FARR

TECHNICAL MANUAL

KT(LW)13625

13-5/8” (34.6 cm) 35K (25K) Lbs.-Ft.
Hydraulic Power Tong

- Specifications
- Operation
- Maintenance
- Assembly

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This manual covers the following models:

The base tong, Model # 80-0931-1, is equipped with the following standard equipment:

- ***Rineer GA15 Single-speed Hydraulic Motor***
- ***Motor Control Valve***
- ***Rigid Sling***
- ***Safety Door System***
- ***Open-Centre Outlet***

See the following table for models equipped with optional components. All tongs are equipped with the standard equipment in addition to the listed options, unless otherwise specified.

		AVAILABLE OPTIONS (In addition to base model)			
MODEL	REV	Lift Cylinder Control Valve	Backup Control Valve	Dump Valve	Closed Centre Outlet
80-0931-3	0	■	■		
80-0931-6	0			■	
80-0931-7	0	■			
80-0931-8	0				■ *
80-0931-9	0	■	■		■ *
80-0931-11	0	■		■	
80-0931-12	0	■		■	■ *
* Replaces open-centre outlet					

This technical manual also applies to the "lightweight" version of this tong. The lightweight tong is similar to the standard tong with a few significant differences, which are clearly identified within this manual.

Model numbers for the "lightweight" (lower torque) versions of the tong are the same as for the standard version with the letters "LW" appended to the model. For example, an 80-0931-3-LW is identical in configuration to the standard 80-0931-3 tong, but will be the "lightweight" version.

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

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

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
March 2006	N/A	N/A	Initial Release
April 2007	N/A	iii	Added Summary of Revisions page
	1	1.3	Corrected specifications page to show single speed rather than 2-speed motor.
Aug 2007	5	5.17	Corrected shifting fork part number.
Jan 2008	5	5.15	Corrected part number for item "Q", lower clutch bearing
	5	5.25	Modified description and part number for item "H", 3/8" hose assembly
OCT 2008	All		Comprehensive content revision - added backup-ready models, added closed-centre models, revised much of the graphics. Revised disassembly and assembly procedures. Added new decommissioning, storage, and recommissioning procedures. Added chain sling procedures and warnings.
JULY 2009			Moved decommissioning and recommissioning checklists to appendices following Section 7. Section Six has been renumbered to Section Five, Section Seven renumbered to Section Six, Section Eight renumbered to Section Seven.
	5	5.33	Added part numbers for Items J and L.
	Appendices		Added daily tong, backup, and power unit daily maintenance checklists, monthly tong maintenance checklist. Moved decommissioning and recommissioning checklists to this section.
OCT 2010	N/A	N/A	Revised graphical design, added component illustrations for 80-0931-X-LW
JULY 2011	Intro	iii	Revised list of supported models
	2	2.7	Removed hydraulic schematic, tong without safety door (no longer supported).
	2	2.7-2.8	Revised hydraulic schematics
	2	2.13	Corrected list of available jaw die kits
	2	2.14	Revised section 2.F.1, "Suspension & Restraint".
	2	2.19	Added section 2.G.3, "Shifting Gears".
	3	3.1	Revised section 3.A, General Maintenance Safety Practices
	3	3.1	Added Section 3.C, "Preventive Maintenance Practices
	3	3.10	Added Section 3.E.4, "Shifter Detent Force Adjustment".
	3	3.22	Moved all maintenance checklists from appendix to "Maintenance" section.
	6	All	Complete revision of torque measurement section
OCT 2011	5		Checked & corrected part numbers for fasteners where necessary - all B.O.M.s in Section 5
JAN 2012	1	1.3	Corrected specifications page

The information presented in this document will provide setup, operating, and maintenance instructions for your KT-13625 or LW-13625 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

Farr Canada Corp. uses three indicators to describe items of three degrees of importance.

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

This identifies a HAZARD to operators or equipment

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

This identifies a WARNING to users

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

This identifies a CAUTION to users

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

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

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Congratulations on the purchase of your FARR® KT-13625 / LW-13625 13-5/8" 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
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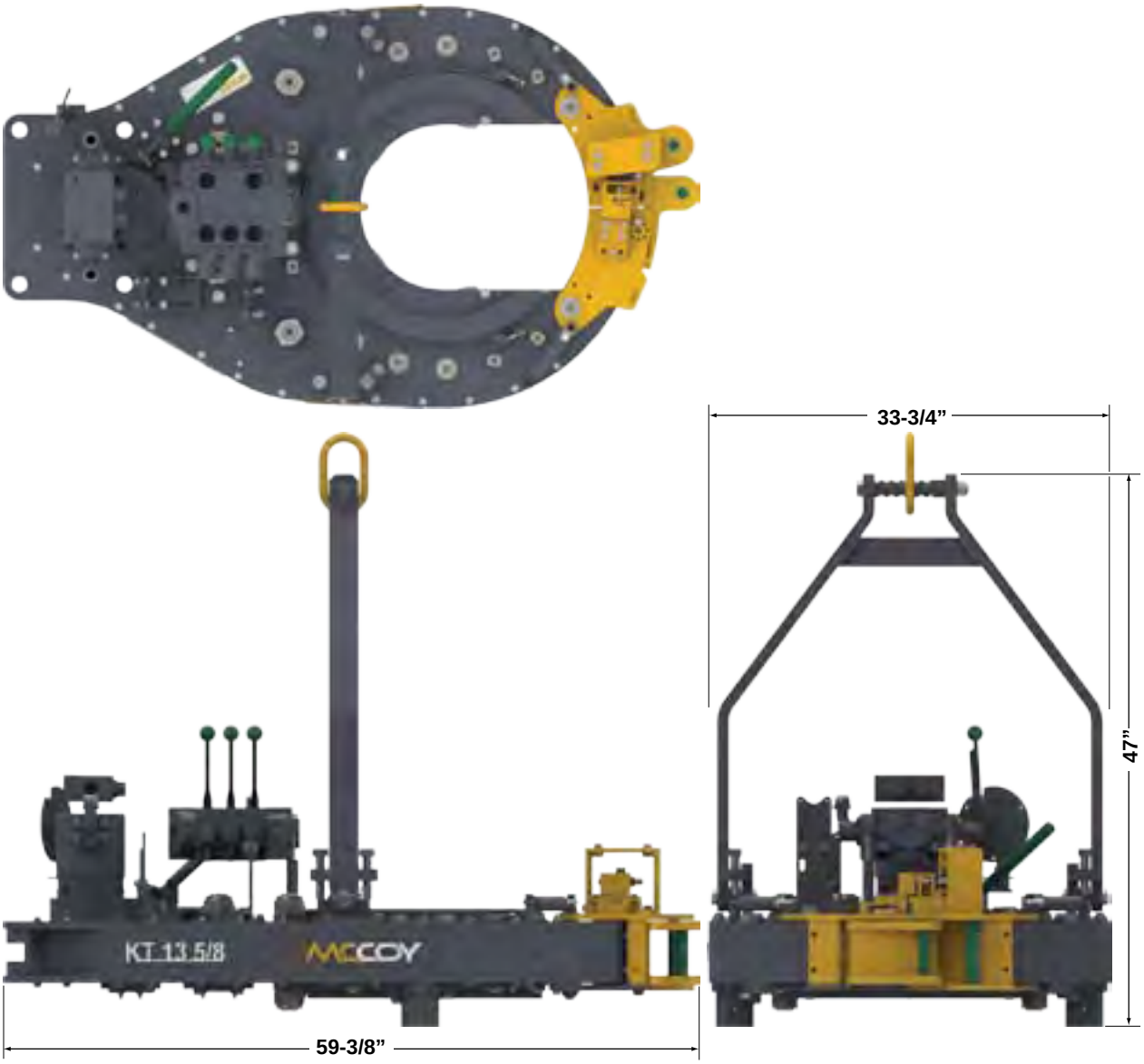
Customer Care: customerCareFarr@mccoyglobal.com

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



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

Specifications - KT13625

Torque Table (Standard Tong) **				
Pressure	High Gear		Low Gear	
PSI / MPa	Lbs.-ft.	Nm	Lbs.-ft.	Nm
1500 / 10.34	3530	4786	17640	23917
2000 / 13.79	4970	6738	24840	33679
2500 / 17.24	6410	8691	32040	43440
2750 / 18.96	7130	9667	35640	48321
MAXIMUM RATED TORQUE: 35000 LBS.-FT. / 47450 Nm				

Speed Table		
Flow (US GPM / LPM)	Low Gear (RPM)	High Gear (RPM)
10 / 37.9	1.6	8
20 / 75.71	3.2	16
40 / 151.4	6.4	32
60 / 227.1	9.6	48

Specifications - LW13625

Torque Table (Lightweight Tong) **				
Pressure	High Gear		Low Gear	
PSI / MPa	Lbs.-ft.	Nm	Lbs.-ft.	Nm
1000 / 6.895	1696	2299	8482	11500
1500 / 10.34	2866	3886	14332	19432
2000 / 13.79	4036	5472	20181	27362
2400 / 16.55	4972	6741	24861	33707
MAXIMUM RATED TORQUE: 25000 LBS.-FT. / 33895 Nm				

Speed Table		
Flow (US GPM / LPM)	Low Gear (RPM)	High Gear (RPM)
10 / 37.9	1.8	9.2
20 / 75.71	3.7	18.5
40 / 151.4	7.4	36.9
60 / 227.1	11.1	55.4

** These are ideal values. Actual achieved torque is highly dependant upon tong efficiency, final position of rotary gear when full torque load is reached, and the motor with which the tong is equipped.

Hydraulic Requirements, Standard Tong (max.):	60 US GPM / 3000 PSI (227.1 LPM / 20.684 MPa)
Hydraulic Requirements, Lightweight Tong (max.):	60 US GPM / 2500 PSI (227.1 LPM / 17.237 MPa)
Length (Doors Closed):	59-3/8" inches / 150.8 cm
Height:	47" / 119.4 cm
Width:	33-3/4" inches / 85.7 cm
Space Required on Pipe:	8" / 20.3 cm
Maximum Elevator Diameter:	N/A
Torque Arm Length:	36 inches / 91.4 cm (centre line of pipe to centre line of anchor)
Max. Weight (Approximate):	1790 lb. / 814 kg.
Casing Jaws Available (inches):	See Pg. 2.12
Recommended Spring Hanger:	85-0106X (1800lbs. capacity)

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*
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/m3)	*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/cm2	*0.04*
Copper Corrosion Test	*1A*
Filterability: Denison - Wet & Dry	*Pass*
Afnor - Wet & Dry	*Pass*
Cincinatti 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*
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 MCCOY DRILLING & COMPLETIONS.

MCCOY DRILLING & COMPLETIONS DOES NOT GUARANTEE THE INTEGRITY OF MODIFIED OR DAMAGED LOAD-BEARING DEVICES, UNLESS THOSE MODIFICATIONS ARE PERFORMED BY MCCOY DRILLING & COMPLETIONS.

McCoy Drilling & Completions 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

1. **Inspection Of Slings**

McCoy Drilling & Completions 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.

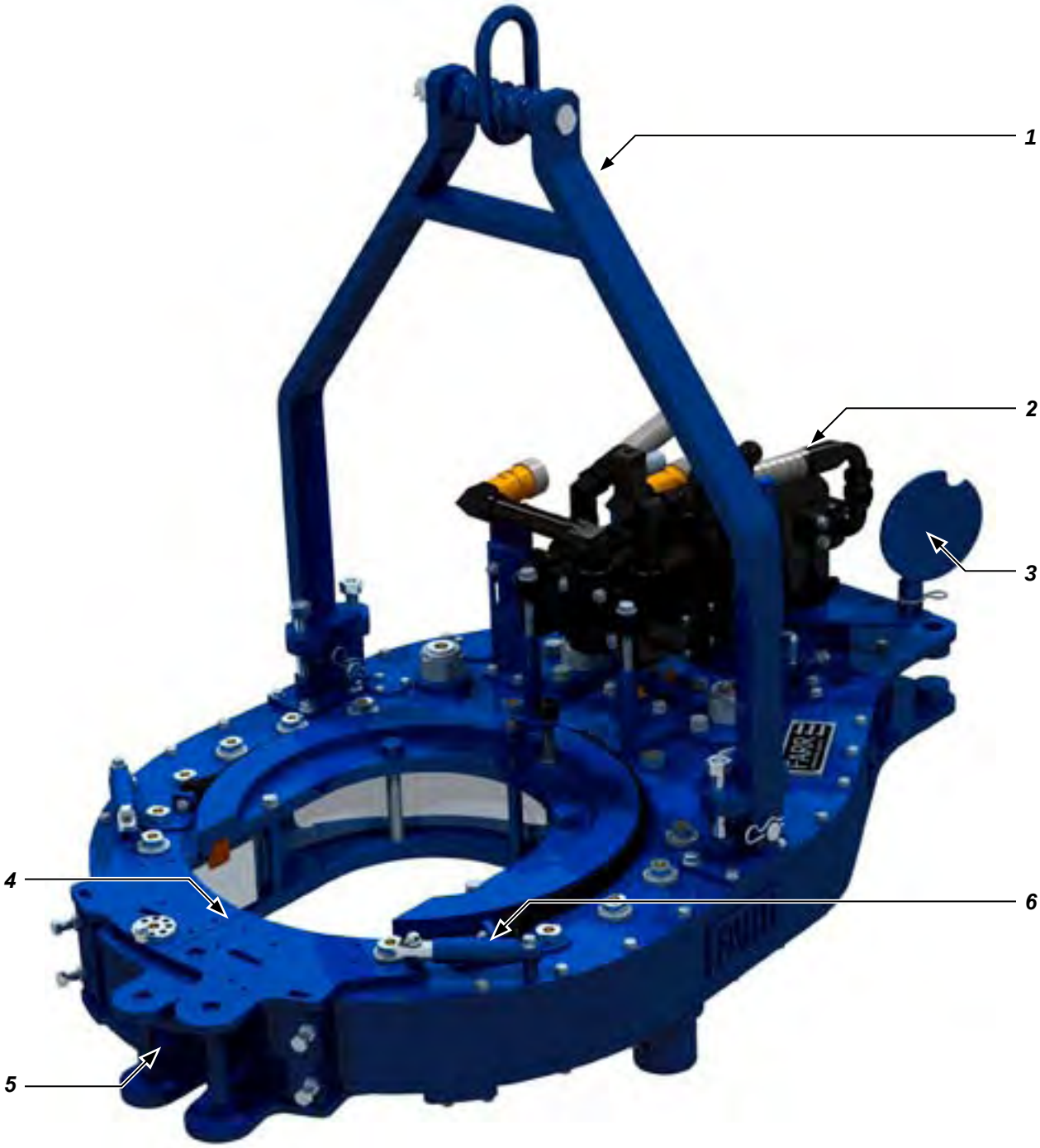
- *Load-bearing devices that are damaged or defective shall not be used.*
- *Slings shall not be shortened with knots or bolts or other makeshift devices.*
- *Sling legs shall not be kinked.*
- *Load-bearing devices shall not be loaded in excess of their rated capacities.*
- *Slings shall be securely 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*

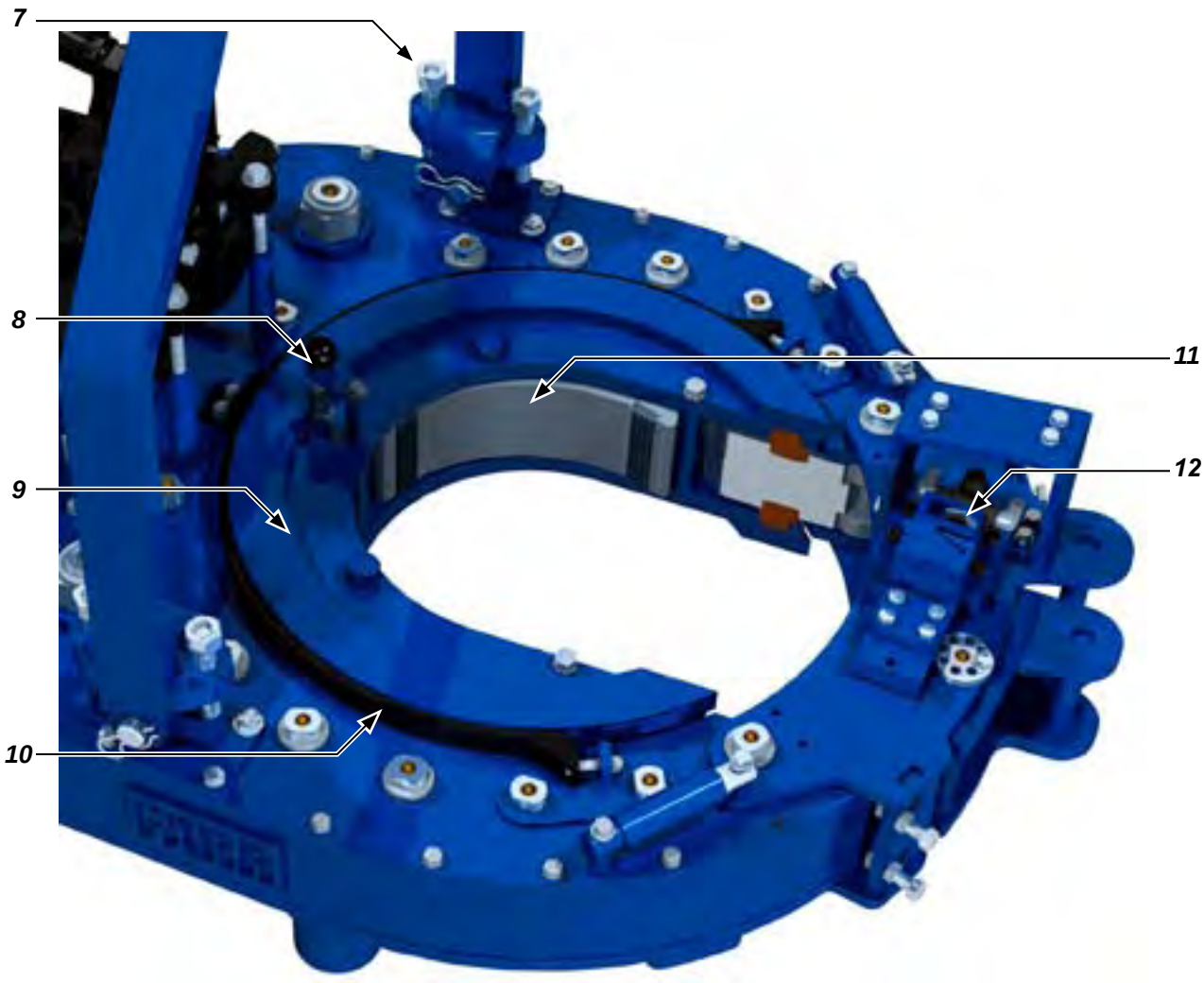
Proper storage of out-of-service load bearing devices is important to ensure full integrity of the device once it is returned to service. Farr recommends observing the following practices.

- *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



Item	Description
1	Rigid Sling
2	Hydraulic Valve Assembly
3	Torque Gauge Mounting Plate
4	Tong Doors
5	Tong Door Latch
6	Tong Door Cylinder

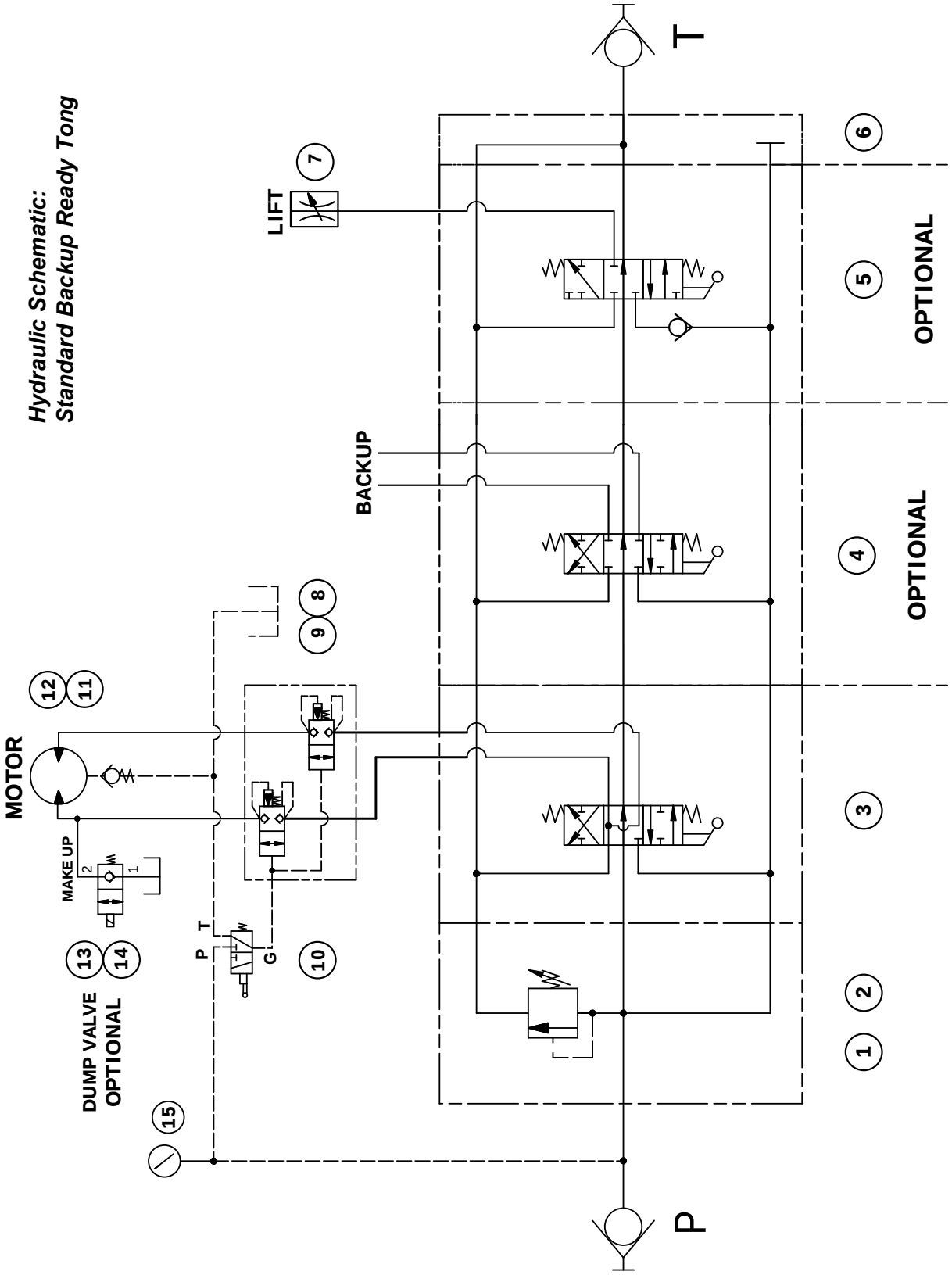


Item	Description
7	Tong Leveling Adjustment
8	Backing Pin Assembly
9	Cage Plate Assembly
10	Brake Band
11	Tong Jaws with Die Inserts
12	Safety Door Assembly

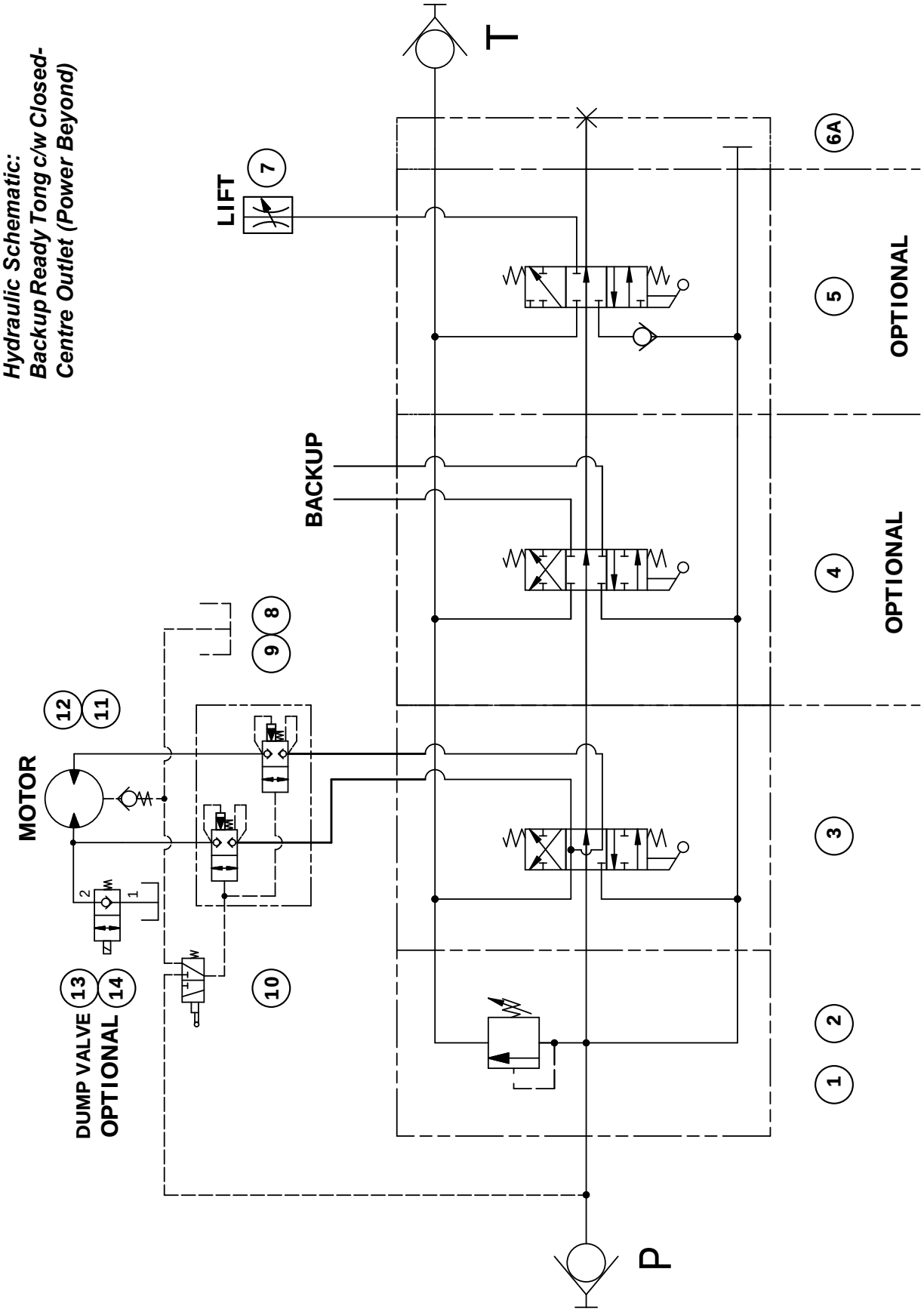
Item	Description
13	Inspection Panel
14	Manual Shift Assembly
15	Hydraulic Motor
16	Motor Mount

C. HYDRAULIC SCHEMATICS / HYDRAULIC COMPONENT IDENTIFICATION

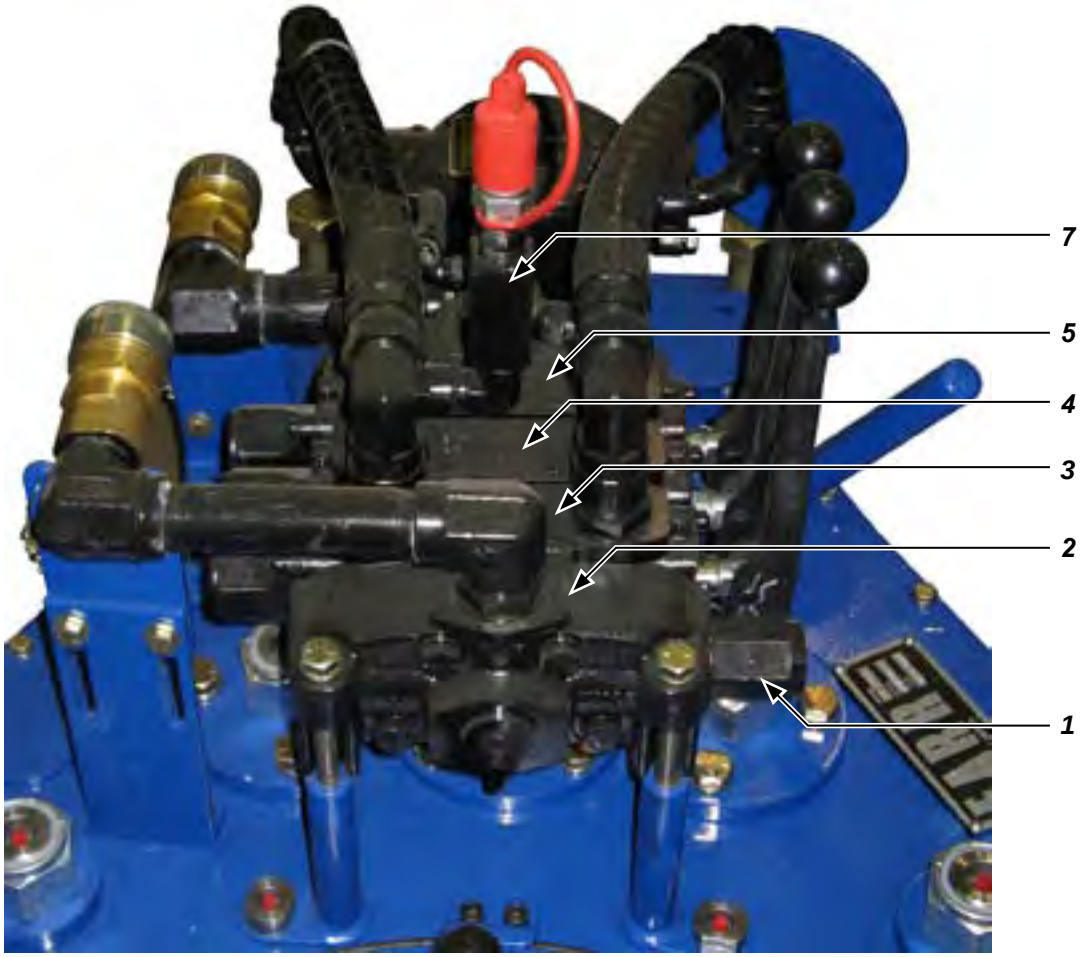
Your tong may be equipped with one, two, or three control valves, depending upon the specific model. Disregard the control valves or optional equipment indicated on the following schematics that do not apply to your specific model.

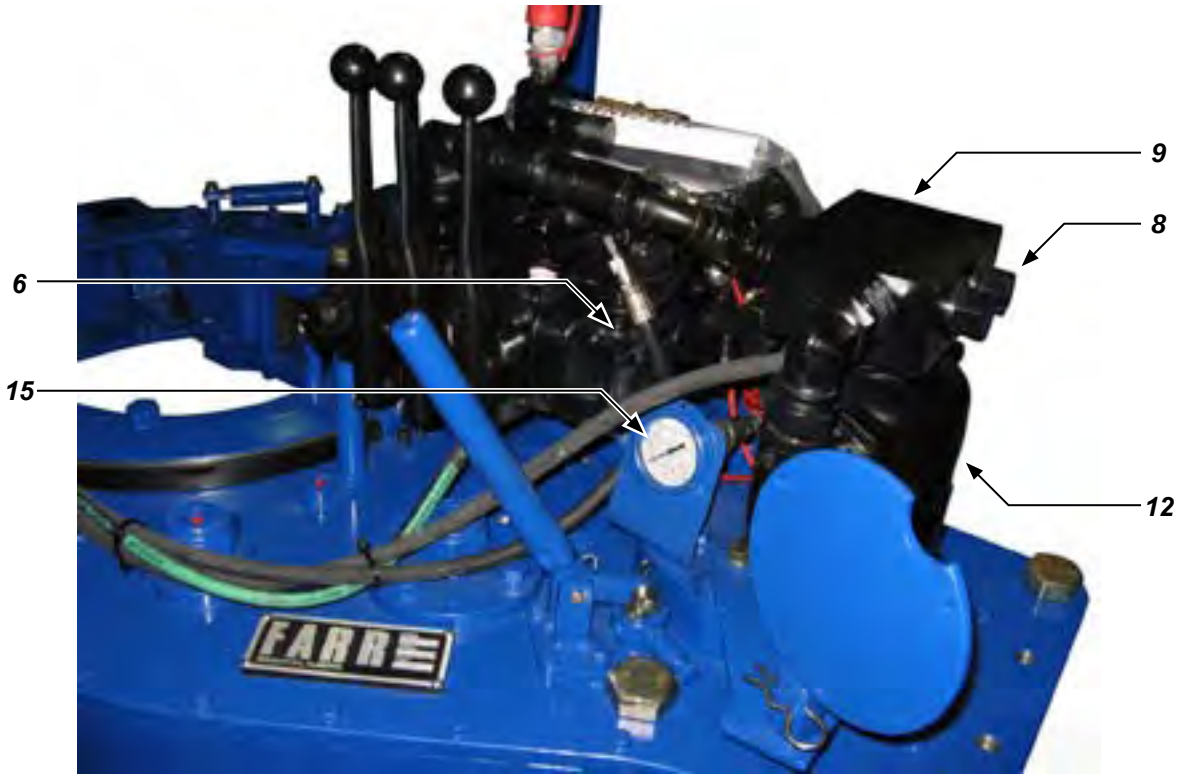


Hydraulic Schematic:
Backup Ready Tong c/w Closed-
Centre Outlet (Power Beyond)



Item	Description	Part Number	Page
1	Inlet Valve. DVA35-A880 w/2500 TO 3500 DVG35 HMRV CARTRIDGE	10-9016	2.10
2	Relief Valve, DVA35-MRV-2	10-0062	2.10
3	Motor Section, DVA35-MA8, 4WAY SAE PORTS	10-9014	2.10
4	Backup Section, DVA35-DA8, SAE PORT (Optional)	10-9019	2.10
5	Lift Cylinder Section, DVA35-SA8, (1" ORB PORT) (Optional)	10-9015	2.10
6	Outlet Section, DVA35-TR99, SAE PORT	10-0086	2.10
6A	Outlet Section - Closed Centre, DVA35-PB90, SAE PORT (Optional)	08-1825	2.10
7	Flow Control Valve, Parker N800S	08-9062	2.10
8	LKHC-XDN Pilot-To-Operate Cartridge Valve	08-1625	2.10
9	Safety Door Valve Block	101-0727	2.10
10	Safety Door Switch	08-0337	2.11
11	Check Valve	02-9022	2.11
12	Rineer GA15-15 Hydraulic Motor (Standard Tong)	87-0112	2.10
	Rineer GA15-13 Hydraulic Motor (Lightweight Tong)	87-0110	2.10
13	Dump Valve (Optional)	08-9284	
14	Dump Valve Body (Optional)	08-9283	
15	3000 PSI Pressure Gauge	02-0245	2.10

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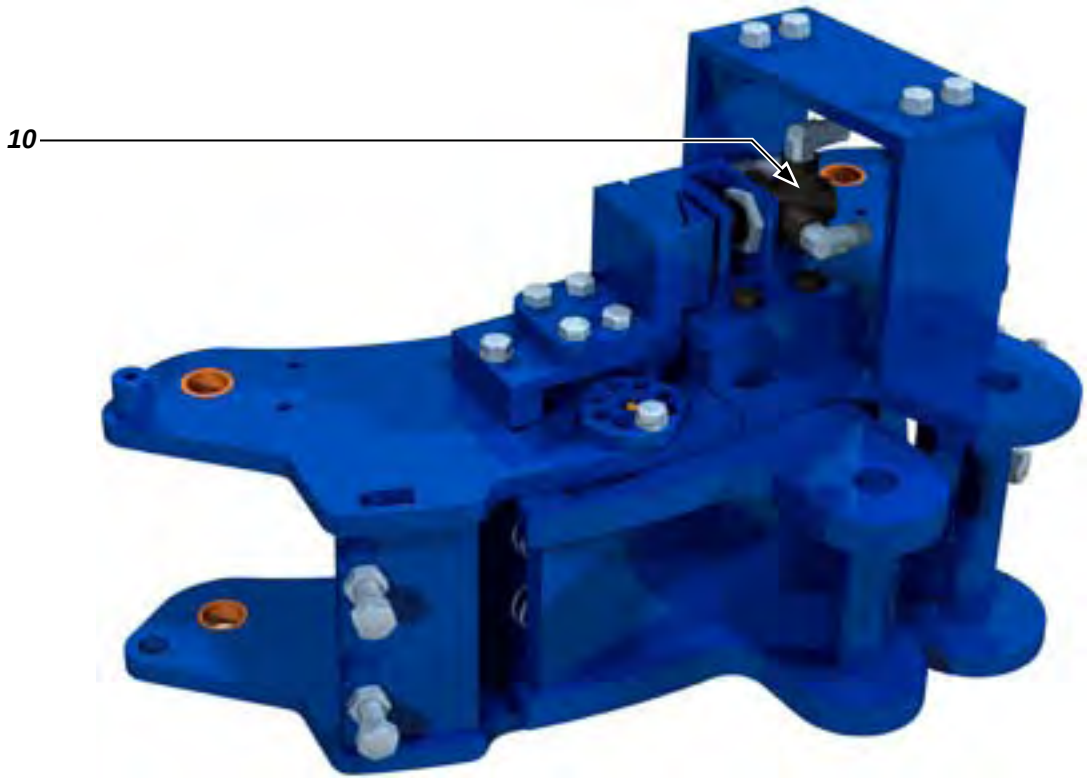
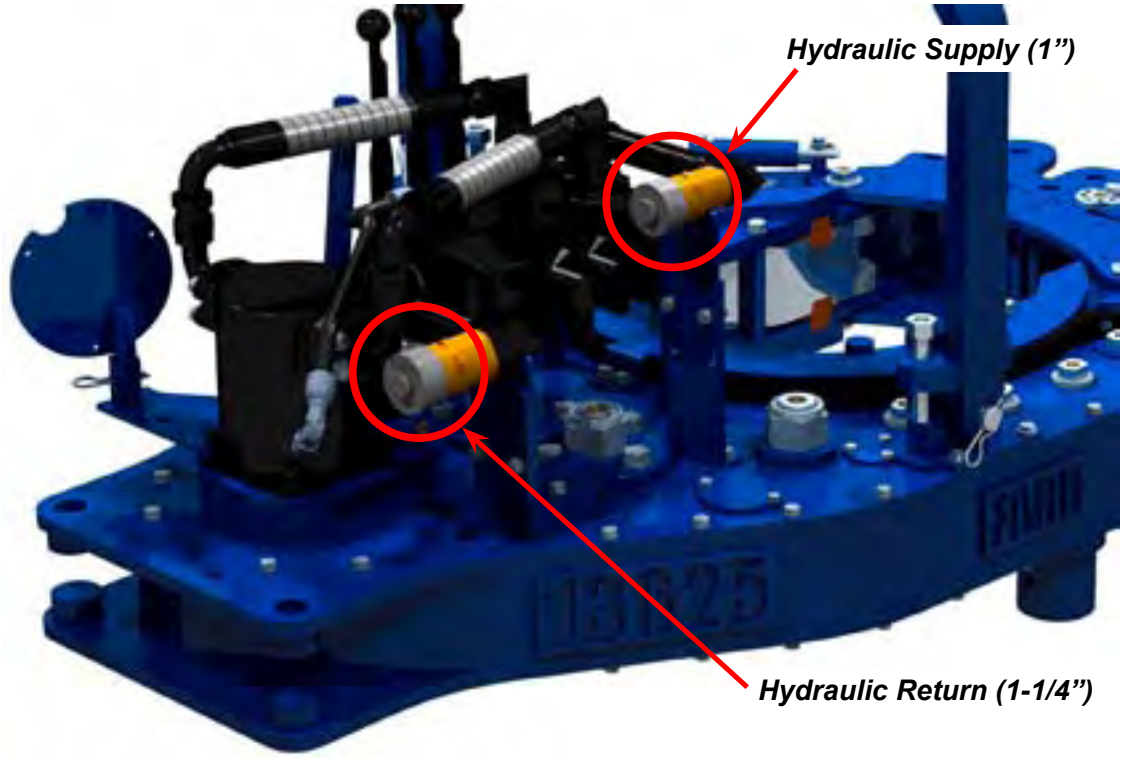


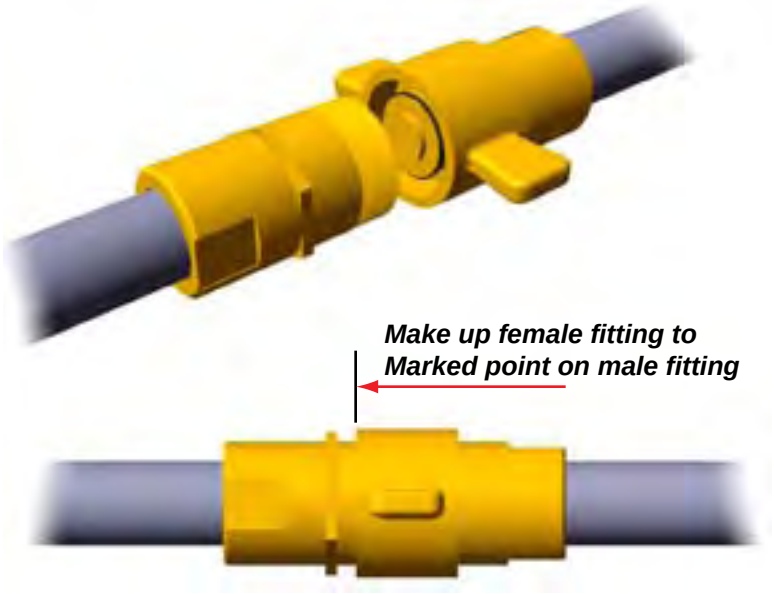
D. HYDRAULIC CONNECTIONS

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

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.



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.



E. TONG JAW AVAILABILITY & INSTALLATION

1. Jaw Availability

The following table lists all jaw die kits that are available as standard stocked sizes for this model of tong. McCoy Drilling & Completions | Farr offers a good selection of standard jaw sizes. However, please note that we can custom-engineer and manufacture any size of jaw within the range of the tong. Jaw systems are available to allow use of die inserts intended for specialized applications. Call our sales office for information on jaw and die systems designed for higher or lower grip, or non-marking applications.

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

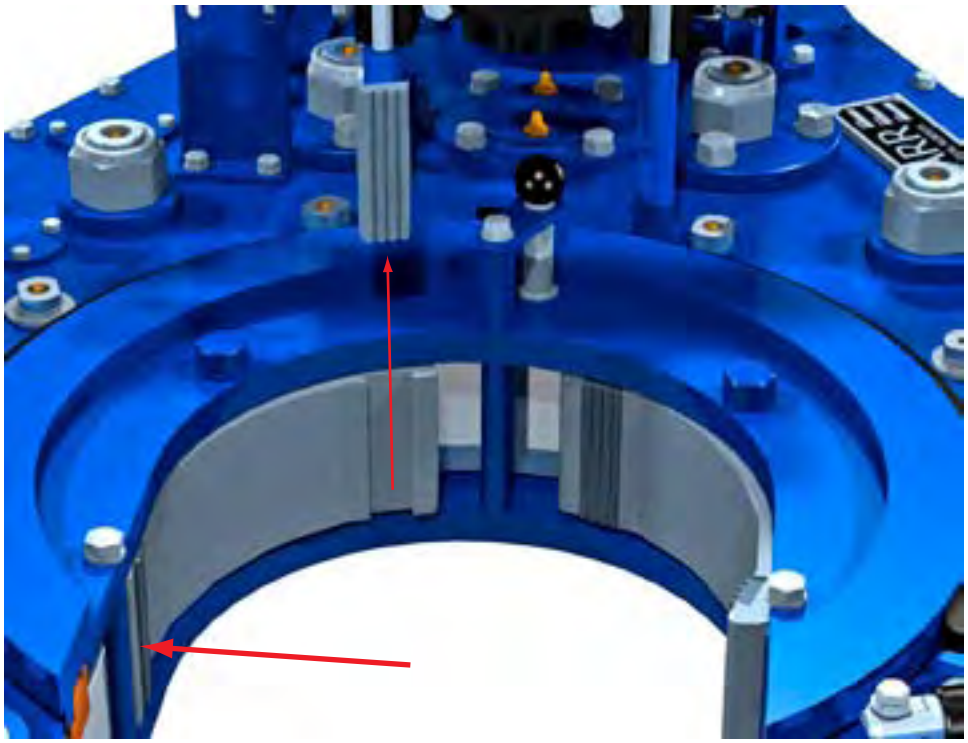
http://www.mccoyglobal.com/dies-inserts

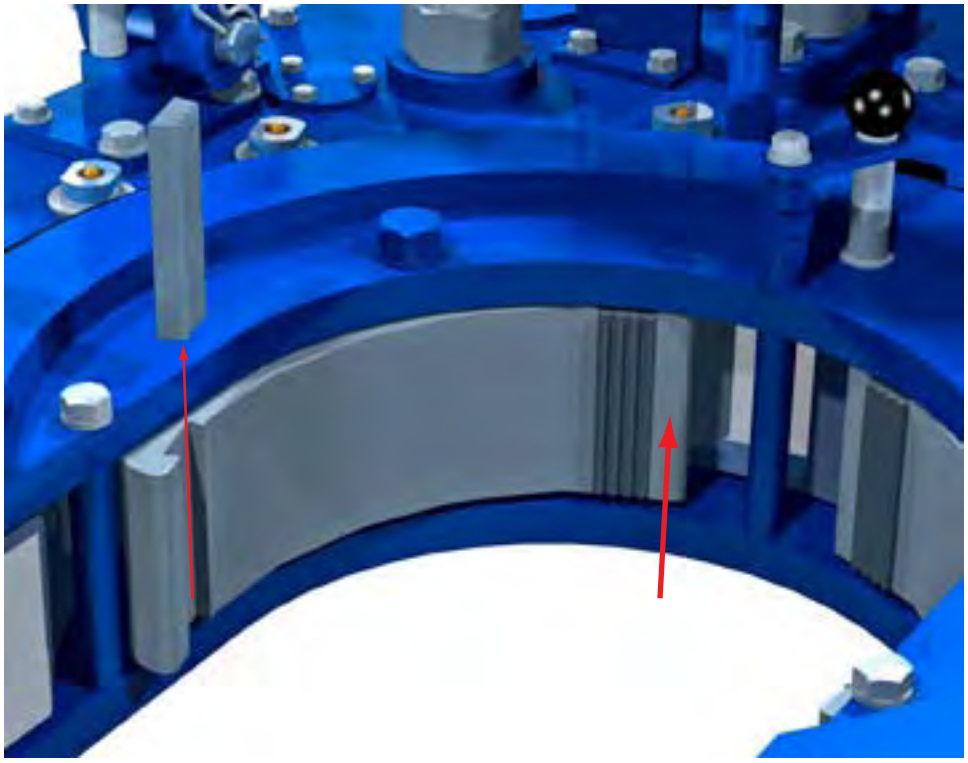
Description	Part Number
3-1/2" Jaw Die Kit	997-JDK-287
4" Jaw Die Kit	997-JDK-288
4-1/2" Jaw Die Kit	997-JDK-290
4-3/4" Jaw Die Kit	997-JDK-291
5" Jaw Die Kit	997-JDK-295
5-1/2" Jaw Die Kit	997-JDK-300
6" Jaw Die Kit	997-JDK-306
6-5/8" Jaw Die Kit	997-JDK-305
7" Jaw Die Kit	997-JDK-310
7-5/8" Jaw Die Kit	997-JDK-315
8-5/8" Jaw Die Kit	997-JDK-320
9-5/8" Jaw Die Kit	997-JDK-325
10-3/4" Jaw Die Kit	997-JDK-330
11-3/4" Jaw Die Kit	997-JDK-335
13-3/8" Jaw Die Kit	997-JDK-340
13-5/8" Jaw Die Kit	997-JDK-510
All jaw die kits use flat die PN 13-0008-314-0	

2. *Jaw / Jaw Die Removal & Installation*

- *Push against the front of the jaw to cause the assembly to swivel around the pivot bolt.*
- *Remove the rear die - if it does not loosen it may have to be lightly tapped.*
- *Push against the rear of the jaw to cause the assembly to swivel the opposite way around the pivot bolt.*
- *Remove the front die*

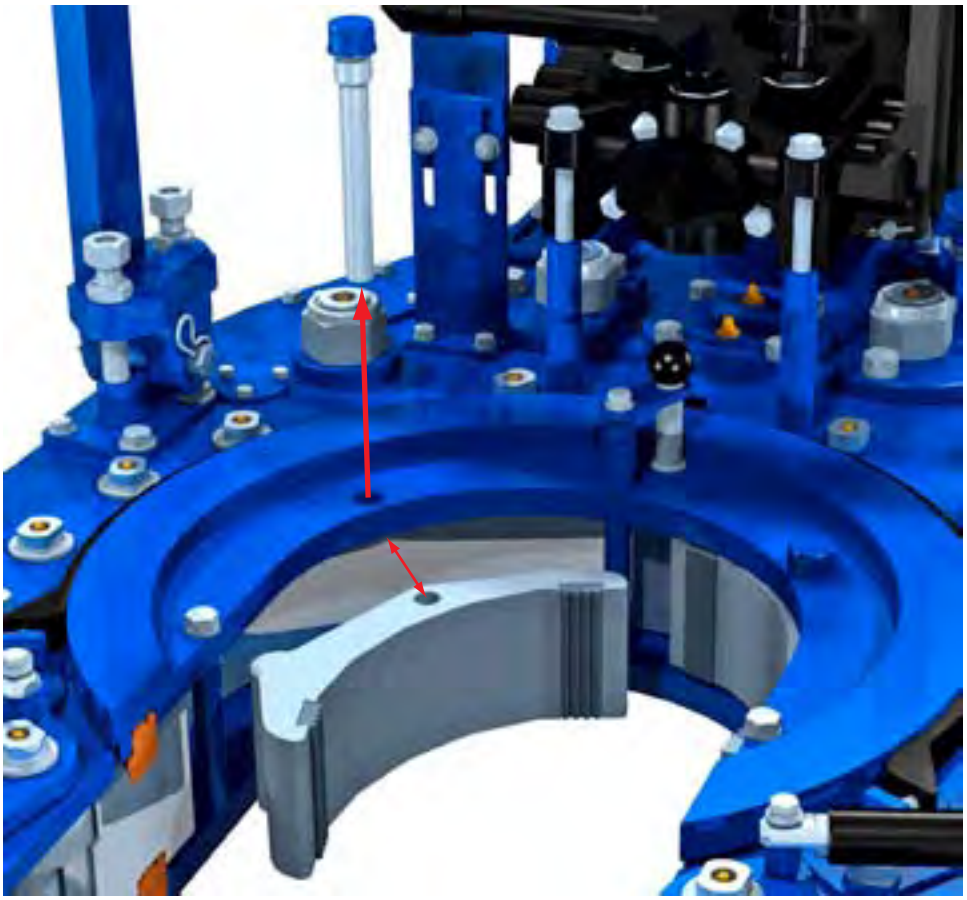
Reverse this procedure to install new jaw dies.





Jaw / Jaw Die Removal & Installation (Continued)

If removal of entire jaw assembly is required, simply remove the jaw pivot bolt, and remove the jaw.



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*

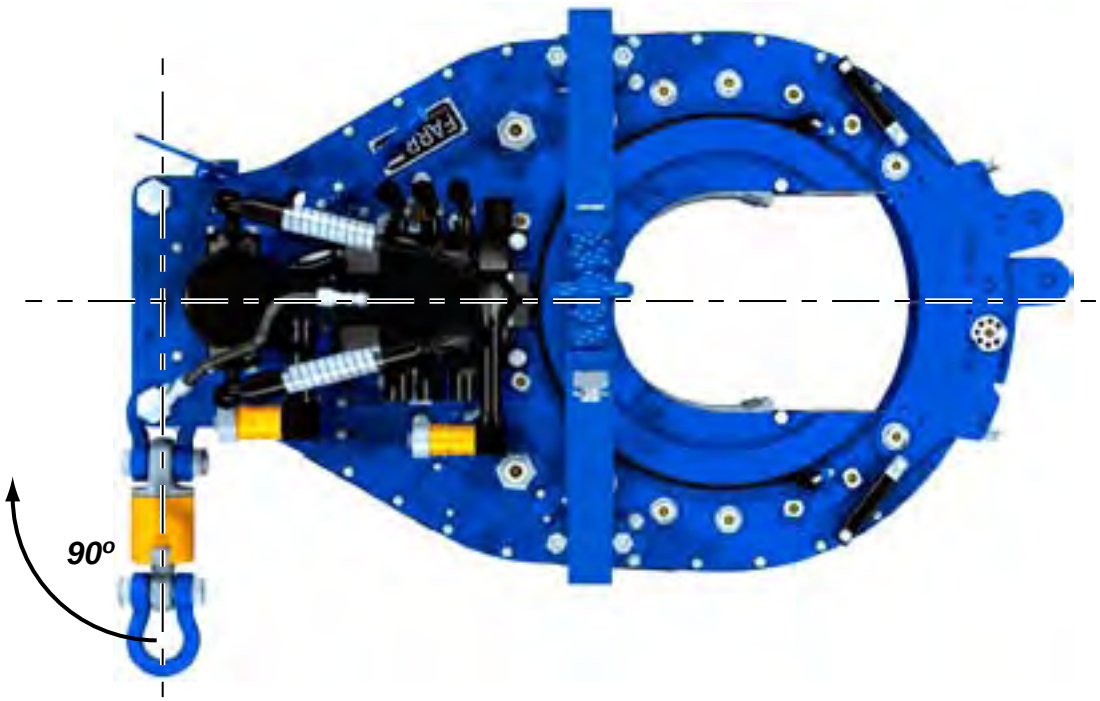
If you do not know which specific spring hanger is in use, check the specification page in this manual for information on the recommended spring hanger for this application. McCoy Drilling & Completions will not guarantee or specify spring hangers other than what has been supplied by McCoy.

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.

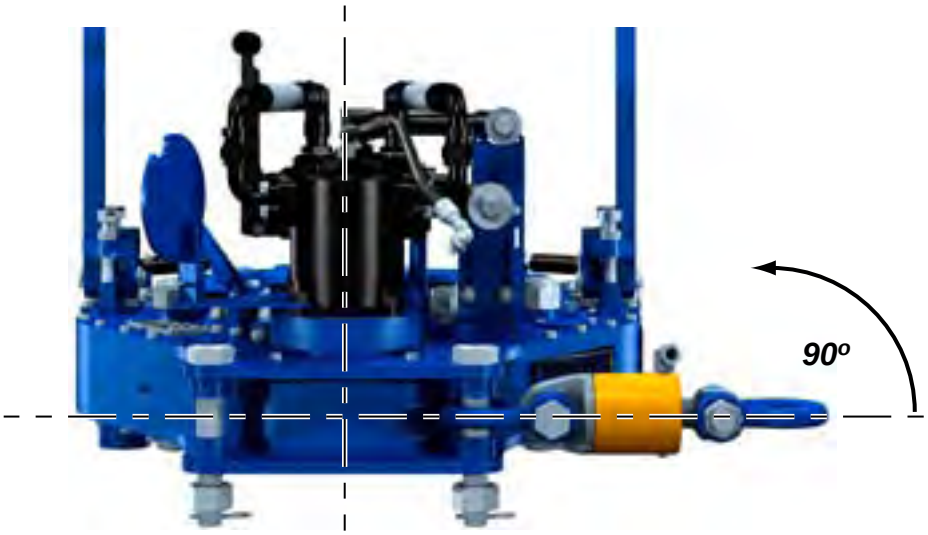
All forces upon the suspension line must be considered when calculating necessary strength of the suspension line. The weight of the tong, the weight of the lift cylinder, the weight of the spring hanger, and the force imparted on the suspension line by the spring hanger must all be added together in 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.

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 following illustrations). 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.



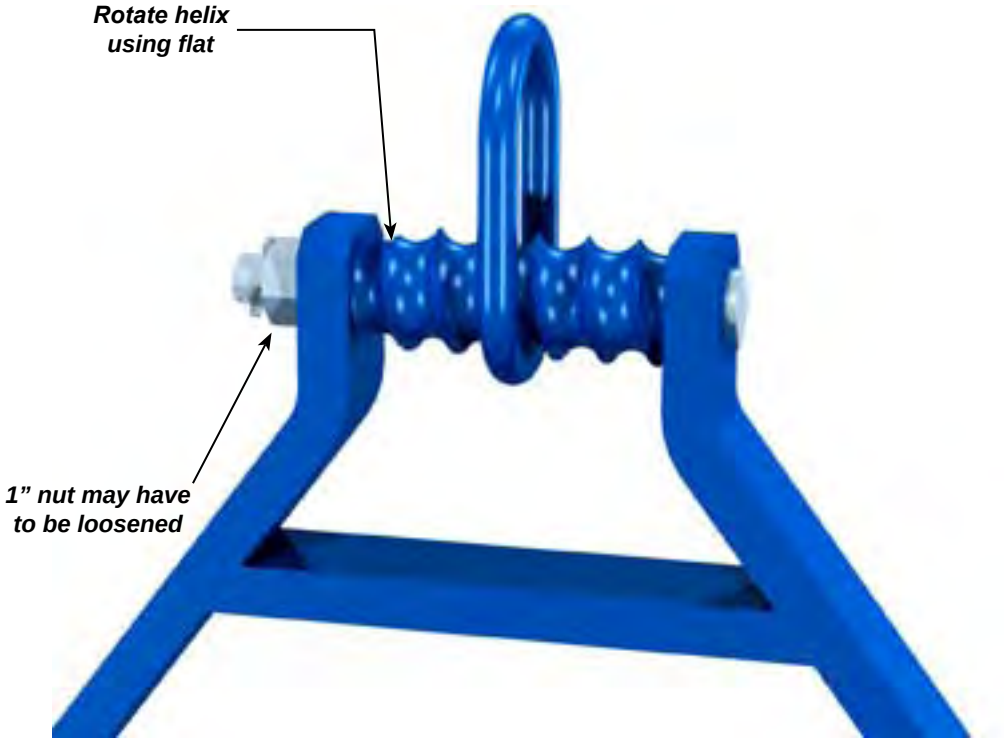
Suspension & Restraint Continued:



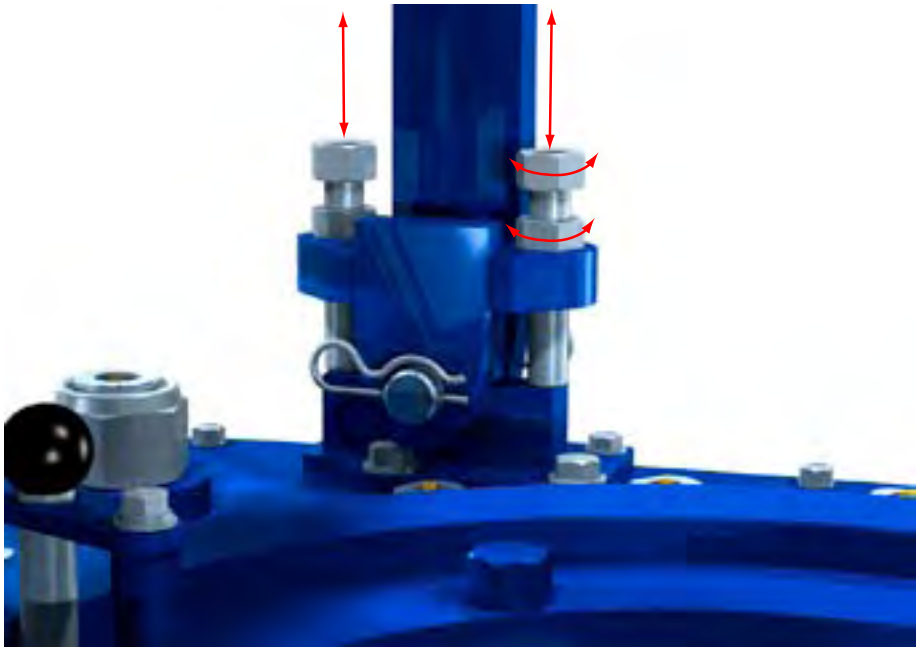
2. *Tong Leveling*

The tong must be leveled side-to-side and front-to-rear before placing into service. The following guidelines wil 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 1" jam 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 - retighten the nut if necessary



ii. *Place a level lengthwise (front to back) along the tong, ensuring that it is parallel with the surface of the tong. Loosen the 3/4" jam nuts on the adjusting bolts on rigid sling brackets. Completely loosen the adjusting bolts. Turn front or rear adjusting bolt equally on each hanger lug until tong hangs level front-to-back. Lock adjusting bolts in place with the jam nuts.*



G. TONG OPERATION

1. Operator Training

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

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

2. 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 Drilling & Completions 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, energize the hydraulic power unit 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.

3. 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 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.

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.

BACKUP (Applies to backup-ready tongs only)

This is a two-way direct acting valve, without proportional control. Pushing the valve handle forward will cause the backup to engage. Pulling backward, towards the operator, reverses the operation.

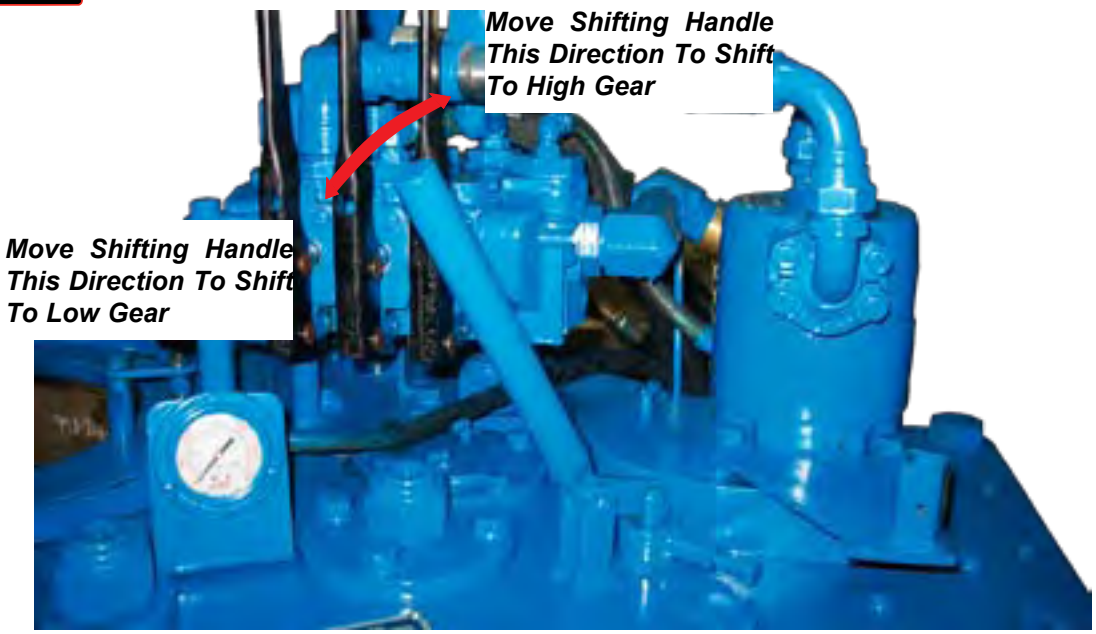
4. *Shifting Gears*

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 top of next page).

Shifting Gears (Continued):

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



5. General Operational 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.

THE "SNAP-BREAK' METHOD IS HAZARDOUS TO PERSONNEL AND EQUIPMENT

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.

Farr Canada Corp. 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 Farr Canada Corp.. Replaced fasteners must be Grade 8 or equivalent, or whatever fastener is specified by Farr Canada Corp..

A. GENERAL MAINTENANCE SAFETY PRACTICES

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

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

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

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

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

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

Farr Canada Corp. 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 PRACTICES

Regular maintenance programs are necessary, and must be established to assure safe, dependable operation of your Hydraulic Tubular Connection System and to avoid costly breakdown maintenance. The following maintenance procedures provides information required to properly maintain your equipment. Your equipment may require more, or less maintenance depending upon the frequency of use and the field conditions under which your equipment operates. These maintenance procedures are designed for equipment operating at 10°C to 35°C ambient temperature for 10 hours per day. Farr Canada Corp. 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 Farr Canada Corp. 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.

Farr Canada Corp. 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 Guide Rings / Cam Followers

(Fig. 1) For tongs equipped with support ring style cage plates, apply grease to the top and bottom guide rings through the grease fittings recessed into the top and bottom cage plates (four locations top, four locations bottom).

(Fig. 2) For tongs equipped with cam follower style cage plates, apply grease to the grease fittings recessed in both the top and bottom cage plates (22 locations total - 11 top / 11 bottom, see Cage Plate Assembly - Cam Follower Style drawing for further information).

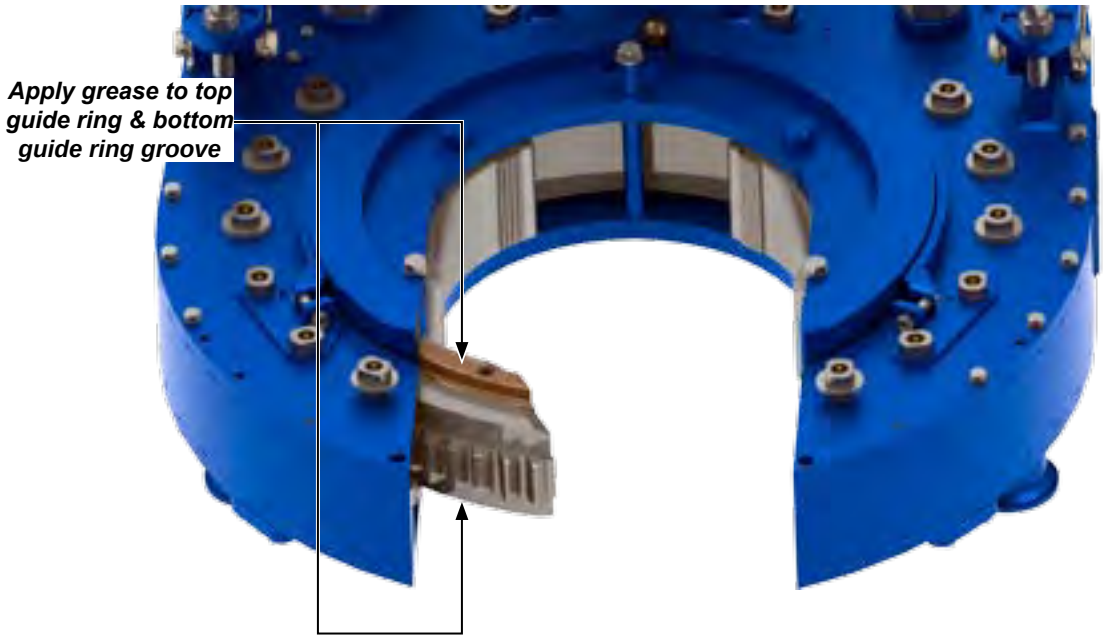


FIGURE 1: GUIDE RING LUBRICATION - KT13625 TONG

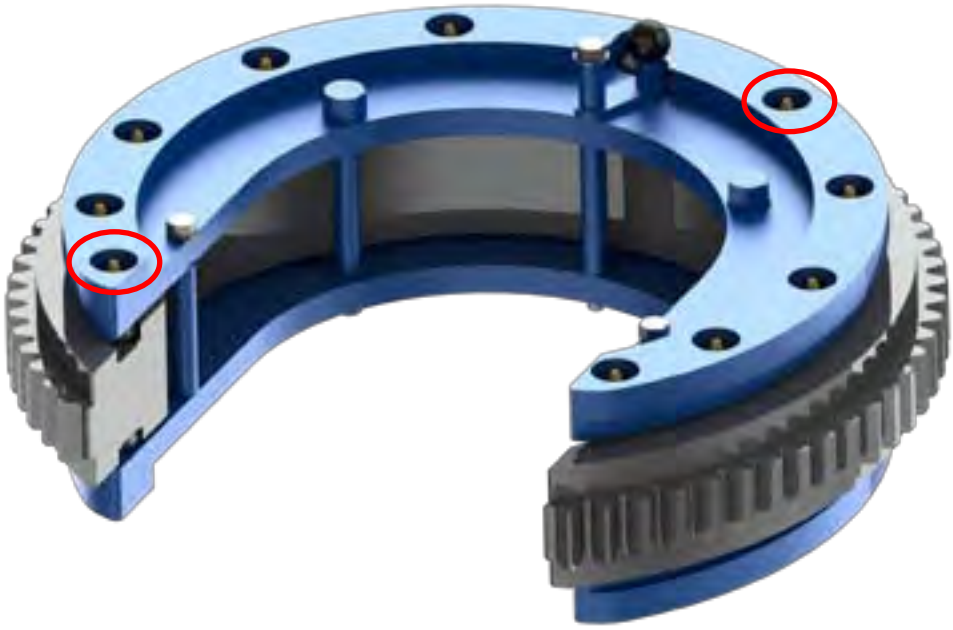


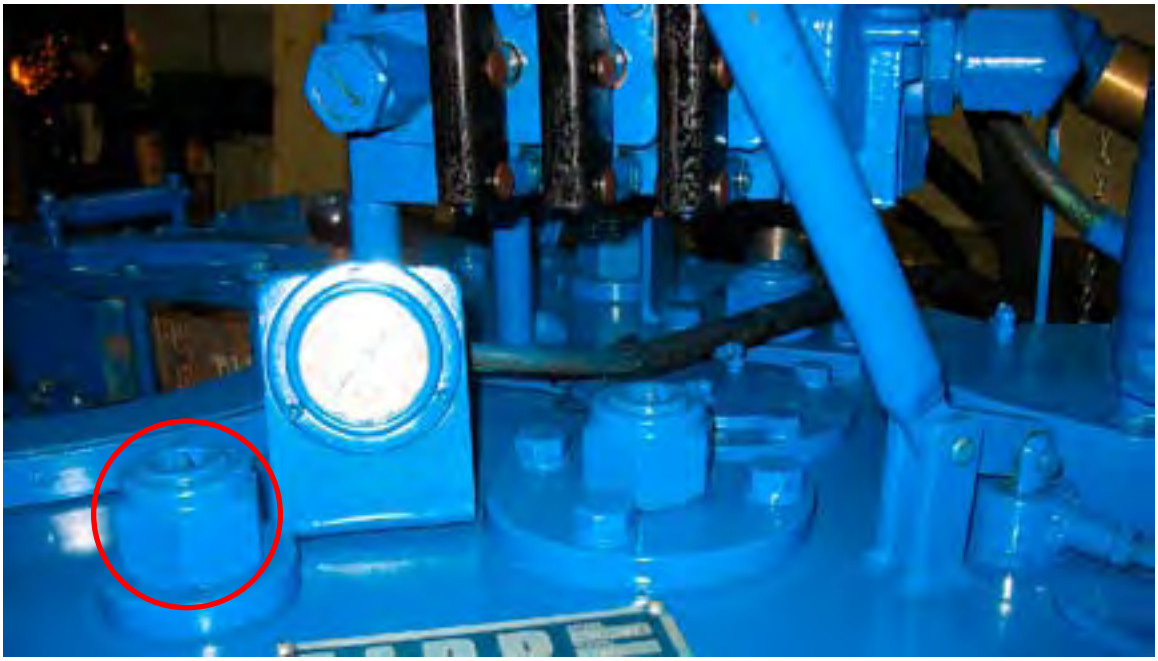
FIGURE 2: CAM FOLLOWER LUBRICATION - LW13625 TONG

2. ***Support Roller Bearings***

Supply grease to these bearings through the grease fittings in the ends of the rotary roller shafts, located on the top of the tong (14 locations total).

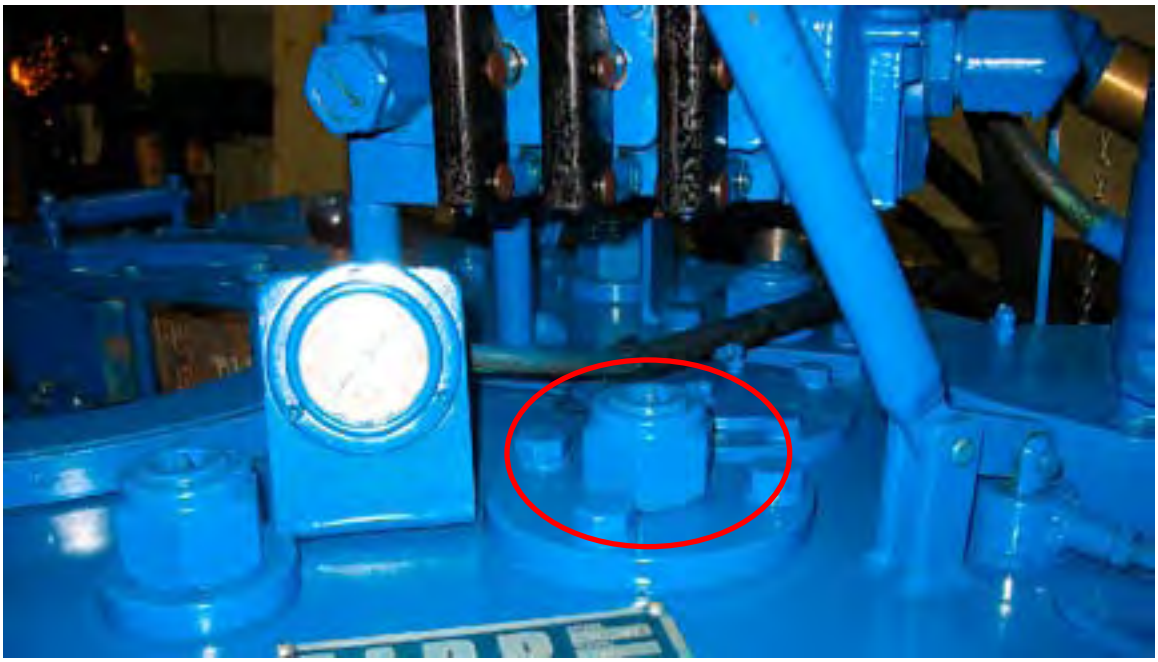
3. ***Rotary Idler Bearings***

Apply grease to these bearings through the grease fittings in the ends of the rotary idler shafts located on the left and right sides of the tong (2 locations total).



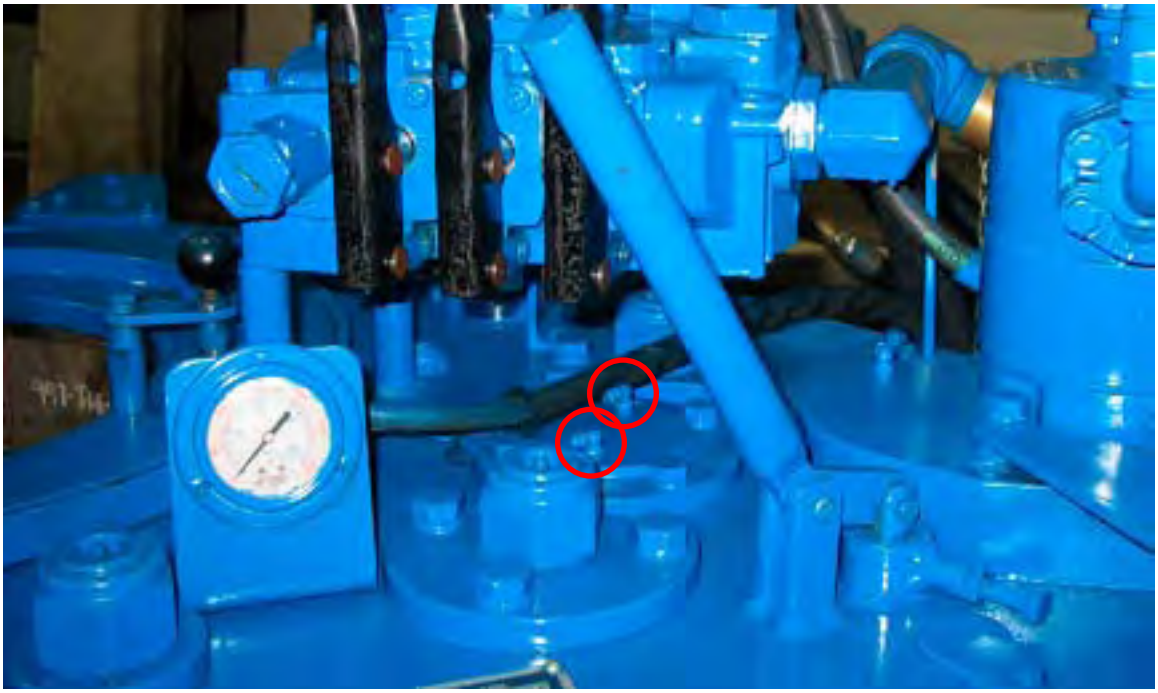
4. ***Pinion Idler Bearings***

Apply grease to these bearings through the grease fittings in the ends of the idler half shafts, located on the top face of the tong (2 locations total).

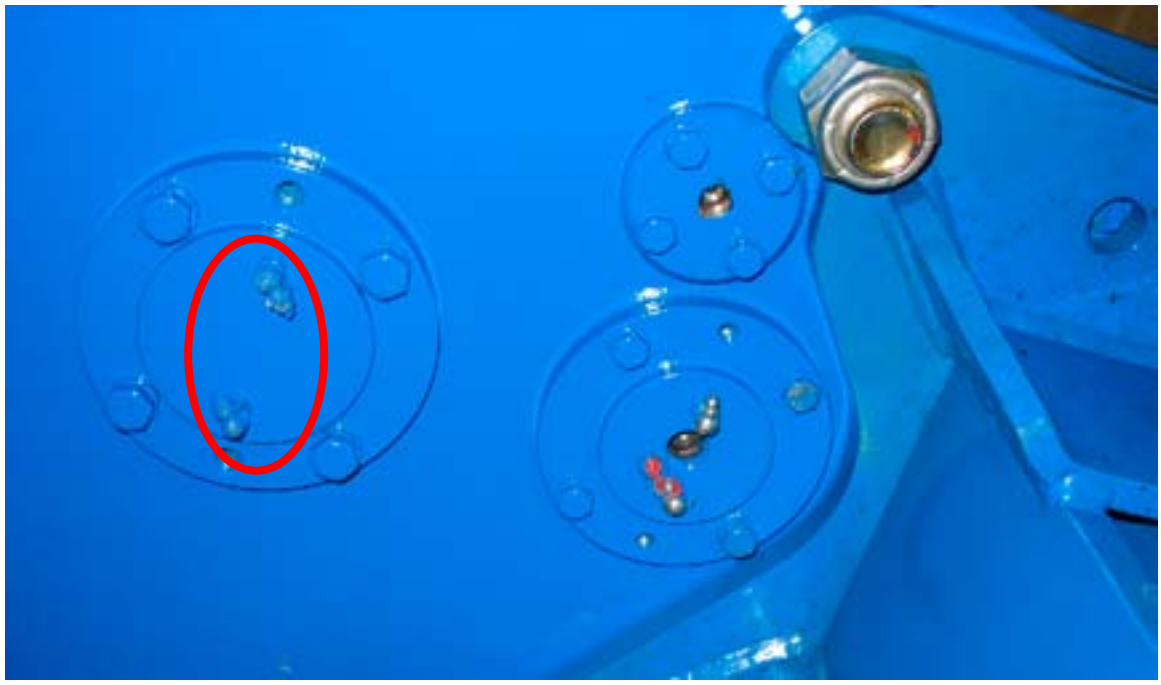


5. ***Pinion Bearings***

Apply grease to these bearings through the grease fittings in the pinion bearing caps, which are located on the top and bottom face of the tong (four locations total).

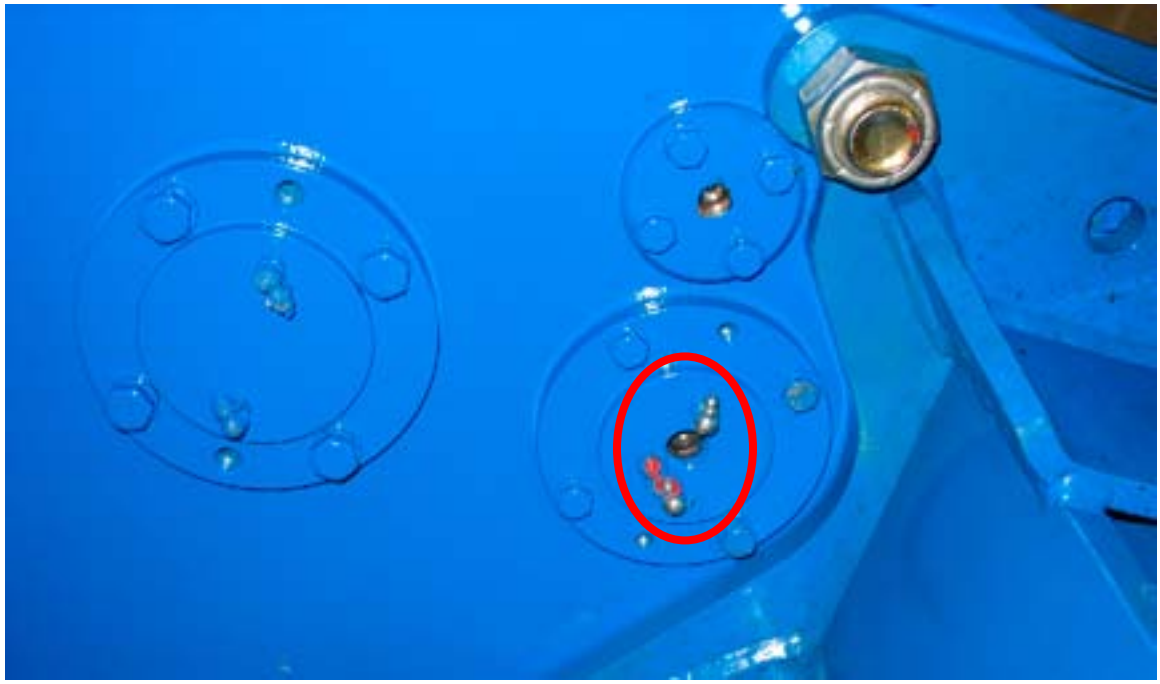


Pinion Bearings Continued:



6. Clutch Shaft

Apply grease to these bearings through the three grease fittings in the clutch bearing cap, which is located at the bottom face of the tong.



7. ***Shifting Shaft***

Apply grease to the shifting shaft and shifting shaft bushings, which may be accessed through the cover plate on the side of the tong.

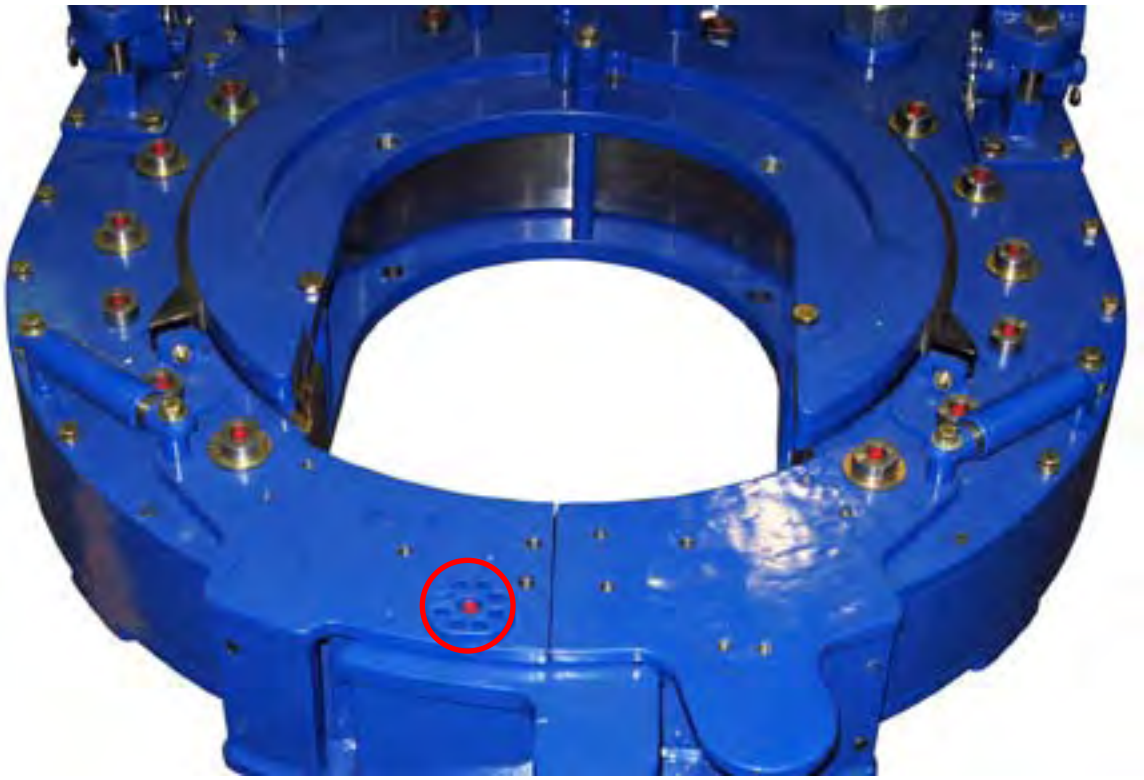
Access shifter components through this panel

8. ***Motor Mount Housing***

Apply grease to the gears in this housing through the grease fitting on the top of the motor mount.

9. Door Latch Cam

Apply grease to the door latch cam through the grease fitting in the top of cam adjustment boss.



10. Door Spring Cylinders

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

Recommended lubrication amount at the completion of each job:

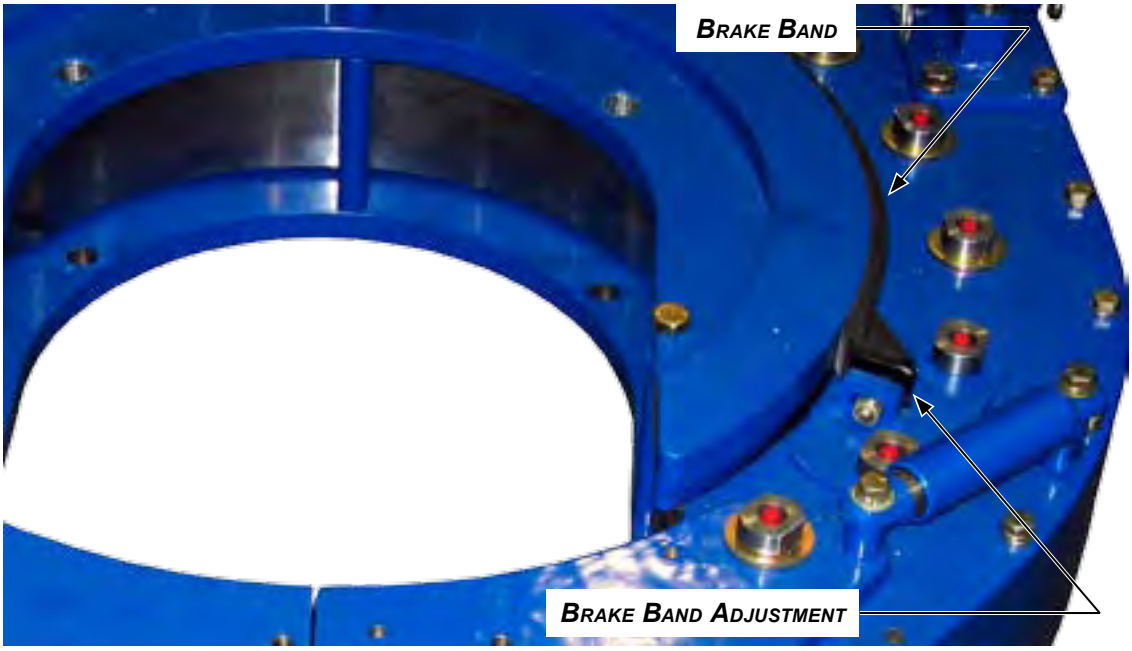
1.	*Cage Plate Guide Ring / Cam Followers (Upper and lower)*	*1 shot grease*
2.	*Rotary Roller Bearings (Upper and lower)*	*3 shots grease*
3.	*Rotary Idler Bearings*	*4 shots grease*
4.	*Pinion Idler Bearings*	*4 shots grease*
5.	*Pinion Bearings (Upper and lower)*	*2 shots grease*
6.	*Clutch Shaft Bearings*	*1 shot grease*
7.	*Motor Mount Housing*	*10 shots grease*
8.	*Shifting Shaft*	*as required*
9.	*Door Latch Adjustment Cam*	*1 shot grease*

Farr recommends that a liberal coating of grease be applied to the cam surface of the rotary drive gear prior to jaw installation. Also, the clutch inspection plate should periodically be removed, and a liberal coating of grease applied to the clutch, drive gears and shifting shaft.

E. ADJUSTMENTS

1. Brake Band Tension 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.



TOP AND BOTTOM BRAKE BANDS MUST BE ADJUSTED SIMULTANEOUSLY AND EQUALLY

2. Door Latch Adjustment

Normal operation of the tong may cause wear of the door latch, which will cause the door to develop a loose fit at the latch. A latch cam plate is located at the top face of the door. The cam plate has eight positioning holes located on a 360 degree bolt circle. The latch cam shaft extends down through the door and is secured at the top by a 3/8" hex head bolt. To make adjustments in door alignment, remove the 3/8" bolt and turn the cam with a wrench. When the door has been adequately aligned, replace the 3/8" bolt (see illustration next page).

THE DOOR IS AN IMPORTANT PART OF THE STRUCTURAL INTEGRITY OF THE TONG. IT IS IMPERATIVE TO KEEP A SECURE FIT AT THE DOOR IN ORDER TO MAINTAIN PROPER GEAR ALIGNMENT, AND TO MINIMIZE THE POSSIBILITY OF DAMAGE TO THE GEAR TRAIN WHEN OPERATING THE TONG AT SPECIFIED TORQUE. A CLOSED DOOR ALSO ENSURES SAFETY OF OPERATING PERSONNEL.

Door Latch Adjustment Continued:

3. Door Alignment

Each door weldment is equipped with two set screws, along with jam nuts to lock position, to align the door when it is in the closed position.

INITIAL ALIGNMENT

Ensure tong doors are closed, and inspect how one door aligns with the other at the point at which they meet. If misalignment is seen, choose one or the other door to adjust. Use a box-end wrench to loosen the lock nuts on the insides of the door weldment - the nuts may be accessed from the side of the door weldment. Use a hex key to turn the hex head set screws either clockwise or counter-clockwise to adjust the door. Note that the top and bottom of the door weldment may not need to be adjusted equally - each set screw should be adjusted independently until the doors are aligned.

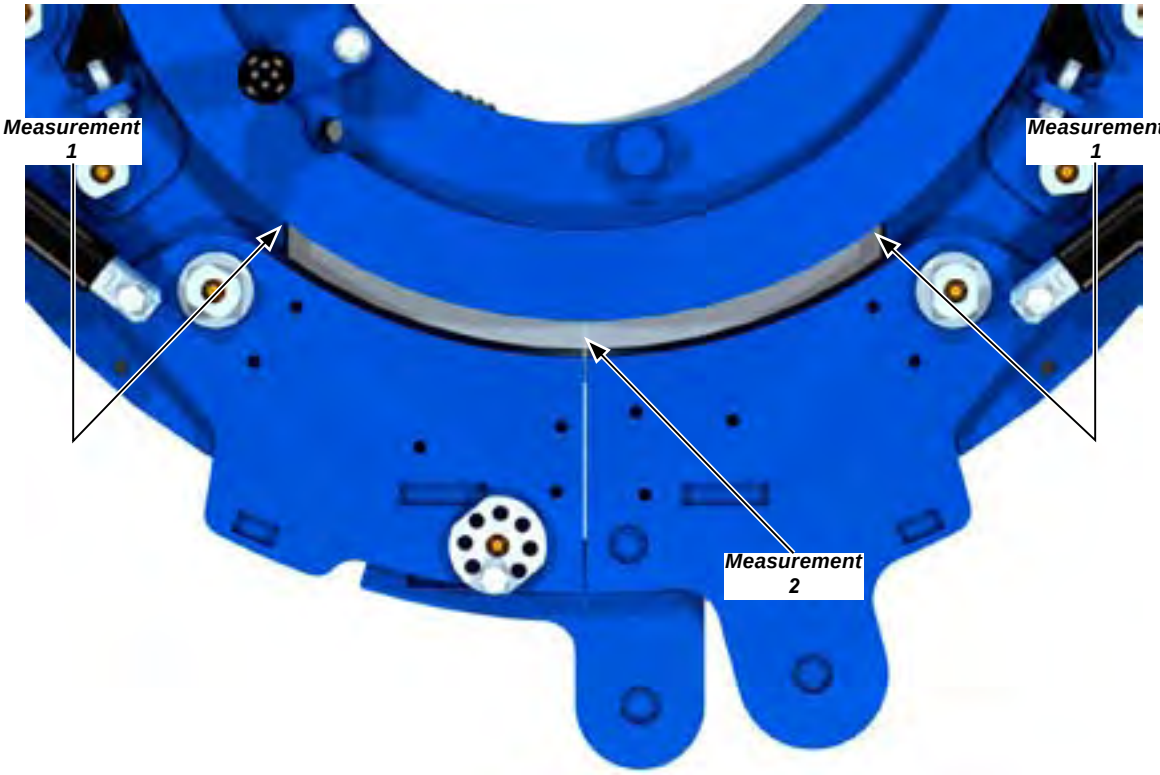
FINAL ALIGNMENT

Rotate the cage plate, and stop it when the inside circumference of the door is completely covered. Perform three measurements (see illustration next page):

1) From the insides of the outer edge of each door weldment to the cage plate (2 measurements total).

2) From the exact centre point (where the two doors meet) to the cage plate.

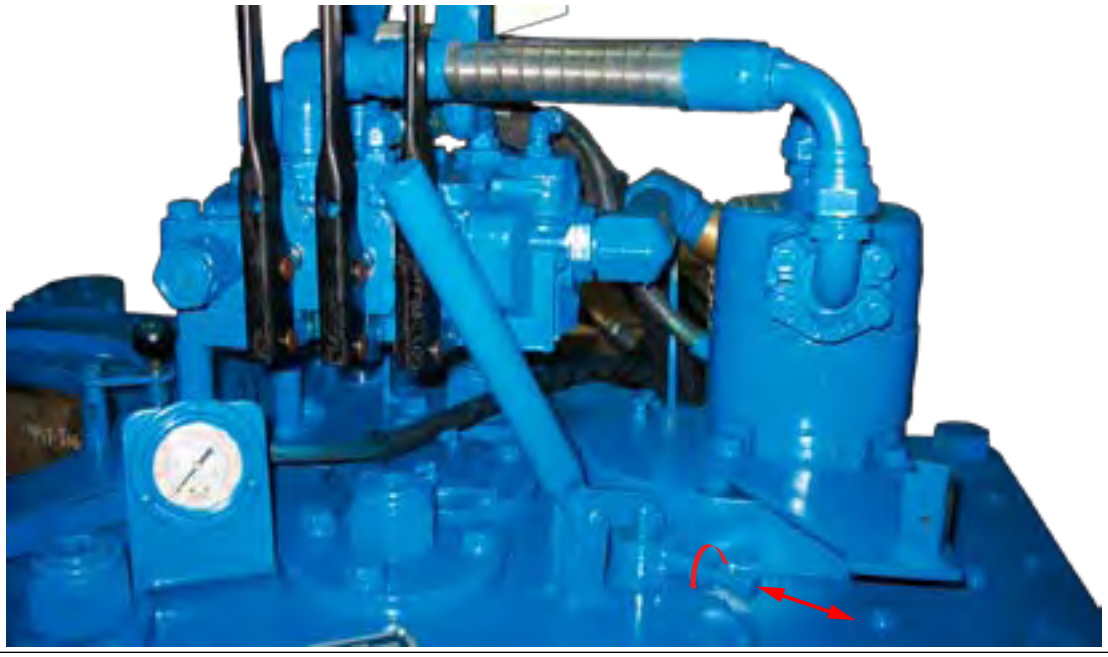
Door Alignment Continued:



The three measurements should be equal. If the centre measurement is less than the two outside measurements, loosen all four locking nuts on the set screws, and turn all four set screws EQUALLY clockwise, until the centre measurement is equal to the two outer measurements. If the centre measurement is more than the two outside measurements, loosen all four locking nuts on the set screws, and turn all four set screws EQUALLY counter-clockwise, until the centre measurement is equal to the two outer measurements. Ensure that the locking nuts are tightened when this procedure is complete.

4. ***Shifter Detent Force 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. 5.16 - 5.17).



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 Assembly

Periodic calibration of the torque gauge is recommended to assure accurate torque readings. When having the torque gauge serviced and calibrated, it is critical to note the arm length of the tong, as indicated in the "Specifications" section. 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.

FASTENERS USED FOR MAINTENANCE OR OVERHAUL OF LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, LEGS) MUST BE TIGHTENED TO THE PROPER TORQUE.

1. *Ensure the tong is placed on supports that provide adequate support, but still allows access to the bottom cage plate assembly.*
2. *Disconnect the hydraulic connections from the motor. Undo the restraints securing the inlet and outlet lines from their supports, and lift the hydraulic valve section away from the tong. Remove the inlet and outlet support pieces.*
3. *Remove the rigid sling assembly, and the two rigid sling hangers.*
4. *Remove the two tong door stop cylinders. Use caution as the door springs may be retain energy from being compressed.*
5. *Remove each door assembly by removing the door roller shafts. Support each door assembly as the roller shaft is removed. Remove the nut from the bottom of the roller shaft, and use a soft alloy material (e.g. brass rod, etc.) to*

   lightly tap the shaft up through the support roller assembly until it comes free at the top . Use caution that the threads on the ends of the support roller shafts are not damaged.

NOTE: If your tong is equipped with the safety door system you may leave the safety door switch components in place on the door assemblies.

6. *Remove the two socket head cap screws securing the torque gauge mount, and lift the gauge mount out of place.*
7. *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.*
8. *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.*
9. *Remove the snap ring that secures the top clutch gear. Remove the top clutch gear and top clutch bushing. Remove the #10 x 3/4" socket head cap screws securing the bearing retainer to the top plate, and remove the bearing retainer.*
10. *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 detent assembly.
11. *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 loosen the shifting fork. The shifting shaft may now be carefully rotated and pulled out of the top shifter bushing.*

Top Plate Removal Continued:

12. *Loosen both brake bands (See page 3.7) by backing off the brake band adjustment bolts until the nut is flush with the end of the bolt.*
13. *Remove the backing pin assembly, but leave the rear cage plate bolt in place.*

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

14. *Remove the jaw pivot bolts and the jaw assemblies.*
15. *Remove the two front cage plate bolts, and the rear cage plate bolt, and the cage plate spacers. The cage plates may now be removed - use caution not to damage the bottom cage plate support ring or cage plate cam followers.*
16. *Pull the top bearing cap and spacer for the pinion drive gear by removing the four 1/2" bolts which secure the bearing cap. 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 CANADA CORP. SERVICE PERSONNEL RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.

17. *Remove the 1-1/2" nuts and pads for the rotary idler gears, and the 1-1/2" nuts, 5/8" bolts, and half-moon pads from the pinion idler gears.*
18. *Remove the bottom roller shaft nuts.*
19. *Carefully remove the remaining twelve support roller shafts. A soft alloy material (e.g. brass rod, etc.) may be required to lightly tap the shafts up through the support roller assembly until they come free at the top. Use caution not to misplace the brake band lug weldments or the two hydraulic valve mounting posts that will come free with this step.*
20. *Remove the hex head bolts around the perimeter of the tong which secure the top plate to the gear case housing.*
21. *Remove the countersunk socket head screws around the perimeter of the tong.*
22. *With all the above steps taken, the top tong plate can be lifted off providing access to the inside of the gear case.*

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.

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

TIGHTENING TORQUE GUIDE			
SAE GRADE 8 - FINE THREAD			
SIZE	CLAMP LOAD	PLAIN	PLATED
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.

APPLY A THIN LAYER OF GREASE TO THE SURFACE OF EACH MOVING PART DURING ASSEMBLY TO AID IN THE ASSEMBLY PROCESS.

1. *Position the tong body gear case on a suitable stationary support such that the bottom body plate is accessible.*
2. *Press support roller bearings into the support roller cups and secure with retaining rings (28 total).*

   KT-13625 Tongs

   Press roller bearing (PN 02-0014) into a support roller cup (997-D21-135) and secure with an inside retaining ring (02-0013). Repeat for all remaining roller cup assemblies.

   LW-13625 Tong

   Press ball bearing (PN 02-0101) into a support roller cup (997-D21-135) and secure with an inside retaining ring (02-0013). Repeat for all remaining roller cup assemblies.
3. *Use the roller cup assemblies to assemble five support roller assemblies as shown on Pp. 5.4 - 5.5, but at this time use only items B, D, E, F, G, & H (i.e. all the support roller components that reside between the top and bottom plates of the tong, plus the support roller shaft.*
4. *Install five support roller assemblies plus shafts along one side of the body case. Insert shafts through the bottom plate, but do not install the bottom nylock nuts or, where used, the narrow flat washers.*
5. *Install rotary gear (PN 997-D1-B), making sure the backing pin slots are on the side facing up. Ensure one side is supported by the support rollers installed in Step 3, and have the opening in the rotary gear oriented as shown in the following illustration.*

6. *Install support roller assemblies in the locations exposed by the opening in the rotary gear. Continue to rotate the rotary gear, installing support roller assemblies in the rotary gear opening as it is rotated. Finish with the rotary gear aligned with the opening in the bottom plate. Do not install the two door pivot support roller assemblies at this time.*
7. *Press pinion bearing (PN 1234-08-01B) into bottom pinion bearing cap, 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.*
8. *Press lower clutch bearing (PN 02-0014) into bottom clutch bearing cap, 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.*
9. *Install a retainer clip (PN 02-0009) into both rotary idler gears. Press an idler bearing (PN 02-0075) into each gear and secure with a second retainer clip.*
10. *Lightly grease the larger circumference of the two rotary idler shafts and slide them through the bearing and gears assemblies, centering the gear on the shaft.*
11. *Slide two bearing seals (PN 02-0010) over each end of the idler shafts and press against the retainer clips.*
12. *Slide a bearing spacer (PN 997-D20-121) over each end of the rotary idler shafts.*
13. *Place each rotary idler assembly through the bottom plate, ensuring the ends of the shafts with the threaded hole for the grease fitting are pointed upward.*

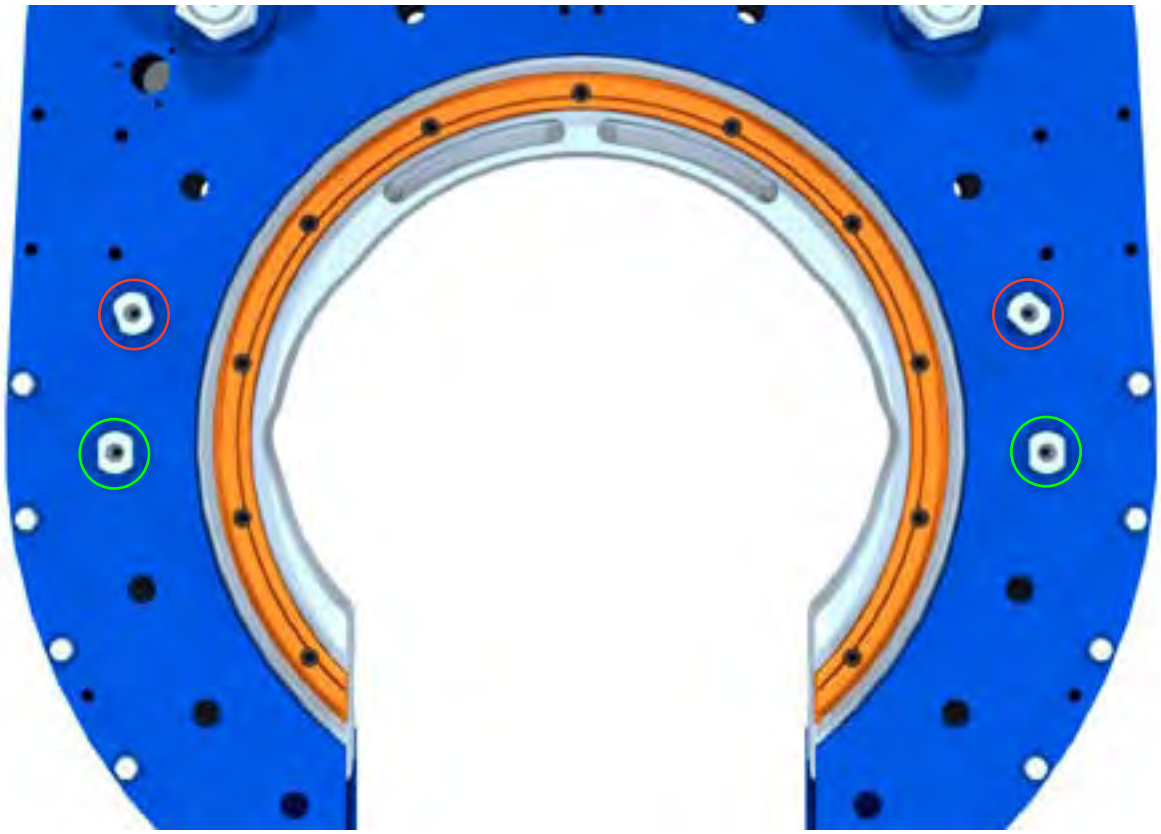
Assembly Procedure Continued:

14. *Place an idler pad (PN 997-D20-125) over the bottom side of each rotary idler shaft, and secure each with a 1-1/2" UNF nylock nut.*
15. *Place low pinion gear shoulder side down over the lower bearing and bearing cap, centering as best as able.*
16. *Install pinion gear shaft into the spline of the bottom pinion gear and the lower pinion bearing.*
17. *Slide 2 needle bearings (02-1404) over each end of the clutch shaft, and press up against centre gear. Slide low clutch gear over the bottom end of the clutch shaft, onto the two needle bearings. Slide bottom clutch spacer (pn 997-99) over lower end of shaft, and place lower end of clutch shaft into the lower clutch bearing that has been pre-mounted in the lower body plate.*
18. *Install shifting collar which will slip over clutch shaft and mesh with low or high clutch gear.*
19. *Install the lower shifting bushing (PN 101-0003) in the bottom body plate using four 3/8" NC x 1" hex bolts and 3/8" lock washers.*
20. *Assemble the shifting fork, shaft, and the 5/8" hex nut and 5/8" hex jam nut to secure the fork to the shaft. Place the end of the shifting shaft in the lower shifting bushing and mesh the shifting fork with the shifting collar.*
20. *Install a retainer clip (PN 02-0009) into both pinion idler gears. Press an idler bearing (PN 02-0075) into each gear, and secure with a second retainer clip.*
21. *Slide each pinion idler half-shaft through pinion gear assemblies. Slide a bearing seal (PN 02-0010) over the ends of each half-shaft, and secure with a shaft retainer clip (PN 02-0008).*
22. *Place pinion idler assemblies, less the idler pads and top fasteners, on top of the lower pinion gear and place them as best as possible - their position may have to be adjusted slightly as the top plate is attached (see following illustration).*

23. *Install high pinion gear (shoulder side up).*
24. *Install high clutch gear, followed by the top clutch bearing spacer (PN 101-3599).*
25. *(If installing a support ring style cage plate) Install top support ring (PN 997-HT-23-TOP) in the rotary gear using eleven 3/8" x 1-3/4" socket head cap screws.*
26. *Carefully remove all support roller shafts, using caution not to shift the position of the installed support roller assemblies or to damage the threads on the end of the shafts.*
27. *Insert three dowel pins into the side body of the tong - two in the un-threaded holes on either side, near the front opening, and one in the un-threaded hole in the rear centre of the body.*

Assembly Procedure Continued:

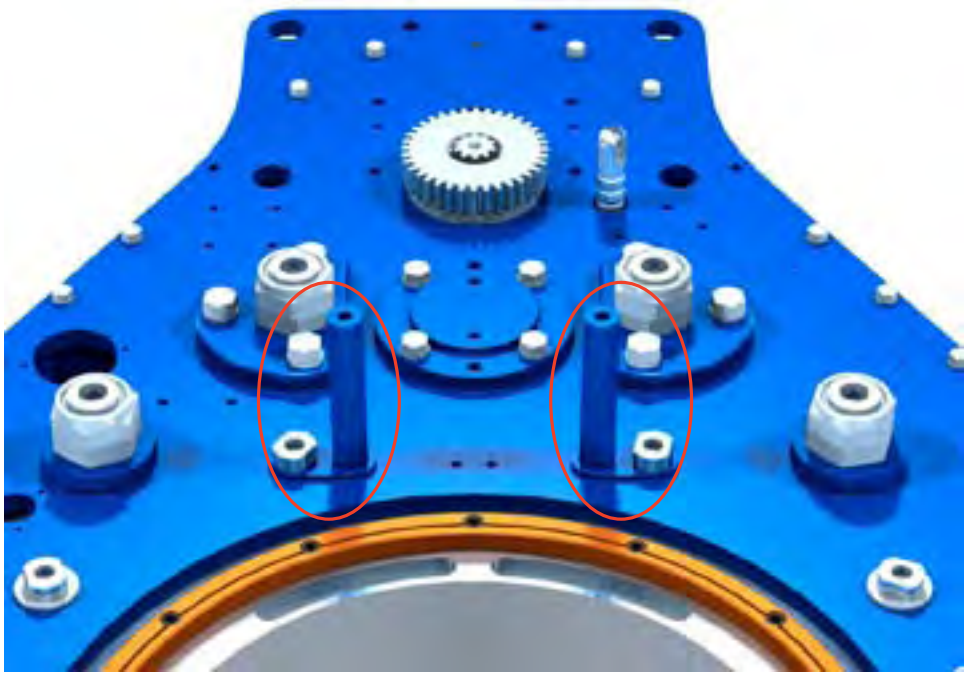
28. *Carefully position and install the top plate. Use caution not to damage the top of the clutch and pinion idler shafts. Secure the top plate with 22 3/8" NC x 1-1/2" hex bolts and 3/8" lock washers, and two 3/8" NC x 1-3/4" hex socket head cap screws. Do not install fasteners at the rigid sling hanger locations.*
29. *Install half-moon idler pads over the ends of the pinion idler shafts, and secure each with three 5/8" NC x 1-3/4" hex bolts and 5/8" lock washers, followed by a 1-1/2" UNF nylock nut.*
30. *Slide the remaining rotary idler pads over the rotary idler shafts and secure with 1-1/2" UNF nylock nuts.*
31. *Press the remaining pinion bearing (PN 1234-08-01B) into the top pinion bearing cap and install over the top of the pinion gear shaft - secure with four 1/2" NC x 1-1/4" hex bolts and 1/2" lock washers.*
31. *Install top clutch bearing retainer into top plate and secure with two 10-24 x 3/4" hex socket head cap screws. Insert top clutch bearing (PN 02-1403), followed by the clutch bearing bushing (PN 997-HT-60).*
32. *Install clutch drive gear and retaining snap ring (PN 1234-00-04).*
33. *Re-install support roller shafts:*
    i) *"Backup-ready tongs" use longer support roller shafts (PN 101-1268) in four locations where they are coincidental with the two front leg mount weldments (PN 997-917-00, as indicated by the **red and green** circles in the illustration below. "Stand-alone" tongs use the longer support roller shafts in only two locations where the support rollers are coincidental with the leg weldments (997-D8-160A), as indicated by only the green circles in the following illustration. All other support rollers, with the exception of the door pivot rollers, use a standard support roller shaft (PN 101-1266).*



33. *Re-install support roller shafts cont'd:*
    ii) *Ensure the two top and two bottom brake band lug weldments are installed with the two front support roller shafts on each side as shown in the illustration on the following page. Note that no flat washers are used where the shafts are coincidental with the brake band lug weldments.*

Assembly Procedure Continued:

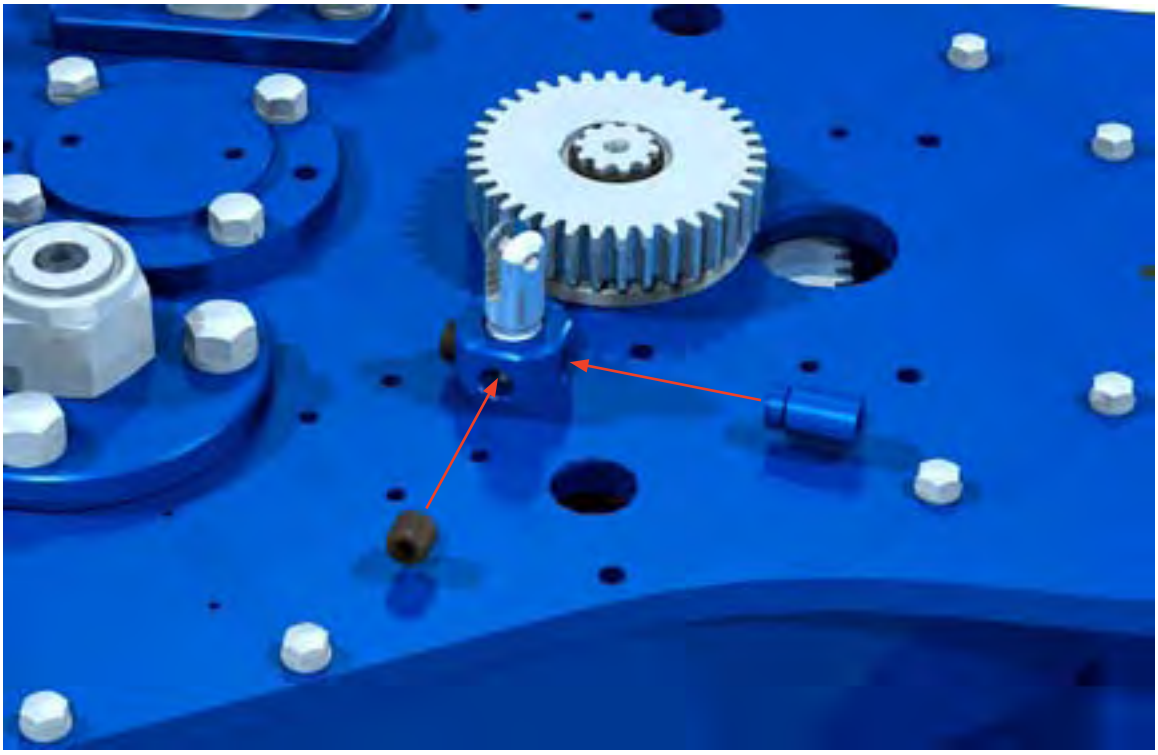
iii) *Two rear hydraulic valve mount weldments (PN 101-0011) are coincidental with the two rear support roller shafts as shown in the following illustration. Note that no flat washers are used where the shafts are coincidental with the brake band lug weldments, but flat washers are used on the bottom.*



iv) *Install the remainder of the support roller shafts, except for the door pivot rollers. Use 7/8" narrow flat washers on the remainder.*

Assembly Procedure Continued:

34. *Thread the top shifter bushing into the top plate, over the shifter shaft, until snug. Thread the detent tube (PN 101-0019) into the top shifter bushing as shown. Thread three 5/8" NC x 5/8" hex socket set screws into the remaining three ports in the bushing - do not bottom out the set screws on the shifting shaft, or the shaft will not move.*



35. *Insert the shifter detent ball (PN 02-0018) into the detent tube, followed by the detent spring (PN 02-0040). Thread a 7/16" NF hex jam nut onto a 7/16" UNF x 1-1/4" hex nut, then thread the 7/16" bolt into the detent tube.*
36. *Insert two 5/16" x 7/8" dowel pins into the un-threaded holes in the rear of the tong, adjacent to the clutch drive gear.*
37. *Attach motor mount to top plate, and secure with four 1/2" NC x 1-3/4" hex socket head cap screws.*
38. *Bolt the shifter lug weldment onto the top plate with four 3/8" NC x 1-1/2" hex bolts and 3/8" lock washers.*
39. *Attach the motor gear to the motor shaft, securing with two 3/8" NC x 3/8" hex socket set screws. Do not neglect to install the 3/8" square key.*
40. *Install the motor onto the motor mount. The LH side of the motor is secured with two 1/2" NC x 1-1/4" hex bolts and 1/2" lock washers, which also secures the torque gauge holder weldment. Secure the RH side of the motor with two 1/2" NC x 1" hex bolts and 1/2" lock washers.*
41. *Install shifting handle. Secure the handle to the shifter shaft and shifter pivot lug weldment with 5/16" clevis pins.*
42. *Install the rigid sling mounting lugs using two 3/8" NC x 1-3/4" hex bolts and 3/8" lock washers, and two 1/2" NC x 1-1/4" hex bolts and lock washers per side.*

ALL FASTENERS USED DURING REASSEMBLY OF LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) MUST BE SECURED WITH RED LOCTITE™.

43. *Mount the tong legs, or the front leg mount weldments, depending on whether the tong is being prepared to be "backup ready" or "stand alone".*
    i. *If this tong is not to be used with a backup, the front leg weldments will be coincidental with one support roller shaft per side, which was installed in step 33. The rear leg is mounted directly behind the clutch bearing cap, and is secured to the bottom plate using a single 7/8" NC x 1" hex socket head cap screw.*

Assembly Procedure Continued:

ii. *If this tong is being prepared to be "backup ready" the front leg mount weldments are coincidental with two longer support roller shafts, which were installed in step 33.*

44. *If not already done, thread the remaining 7/8" thin nylock nuts on to the support rollers.*

Assembly Procedure Continued:

45. *Install the cage plates:*

    KT13625 Tong:

    i. *Pre-grease the support ring slot in the lower cage plate. Install the lower support ring (PN 997-HT-23-BOT) in the lower cage plate using eleven 3/8" x 1-3/4" socket head cap screws.*

    ii. *Pre-grease the support ring slot in the rotary gear. Install the upper support ring in the rotary gear using eleven 3/8" x 1-3/4" socket head cap screws.*

    iii. *Pre-grease the support ring slot in the top cage plate, and set top cage plate in place, mating the support ring slot with the support ring attached to the rotary gear.*

    iv. *Slide a 1/2" narrow flat washer followed by the backing pin spacer (PN 101-4093) over a 1/2" UNC x 8" hex bolt. Slide the backing pin retainer (PN 101-4139) over the backing pin spacer.*

    v. *Secure the bottom cage plate to the top cage plate. Use two 1/2" NC x 6" hex bolts at the front and the 1/2" x 8" bolt and spacer assembly in the rear, ensuring the backing pin spacer remains between the head of the bolt and the top of the top cage plate.* ***ASSEMBLY NOTE:*** *Do not neglect to install the three cage plate spacers (PN 997-38B) between the two cage plates during installation (See exploded diagram, Pp. 5.28 - 5.29).*

    LW13625 Tong:

    i. *Install eleven cam followers (02-0016) in the lower cage plate using 5/8" UNF hex jam nuts and 5/8" lock washers.*

    ii. *Install eleven cam followers in the top cage plate using 5/8" UNF hex jam nuts and 5/8" lock washers.*

    iii. *Lightly grease the top and bottom slots in the rotary gear, and set top cage plate in place, mating the cam followers on the cage plate with the slot on the rotary gear.*

    iv. *Slide a 1/2" narrow flat washer followed by the backing pin spacer (PN 101-4093) over a 1/2" UNC x 8" hex bolt.*

    v. *Secure the bottom cage plate to the top cage plate. Use two 1/2" NC x 6" hex bolts at the front, and the 1/2" x 8" bolt and spacer assembly in the rear ensuring the backing pin spacer remains between the head of the bolt and the top of the top cage plate.* ***ASSEMBLY NOTE:*** *Do not neglect to install the three cage plate spacers (PN 997-38B) between the two cage plates during installation (See exploded diagram Pp. 5.30 - 5.31).*

46. *Install backing pin.*

    i. *Thread the 3/8 UNC x 1-1/2" threaded stud (PN 101-4097) into the backing pin (PN 101-4042).*

    ii. *Insert the backing pin and stud through the bottom of the backing pin retainer installed in Step 45(iv). Slide the short backing pin spacer (PN 101-4096) over the top of the stud, and thread the backing pin knob (PN 02-0017) on to the top of the threaded stud.*

    iii. *Lift the backing pin and insert into one of the two receptacles in the rear of the top cage plate.*

47. *Install upper and lower brake band weldments (PN 997-D23-29). Secure the brake bands to the top and bottom plates with one brake band retainer (PN 101-0140) per side - secure brake band retainers with 3/8" NC x 1" hex bolts and 3/8" lock washers. Install front adjustment springs, bolts, and nuts.*

48. *Install the door pivot support roller components that fit within the body plates, i.e. everything except the two pivot roller shafts.*

49. *Install two door pivot shoulder bushings (PN 101-0045) in each of the RH door weldment (PN 101-0034) and the LH door weldment (PN 101-0032).*

50. *Thread a 3/8" UNC hex jam nut on to a 3/8" UNC x 1-1/2" hex bolt. Thread the bolt in to the RH door weldment and lock it in place with the jam nut. This will serve as a latch adjustment.*

51. *Position the door latch weldment (PN 101-0038) in front of the RH door weldment, and insert two door latch springs (PN 997-16) between the two weldments. Secure the latch weldment to the door weldment with the latch adjustment cam (the springs may need to be lightly compressed to facilitate the installation of the latch cam). Secure the door latch cam to the top of the RH door weldment using a 3/8" UNC x 1" hex bolt. See Pp. 5.32 - 5.33 for an exploded illustration of the door assembly.*

52. *Align the door pivot holes with the pivot holes in the top and bottom plates. Insert the door pivot roller shafts (PN 101-0046) from the top - they may have to be tapped lightly with a soft metal or rubber hammer. Use caution when sliding the shaft through the support roller components. Once the shafts have been tapped all the way through, secure each with a 3/4" UNF thin nylock nut and 3/4" narrow flat washer.*

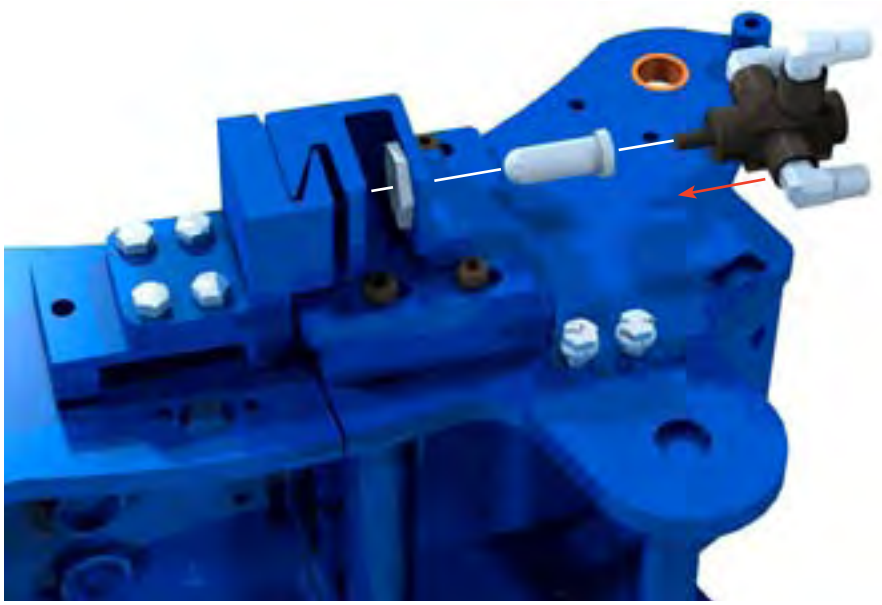
53. *Install two mechanical door stops (PN 101-0014) on the underside of the tong, near the doors. Secure using two 3/8" NC x 1-3/4" bolts each.*

54. *Install door cylinder mounting lugs (1050-12-001) into the threaded locations directly adjacent to the brake band lug weldments on the top plate.*

55. *Install the door stop cylinder assemblies using two 3/8" NC x 1-1/4" hex bolts, two 3/8" lock washers, and two 3/8" narrow flat washers per cylinder. Do not neglect to install the door stop spacers (PN 997-13B) under the flat washers through each end of the cylinders.*

Assembly Procedure Continued:

56. *If your tong is equipped with the safety door option, it may now be installed (See Pp. 5.34 - 5.35) using the following procedure:*
    - i. *Attach safety door latch plate, PN 101-0320 to the LH door weldment using three 3/8" NC x 1" hex socket head cap screws.*
    - ii. *Attach safety door latch block, PN 101-0319, to the RH door weldment using two 3/8" NC x 1-1/2" socket head countersunk cap screws and one 3/8" NC x 1-1/2" hex bolt and lock washer.*
    - iii. *Attach safety door latch block, PN AE13-301S, to safety door latch plate, PN AE13-311, using three 3/8" NC x 1" flat head countersunk cap screws.*
    - iv. *Attach the assembly from step iii to the safety door latch plate, PN 101-0320, using four 5/16" x 3/4" shoulder bolts.*
    - v. *Attach safety door latch block, PN AE13-302M to the safety door latch block, PN 101-0319, using four 3/8" NC x 3/4" hex bolts.*
    - vi. *Insert load plunger, PN AE12-306, into LH safety door latch block, PN AE13-301S.*
    - vii. *Attach three 1/4" NPT JIC elbows to the Deltrol safety door valve, PN 08-0337M. Position a 15/16" valve lock nut as shown in the illustration, and secure the safety door valve to the safety door latch block using the valve lock nut (see following illustration).*



    - viii. *Attach the front safety door guard plate weldment, PN 101-0387, to the LH tong door weldment using two 3/8" NC x 1" hex bolts and lock washers. Attach the rear safety door guard plate weldment, PN 101-0386, to the safety door latch plate, PN 101-0320, using a single 3/8" NC x 1" hex bolt and lock washer. Secure the top guard plate to the front and rear plates using four 3/8" NC x 3/4" hex bolts and lock washers. Note that a door adjustment may be necessary to obtain proper operation (refer to 3.D.3).*
57. *Install inlet coupling support assembly (PN 1050-C-175) to the top plate, between the RH pinion idler and RH rotary idler, using two 3/8" NC x 1" hex bolts and 3/8" lock washers. Attach the outlet coupling support weldment mount (PN 101-0021) to the top plate to the RH side of the motor mount using four 3/8" NC x 1" hex socket head cap screws. Attach the outlet coupling support weldment (PN 101-0071) to the weldment mount using two 3/8" NC x 1" hex bolts and 3/8" lock washers*
58. *Install the hydraulic valve assembly to the valve mount weldments using one 1/2" NC x 5" hex bolt and 1/2" narrow flat washer per valve mount. Install main inlet and outlet lines, and the remainder of the hydraulic connections.*
59. *Install grease fittings:*
    - i. *Install one 1/4" straight thread grease fitting (PN 02-0097) into the top side of each support roller shaft, including the door pivot rollers (14 locations total).*
    - ii. *Install one 1/4" straight thread grease fitting (PN 02-0097) into the top side of the latch adjustment cam.*
    - iii. *Install one 1/8" NPT grease fitting (PN 02-0005) into the top of each idler shaft or half-shaft (four locations total).*
    - iv. *Install one 1/8" NPT grease fitting (PN 02-0005) into the end of the clutch shaft, in the centre of the clutch bearing cap.*
    - v. *Install two 1/8" NPT 90° grease fittings (PN 02-0093) in each pinion bearing cap (four locations total).*

Assembly Procedure Continued:

60. *Install grease fittings continued:*
    - vi. *Install two 1/8" NPT 90° grease fittings (PN 02-0093) in clutch bearing cap (two locations total).*
    - vii. *Install one 1/8" NPT 90° grease fitting (PN 02-0093) in the top of the motor mount.*
    - viii. ***LW13625 ONLY:** Install one 1/8" NPT grease fitting (PN 02-0005) into each cam follower in the top and bottom cage plates (22 locations total)*
61. *Attach the rigid sling to the rigid sling hanger weldments using two rigid sling pins (PN 997-955). Secure each pin with two 0.148" X 2.938" hitch pins.*
62. *When installing the load cell and load cell tie-off, use LC anchor/tie off bolt assembly PN 101-0078, consisting of heavy hex bolt (modified), PN 101-0040, 1-1/4" NC heavy hex nut, and 0.148" x 2.938" hitch pin.*

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 - "McCoy Grey" is paint color number RAL7015 (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 cold 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-INDUCED INJURIES

1. ☐ *Perform an initial wash of the tool in order to remove the majority of dirt and grease build-up. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.*
2. ☐ *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 - "McCoy Grey" is paint number RAL7015. 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 degreased, 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.*

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Adequate maintenance and proper fluid selection is essential for minimizing hydraulic-related failures. All troubleshooting must be performed by a technician trained in hydraulic systems, and familiar with the equipment design, assembly and operation.

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

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.

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.

TONG WILL NOT DEVELOP SUFFICIENT TORQUE Cont'd:

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. SUGGESTS THAT THE LOAD CELL/TORQUE GAUGE ASSEMBLY BE RETURNED TO THE FACTORY FOR RE-CALIBRATION ON A YEARLY BASIS.

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 band(s) is (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.

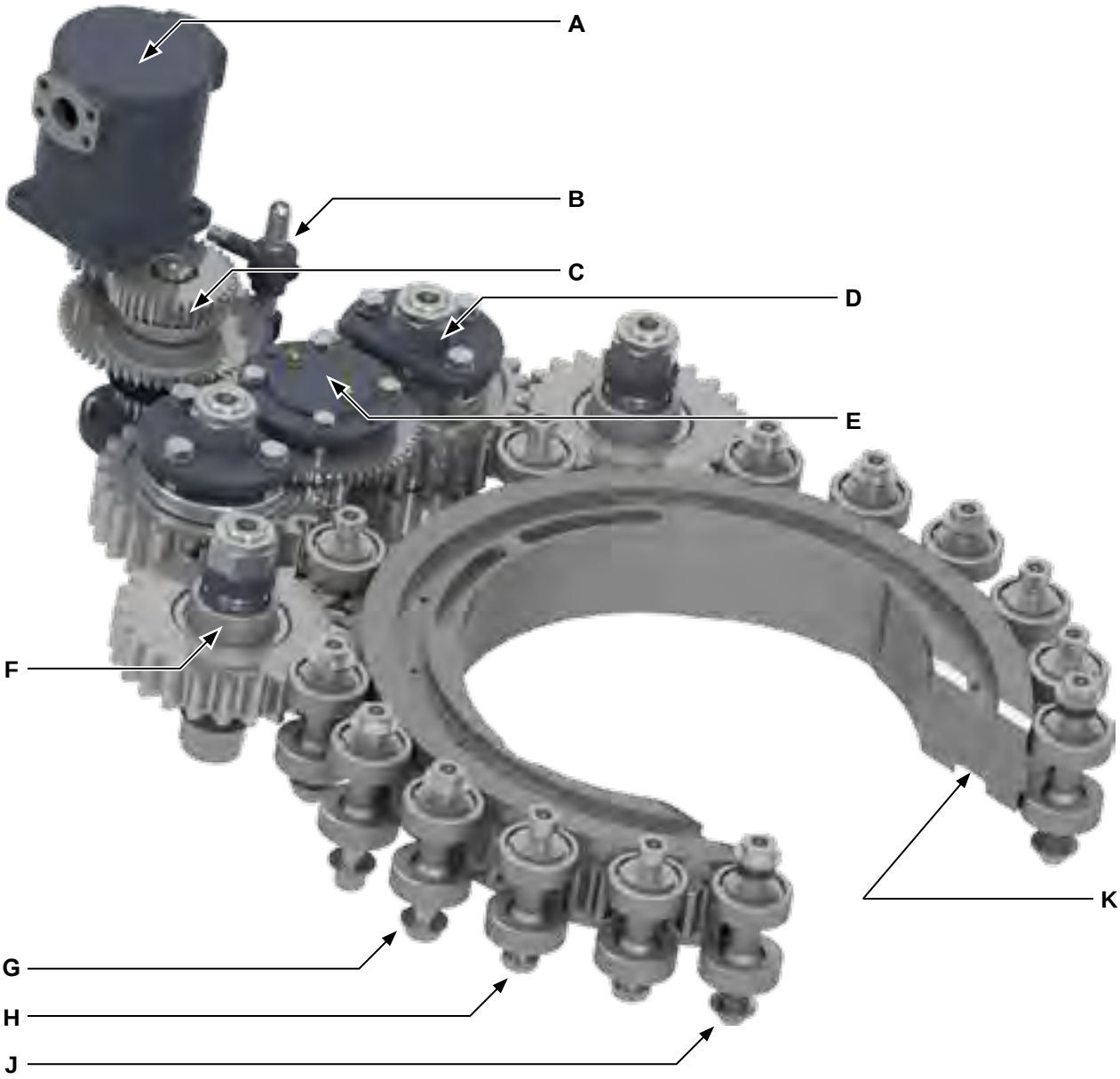
H. GENERAL COMMENTS

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.

Assemblies and Parts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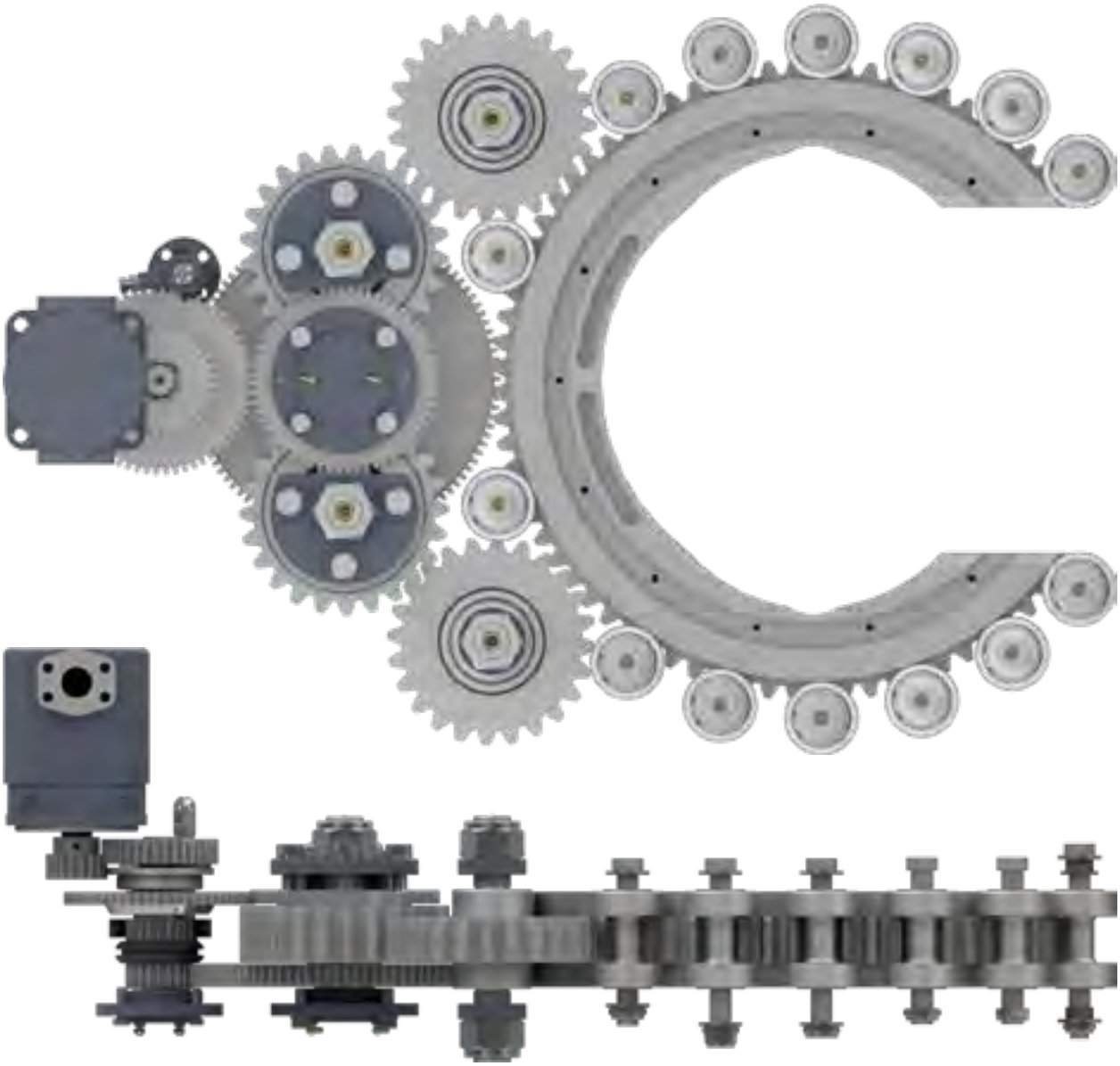
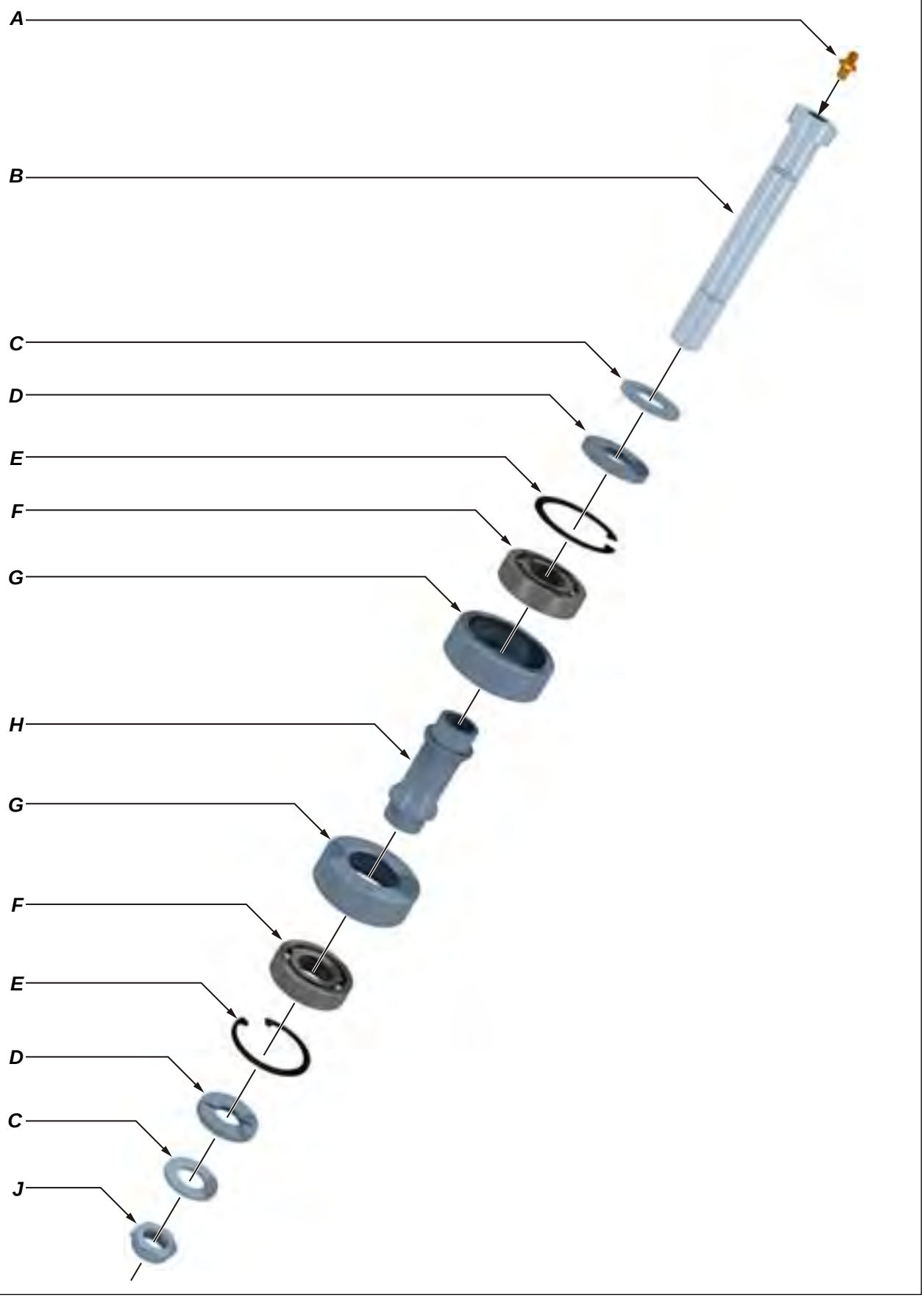


Item	Type	Description	Qty	Part Number
A	Part	Hydraulic Motor	1	87-0112
B	Assembly	Shifting Assembly (See Pp. 5.16 - 5.17)	1	
C	Assembly	Clutch Assembly (Pp 5.14 - 5.15)	1	
D	Assembly	Pinion Idler Assembly (Pp. 5.10 - 5.11)	2	
E	Assembly	Pinion Assembly (Pp 5.12 - 5.13)	1	
F	Assembly	Rotary Idler Assembly (Pp 5.8 - 5.9)	2	
G	Assembly	Support Roller Assembly, Front Leg Coincidental (Pp. 5.4 - 5.5)	4	
H	Assembly	Support Roller Assembly (Pp. 5.4 - 5.5)	8	
J	Assembly	Door Door Pivot Roller Assembly (Pp. 5.6 - 5.7)	2	
K	Part	Rotary Gear	1	997-D1-B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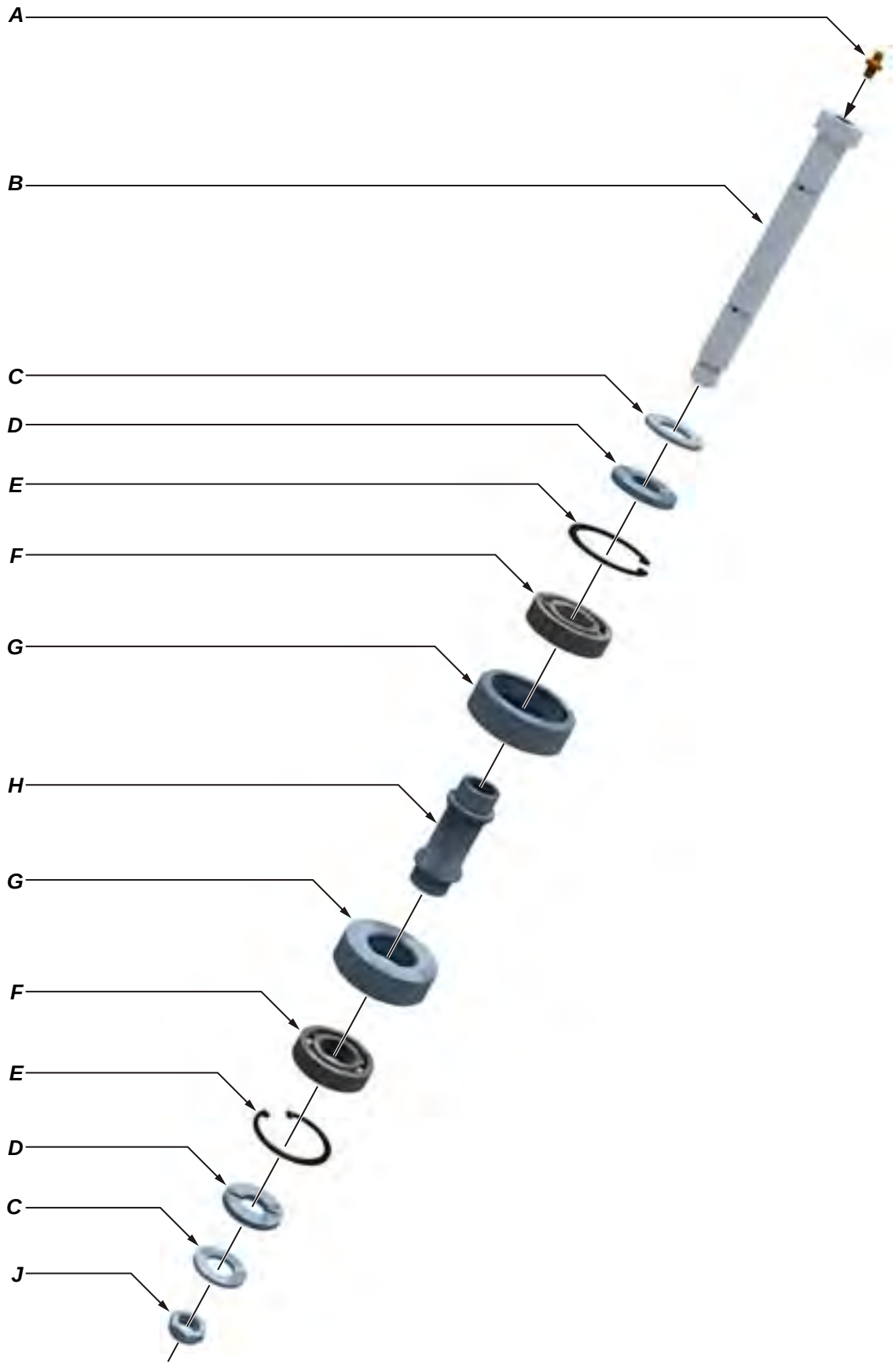
Item	Type	Description	Qty	Part Number
A	Part	1/4-24 NF Grease Fitting	1	02-0097
B	Part	Support Roller Shaft (See Note A)	1	101-1266 / 101-1268
C	Part	7/8" Narrow Washer (See Note B)	2	09-5123
D	Part	Roller Cap Spacer	2	997-D21-140
E	Part	BS 3673 Metric B062M Retaining Ring	2	02-0013
F	Part	Cylindrical Roller Bearing (KT13625 Tongs)	2	02-0014
	Part	Ball Bearing Roller Bearing (LW13625 Tongs)	2	02-0101
G	Part	Roller Cup	2	997-D21-135
H	Part	Support Roller Sleeve	1	997-D21-134
J	Part	7/8" UNF Thin Hex Nylock Nut	1	09-5722

NOTE A: Where the support roller is coincidental with the front leg assembly, shaft number 101-1268 is used (4 occurrences).

NOTE B: Upper washers are not used where the support roller assembly is coincidental with the brake band retainer lug weldments and the hydraulic valve mount post weldments (6 occurrences).

Lower washers are not used where the support roller assembly is coincidental with the brake band retainer lug weldments and the front leg assemblies (8 occurrences - backup ready, or 6 occurrences - stand-alone tong).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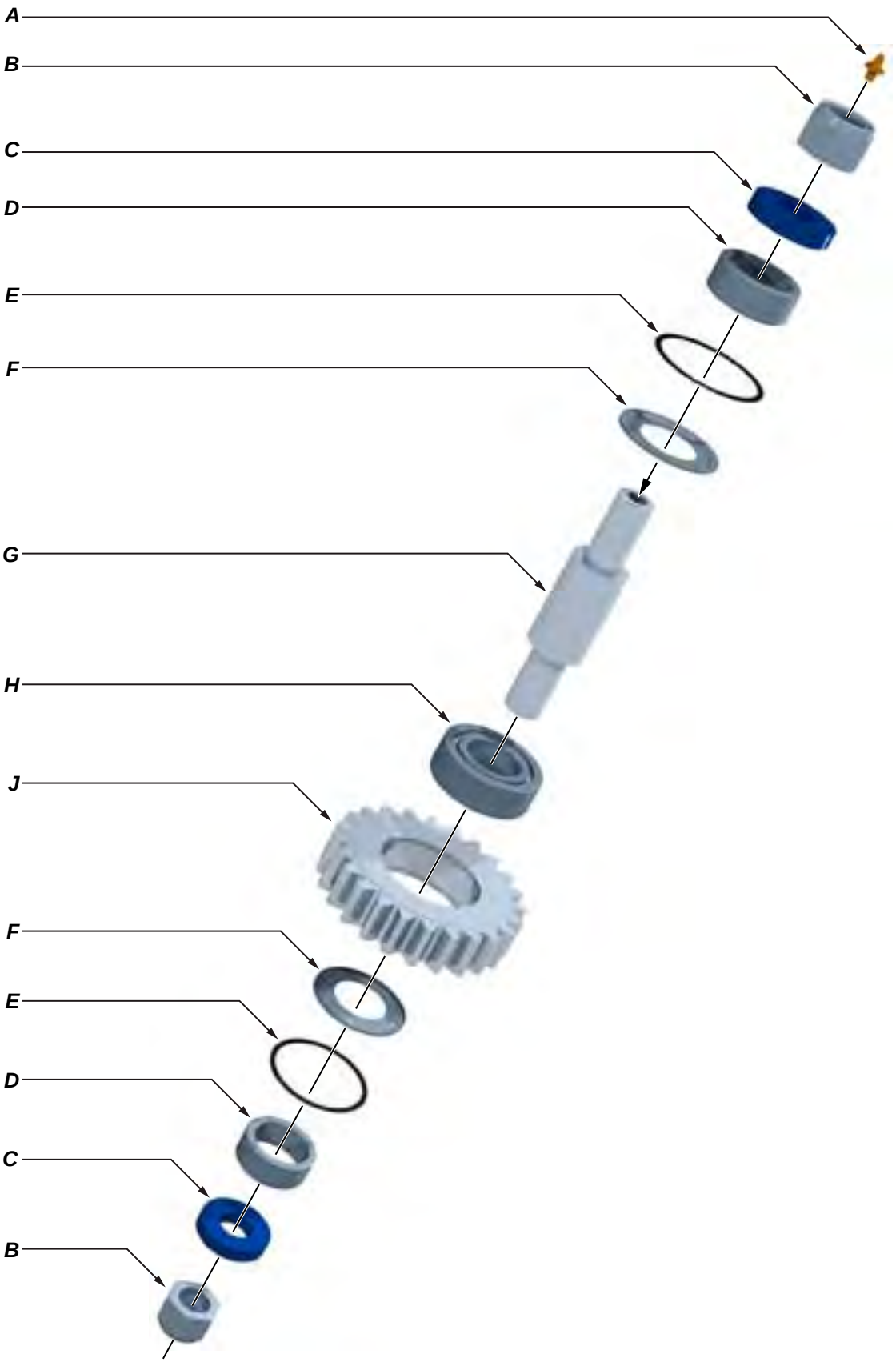
Item	Type	Description	Qty	Part Number
A	Part	1/4-24 NF Grease Fitting	1	02-0097
B	Part	Support Roller Shaft	1	101-0046
C	Part	7/8" Narrow Washer	2	09-5123
D	Part	Roller Cap Spacer	2	997-D21-140
E	Part	Metric B062M Inside Snap Ring	2	02-0013
F	Part	Cylindrical Roller Bearing (KT13625 Tongs)	2	02-0014
	Part	Ball Bearing Roller Bearing (LW13625 Tongs)	2	02-0101
G	Part	Roller Cup	2	997-D21-135
H	Part	Door Roller Sleeve	1	997-D21-134
J	Part	3/4" UNF Thin Hex Nylock Nut	1	09-5718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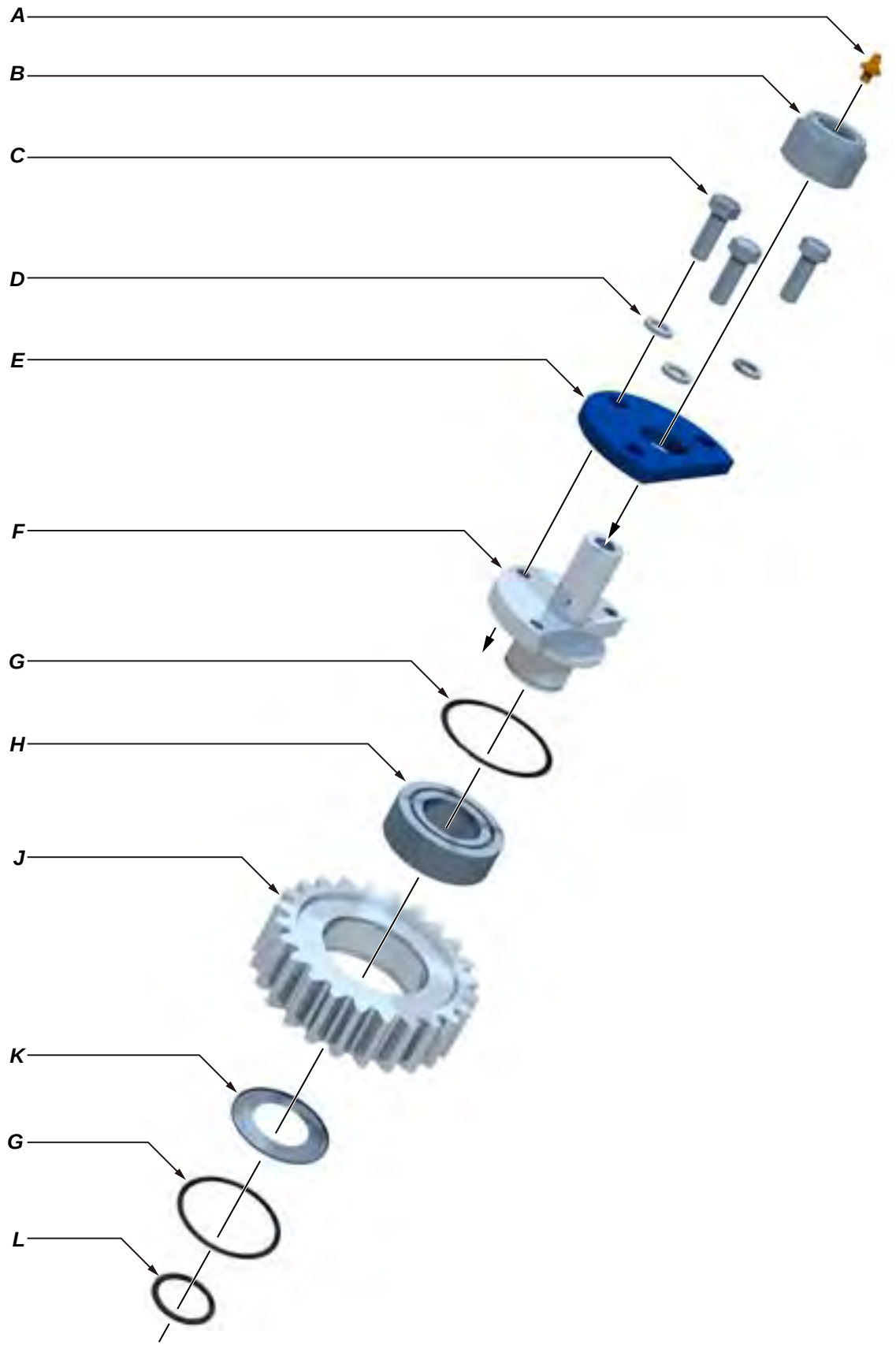
Item	Type	Description	Qty	Part Number
A	Part	Grease Fitting, 1/8" NPT	1	02-0005
B	Part	1-1/2" UNF Nylock Nut	2	02-5740
C	Part	Rotary Idler Pad	2	997-D20-125
D	Part	Idler Gear Bearing Spacer	2	997-D20-121
E	Part	Retainer Clip	2	02-0009
F	Part	Bearing Seal	2	02-0010
G	Part	Rotary Idler Shaft	1	997-D19-117
H	Part	Cylindrical Roller Bearing	1	02-0075
J	Part	Rotary Idler Gear	1	997-A2-119C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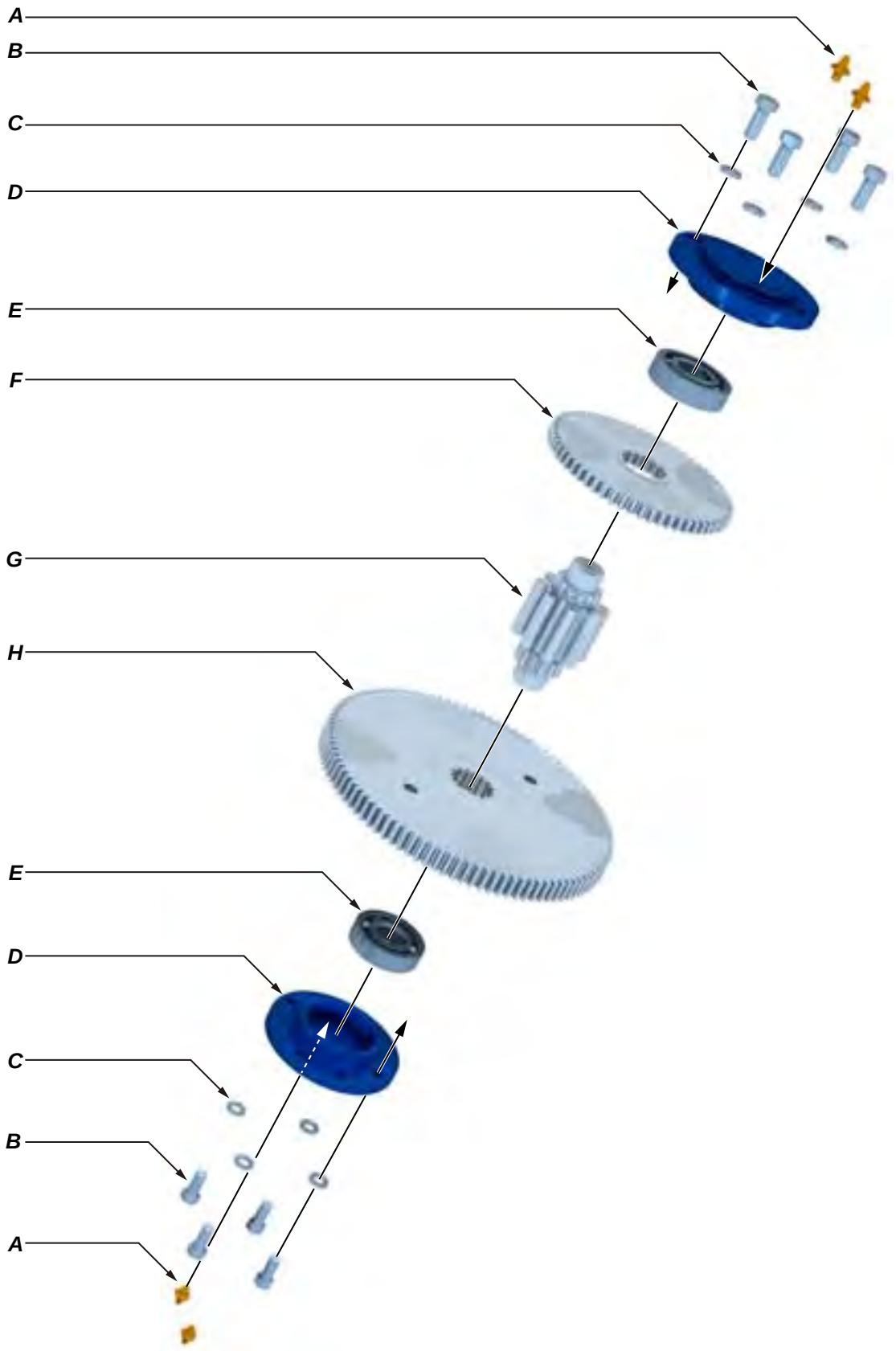
Item	Type	Description	Qty	Part Number
A	Part	Grease Fitting	1	02-0005
B	Part	1-1/2" UNF Nylock Nut	1	09-5740
C	Part	5/8" NC x 1-3/4" Hex Bolt	3	09-1232
D	Part	5/8" Lock Washer	3	09-5114
E	Part	Pinion Idler Pad	1	997-D17-109
F	Part	Pinion Idler Half Shaft	1	997-D17-105B
G	Part	Retainer Clip	2	02-0009
H	Part	Cylindrical Roller Bearing	1	02-0075
J	Part	Pinion Idler Gear	1	997-A2-119B
K	Part	Bearing Seal	1	02-0010
L	Part	Retainer Clip	1	02-0008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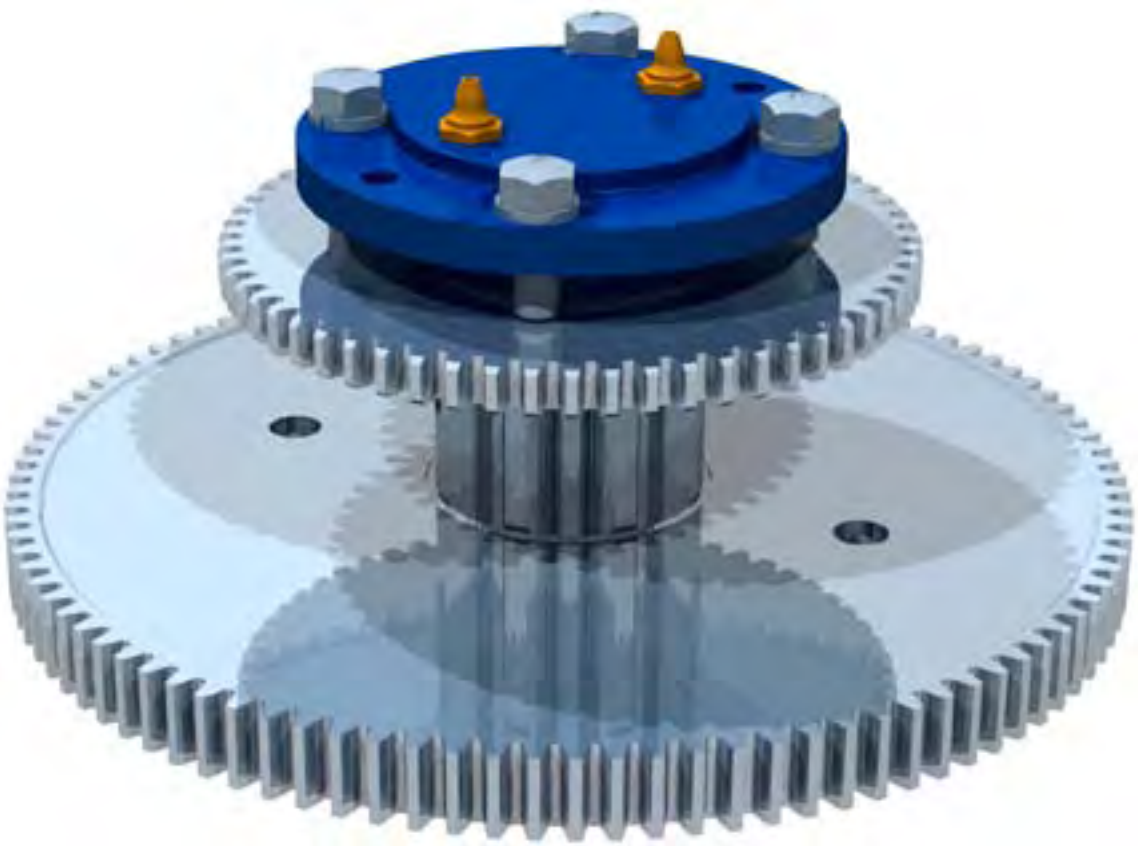
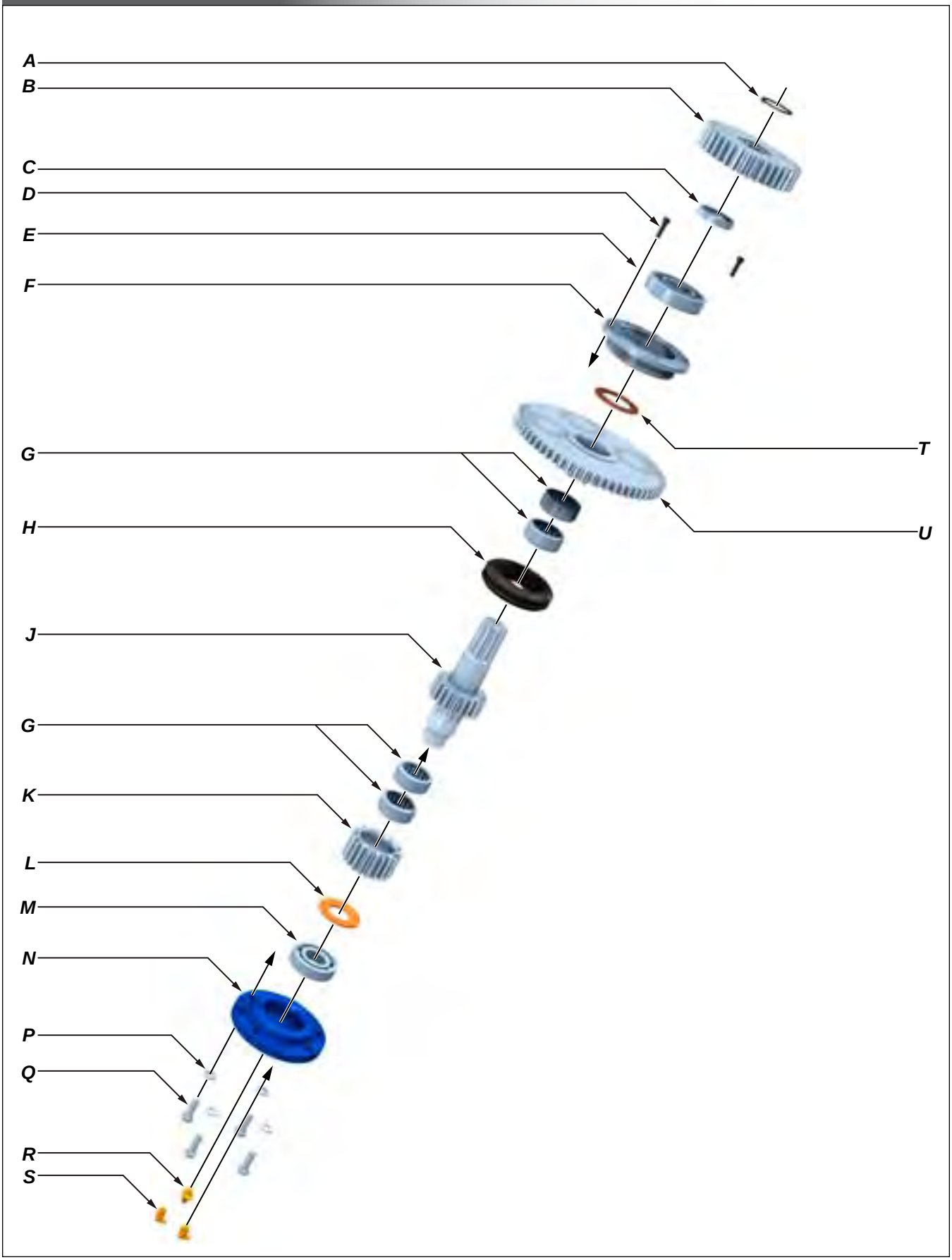


Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	4	02-0005
B	Part	1/2" NC x 1-1/4" Hex Bolts	8	09-1168
C	Part	1/2" Lock Washers	8	09-5110
D	Part	Pinion Bearing Cap	2	997-D15-89
E	Part	Cylindrical Roller Bearing	2	1234-08-01B
F	Part	High Pinion Gear	1	997-A4-87B
G	Part	Pinion Gear Shaft	1	997-A7-86B
H	Part	Low Pinion Gear	1	997-A5-88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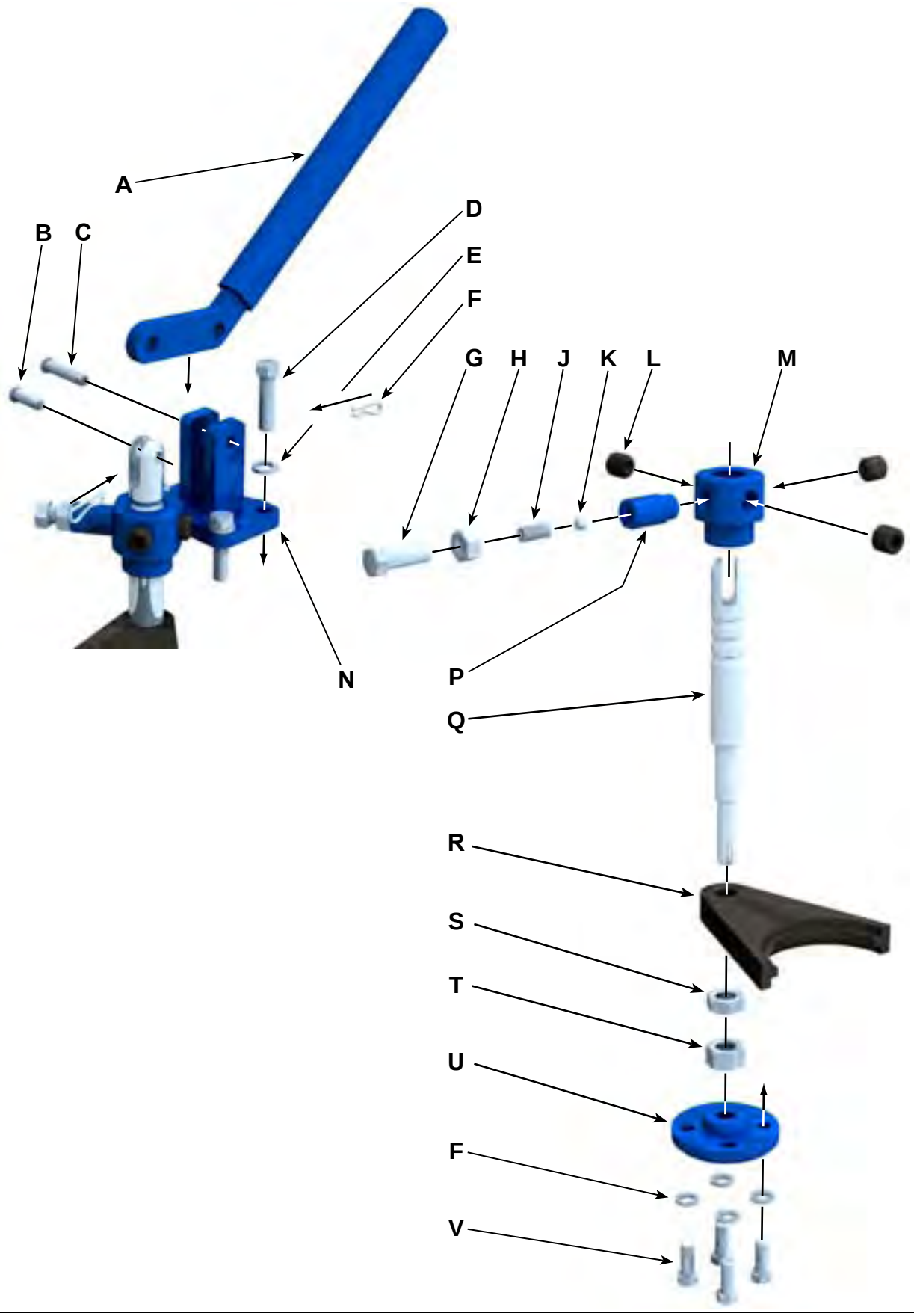
Item	Type	Description	Qty	Part Number
A	Part	Outside Snap Ring	1	1234-00-04
B	Part	Drive Gear	1	997-HT-61
C	Part	Clutch Bearing Bushing	1	997-HT-60
D	Part	#10-24 x 3/4" Hex Socket Head Cap Screw	2	09-0001
E	Part	Cylindrical Roller Bearing	1	02-1403
F	Part	Bearing Retainer	1	997-HT-59
G	Part	Needle Roller Bearing	4	02-1404
H	Part	Shifting Collar	1	997-HT-62
J	Part	Splined Clutch Shaft	1	997-HT-50
K	Part	Low Clutch Gear	1	997-HT-52
L	Part	Clutch Spacer	1	997-99
M	Part	Cylindrical Roller Bearing	1	02-0014
N	Part	Clutch Bearing Cap	1	997-HT-54
P	Part	3/8" Lock Washer	4	09-5106
Q	Part	3/8" NC x 1-1/4" Hex Bolt	4	09-1048
R	Part	1/8" NPT Grease Fitting	1	02-0005
S	Part	1/8" NPT 90 Deg. Grease Fitting	2	02-0093
T	Part	Clutch Spacer	1	101-3599
U	Part	High Clutch Gear	1	997-HT-51B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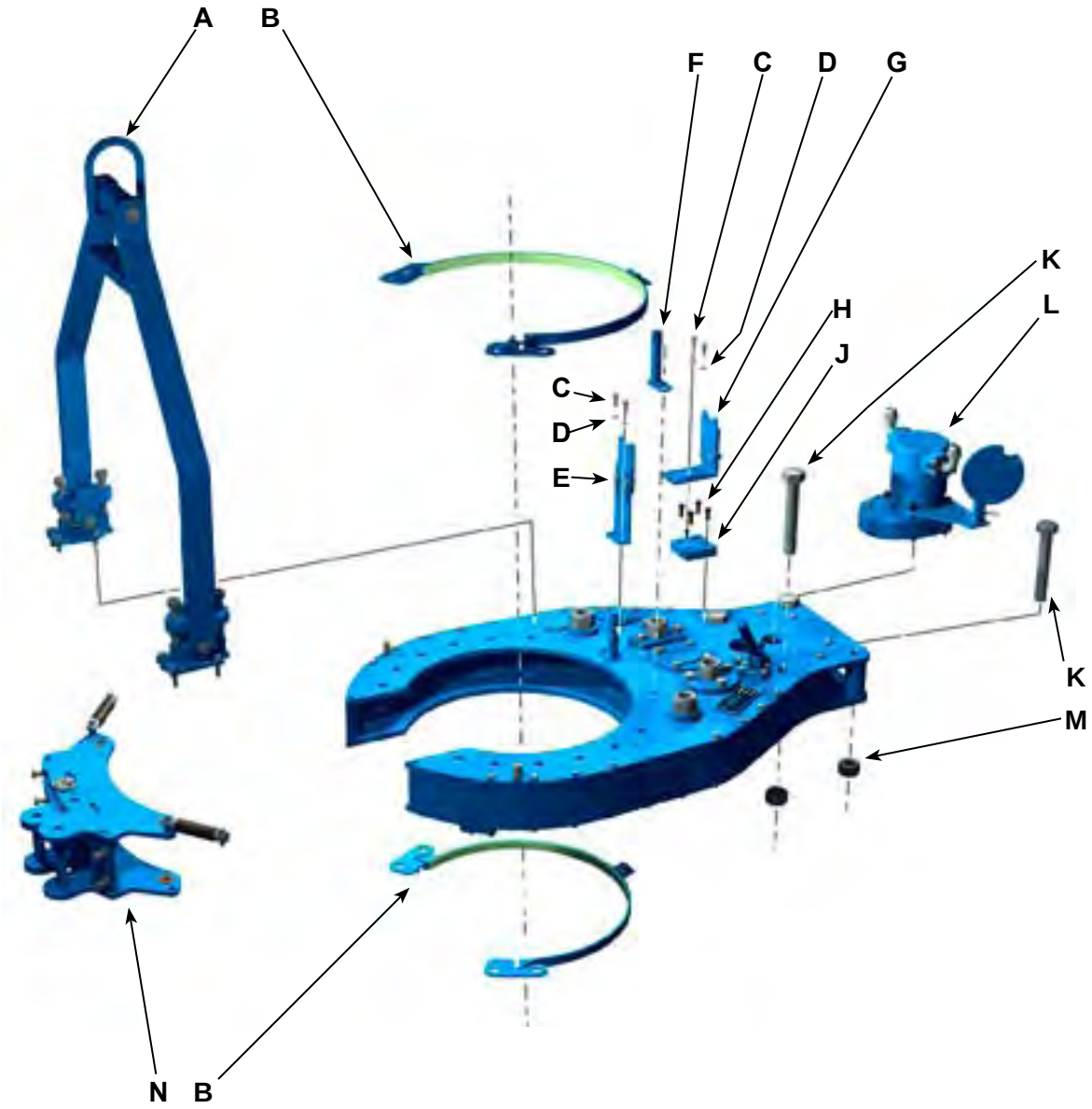
Item	Type	Description	Qty	Part Number
A	Part	Shifting Handle Weldment	1	1037-D-20B
B	Part	5/16" x 1" Clevis Pin	1	02-0020
C	Part	5/16" x 1-1/2" Clevis Pin	1	09-0256
D	Part	3/8" NC x 1-1/2" Hex Bolt	4	09-1553
E	Part	3/8" Lock Washer	8	09-5106
F	Part	HITCH PIN .0930 X 1.125, Spaenaur CP-83H	2	
G	Part	7/16" UNF x 1-1/4" Hex Bolt	1	09-1608
H	Part	7/16" UNF Hex Jam Nut	1	09-5508
J	Part	Detent Spring	1	01-0040
K	Part	Detent Ball	1	02-0018
L	Part	5/8" NC x 5/8" Hex Socket Set Screw - Cup Point	3	
M	Part	Threaded Shifter Bushing	1	101-0020
N	Part	Shifter Lug Weldment (Bolted)	1	101-0016
P	Part	Knob Collar Pipe	1	101-0019
Q	Part	Shifting Shaft	1	997-B1-71
R	Part	Shifting Fork	1	997-HT-72
S	Part	5/8" UNF Hex Jam Nut	1	09-5915
T	Part	5/8" UNF Hex Nut	1	09-5914
U	Part	Lower Shifting Shaft Bushing	1	101-0003
V	Part	3/8" NC x 1" Hex Bolt	4	09-1046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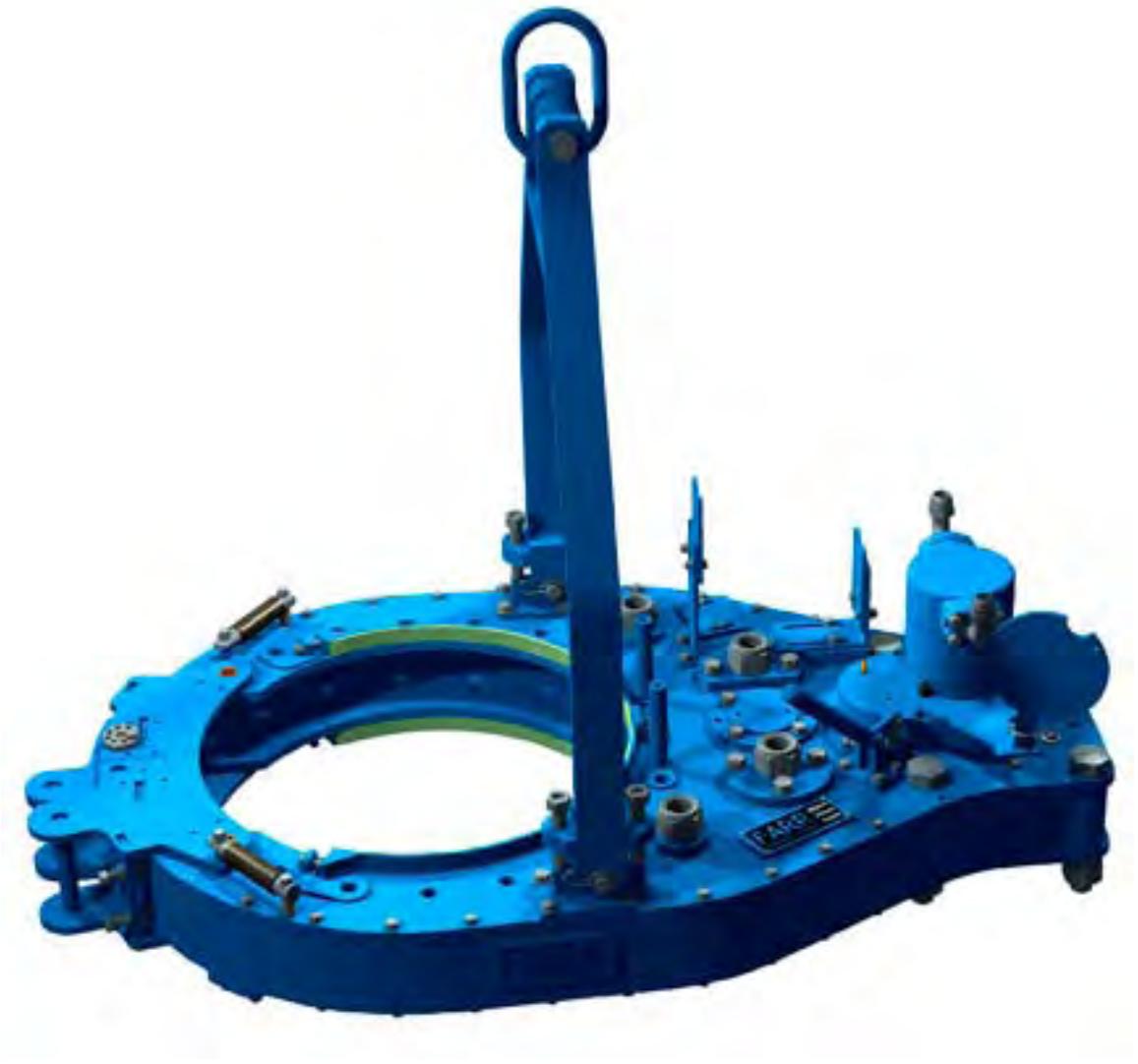
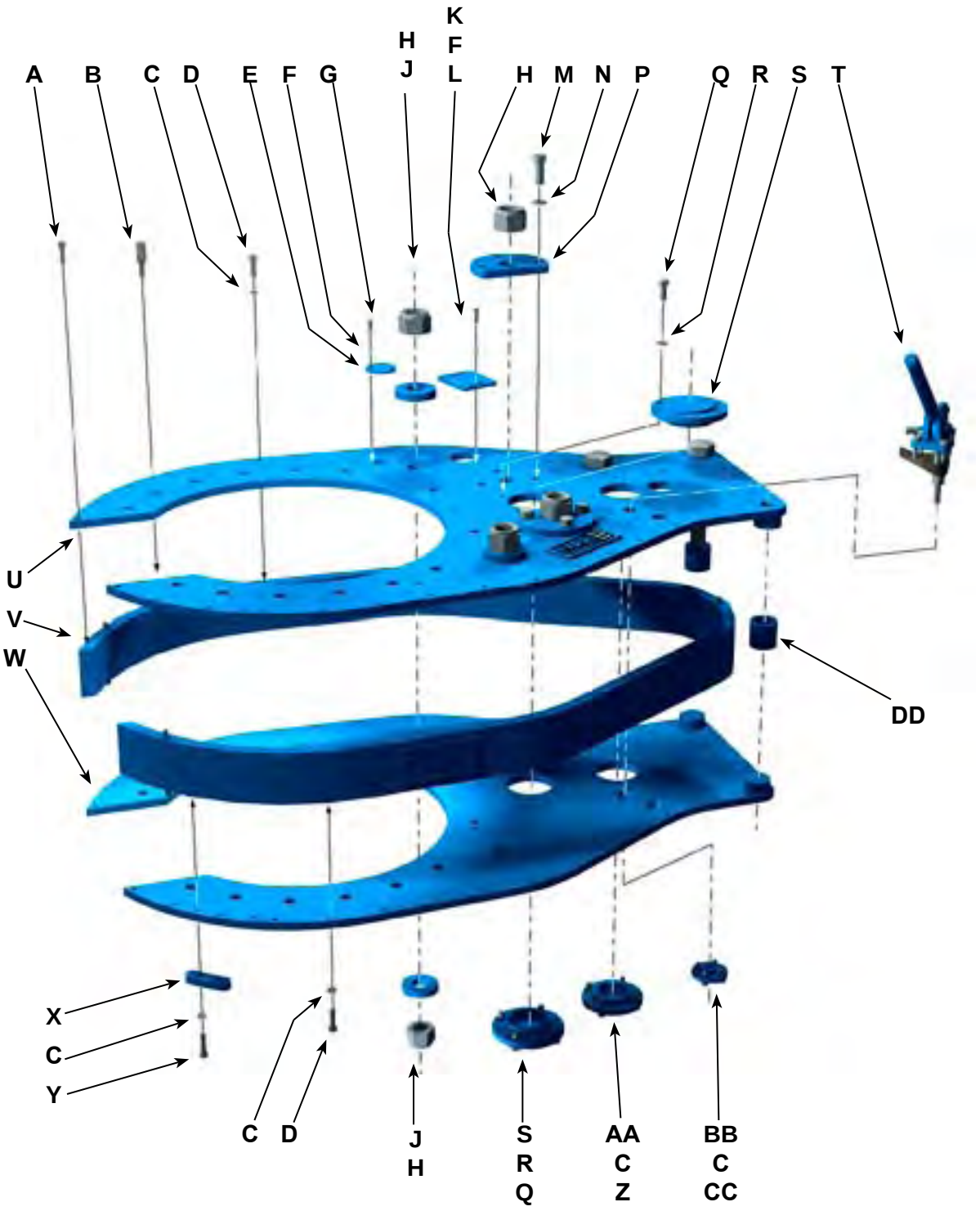


Item	Type	Description	Qty	Part Number
A	Assembly	Rigid Sling Assembly	1	See Pp. 5.38 - 5.39
B	Weldment	Brake Band Assembly	2	997-D23-29
C	Part	3/8" NC x 1" Hex Bolt	4	09-1046
D	Part	3/8" Lock Washer	4	09-5106
E	Assembly	Adjustable Hydraulic Support Assembly	1	1050-C-175
F	Weldment	Hydraulic Valve Mount Post Weldment	2	101-0011
G	Assembly	Adjustable Hydraulic Support Assembly	1	101-0071
H	Part	3/8" NC x 1" Hex Socket Head Cap Screw	4	09-1738
J	Part	Hydraulic Support Mount Block	1	101-0021
K	Part	1-1/4" NC x 7" Heavy Hex Bolt	4	09-9155
L	Part	Motor and Motor Mount	1	See Pp. 5.24 - 5.25
M	Part	1 1/4" NC Hex Nut	4	09-5832
N	Part	Tong Door Assembly	1	See Pp. 5.32 - 5.33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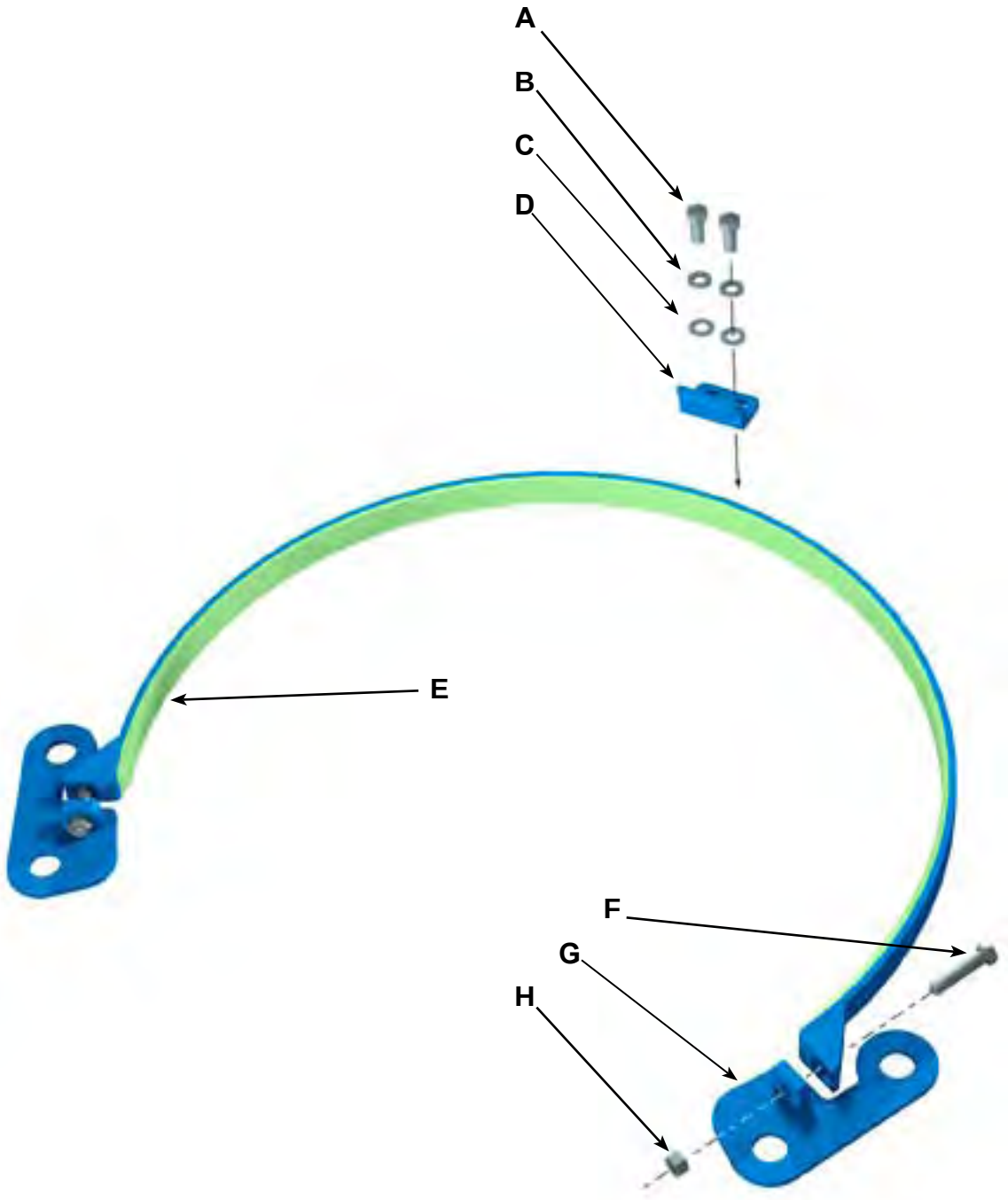
Item	Type	Description	Qty	Part Number
A	Part	3/8" UNC x 1-1/4" Hex Socket Head Cap Screw	4	09-2048
B	Part	Threaded Door Cylinder Lug	2	1050-12-001
C	Part	3/8" Lock Washer	54	09-5106
D	Part	3/8" UNC x 1-1/2" Hex Bolt	42	09-1553
E	Part	Electronic Turn Sensor Cover	1	101-0012
F	Part	1/4" Lock Washer	4	09-5102
G	Part	1/4" UNC x 3/4" Hex Cap Screw	2	09-1005
H	Part	1-1/2" UNF Nylock Nut	8	09-5740
J	Part	Rotary Idler Pad	4	997-D20-125
K	Part	1/4" UNC x 1" Hex Bolt	2	09-1007
L	Part	Short Turn Sensor Cover Plate	1	101-1246
M	Part	5/8" UNC x 1-3/4" Hex Bolt	6	09-1232
N	Part	5/8" Lockwasher	6	09-5114
P	Part	Pinion Idler Pad	2	997-D17-109
Q	Part	1/2" NC x 1-1/4" Hex Bolt	8	09-1168
R	Part	1/2" Lockwasher	8	09-5110
S	Part	Pinion Bearing Cap	2	997-D15-89
T	Assembly	Manual Shifter Assembly	1	See Pp. 5.16 - 5.17
U	Part	Top Body Plate	1	101-0025
V	Weldment	Side Body Weldment	1	101-0017
W	Part	Bottom Body Plate	1	101-0026
X	Part	Door Stop	2	101-0014
Y	Part	3/8" UNC x 1-3/4" Hex Bolt	4	09-1557
Z	Part	3/8" UNC x 1-1/4" Hex Bolt	4	09-1048
AA	Part	Clutch Bearing Cap	1	997-HT-54
BB	Part	Bottom Shifter Bushing	1	101-0003
CC	Part	3/8" UNC x 1" Hex Bolt	4	09-1046
DD	Part	Rear Lug Spacer	2	101-1378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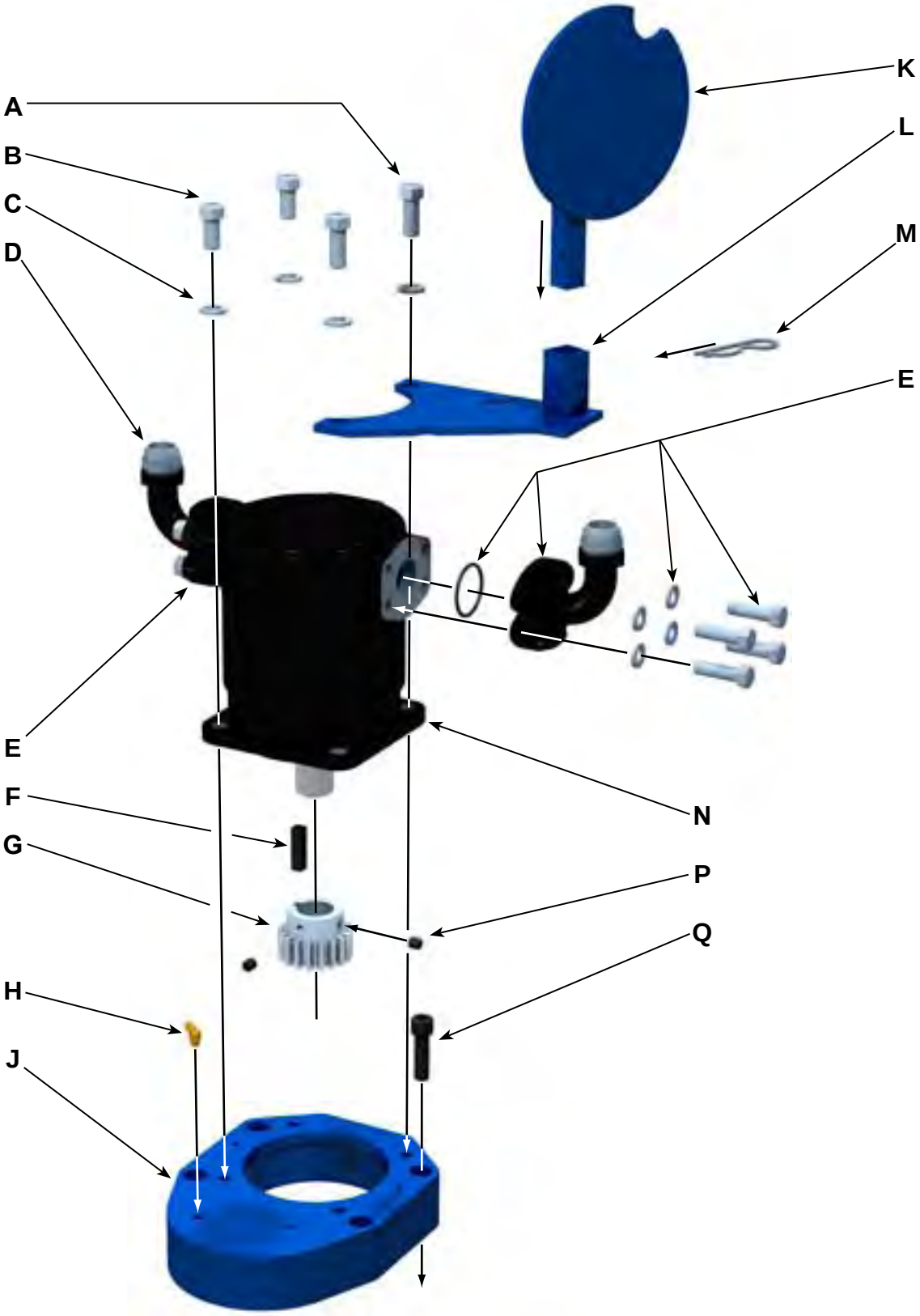
Item	Type	Description	Qty	Part Number
A	Part	3/8" UNC x 1" Hex Bolt	2	09-1046
B	Part	3/8" Lock Washer	2	09-5106
C	Part	3/8" Narrow Washer	2	09-5124
D	Part	Brake Band Retainer	1	101-0140
E	Weldment	Lined Brake Band Weldment	1	997-D23-29
F	Part	3/8" UNF x 1-3/4" Hex Bolt	2	19-1552
G	Weldment	Brake Band Lug Weldment (Left)	2	101-0007
	Weldment	Brake Band Lug Weldment (Right)	2	101-0008
H	Part	3/8" UNF Hex Nylock Nut	2	09-5706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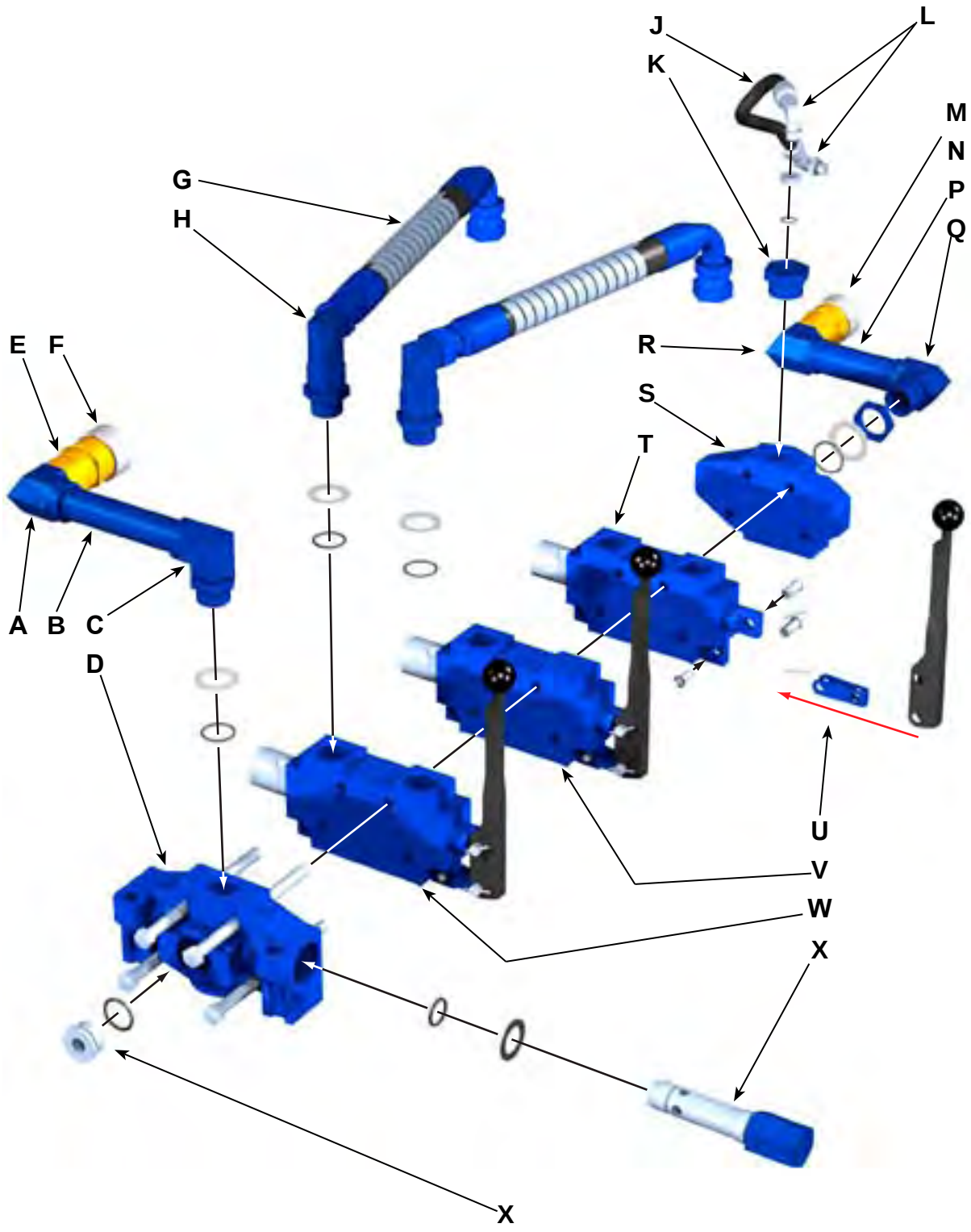
Item	Type	Description	Qty	Part Number
A	Part	1/2" UNC x 1-1/4" Hex Bolt (Motor)	2	09-1168
B	Part	1/2" UNC x 1" Hex Bolt (Motor)	2	09-1166
C	Part	1/2" Carbon Steel Lock Washer	4	09-5110
D	Part	FLANGE ELBOW#20(1 1/4")/JIC 1" Fitting	2	02-9216
E	Kit	#20 Split Flange Kit	2	02-9217
	Part	#20 (1-1/4") Split Flange	2	02-9218
	Part	O-Ring	1	02-9219
	Part	7/16" UNC x 1-1/2" Hex Bolt	4	09-1110
	Part	7/16" Carbon Steel Lock Washer	4	09-5108
F	Part	USAS B17.1 - 3/8 "x 3/8" x 1-1/2 Square Key	1	
G	Part	Motor Gear		997-A10-149
H	Part	1/8" NPT x 45 ° Grease Fitting	1	02-0006
J	Part	Motor Mount	1	997-150
K	Part	Torque Gauge Mount Weldment	1	1500-09-03A
L	Part	Torque Gauge Holder Weldment	1	1500-09-04A
M	Part	HITCH PIN .148 X 2.938	1	
N	Part	RINEER GA 15-15 Hydraulic Motor (KT13625 Tong)	1	87-0112
	Part	RINEER GA 15-13 Hydraulic Motor (LW13625 Tong)	1	87-0110
P	Part	3/8" UNC Hex Socket Set Screw - Flat Point	2	09-2011
Q	Part	1/2" UNC x 1-3/4" Hex Socket Head Cap Screw (Motor Mount)	4	09-2172
Kit		Seal kit for Rineer GA15 motor	87-7110	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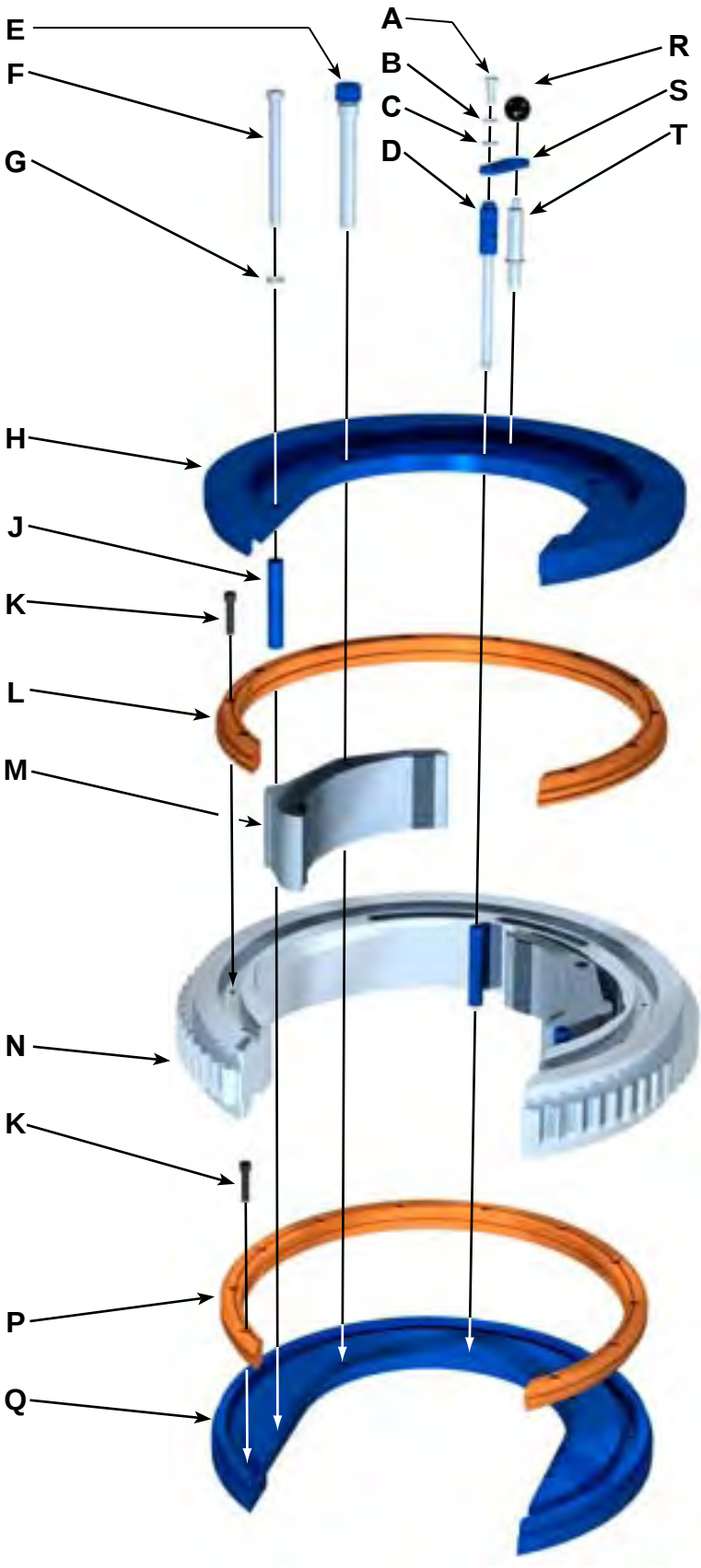
Item	Type	Description	Qty	Part Number
A	Part	M-NPT/F-NPT 90d 1" Fitting	1	02-9221
B	Part	1" Long Nipple	1	101-0079
C	Assembly	M-ORB/F-NPT 90d 1" Fitting (Includes seals)	1	02-9206
D	Part	Hydraulic Inlet, DVA35-A880	1	10-9016
E	Part	Male 1" Quick Coupler Fitting	1	02-9214
F	Part	1" Dust Cap	1	02-9213
G	Assembly	1" Hydraulic Connection Hose Assembly	2	08-1724
H	Assembly	M-ORB/JIC LONG 90d 1" (Includes seals)	1	02-9210
J	Assembly	Motor Drain Hose Assembly	1	101-0072
K	Part	ORB HEX BUSHING	1	10-9001
L	Assembly	M-ORB/JIC 90 DEG 3/8" Fitting (Includes seals)	2	02-9200
M	Part	1-1/4" Dust Cap	1	02-9212
N	Part	Male 1-1/4" Quick Coupler Fitting	1	02-9215
P	Part	1-1/4" Long Nipple	1	101-0070
Q	Assembly	M-ORB/F-NPT 90d 1 1/4" Fitting (Includes seals)	1	02-9202
R	Part	M-NPT/F-NPT 90d 1 1/4" Fitting	1	02-9220
S	Part	Hydraulic Outlet, DVA35-TR99	1	10-0086
T	Part	DVA35-DA8 4WAY SAE Ports	1	10-9019
U	Assembly	Handle Assembly	3	01-0409
	Part	Hydraulic Valve Handle	1	01-0409-HANDLE
	Part	Valve Handle Link	2	01-0409-LINK
	Part	Hydraulic Handle Pin	2	01-0409-PIN1
	Part	Hydraulic Handle Auxilliary Pin	1	01-0409-PIN2
	Part	Valve Handle C-Clip	2	01-0409-CIRCLIP
	Part	Cotter Pin	2	01-0409-COTTER
V	Part	DVA35-SA8 Valve (1" ORB PORT)	1	10-9015
W	Part	DVA35-MA8 4-Way Directional Valve, SAE Port	1	10-9014
X	Assembly	Hydraulic Relief Valve (includes seals)	1	10-0010R
Y	Part	1" Orb Plug Fitting (includes o-ring)	1	02-9222
SEAL KIT		Seal kit for DVA35 Valve	02-9133	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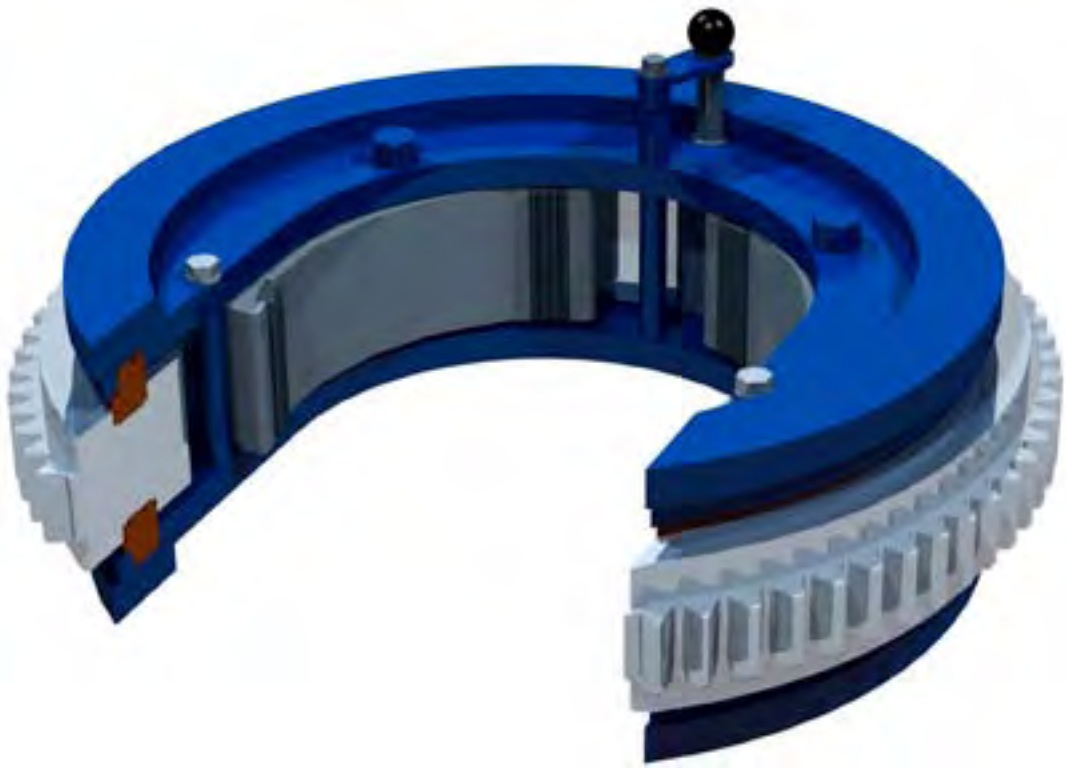
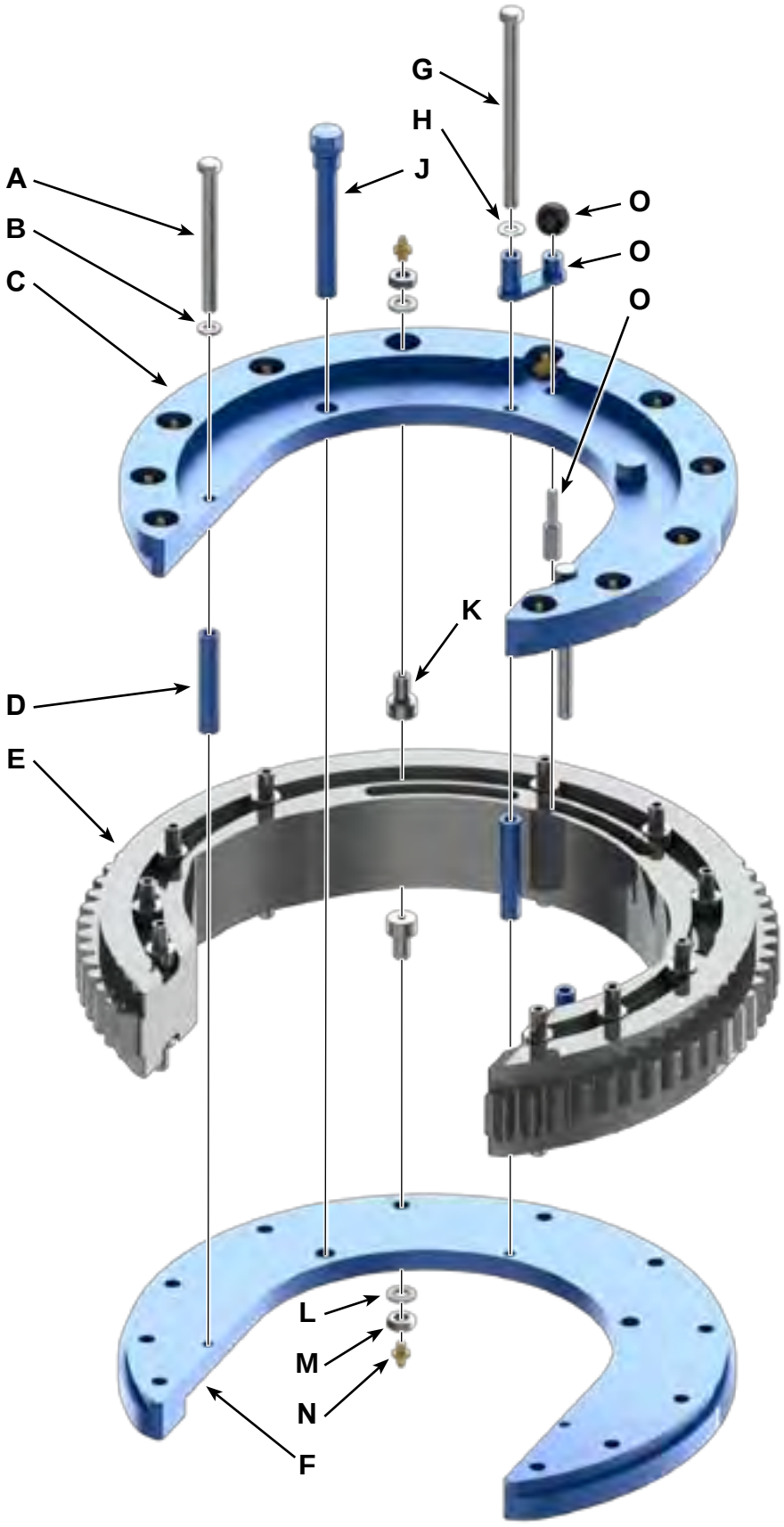


Item	Type	Description	Qty	Part Number
A	Part	3/8" UNC x 1" Hex Bolt	1	09-1046
B	Part	3/8" Lock Washer	1	09-5106
C	Part	3/8" Narrow Washer	1	09-5124
D	Part	Rear Cage Plate Bolt	1	997-D3-36
E	Part	Jaw Pivot Bolt	2	997-D3-28
F	Part	1/2" UNC x 6" Hex Bolt	2	09-1190
G	Part	1/2" Lock Washer	2	09-5110
H	Part	Top Cage Plate	1	997-HT-21
J	Part	Cage Plate Spacer	3	997-38B
K	Part	3/8" UNC x 1-3/4" Hex Socket Head Cap Screw	22	09-2052
L	Part	High Torque Support Ring (Top)	1	997-HT-23-TOP
M	Part	Jaw Assembly (13-5/8" shown)	2	See Pp. 2.13 - 2.15
N	Part	Rotary Gear	1	997-D1-B
P	Part	High Torque Support RIng (Bottom)	1	997-HT-23-BOT
Q	Part	Bottom Cage Plate	1	997-HT-22
R	Part	Backing Pin Knob	1	02-0017
S	Part	Backing Pin Retainer	1	997-D3-40A
T	Part	Backing Pin	1	997-D3-39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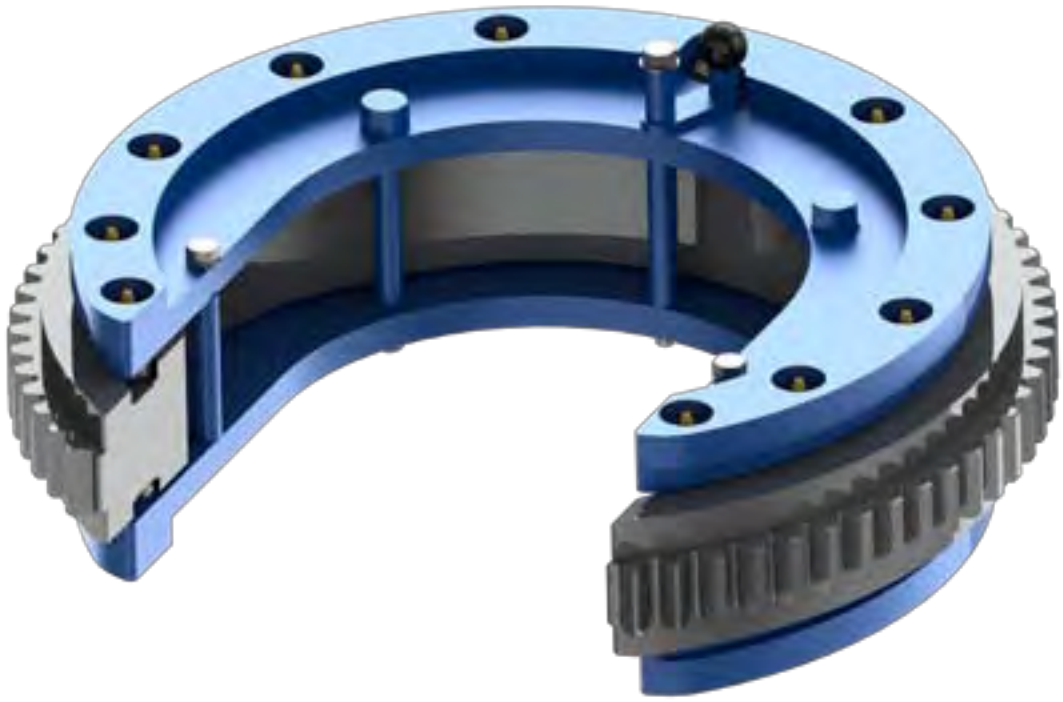
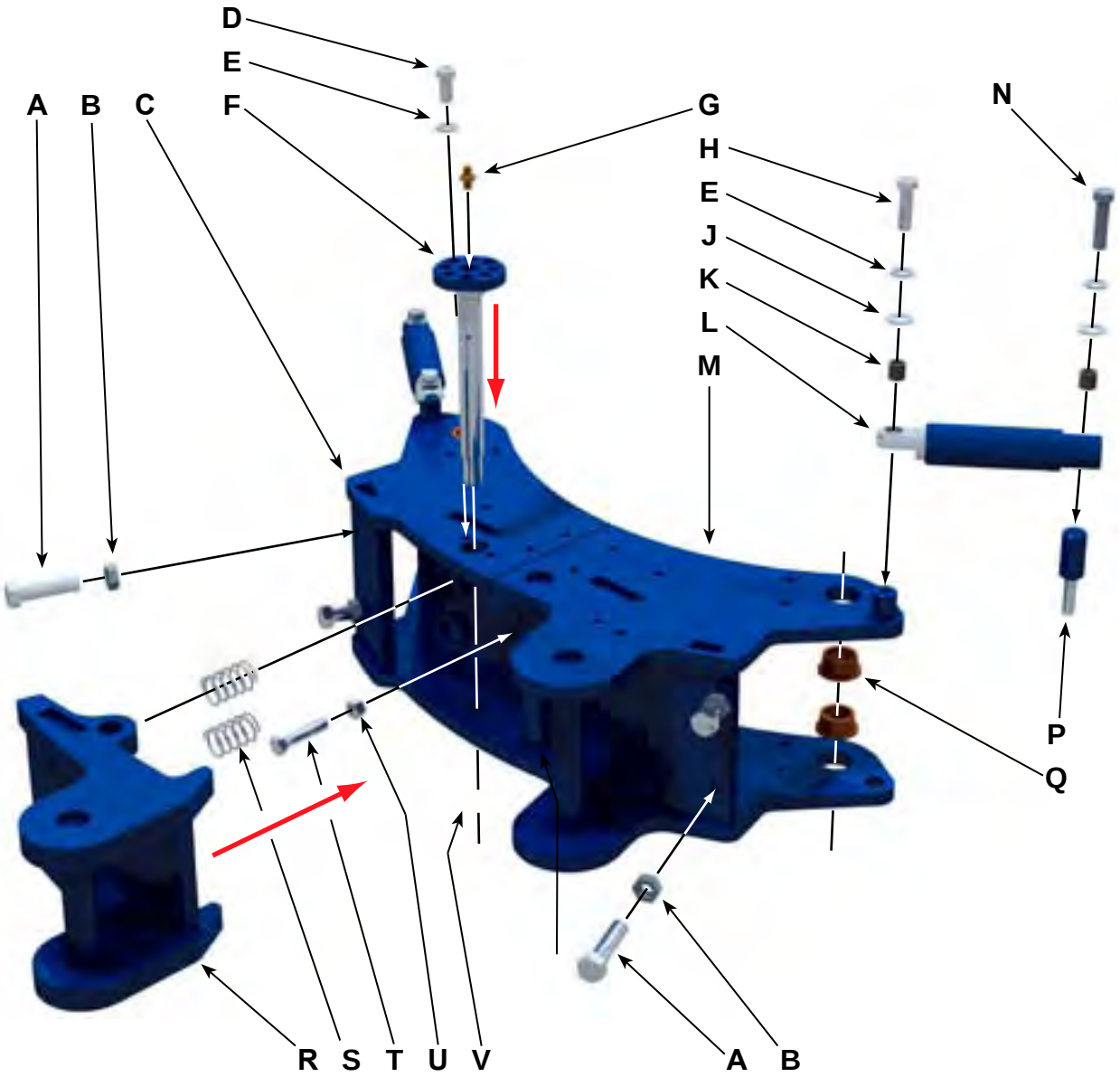


Item	Type	Description	Qty	Part Number
A	Part	1/2" UNC x 6" Hex Bolt	2	09-1190
B	Part	1/2" Lock Washer	2	09-5110
C	Part	Top Cage Plate	1	997-D2-21
D	Part	Cage Plate Spacer	3	997-D3-38
E	Part	Rotary Gear	1	997-D1-B
F	Part	Bottom Cage Plate	1	997-D2-22
G	Part	1/2" UNC x 8" Hex Bolt	1	09-1198
H	Part	1/2" Narrow Washer	1	09-5119
J	Part	Jaw Pivot Bolt	2	997-D3-28
K	Part	Cage Plate Cam Follower	22	02-0016
L	Part	5/8" Lock Washer	22	09-5114
M	Part	5/8" UNF Hex Jam Nut	22	09-5514
N	Part	1/8" NPT Grease Fitting	22	02-0005
O	Assembly	Backing Pin Assembly	1	101-4140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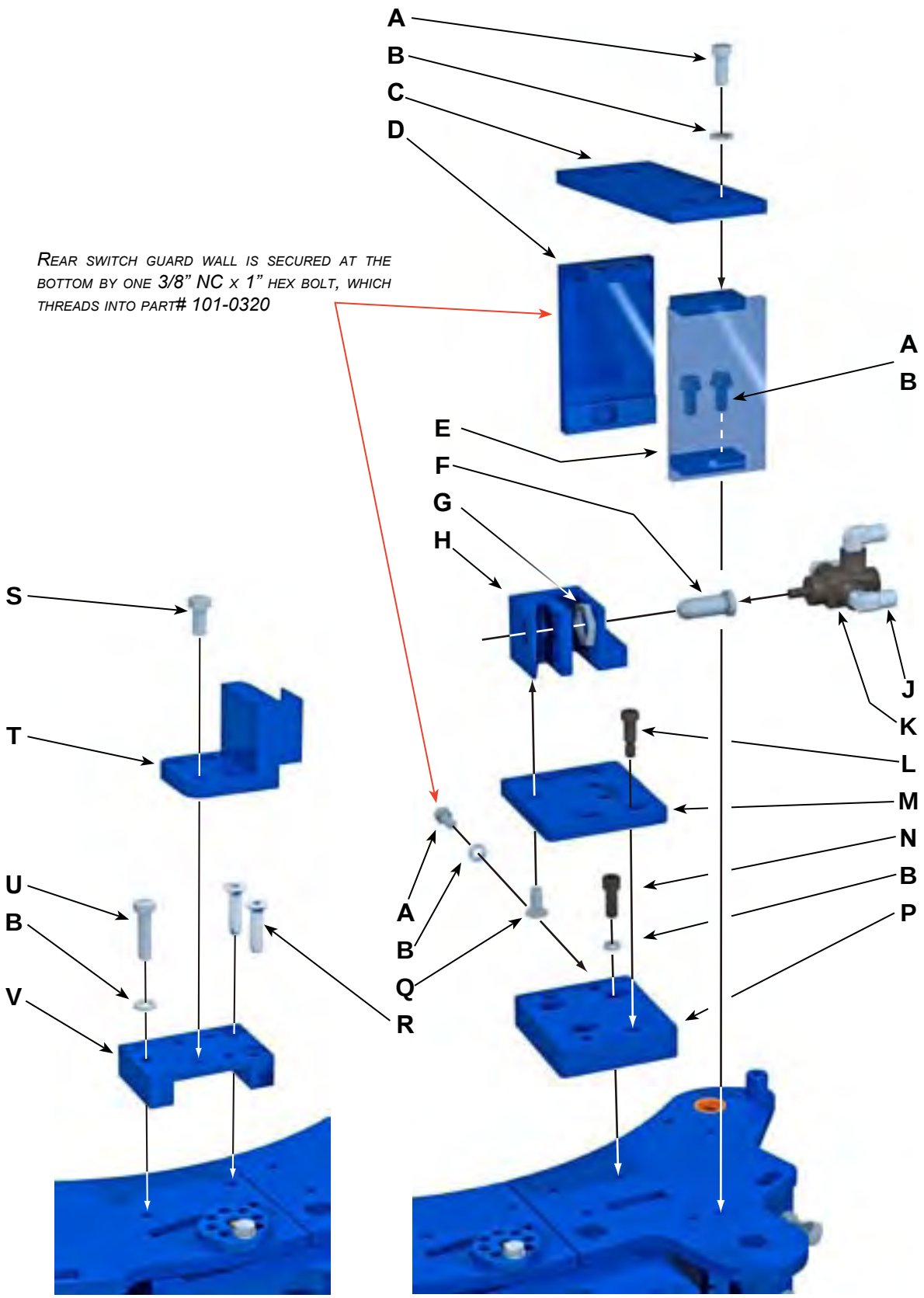
Item	Type	Description	Qty	Part Number
A	Part	1/2" UNC x 2" Hex Bolt	4	09-1174
B	Part	1/2" UNC Hex Jam Nut	4	09-5810
C	Weldment	RH Door Weldment	1	101-0034
D	Part	3/8" UNC x 3/4" Hex Bolt	1	09-1044
E	Part	3/8" Carbon Steel Lock Washer	9	09-5106
F	Part	Door Latch Cam	1	997-A11-14
G	Part	Grease Fitting	1	02-0097
H	Part	3/8" UNC x 1-1/4" Hex Bolt	2	09-1048
J	Part	3/8" Narrow Washer	4	09-5124
K	Part	Door Stop Spacer	4	997-13B
L	Assembly	Door Cylinder Assembly	2	101-0069
M	Weldment	Left Hand Door Weldment	1	101-0032
N	Part	3/8" UNC x 1-1/2" Hex Bolt	2	09-1553
P	Part	Door Cylinder Mounting Lug	2	1050-12-001
Q	Part	Shoulder Bushing	4	101-0045
R	Weldment	Door Latch Weldment	1	101-0038
S	Part	Door Latch Spring	2	997-16
T	Part	3/8" UNC x 1-3/4" Hex Bolt	1	09-1557
U	Part	3/8" UNC Hex Nut	1	09-5806
V	Part	5/8" UNC Hex Jam Nut	1	09-9141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Rear switch guard wall is secured at the bottom by one 3/8" NC x 1" hex bolt, which threads into part# 101-0320
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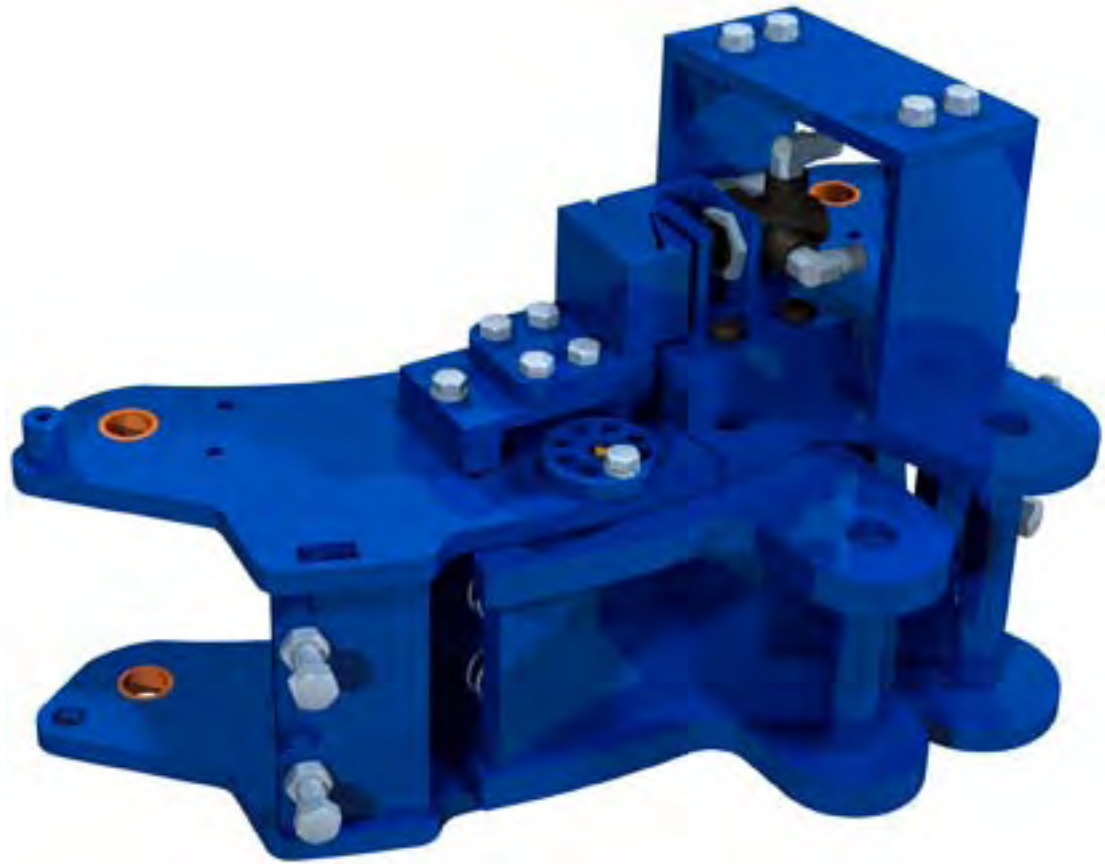
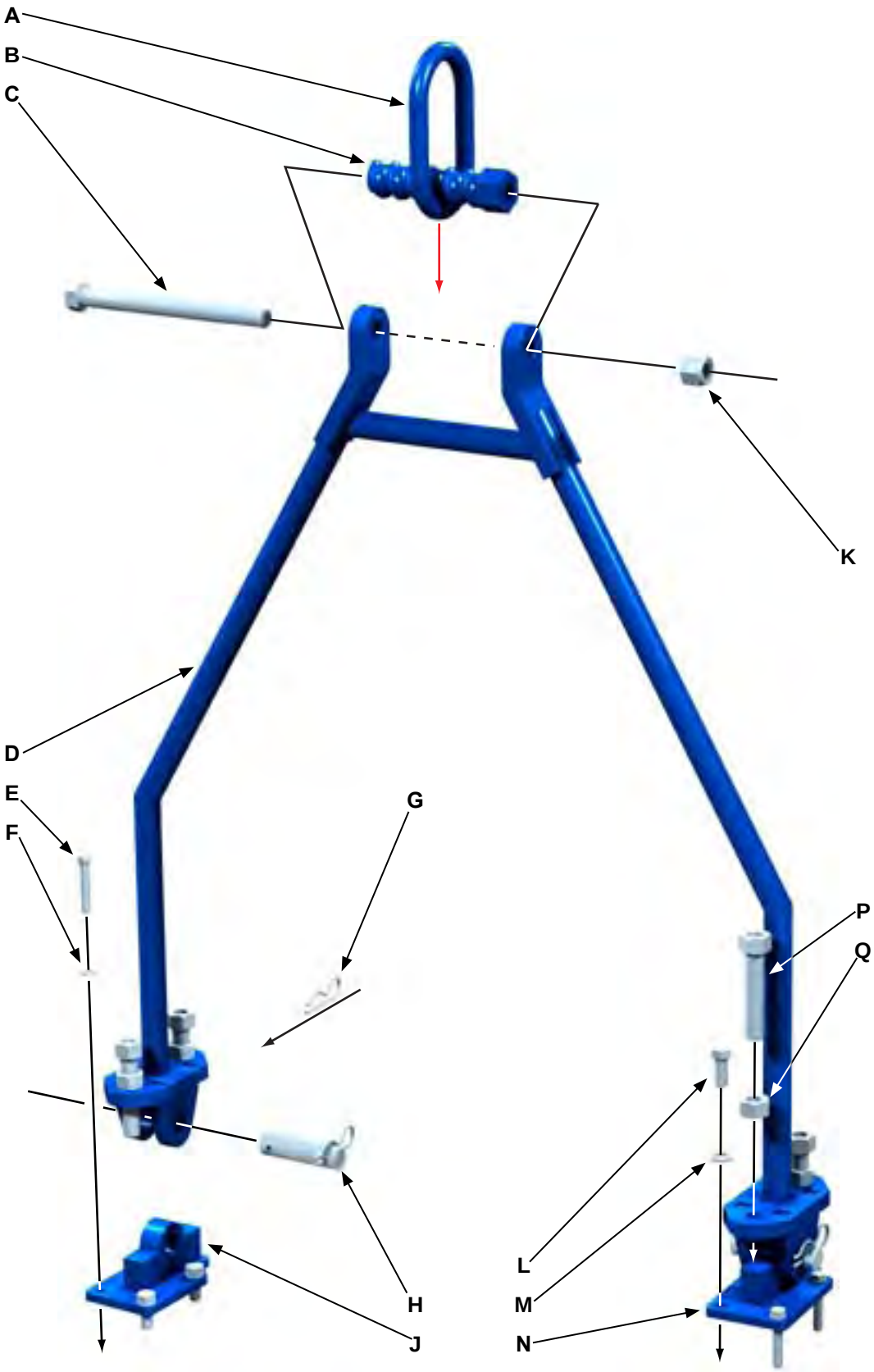


Item	Type	Description	Qty	Part Number
A	Part	3/8" UNC x 1" Hex Bolt	7	09-1046
B	Part	3/8" Carbon Steel Lock Washer	11	09-5106
C	Part	Switch Guard Plate	1	101-0384
D	Weldment	Rear Switch Guard Wall Weldment	1	101-0386
E	Weldment	Front Switch Guard Wall Weldment	1	101-0387
F	Part	Load Plunger	1	AE12-306
G	Part	15/16" Valve Lock Nut	1	09-0278
H	Part	Safety Door Latch Block	1	AE13-301S
J	Part	1/4 inch NPT - JIC 90 degree Elbow	3	08-0284
K	Part	Deltrol Gauge Isolator Valve GI21S	1	08-0337M
L	Part	5/16' X 3/4" UNC Shoulder Bolt	4	09-0227
M	Part	Door Latch Plate	1	AE13-311
N	Part	3/8" UNC x 1" Hex SHCS	3	09-1738
P	Part	Safety Door Latch Plate	1	101-0320
Q	Part	3/8" UNC x 3/4" Hex FHCS	3	09-4044
R	Part	3/8" UNC x 1-1/2" Hex FHCS	2	09-4050
S	Part	3/8" UNC x 3/4" Hex Bolt	4	09-1044
T	Part	Safety Door Latch Block	1	AE13-302M
U	Part	3/8" UNC x 1-1/2" Hex Bolt	1	09-1553
V	Part	Safety Door Latch Block	1	101-0319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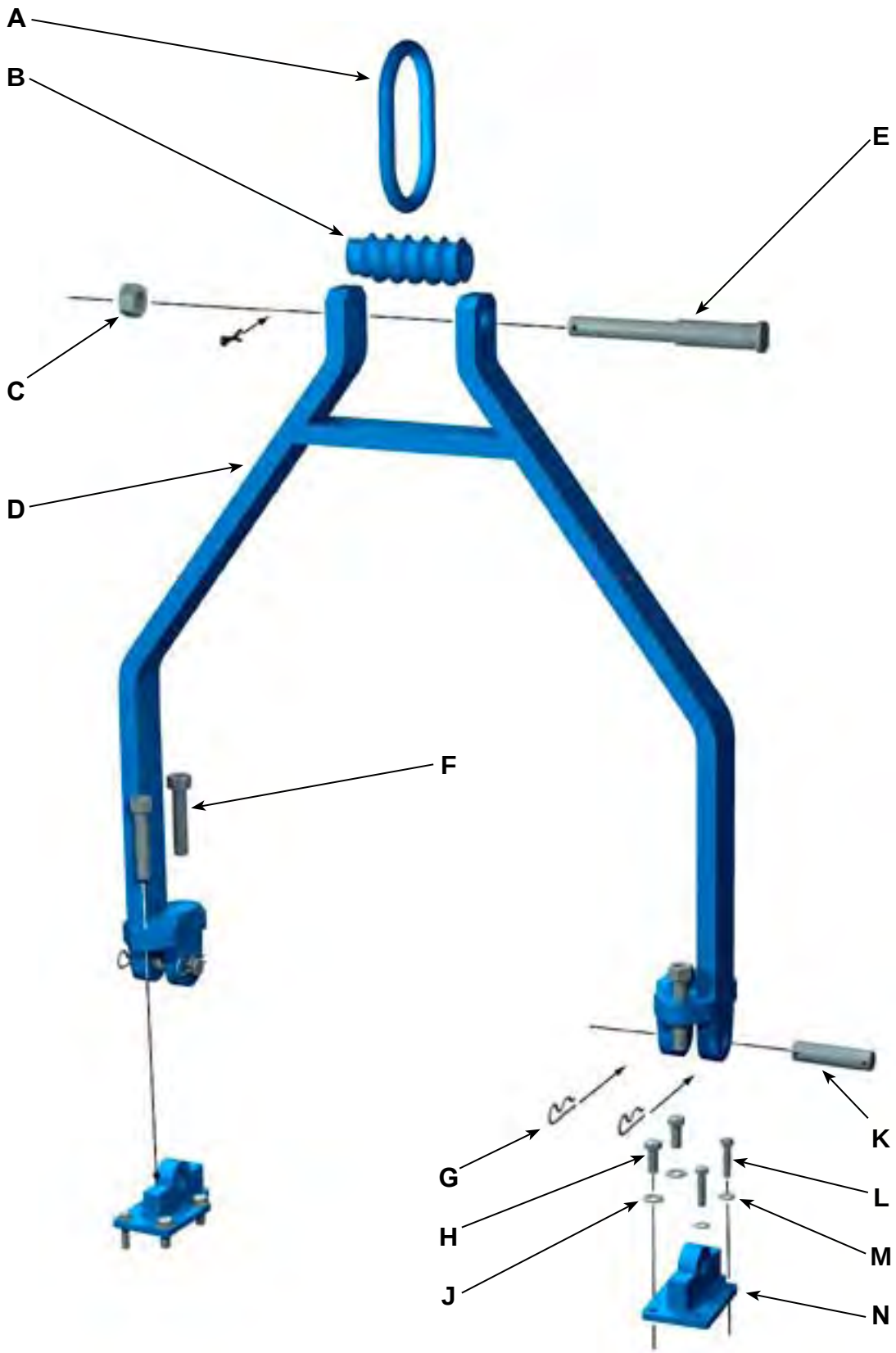
Item	Type	Description	Qty	Part Number
A	Part	Lifting Link	1	02-0516
B	Part	Adjusting Helix	1	1053-1-H
C	Part	3/4" UNC x 9" Hex Bolt	1	09-1322
D	Weldment	Rigid Sling Weldment	1	101-1742
E	Part	3/8" UNC x 2-1/4" Hex Bolt	4	09-1055
F	Part	3/8" Lock Washer	4	09-5106
G	Part	HITCH PIN .148 X 2.938	4	09-0090
H	Part	Hanger Pin	2	1053-C-1C
J	Weldment	RH Hanger Bracket Weldment	1	101-1364
K	Part	3/4" UNC Nylock Nut	1	1429-39-02
L	Part	1/2" UNC x 1-1/4" Hex Bolt	4	09-1168
M	Part	1/2" Lock Washer	4	09-5110
N	Weldment	LH Hanger Bracket Weldment	1	101-1361
P	Weldment	Leveling Bolt Weldment	4	1053-C-1L
Q	Part	3/4" UNC Hex Nut	2	09-5818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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™.

Item	Type	Description	Qty	Part Number
	Assembly	Rigid Sling		101-1363
A	Part	Lift Link	1	02-0516
B	Part	Adjusting Helix	1	1095-220
C	Part	1" NC Hex Nylock Nut	1	09-5725
D	Weldment	Rigid Sling HD Weldment	1	101-1360
E	Part	Hanger Pin	1	1095-218
F	Weldment	Leveling Bolt	4	1053-C-1L
G	Part	HITCH PIN .148 X 2.938	4	
H	Part	1/2" NC x 1-1/4" Hex Bolt	4	09-1168
J	Part	1/2" Plain Narrow Washer	4	09-5119
K	Part	Rigid Sling Pin	2	997-955
L	Part	3/8" NC x 1-3/4" Hex Bolt	4	09-1557
M	Part	3/8" Plain Narrow Washer	4	09-5124
N	Part	RH Bolted Hanger Weldment	2	101-1361
P	Part	LH Bolted Hanger Weldment	2	101-1364

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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

TORQUE GAUGE (FOR ILLUSTRATION PURPOSES ONLY)

TENSION LOAD CELL

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.

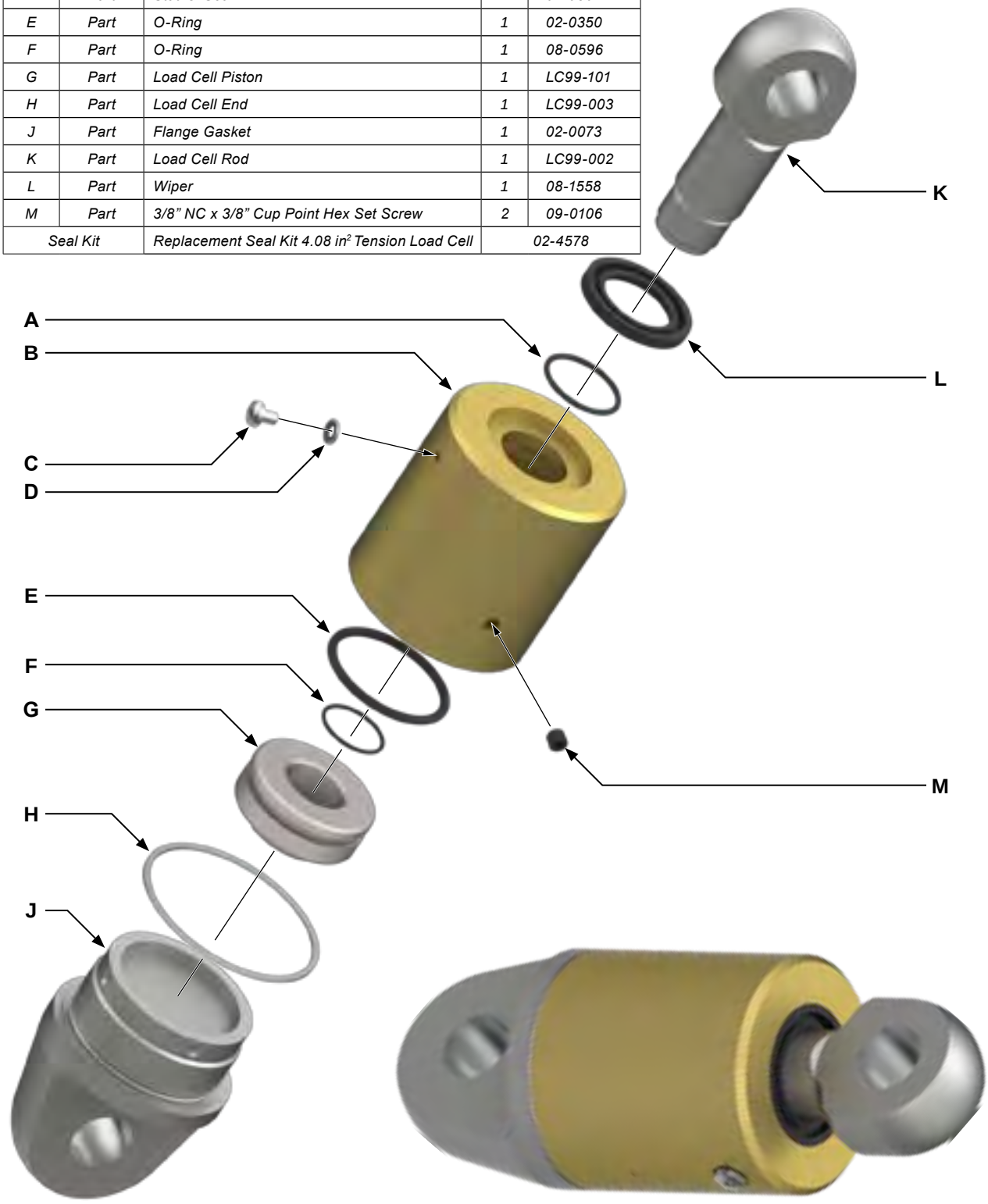
THE TORQUE GAUGE USED IS FULLY DEPENDANT UPON THE ARM LENGTH AND TORQUE RANGE OF THE EQUIPMENT IN USE. THE PART NUMBERS LISTED IN THE FOLLOWING TABLE ARE CORRECT FOR ACCURATELY MEASURING TORQUE USING THE EQUIPMENT FOR WHICH THIS MANUAL IS SUPPLIED.

KT-13625 Tongs				
Item	**Type**	**Description**	**Qty**	**Part Number**
	Assembly	36" - 40K Torque Measurement Assembly	1	10-0016T
A	Part	Tension Load Cell, 4.08^2 in	1	10-0008T
B	Part	40,000 Lbs.-Ft. Gauge, 36" Arm Length (includes following)	1	10-0016G
	Part	1/4" FNPT TEE	1	60-0364
	Part	1/4" NPT Street Elbow	1	08-0023
	Part	1/4" NPT Cap	1	08-0424
C	Part	5 Ft. Hose Assembly	1	02-0069

LW-13625 Tongs				
Item	**Type**	**Description**	**Qty**	**Part Number**
	Assembly	36" - 30K Torque Measurement Assembly	1	10-0017T
A	Part	Tension Load Cell, 4.08^2 in	1	10-0008T
B	Part	30,000 Lbs.-Ft. Gauge, 36" Arm Length (includes following)	1	10-0017G
	Part	1/4" FNPT TEE	1	60-0364
	Part	1/4" NPT Street Elbow	1	08-0023
	Part	1/4" NPT Cap	1	08-0424
C	Part	5 Ft. Hose Assembly	1	02-0069

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

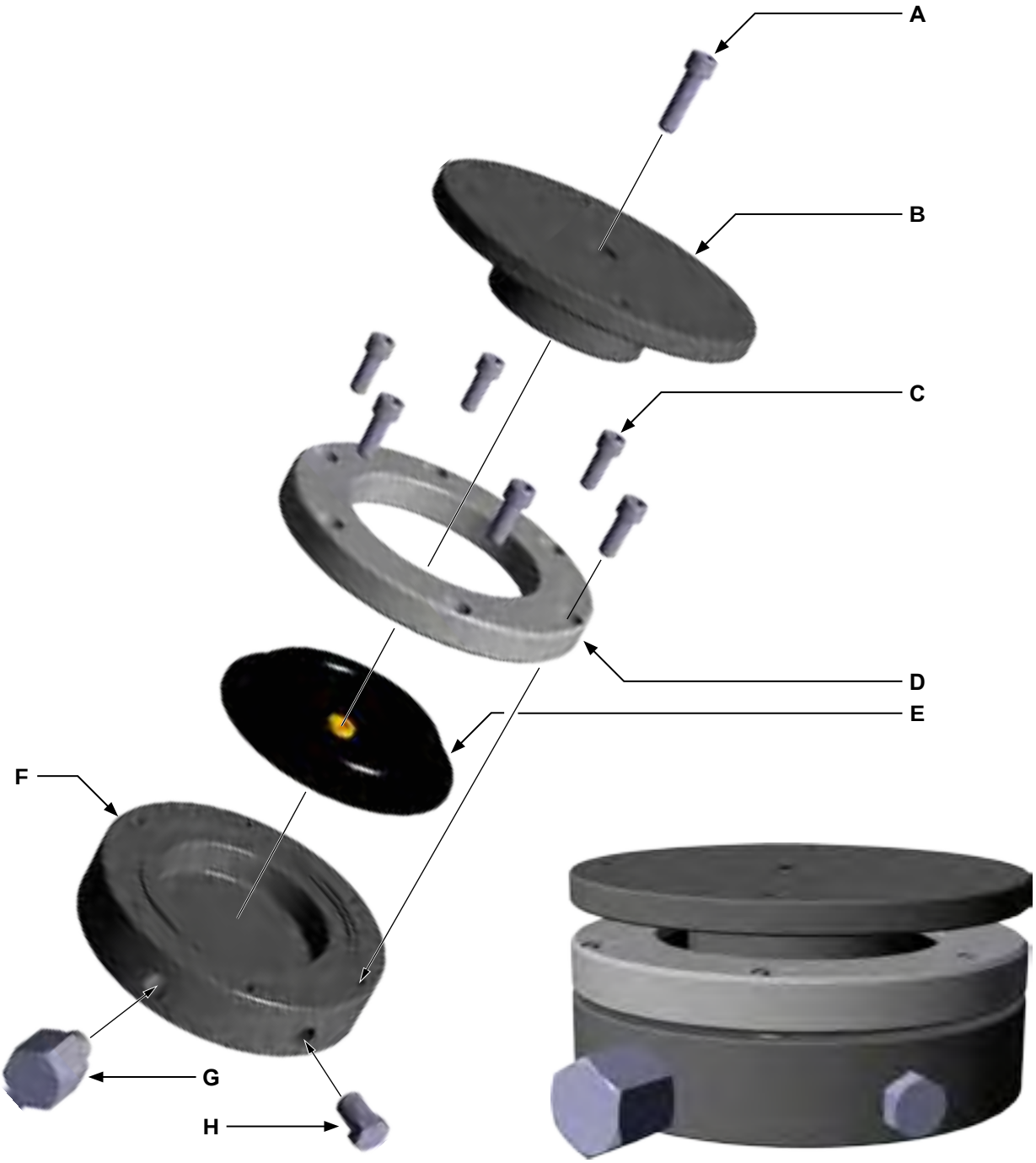
This is the standard tension load cell supplied by McCoy Drilling & Completions | Farr. Contact our sales department for information about optional application-specific tension load cells.

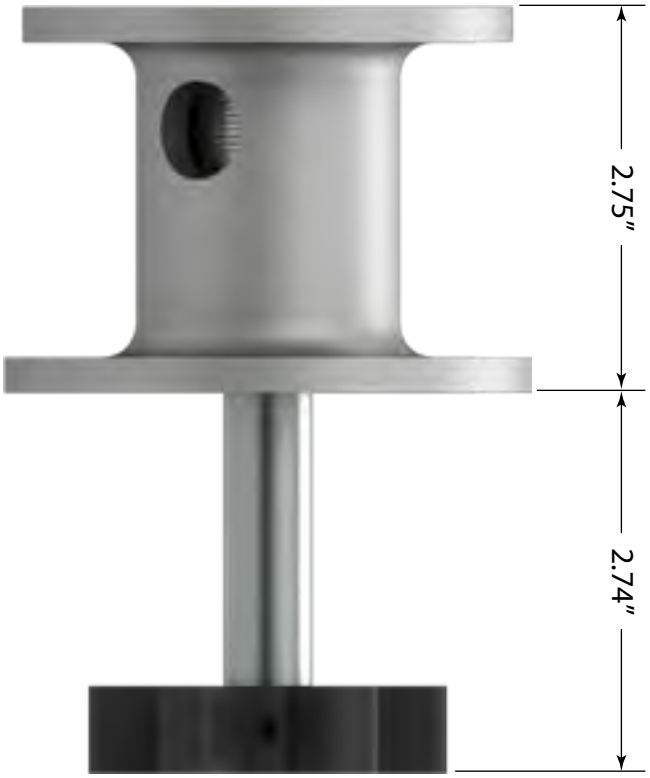


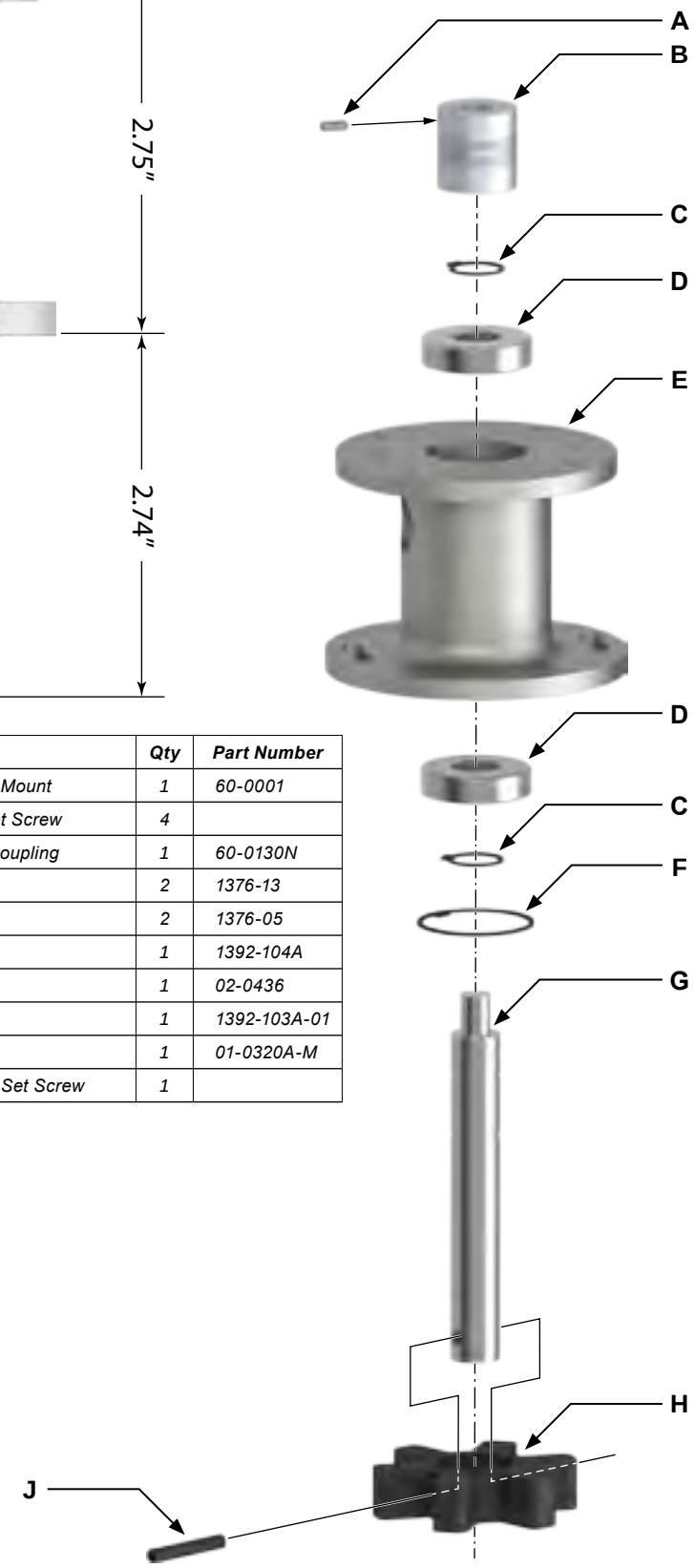
Item	Type	Description	Qty	Part Number
	Assembly	Compression Load Cell, 8 in^2	1	10-0008C
A	Part	5/16" UNC x 1" Hex Socket Head Cap Screw	1	09-2026
B	Part	Load Plate	1	E360-A
C	Part	5/16" UNC x 3/4" Hex Socket Head Cap Screw	6	09-2024
D	Part	Retainer Ring	1	E360-8
E	Part	Diaphragm	1	E358-2
F	Part	Diaphragm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







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	

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

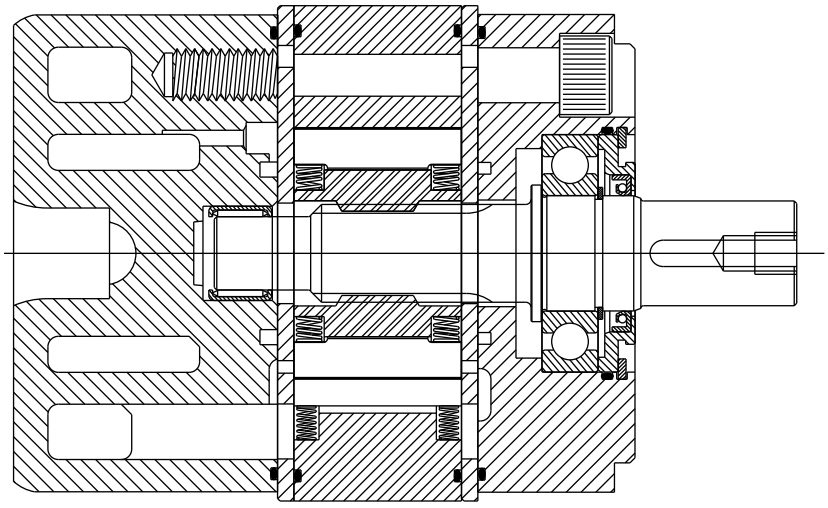
POWER to be the Best!

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.

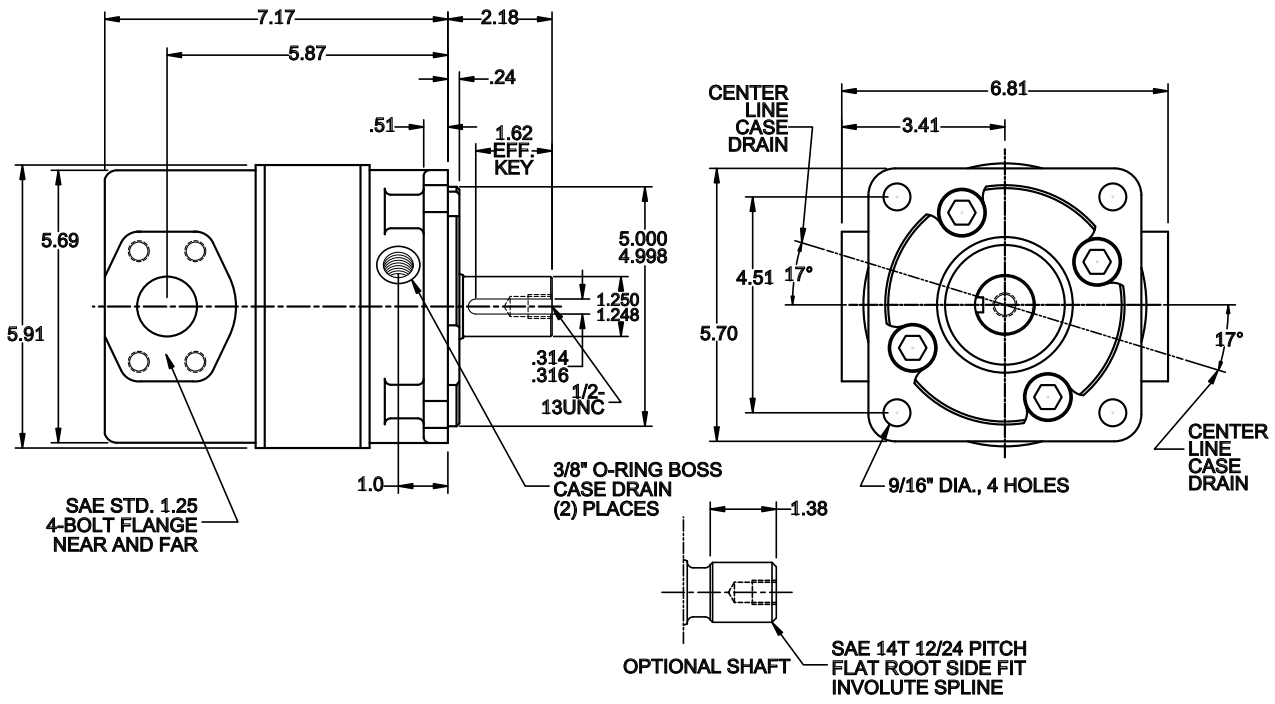
CROSS SECTION



Made in USA

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.

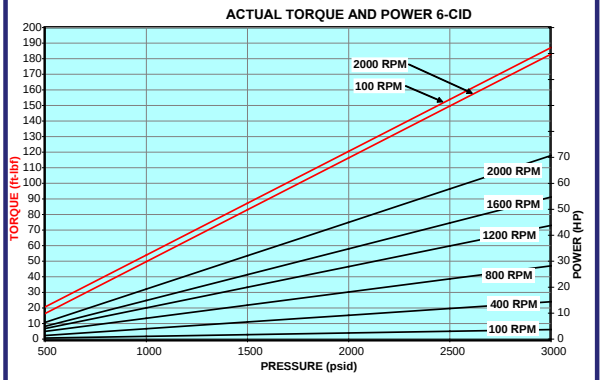
INTERMITTENT CONDITIONS
Intermittent conditions are to be less than 10% of every minute.

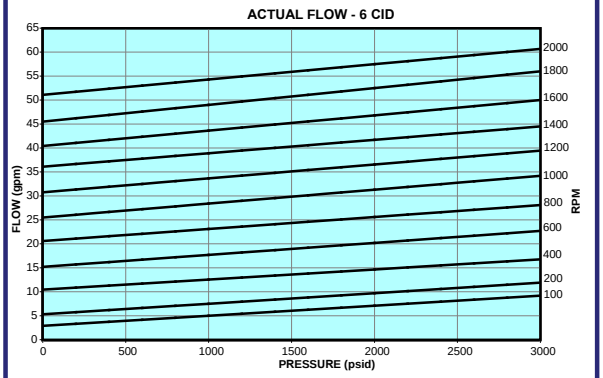
OTHER AVAILABLE MOTORS
For information on additional Rineer Motors, request one of the following publications:

37 Series .....Publication DS371003
57 Series .....Publication DS571003
125 Series .....Publication DS1251003

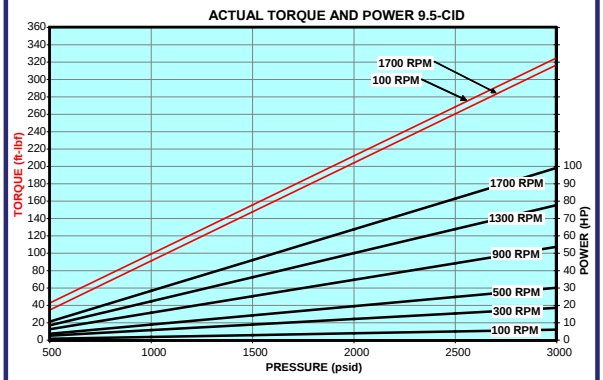
Performance Data - Selected Displacements

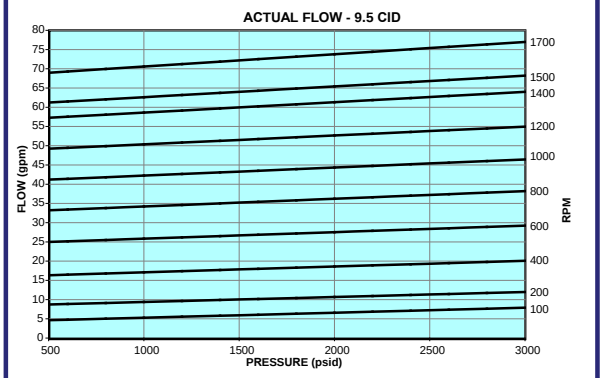
6 C.I.D.



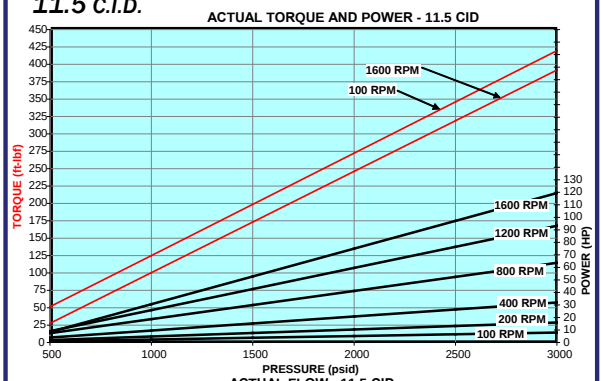


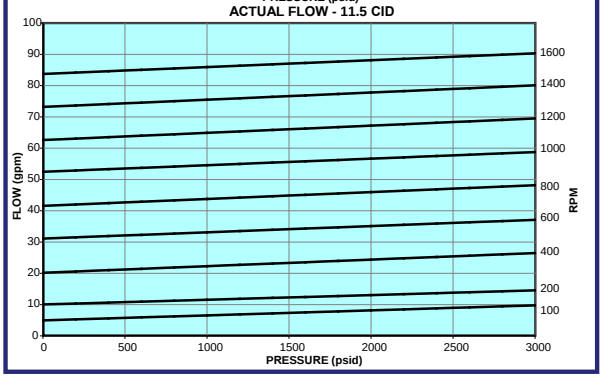
9.5 C.I.D.



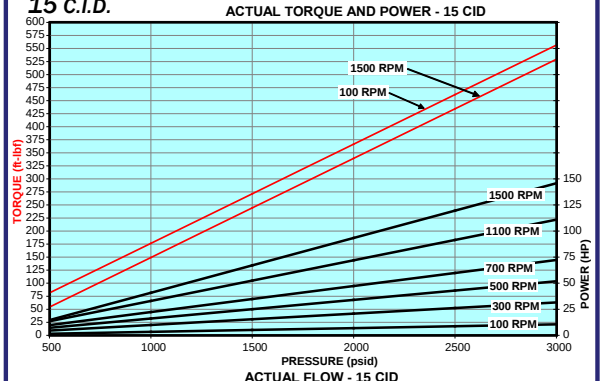


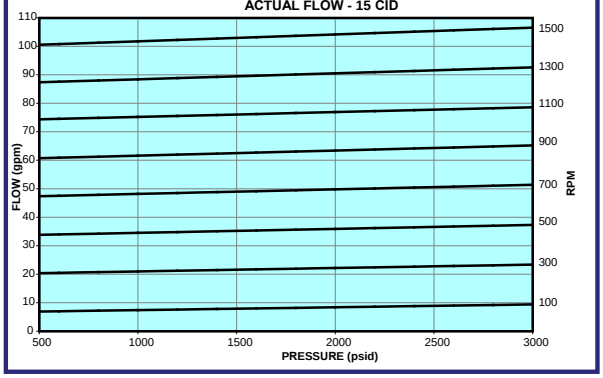
11.5 C.I.D.





15 C.I.D.





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**

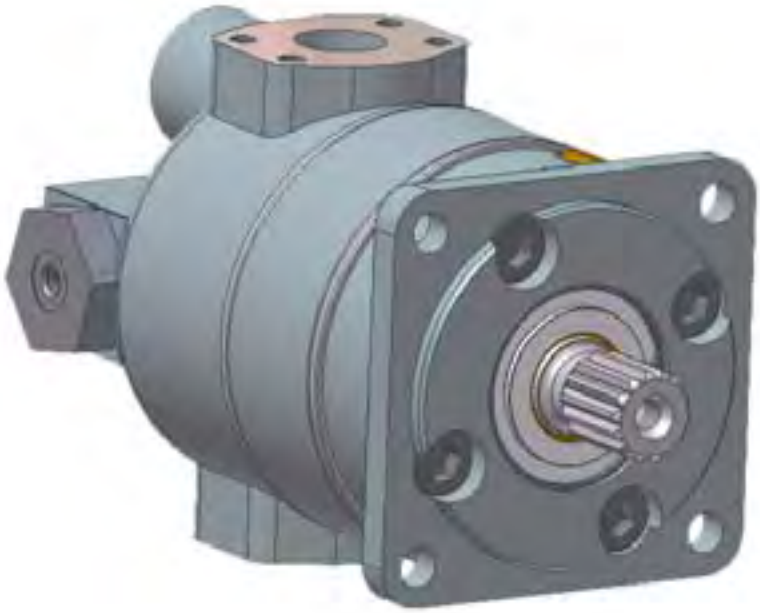
- **M015 - 61/62**
  - M015 - 61 = 015 Single Speed
  - M015 - 62 = 015 Two Speed
  - Options:
    - 62 = Two Speed Single Pilot Open During Crossover
    - 63 = Two Speed Single Pilot Closed During Crossover
    - 65 = Two Speed Double Pilot Open During Crossover
    - 67 = Two Speed Double Pilot Closed During Crossover
- **-1S**
  - 1S = Std.
  - 1H = High Speed
- **-015**
  - 006 = 6 in^3 (98cc)/rev.
  - 007 = 7 in^3 (115cc)/rev.
  - 008 = 8 in^3 (131cc)/rev.
  - 009 = 9.5 in^3 (156cc)/rev.
  - 010 = 10.5 in^3 (172cc)/rev.
  - 011 = 11.5 in^3 (189cc)/rev.
  - 013 = 13 in^3 (213cc)/rev.
  - 015 = 15 in^3 (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. MOTOR EXP. VIEW

ITEM	PART NO.	DESCRIPTION	QTY
1	0150111	SEAL PLATE SNAP RING	1
2	0150135	SEAL PLATE	1
3	0150161	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
8	0150702	SHAFT, KEYED	1
	0150703	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	0150608	PLATE	2
16	0150400	STATOR GA 11.5	1
	0150401	STATOR GA 15	1
	0150402	STATOR GA 13	1
	0150403	STATOR GA 9.5	1
	0150404	STATOR GA 8.0	1
	0150406	STATOR GA 7.0	1
	0150407	STATOR GA 6	1
	0150409	STATOR GA 3.0	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	0150800	REAR HOUSING	1

SERIES: 15
EXPLODED VIEW
MODEL CODE: 015-61-15-015-30-B1-TB-XXX
STANDARD MOTOR

RINEER HYDRAULICS
CORPUS CHRISTI, TEXAS

RECORD REFERENCE
DRAWN BY: JERRY W
DATE: 4-14-98
DWG. NO. 0150041

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

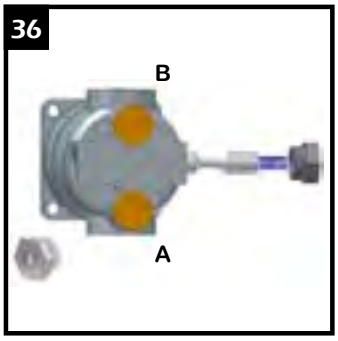
1) Install 5/8-11 bolts.
2) Torque bolts to 50 ft./lbs.

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

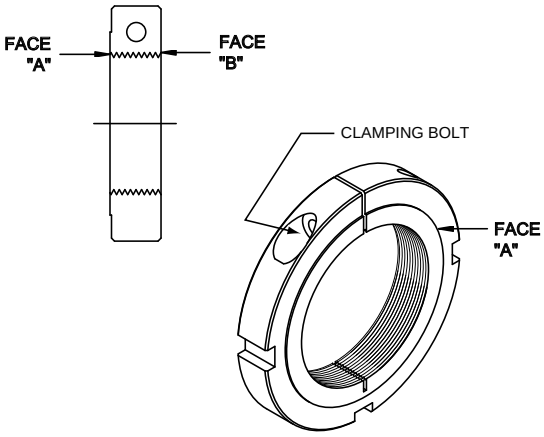


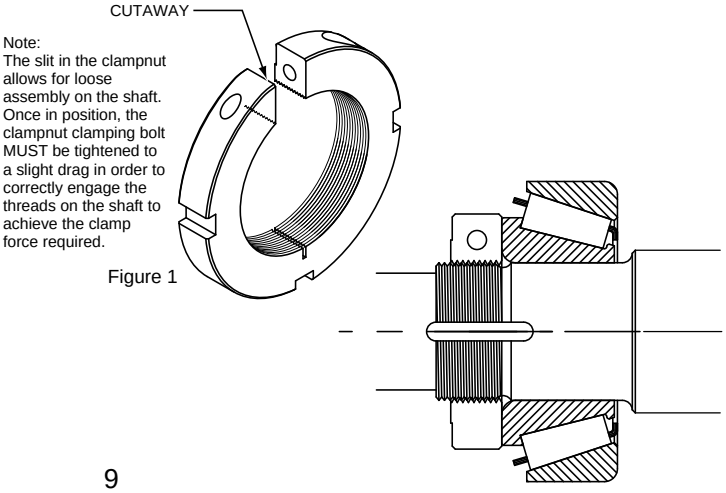
NOTE: Spool should be oriented as shown for two speed motors with model codes 62, 63, 68, & 69.

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.
   (Steps 3 thru 10 must be conducted to completion ONE assembly at a time.)
3) Press bearing cups into bearing housing. Make sure they are pressed completely against bearing shoulders.
4) 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.
5) Insert shaft and large cone into bearing housing.
6) Coat inner race of small cone with #609 (green) Loctite and press small cone onto shaft.
7) 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.
8) 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.
9) Tighten clamping bolt on clampnut to 70 inch pounds and recheck rolling torque. Apply inspectors lacquer to head of the bolt.
10) Allow a minimum of 24 hrs. to dry.





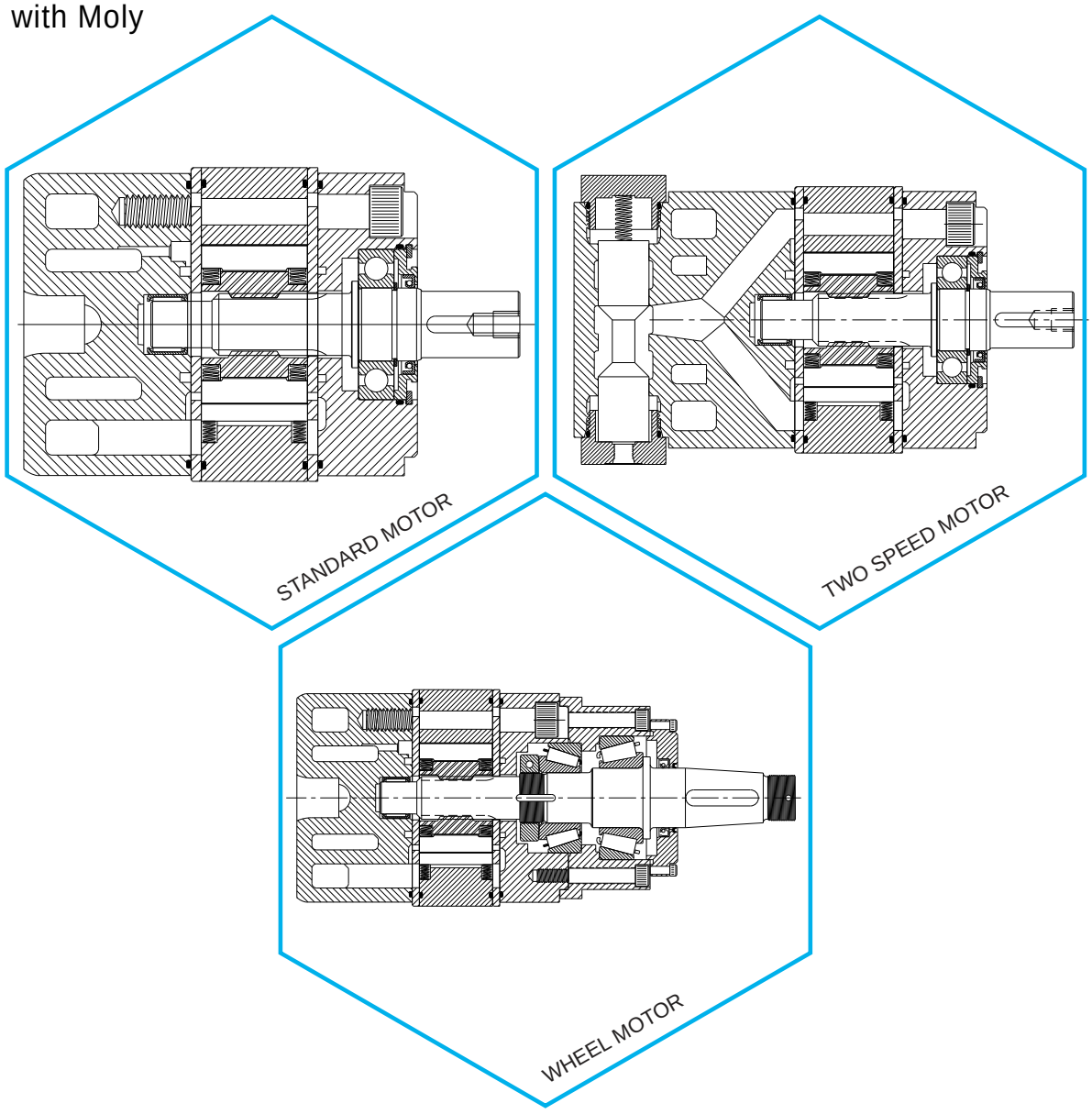
Note:
The slit in the clampnut allows for loose assembly on the shaft. Once in position, the clampnut clamping bolt MUST be tightened to a slight drag in order to correctly engage the threads on the shaft to achieve the clamp force required.

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

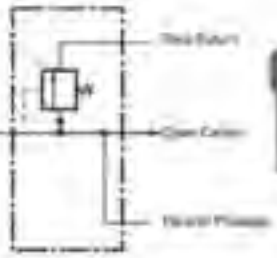


Inlets (2500 psi)

End Inlet

Code	End Port	Top Port
DVA35-A440	1" NPT	1" NPT
DVA35-A880	SAE-16	SAE-16
DVA35-A980	SAE-20	SAE-16
DVA35-A000	NON-PORTED HOUSING	

NOTE: Inlets are machined for a main R/V or R/V plug and are furnished with plastic closures
See Section G, Page 32 for inlet port plugs



Note: For inlets with solenoid section pilot supply machining, see DVG35 inlet section E1

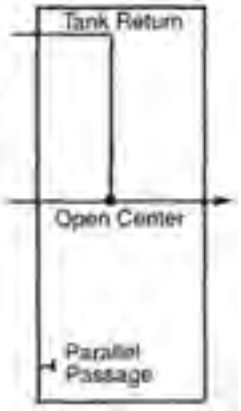
Schematic shown with main R/V

Outlets

Tank Return Type

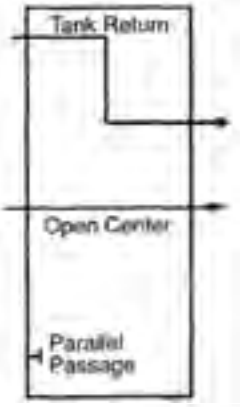
Code	End Port	Top Port
DVA35-TR55	1 1/4" NPT	1 1/4" NPT
DVA35-TR99	SAE-20	SAE-20
DVA35-TR00	NON-PORTED HOUSING	

NOTE: See Section G, Page 32 for Port Plugs



Pressure Beyond Type

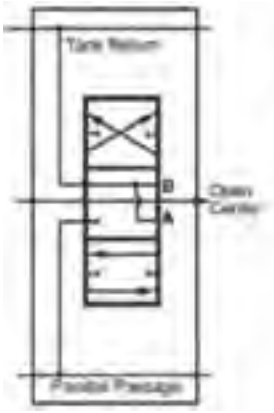
	End Port LP	End Port HP	Top Port LP	Top Port HP
DVA35-PB55	1 1/4" NPT	1 1/4" NPT	1 1/4" NPT	1 1/4" NPT
DVA35-PB90	SAE-20	SAE-20		
DVA35-PB09			SAE-20	SAE-20
DVA35-PB00	NON-PORTED HOUSING			



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

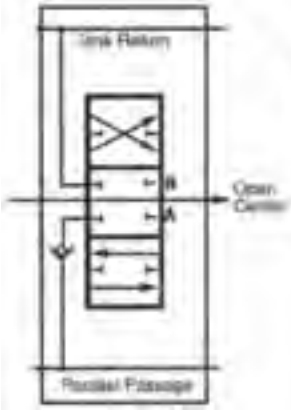


MA8

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



DA8

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

Lo-Boy Work Sections -- Parallel Circuits

Code	4-Way 2-Position Valve in Neutral	3-Way 2-Position Valve in Neutral	4-Way 2-Position Float in Neutral	4-Way 4-Position Float Position Detented	Port Size	Work Port (ISO Mounting)	Spring Return	4-Position Detent	Manual Hydraulic Operator Control	Solenoid Operated	Air Shift		
DVA35-DA0	•					•	•						
DVA35-DA4	•				1"NPT		•						
DVA35-DA8	•				SAE-16		•						
DVA35-SA0		•				•	•						
DVA35-SA4		•			1" NPT		•						
DVA35-SA8		•			SAE-16		•						
DVA35-MA0			•			•	•						
DVA35-MA4			•		1" NPT		•						
DVA35-MA8			•		SAE-16		•						
DVA35-DK8-12V	•				SAE-16					12 VDC			
DVA35-DK8-24V	•				SAE-16					24 VDC			
DVA35-DX4	•				1" NPT				•				
DVA35-DX8	•				SAE-16				•				
DVA35-DV4	•				1" NPT						•		
DVA35-DV8	•				SAE-16						•		
DVA35-MX4			•		1" NPT				•				
DVA35-MX8			•		SAE-16				•				
DVA35-DB4	•				1" NPT			•					
DVA35-DB8	•				SAE-16			•					
DVA35-SB4		•			1"NPT			•					

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 operator 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.

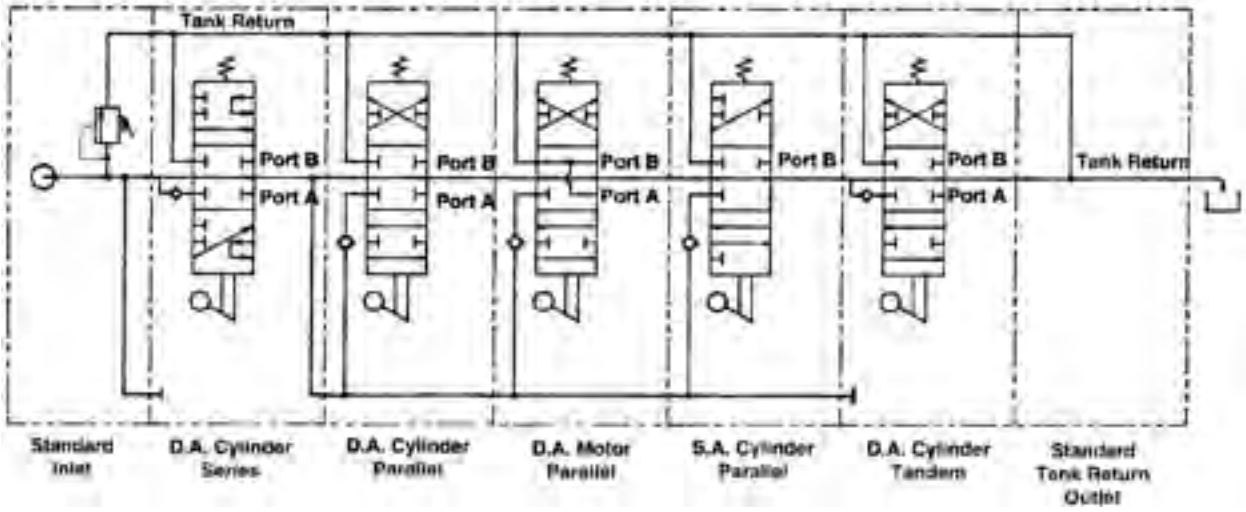
Tandem Circuits

(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

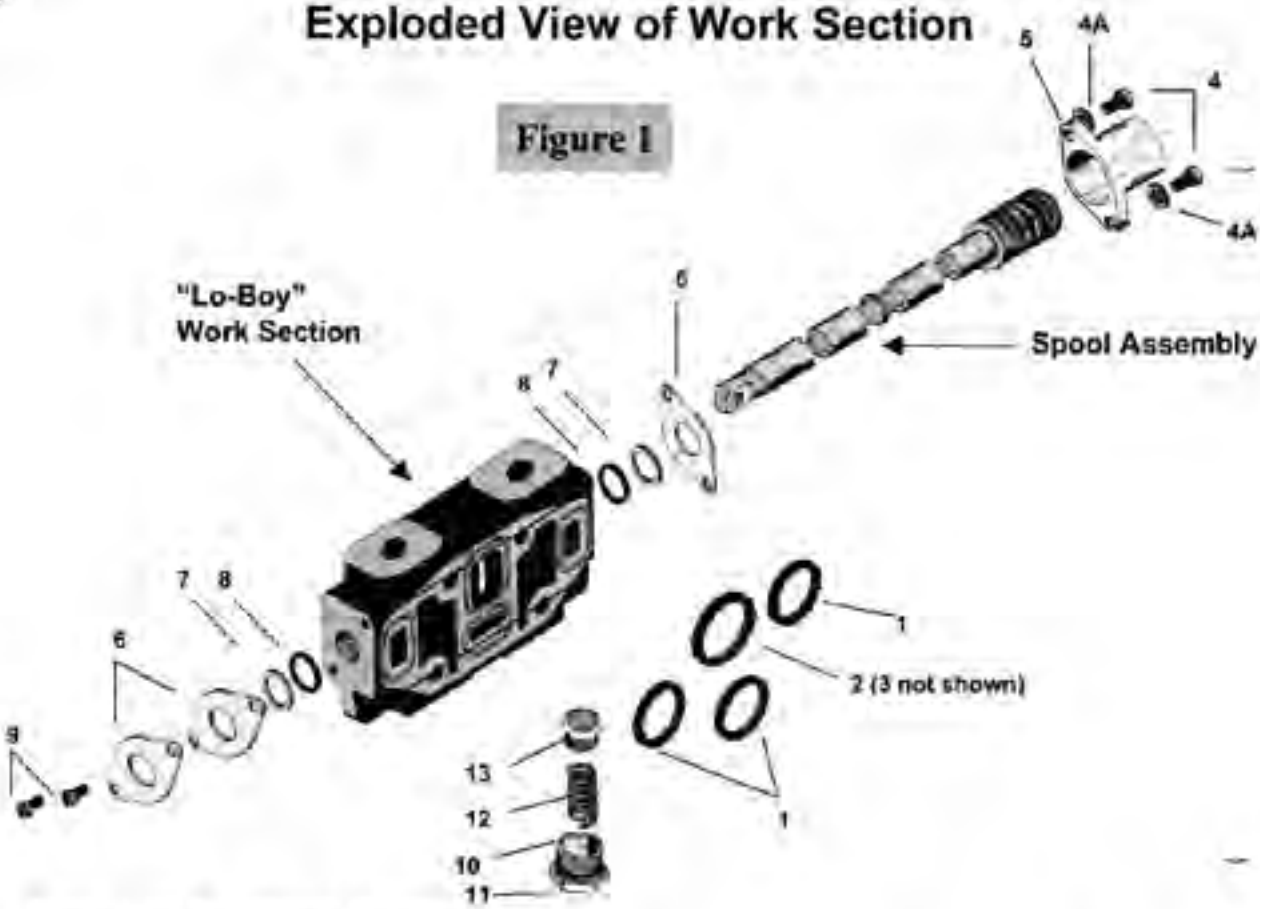
Valves are often used in hazardous environments. Inspect them frequently for damage due to improper use, corrosion or normal wear. If needed, repairs should be made immediately.

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

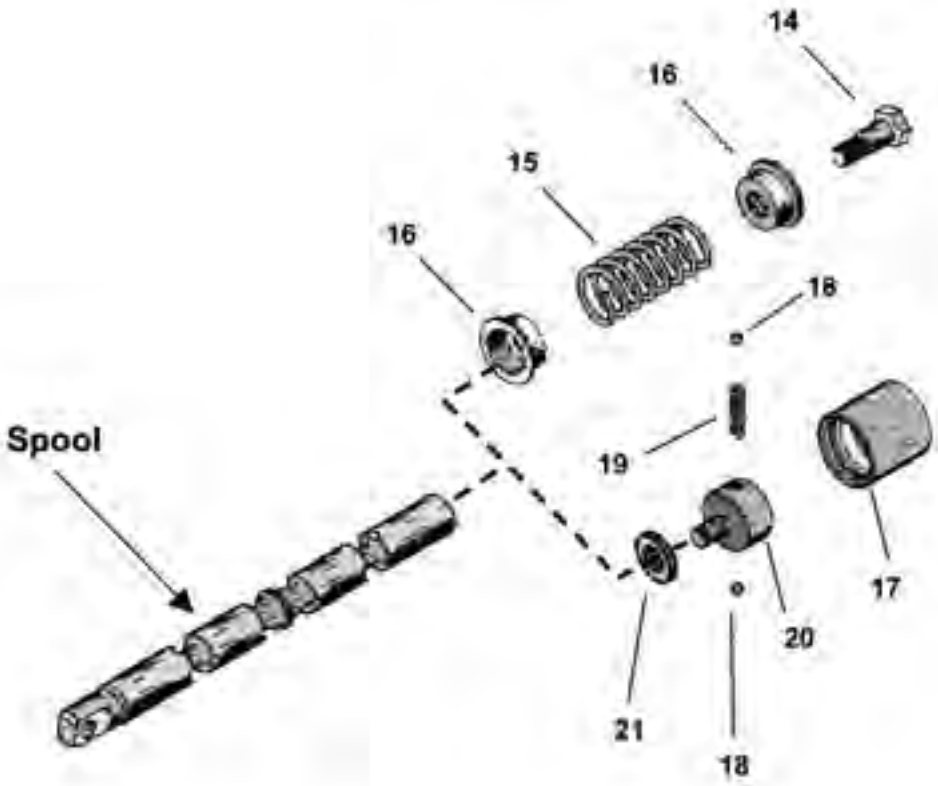


Parts List For Work Section

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	391-2681-376	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 Popper **	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

4 Valve Disassembly Instructions

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

Step 1 - Valve Bank

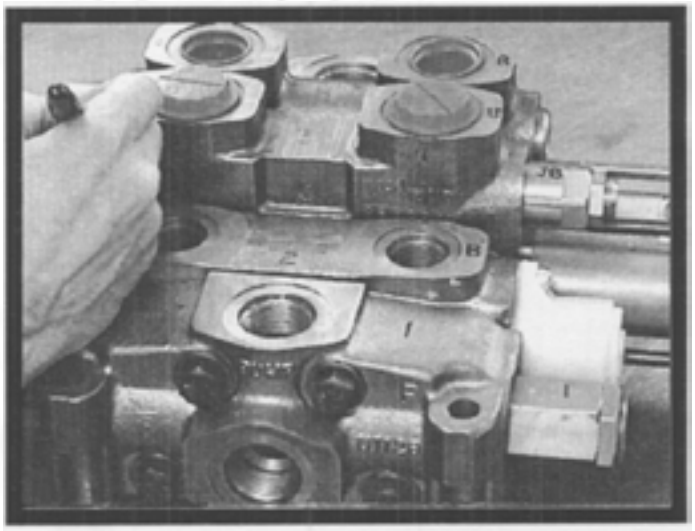
This step is the most critical in the disassembly procedure. It should be followed closely to ensure that the valve bank is properly reassembled after repairs have been made.

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).

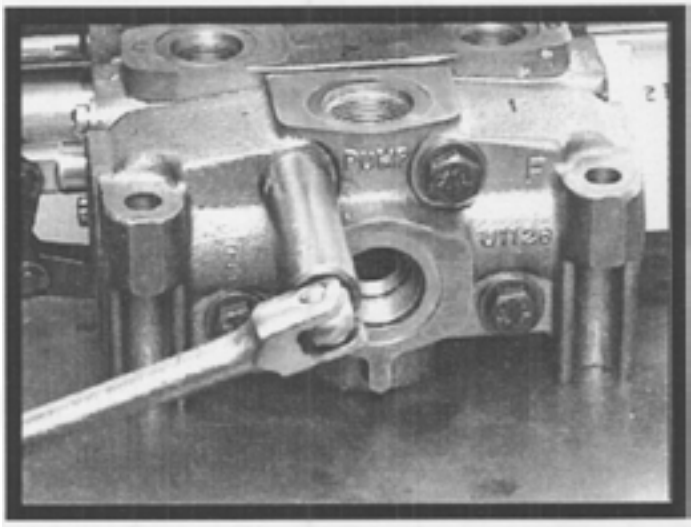
Finally, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they were removed. Inlet and mid-inlet relief valves are marked with a casting number only.



Step 2 - Tie Bolts

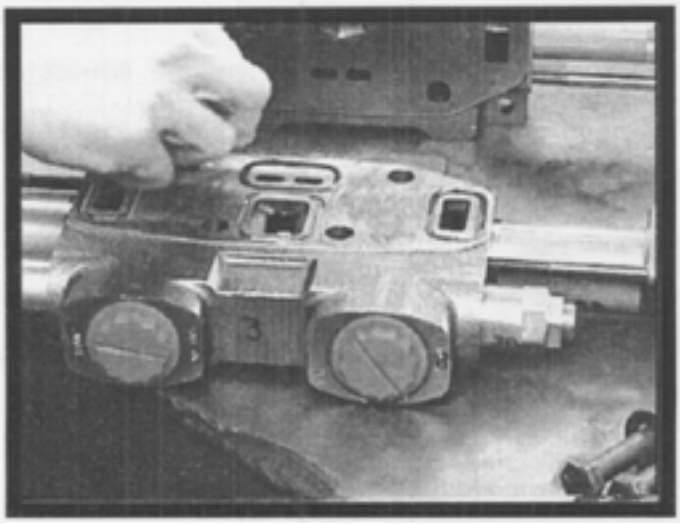
Remove the four, tie bolts that hold the bank together and separate the sections.

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.



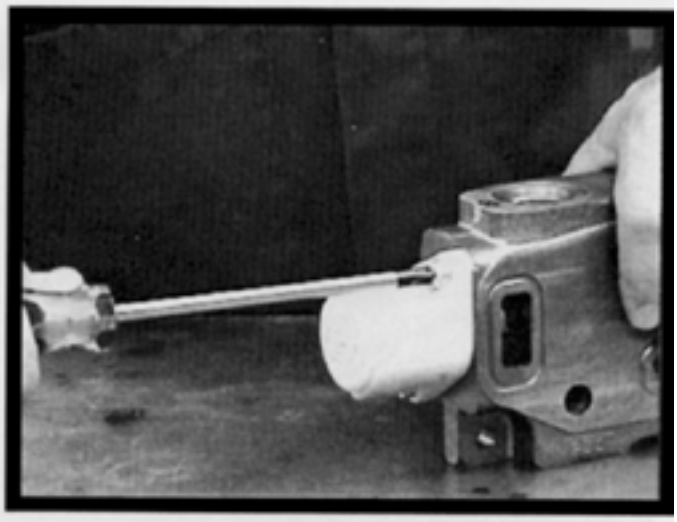
Step 3 - Section Seals

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



Step 4 - Valve Back Cap

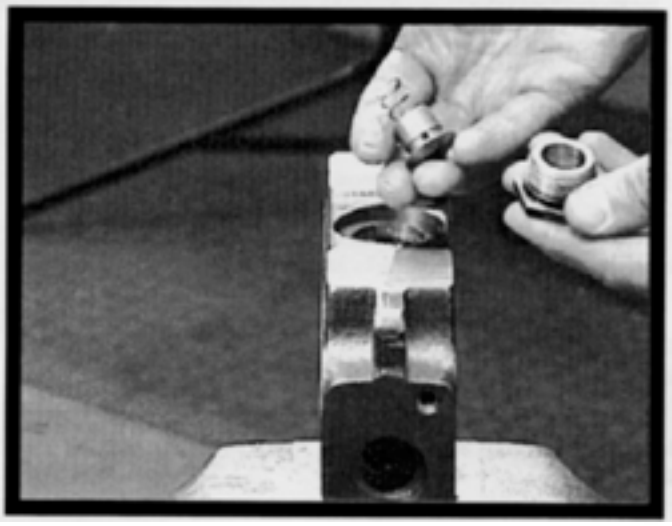
Using a large, Phillips-head screwdriver, remove the two, cap screws (Fig. 1, item 4) which fasten the back cap to the work section. Lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (Fig. 1, item 5).

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 sleeve 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

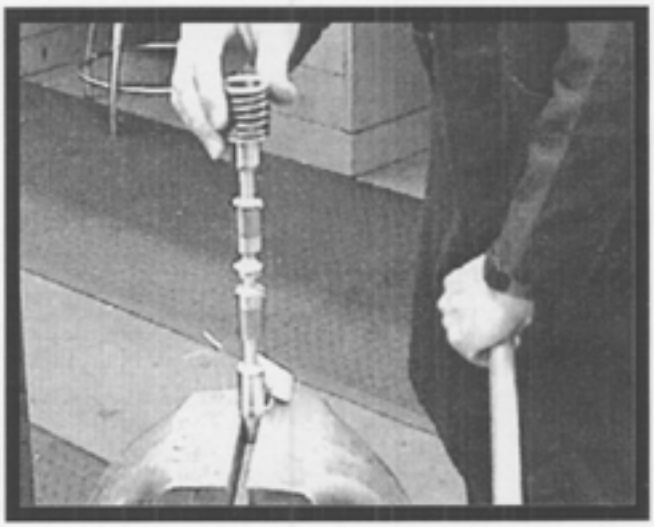
Spring Centered Spool

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.

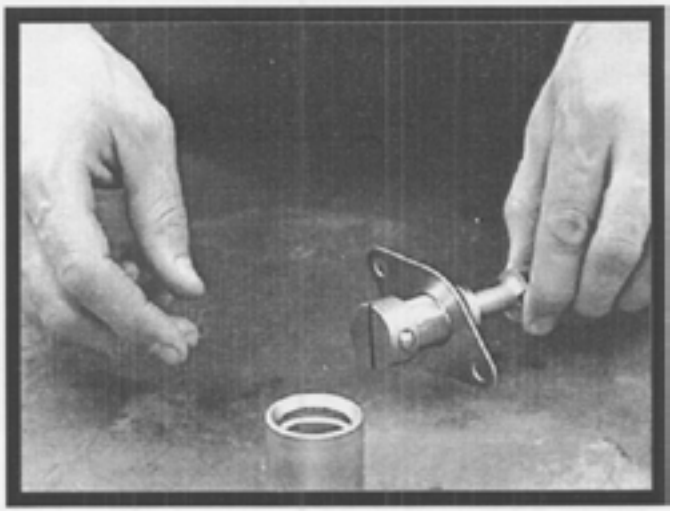
As the stripper-bolt threads disengage, the spring (Fig. 2, item 15) and spring guides (Fig. 2, item 16) will release abruptly from the spool.



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, remark immediately.

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

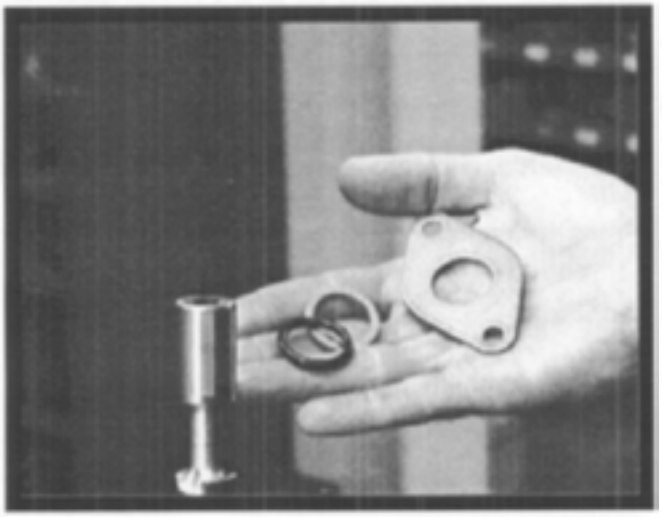
Valve Assembly Instructions

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.

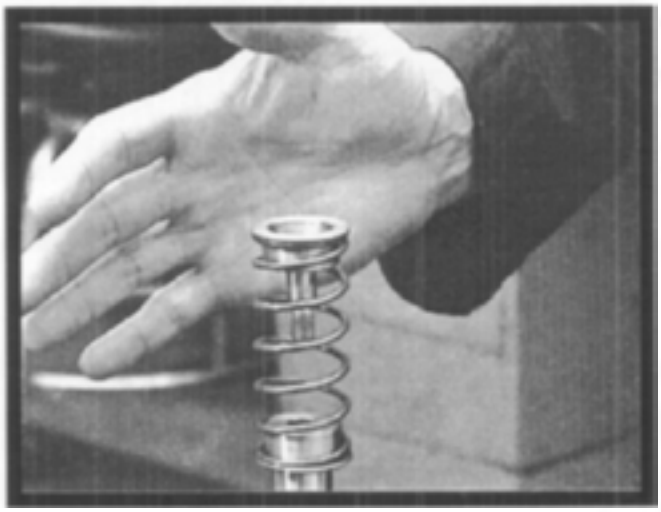
CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or product malfunction. Product should be thoroughly tested to ensure proper operation before the valve is placed back into service.

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

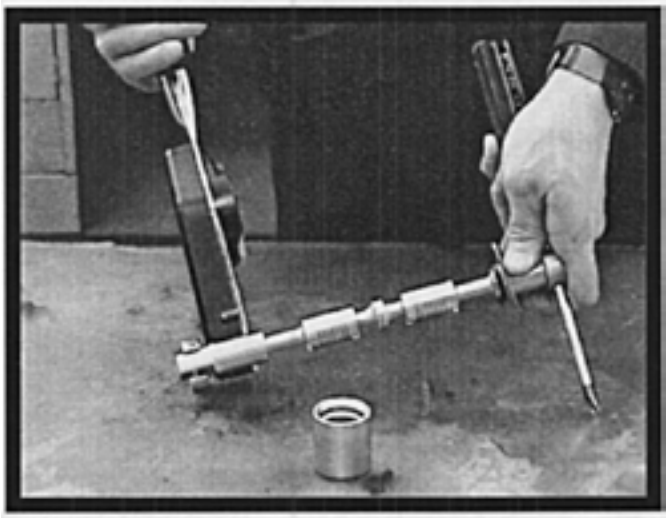
Step 1 - Spool Assembly-Detent

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

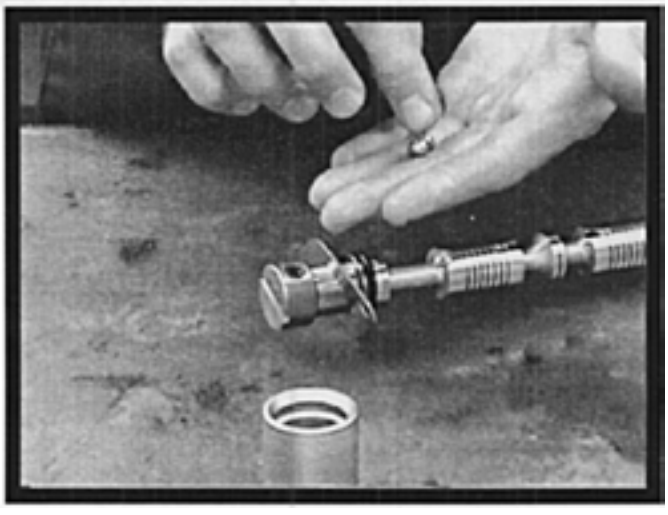
Thread the detent ball retainer (Fig. 2, item 20) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs.. This can be accomplished by using a crows-foot socket on the flats of the clevis, and holding the spool by inserting a round, steel rod or screwdriver through the hole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



Step 3 - Detent Balls and Spring

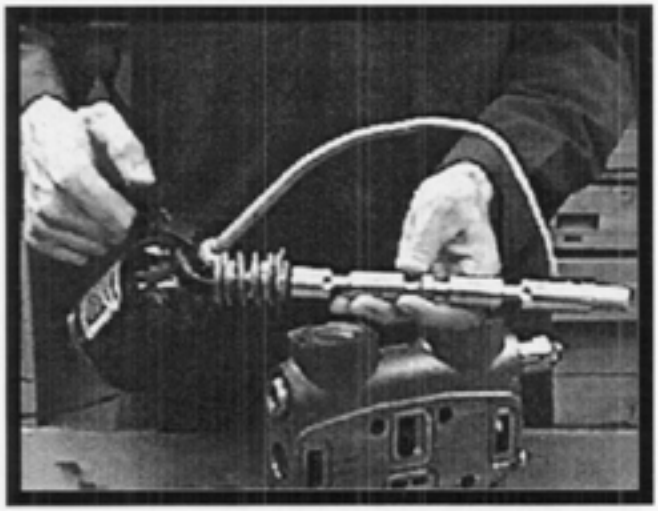
Next, lightly coat the detent balls (Fig. 2, item 18) detent spring (Fig. 2, item 19) and entire inside diameter of the detent sleeve (Fig. 2, item 17) with high temperature grease.

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

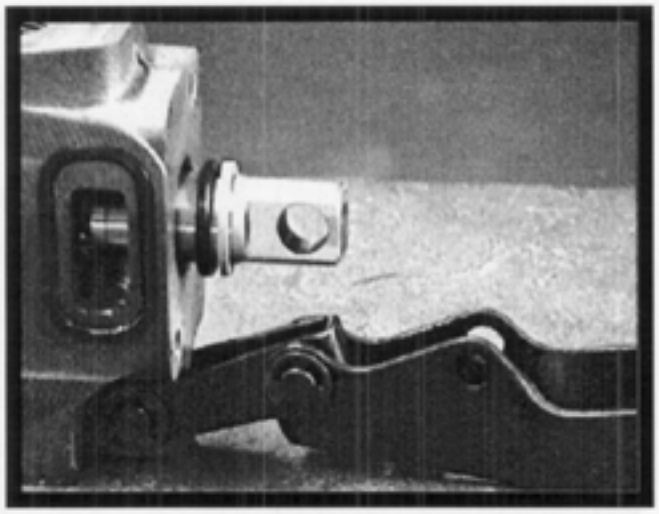
9



Step 1 - Spool Subassembly

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

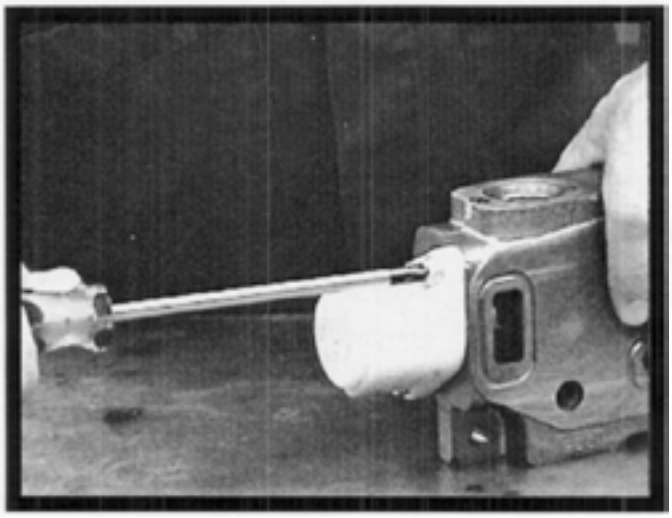
Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid cutting burrs. Be careful not to pinch, roll or damage the seals. Make sure that the spool and housing are in the proper orientation (see Step 7, page 6 disassembly).



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 5). 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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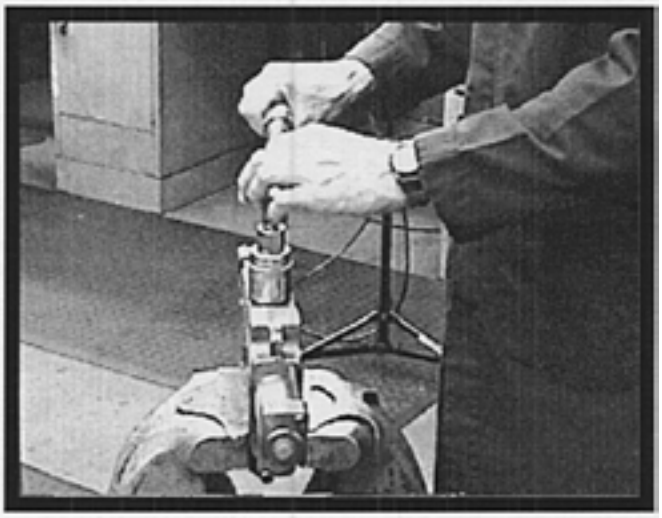
Valve Assembly Instructions

Step 4 - Install Transition Check

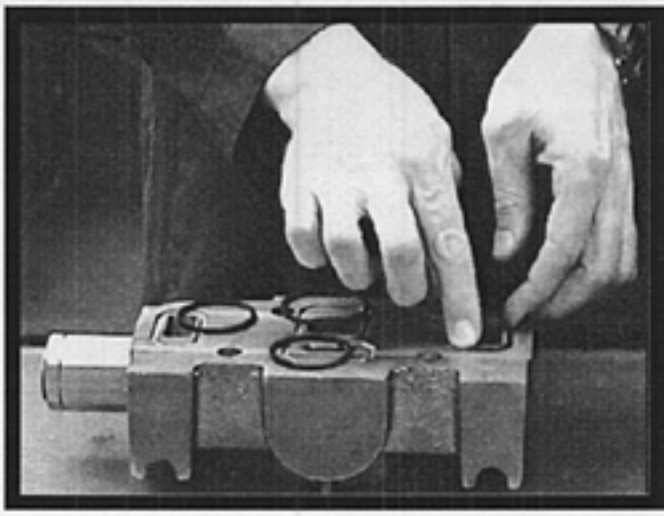
Inspect transition check components for cleanliness. Install check poppet (Fig. 1, item 13) into the transition check cavity. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 11) over the poppet and spring. Turning by hand, engage several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



Step 5 - Relief Valves

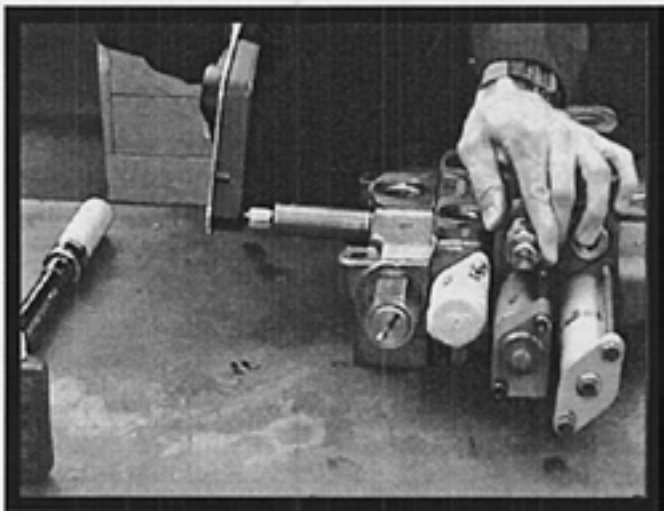
Return all relief valves to their proper positions and torque to 75 ft. lbs

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

sun hydraulics

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

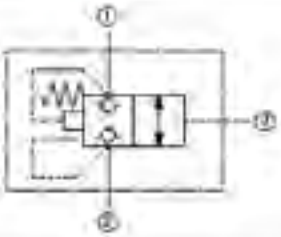
Capacity:
60 gpm (240 L/min.)

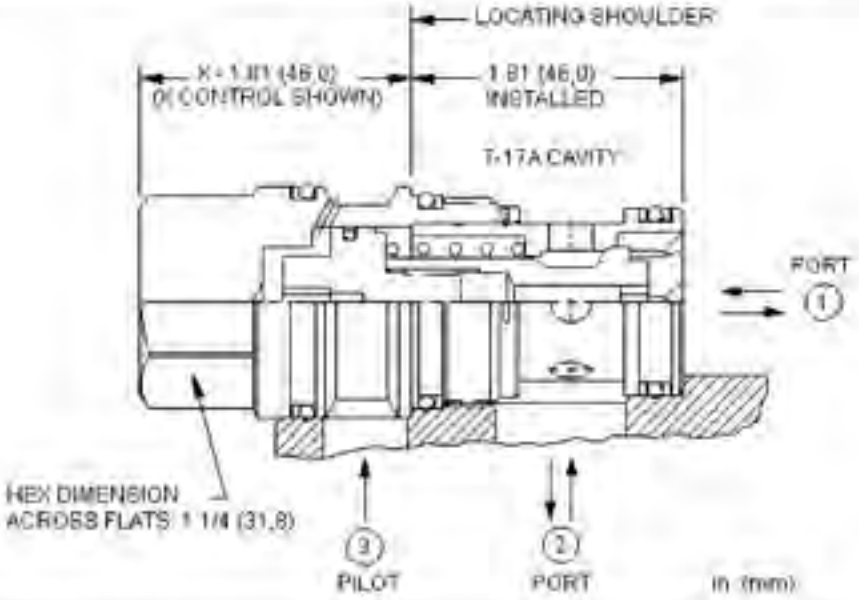
Functional Group:
Products : Cartridges : Corrosion Resistant : Logic Element : Unbalanced Poppet, Pilot-to-open, Switching Element, Spring biased closed, External Pilot Port 3 pilot source

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.





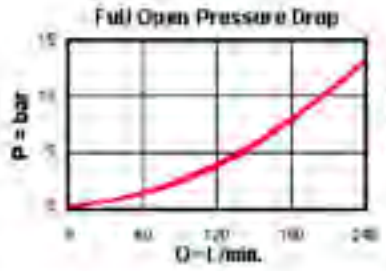
Technical Features

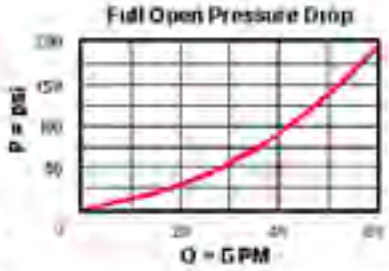
- Because these valves are unbalanced, operation is pressure dependent. Opening and closing of the poppet are functions of the force balances on three areas: 1) Port 1 = 100%, Port 2 = 80%, and Port 3 = 180%.
- These valves are pressure responsive at all three ports, therefore it is essential to consider 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: 990-017-005	





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