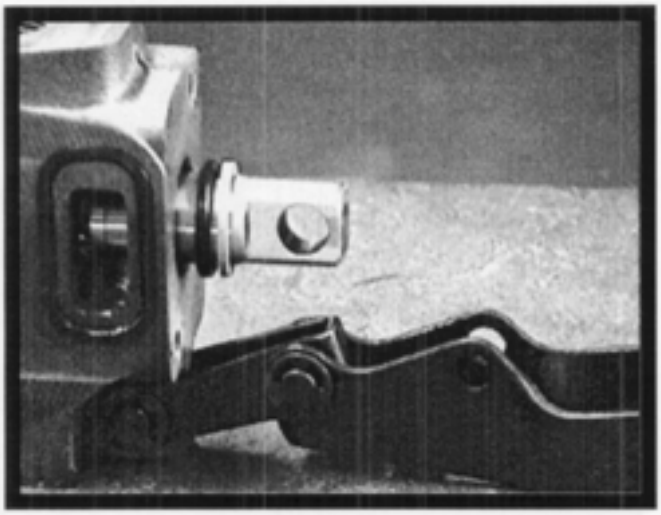




## Step 1 - Spool Subassembly

Apply 2 - 3 drops of Loctite 262™ or equivalent to the fillister screw holes on both ends of the housing.

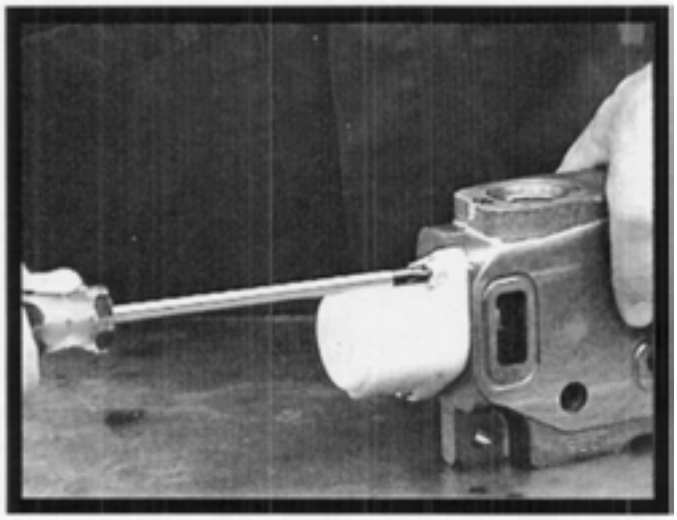
Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll or damage the seals. Make sure that the spool and housing are in the proper orientation (see Step 1, page 6 disassembly).



## Step 2 - Spool Seal and Back up

Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide on the back-up ring (Fig. 1, item 7). Push both items into the counter-bore until they bottom out.

Assemble the two, front, retainer plates (Fig. 1, item 6) using the two short, fillister screws (Fig. 1, item 9). Check retainer plates for proper alignment. Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs..



## Step 3 - Back cap

Install the back cap using the two, long, fillister screws (Fig. 1, item 4). Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs.

**Caution: Excessive torque will damage the back cap ears!**

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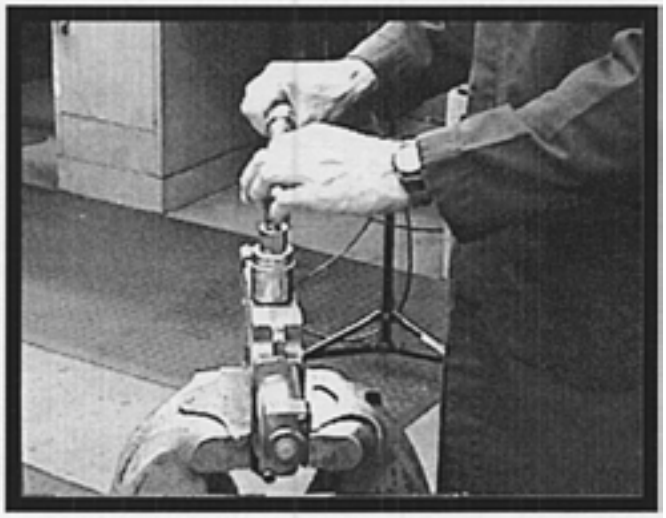
# Valve Assembly Instructions

## Step 4 - Install Transition Check

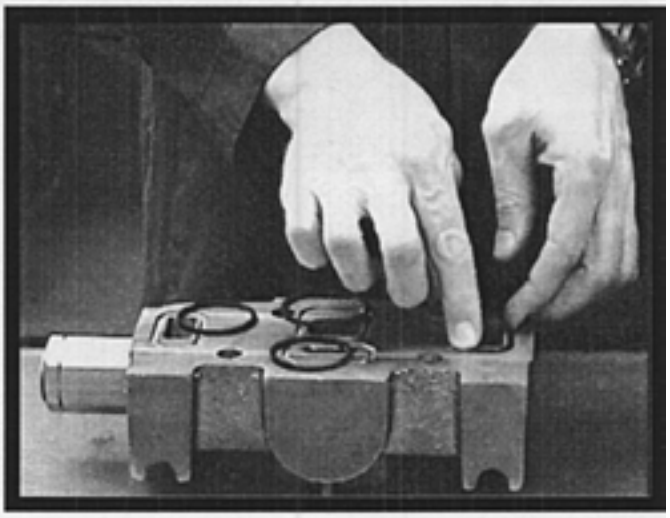
Inspect transition check components for cleanliness. Install check poppet (Fig. 1, item 13) into the transition check cavity. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 11) over the poppet and spring. Turning by hand, engage several threads. Tighten to a final torque of 75 ft. lbs. +/-4ft. lbs..



## Step 5 - Relief Valves

Return all relief valves to their proper positions and torque to 75 ft. lbs.

Install new, section seals. Place section seals (Fig. 1, items 1 & 2, or items 1 & 3) in the proper grooves. Make certain seals stay in their grooves during assembly.



## Step 6 - Install Tie Bolts

Slide the tie bolts through the inlet casting. If cap screws are used, place a washer on the cap screw prior to installation. Place the valve sections on the tie bolts in their proper sequence (see Step 1, page 4). Turning by hand, engage several threads in the outlet. If it is a VG series assembly, assemble nut and washer to either end of the stud and follow above instructions. Torque the tie bolts in a cross-corner pattern.

**Tie Bolt Torque Values**

**VA20 - 29 ft. lbs. (348 in. lbs.)**
**VG20 - 42 ft. lbs. (504 in. lbs.)**
**VA35 - 34 ft. lbs. (408 in. lbs.)**
**VG35 - 75 ft. lbs. (900 in. lbs.)**
**VG80 - 150 ft. lbs. (1800 in. lbs.)**

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## Troubleshooting

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Oil leaks between sections | Pinched, blown or missing section seal | Replace section seal |
| | Stud fasteners not correctly torqued | Replace section seals and re-torque |
| | Mounting plate not level | Loosen mounting bolts and shim as required |
| | Contamination/burrs on seal | Clean seal groove, replace section seal |
| Oil leaks at either end of spool | Over-pressurized tank core | Correct high, back-pressure condition |
| | Worn or damaged spool seals | Replace seals and seal retainers |
| Spring - centered spools do not return to neutral | Broken centering spring | Replace centering spring |
| | Misalignment of operating linkage | Check linkage for mechanical binding |
| | Foreign particles in system | Clean valve and system |
| Load will not hold | Cylinder leaking or worn | Check cylinder - repair |
| | Port relief valve not holding | Remove and clean or replace |
| | Spool or housing scored or worn excessively | Replace section |
| Load drops when spool moved from neutral | Dirt or foreign particles lodged between check-valve poppet and seat | Disassemble, clean & reassemble |
| | Scored or sticking check-valve poppet | Replace poppet |
| No motion, slow, or erratic system operation | Worn pump | Check flow & pressure |
| | Defective cylinder or motor | Repair or replace |
| | Low-reservoir oil level | Add oil to specifications |
| | Clogged suction strainer | Clean or replace |
| | Suction line restricted | Check lines |
| | Relief valve not properly set | Check pressure setting |
| | Relief valve poppet or seat scored & sticking open | Replace relief valve |
| | Valve spool not shifted to full stroke | Check spool linkage travel |

## Pilot-to-open, spring biased closed, unbalanced poppet logic element

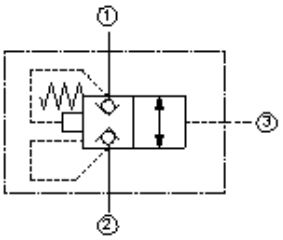
Capacity:
**60 gpm (240 L/ min.)**

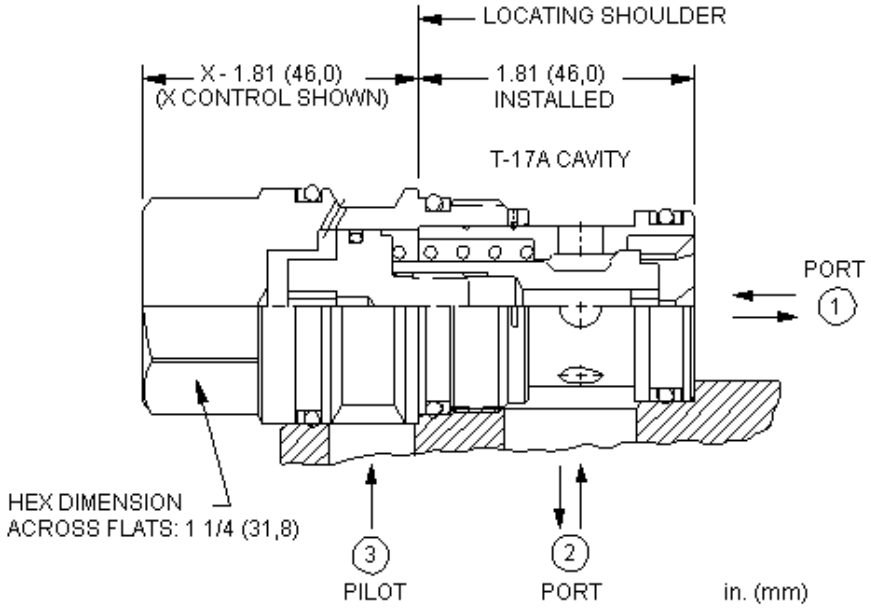
Functional Group:
**Products : Cartridges : Corrosion Resistant : Logic Element : Unbalanced Poppet, Pilot-to-open, Switching Element, Spring biased closed, External Pilot Port 3 pilot source**

Model:
**LKHC**

### Product Description

These unbalanced poppet, logic valves are 2-way switching elements that are spring-biased closed. Pressure at either work port 1 or 2 will further bias the valve to the closed position while pressure at port 3 will tend to open it. The force generated at port 3 must be greater than the sum of the forces acting at port 1 and port 2 plus the spring force for the valve to open. NOTE: The pilot area (port 3) is 1.8 times the area at port 1 and 2.25 times the area at port 2.



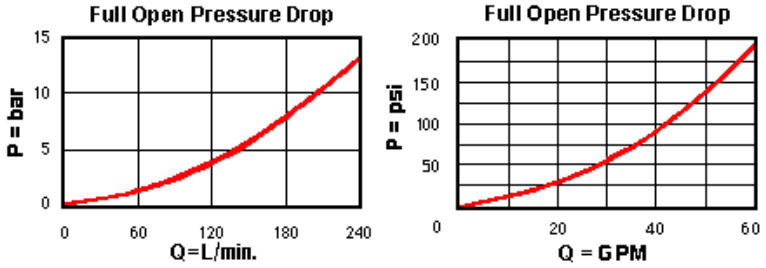

### Technical Features

- Because these valves are unbalanced, operation is pressure dependent. Opening and closing of the poppet are functions of the force balances on three areas: 1) Port 1 = 100%, Port 2 = 80%, and Port 3 = 180%.
- These valves are pressure responsive at all three ports, therefore it is essential to consider all aspects of system operation through a complete cycle. Pressure changes at any one port may cause a valve to switch from a closed to an open position, or vice versa. All possible pressure changes in the complete circuit must be considered to assure a safe, functional system design.

- These valves have positive seals between port 3 and port 2.
- Incorporates the Sun floating style construction to eliminate the effects of internal parts binding due to excessive installation torque and/or cavity/cartridge machining variations.
- Stainless steel cartridge options P or W are intended for use within corrosive environments with all external components manufactured in stainless steel or titanium. Internal working components remain the same as the standard valves.

## Technical Data

| | U.S. Units | Metric Units |
|---|---|---|
| | | |
| **Cavity** | T-17A | |
| **Capacity** | 60 | 240 L/min. |
| **Area Ratio, A3 to A1** | 1.8:1 | |
| **Area Ratio, A3 to A2** | 2.25:1 | |
| **Maximum Operating Pressure** | 5000 | 350 bar |
| **Maximum Valve Leakage at 110 SUS (24 cSt)** | 10 | 10 drops/min.@70 bar |
| **Pilot Volume Displacement** | .15 | 2,5 cc |
| **Series (from Cavity)** | 3 | |
| **U.S. Patent #** | 4,795,129 | |
| **Valve Hex Size** | 1 1/4 | 31,8 mm |
| **Valve Installation Torque** | 150 - 160 | 200 - 215 Nm |
| **Seal Kits** | Buna: 990-017-007 | |
| **Seal Kits** | Viton: 990-017-006 | |




## Option Selection

**LKHC-X D N**

### Preferred Options

| *Control* | *Cracking Pressure* | *External Material/Seal Material* |
|---|---|---|

### Standard Options

**X** Not Adjustable

**N** Buna-N
**V** Viton