FARR CANADA

A Division Of McCoy Corporation

HD31000 Tong

TECHNICAL MANUAL

Best By FARR™

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This manual covers the following models:

TONG MODEL	REV	DESCRIPTION
80-1402	0	31" Tong c/w Staffa C080 motor, rigid sling, motor valve & lift valve.
80-1402-1	0	31" Tong c/w Staffa C080 motor, rigid sling, motor valve, lift valve & safety door.

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WARNINGS

THE LOAD-BEARING DEVICE SUPPLIED BY FARR CANADA, A DIVISION OF MCCOY CORPORATION (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 DESCRIBED IN THIS MANUAL) HAS BEEN DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL. FARR CANADA WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES. FARR CANADA WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO LIFT THE EQUIPMENT DESCRIBED IN THIS MANUAL IF THERE ARE ANY MODIFICATIONS TO THE LOAD-BEARING DEVICE, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED IN THIS MANUAL THAT ADD WEIGHT TO THE EQUIPMENT, UNLESS SUPPLIED BY FARR CANADA.

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 4 - OVERHAUL).

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

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While continually striving to maintain accuracy, Farr Canada hereby states that the information contained in this technical documentation is subject to change without notice. If you feel this document does not meet your needs, please contact our sales office for the most current available documentation for your product.

Summary Of Revisions			
Date	**Section**	**Page**	**Description Of Revision**
Jan 2010	N/A	N/A	Intial Release
May 2011	6	6.9	Corrected door support roller shaft part number

IDENTIFICATION OF WARNINGS AND OTHER NOMENCLATURE OF IMPORTANCE USED IN THIS MANUAL

Farr Canada uses three subsets to describe items in three degrees of importance.

*The highest level of urgency is called a **CRITICAL WARNING**, and is identified with an exclamation point, is red in color, and is surrounded by a double black box. A **CRITICAL WARNING** denotes an item of extreme importance, and failure to heed a **CRITICAL WARNING** may result in bodily injury, death, severe equipment damage, or any combination of these.*

*A **STANDARD WARNING** is identified with an asterisk, and contains information critical to the correct assembly or operation of the unit. A **STANDARD WARNING** may also serve to alert the user to a potential low-level injury hazard. A **STANDARD WARNING** is also surrounded by a double black box, but is amber in colour.*

*An **ALERT** is identified by black text within a double black box. An **ALERT** contains specific information of note that pertains to the correct assembly or operation of the unit.*

!	**Critical Warning**
*	**Standard Warning**
	Alert

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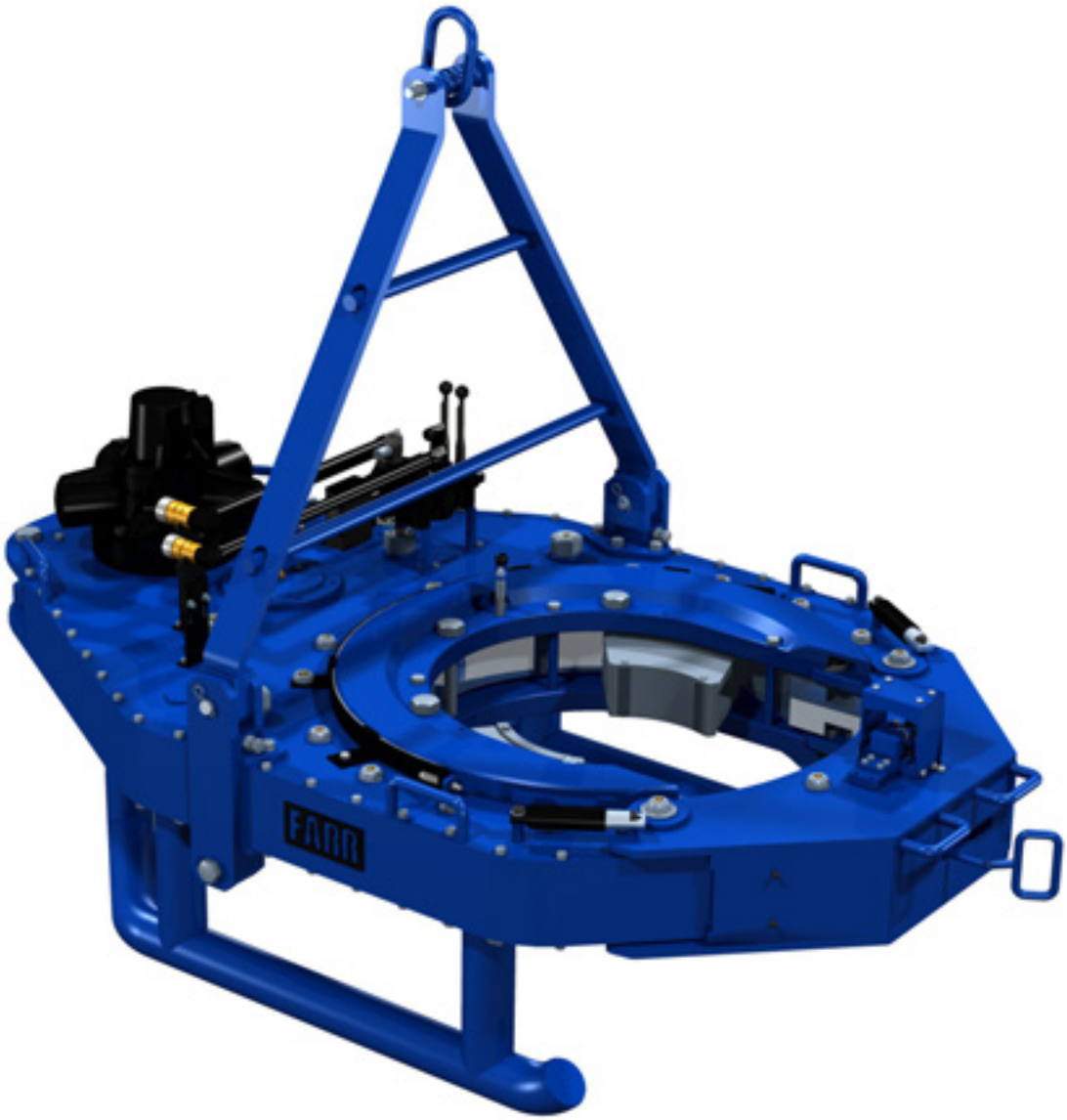
Congratulations on the purchase of your new Farr Canada tong. This unit will provide you with years of outstanding performance. Simple maintenance and care will extend its life and ensure continuing excellent performance and reliability.

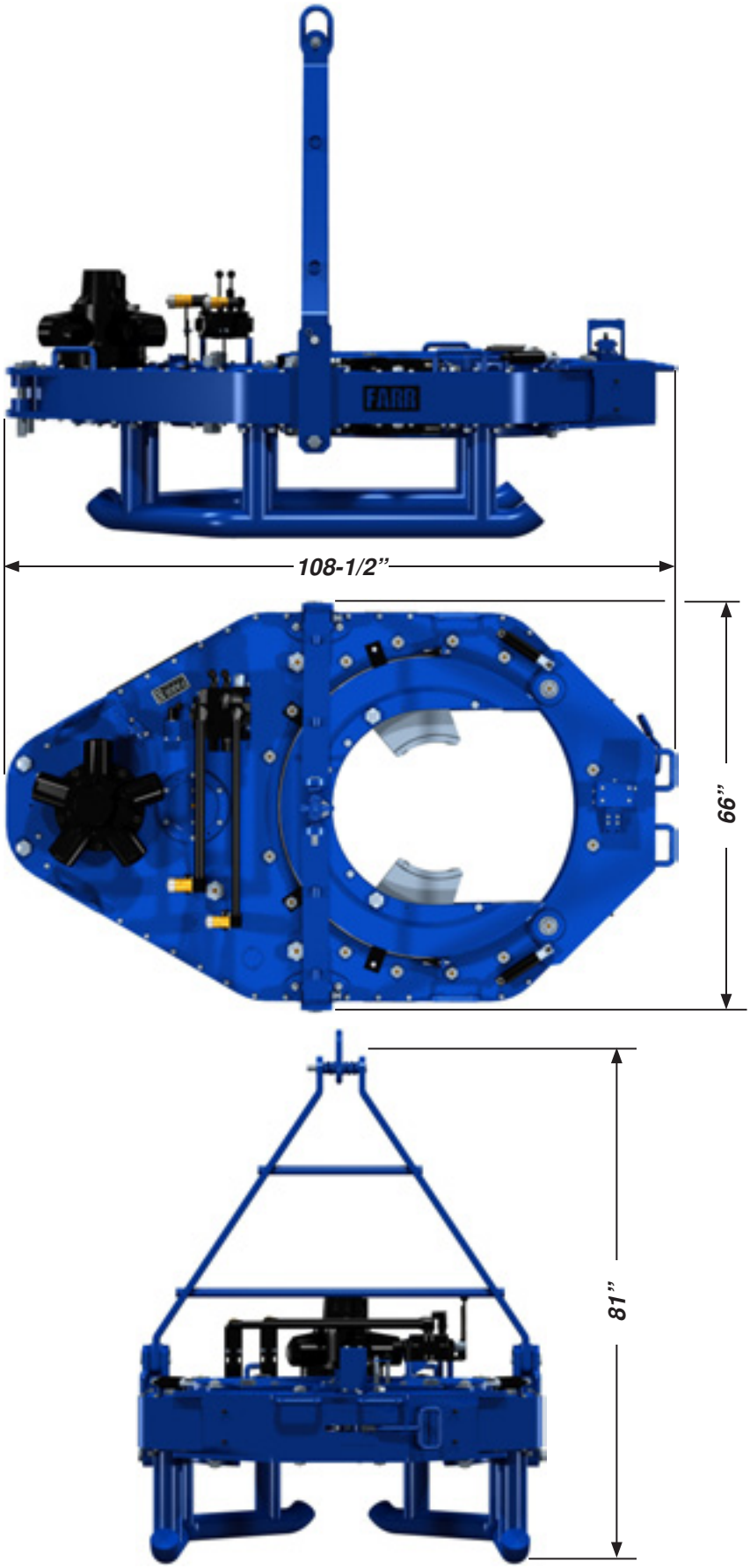
This manual will assist you in giving your equipment the care it requires. Please read the manual and follow the enclosed maintenance instructions. Replacement parts are readily available from FARR Canada Ltd. in Edmonton, Alberta. However, most of the parts that are subject to wear or damage are standard items likely to be found in supply stores or parts depots. 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:

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

Email Engineering: eng@farrcanada.com
Email Sales: info@farrcanada.com
Website: http://www.farrcanada.com





Torque Table **		
Pressure (PSI)	**High Spd. (lbs.-ft.)**	**Low Spd. (lbs.-ft.)**
1000	10185	20370
2000	22167	44334
3000	34149	68299
3500	40140	80281
MAXIMUM RATED TORQUE: 80000 LBS.-FT.		

Speed Table		
Flow (US GPM)	**Low Displacement (RPM)**	**High Displacement (RPM)**
10	1	2
20	2	4
40	4	8
60	6	12

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

Hydraulic Requirements (max.):	*60 GPM / 227 LPM & 3500 psi / 24.1 MPa*
Length:	*114" / 275.6 cm*
Height:	*81" / 205.7 cm*
Overall Width:	*66"/ 167.6 cm*
Torque Arm Length:	*66" / 167.6 cm* *- Centerline of pipe to Centerline of anchor -*
Pipe Space Required:	*10" / 25.4 cm*
Maximum Elevator Diameter:	*Unlimited (tong comes off pipe)*
Weight (Approximate):	*6900 lb. / 3105 kg.*
Casing Jaws Available (inches):	*See Pg. 2.12*

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

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

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

Typical Density (kg/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*
104/105C Vane Pump Test:	*No Data Available*
Vane pump test total ring and vane wear, mg.	*<10*
Oxidation Stability	
Turbine Oil Stability Test Life, hours	*2500+*
Rotary Bomb Oxidation Test, minutes	*325*
FZG Spur Gear Test, Failure Load Stage (FLS)	*12*

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

A. SLING / LOAD BEARING DEVICE SAFETY

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 DESCRIBED IN THIS MANUAL.

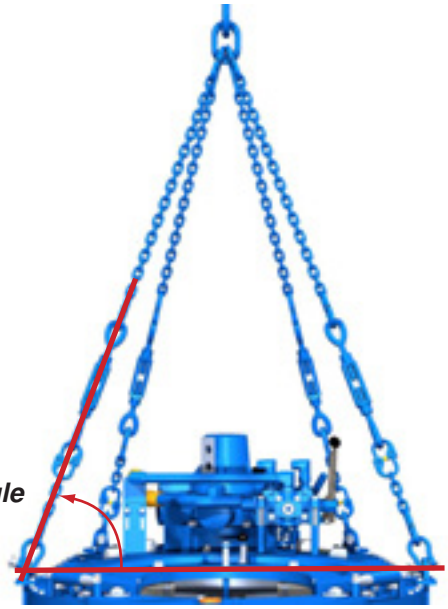
THE SUPPLIED LOAD-BEARING DEVICE HAS BEEN SPECIFIED OR DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL. FARR CANADA WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED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

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

Farr Canada 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*

Farr Canada 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*

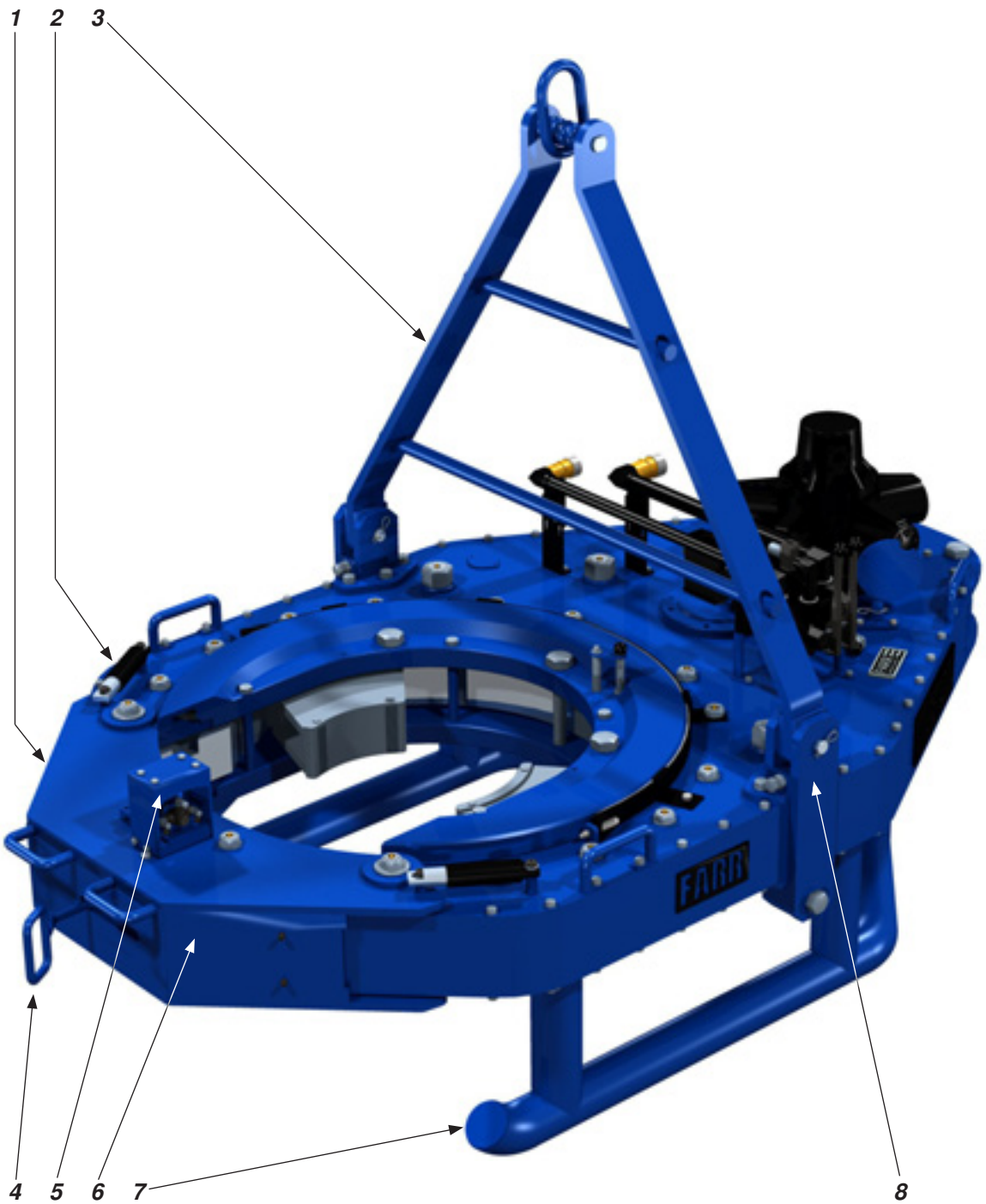
Proper storage of out-of-service load bearing devices is important to ensure full integrity of the device once it is returned to service. Farr Canada recommends observing the following practices.

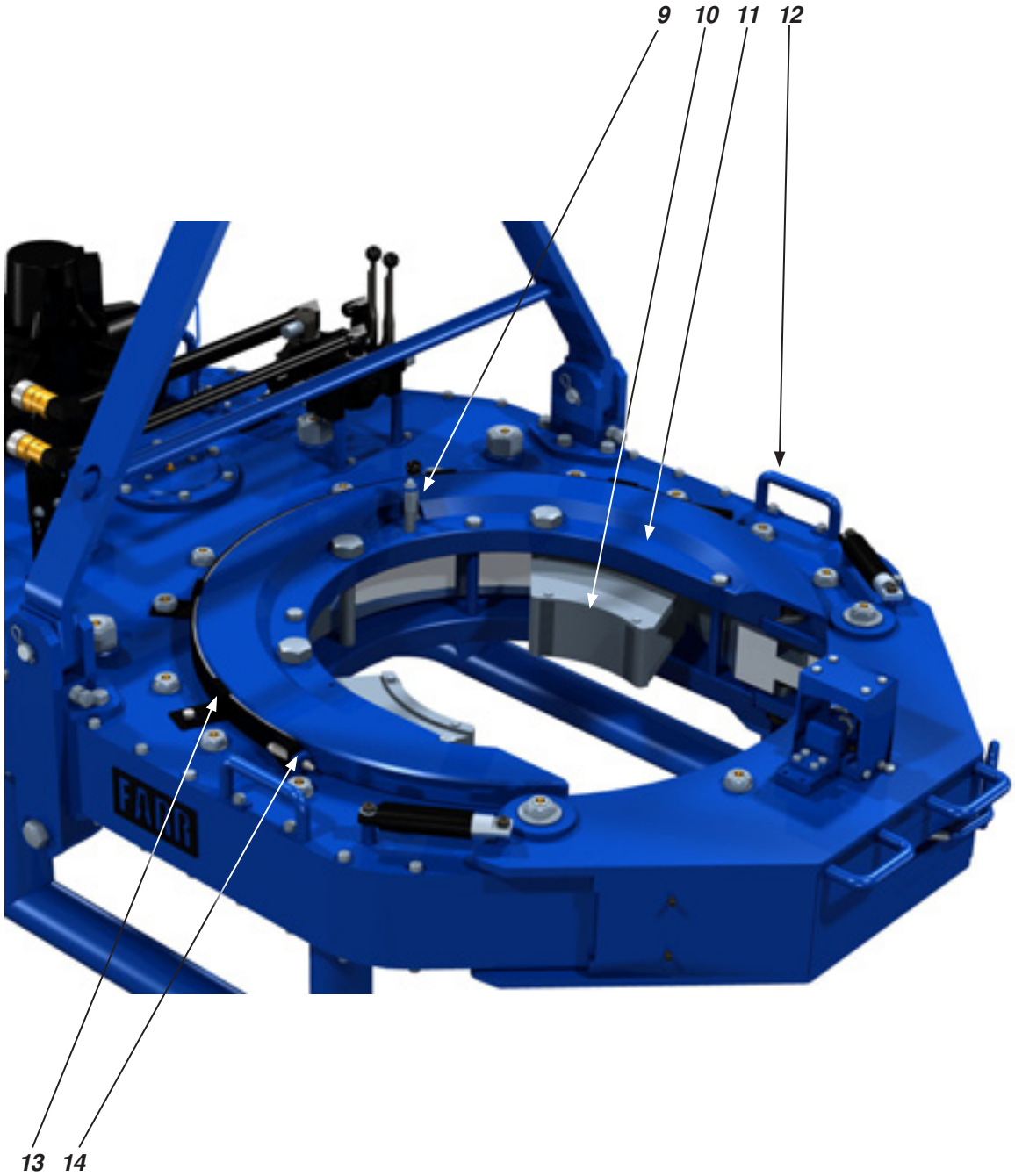
- *Wipe off all excess grease. Use a solvent-based cleaner on rags to wipe all external surfaces to remove residual grease or hydraulic fluid. Once the outside surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.*

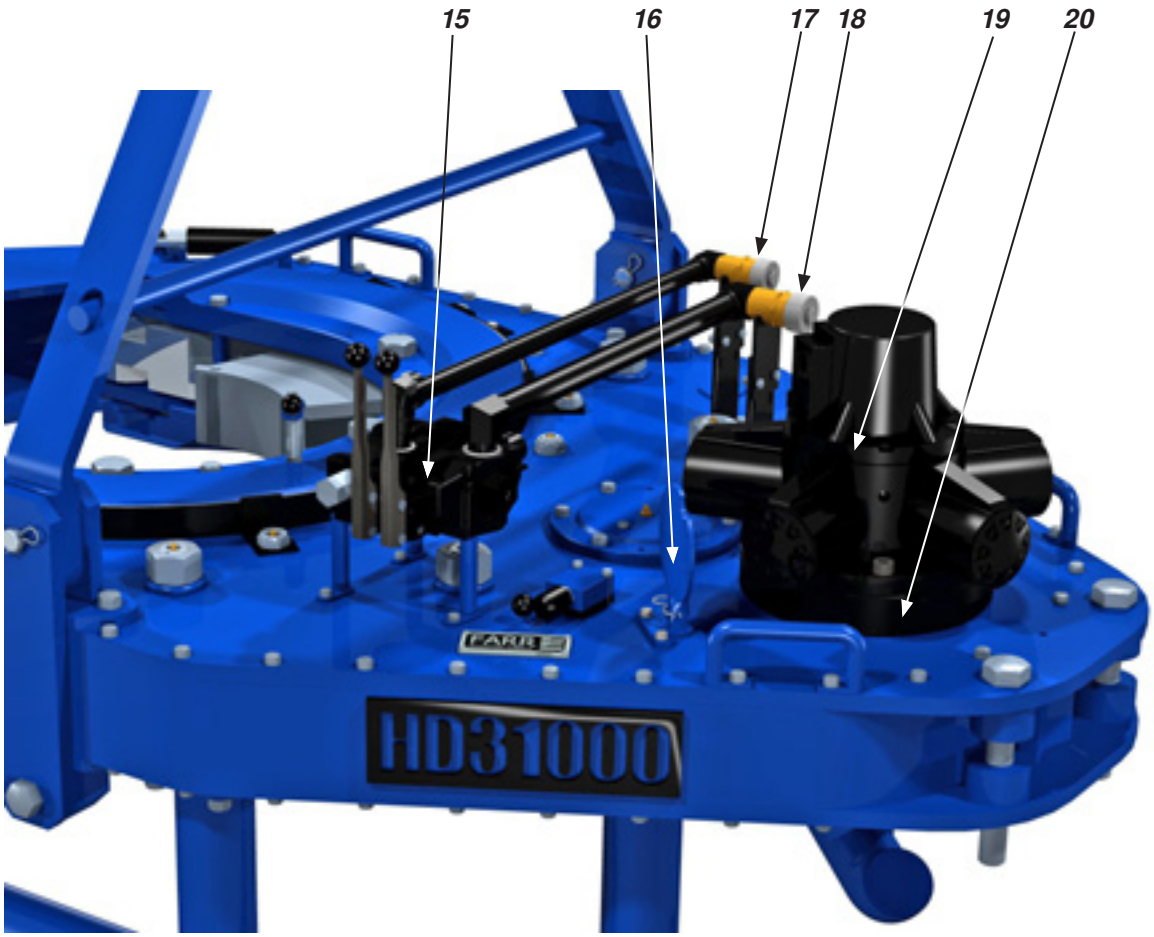
- *Farr Canada recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external surfaces. Refer to manufacturer data sheets for proper application and safety information. Allow the anti-corrosive coating ample time to dry - refer to manufacturer data sheets for drying times at room 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

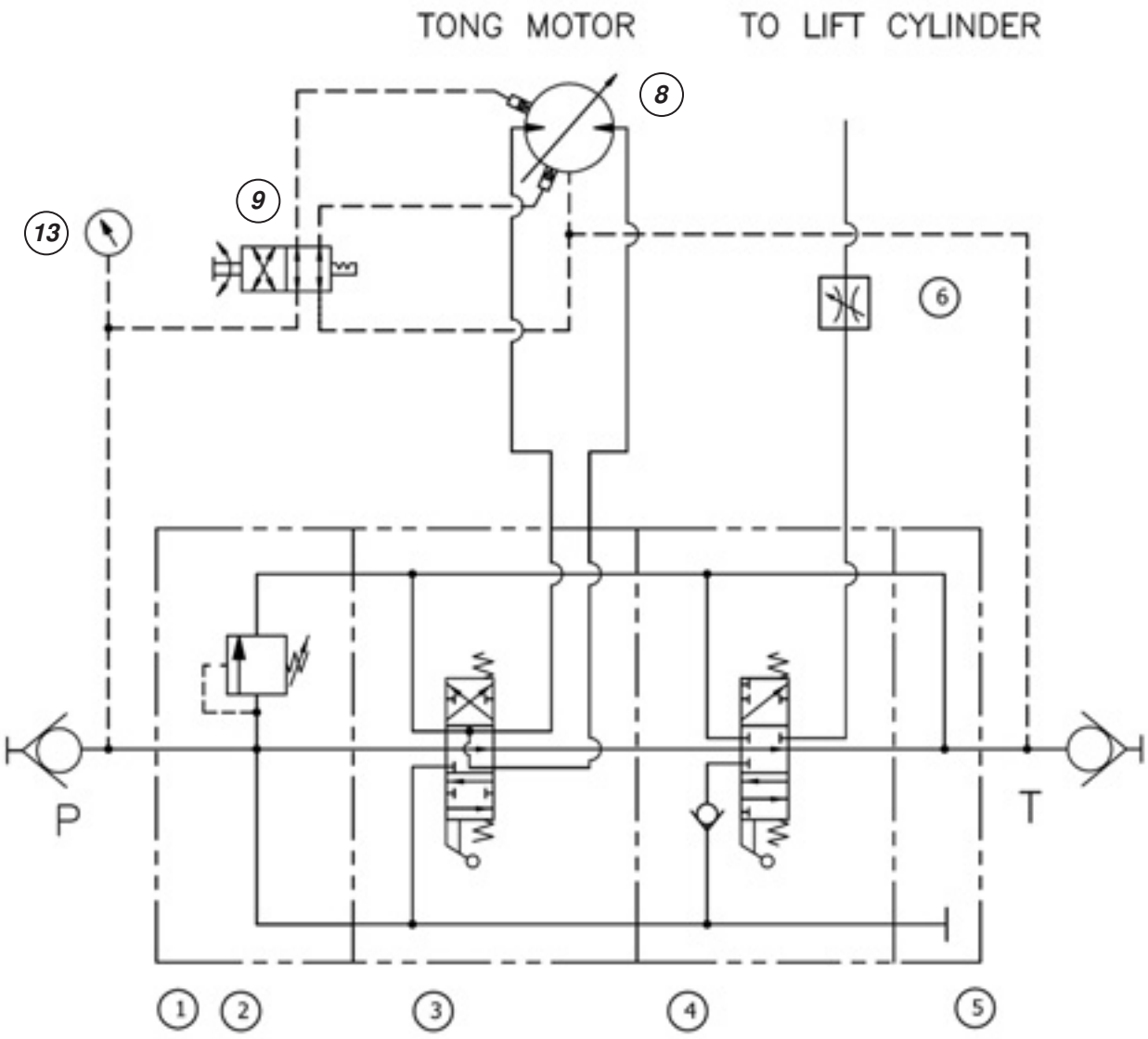






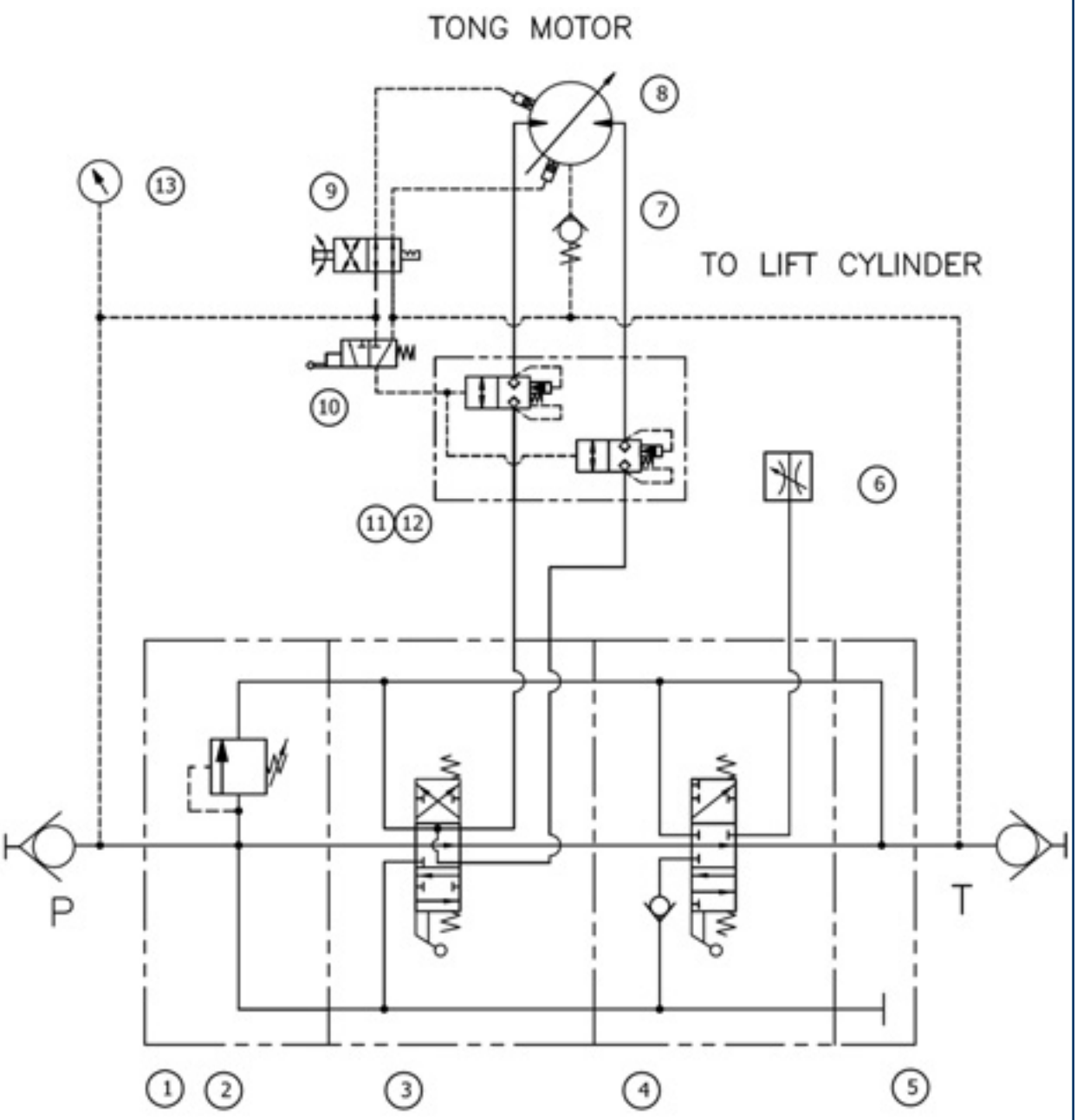
Item	Description	Page
1	RH Door Assembly	2.1
2	Tong Door Cylinder	2.1
3	Rigid Sling	2.1
4	Door Latch Handle	2.1
5	Safety Door Switch Assembly	2.1
6	LH Safety Door Assembly	2.1
7	Tong Leg Weldment	2.1
8	Tong Leveling Assembly	2.1
9	Backing Pin	2.2
10	Tong Jaws (18-5/8" Shown)	2.2
11	Cage Plate Assembly	2.2
12	Tong Body Handle	2.2
13	Brake Band	2.3
14	Brake Band Adjustment Assembly	2.3
15	Hydraulic Valve Bank	2.3
16	Torque Gauge Mount	2.3
17	Hydraulic Inlet Fitting (1")	2.3
18	Hydraulic Outlet Fitting (1-1/4")	2.3
19	Staffa C080 Hydraulic Motor	2.3
20	Motor Mount	2.3

C. HYDRAULIC SCHEMATIC / COMPONENT IDENTIFICATION

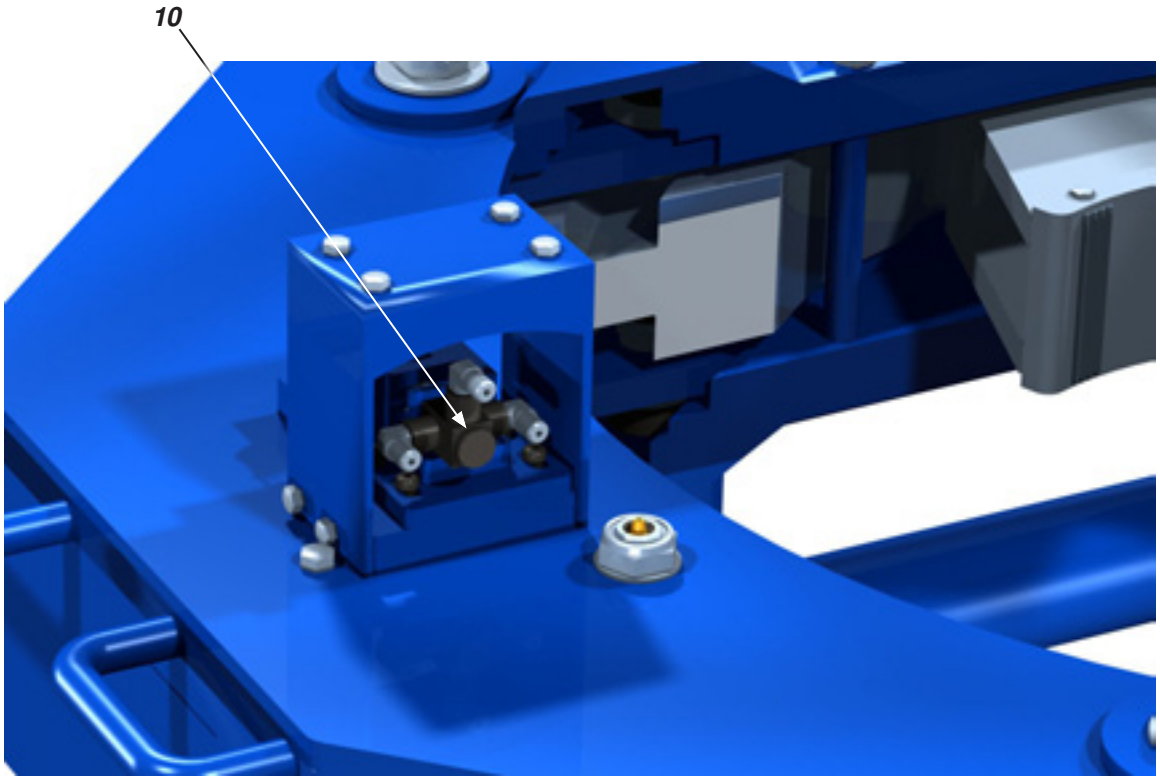


HYDRAULIC SCHEMATIC - 80-1402 TONG WITHOUT SAFETY DOOR

Item	Description	Part Number	Page
1	DVG35-A880 Inlet Valve	10-9023	2.6
2	DVG35-HMRV Relief Valve	10-9029	2.6
3	DVG35-MA8 Motor Section Valve	10-9020	2.6
4	DVG35-DA8 Lift Section Valve	10-9021	2.6
5	DVG35-TR99 Outlet Section Valve	10-9022	2.6
6	N800-S Flow Control Valve	08-9062	2.6
7	Check Valve	02-9228	
8	Staffa HMC-C080-S-90	87-0210	2.6
9	Motor Speed Valve	10-9024A	2.6
10	Safety Door Switch	08-0337M	2.6
11	Safety Door Block	101-0727	
12	Pilot Check Valve	08-1625	
13	Pressure Gauge	02-0245	2.6

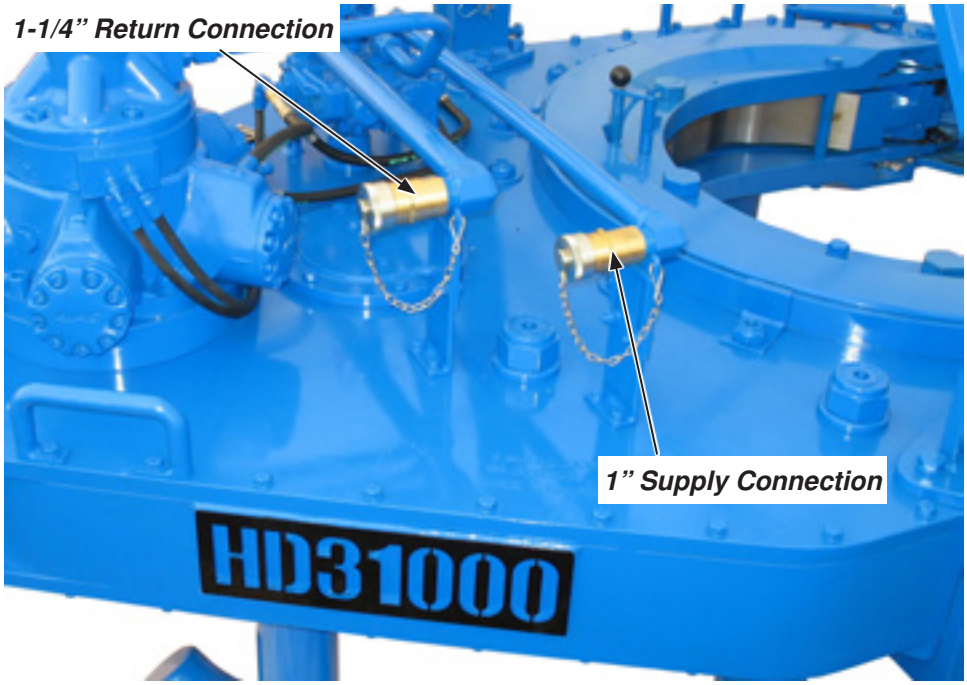


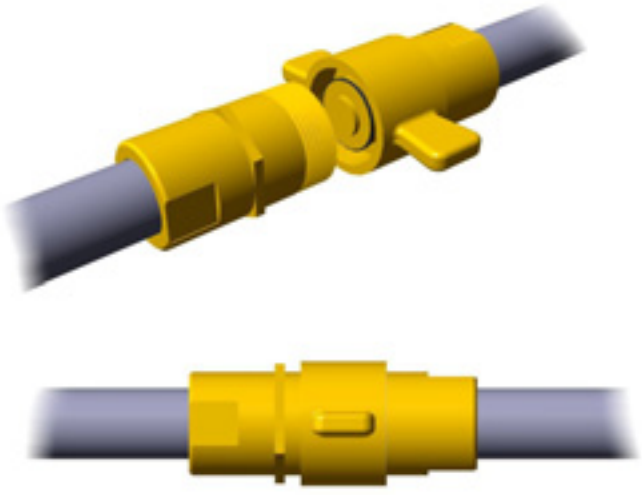
Hydraulic Schematic - 80-1402-1 Tong With Safety Door



D. HYDRAULIC CONNECTIONS

A pair of hydraulic lines - a 1" supply line and a 1-1/4" return line - connect the hydraulic pedestal to the power unit (see illustration below). To minimize the risk of injury perform hydraulic connections 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.





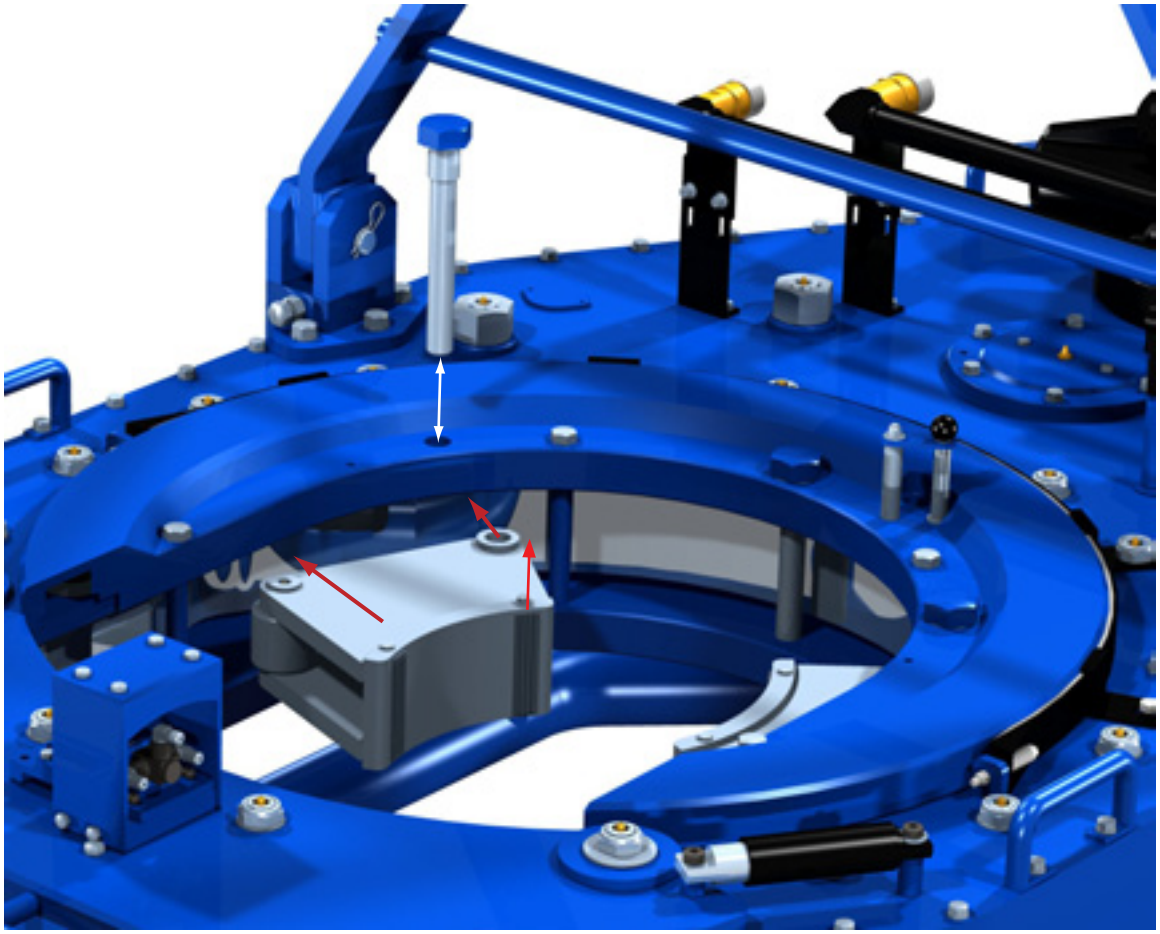
E. TONG JAW AVAILABILITY & INSTALLATION

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

Description	Part Number
10 - 3/4" Jaw Die Kit	1095-JDK-380
13 - 5/8" Jaw Die Kit	1095-JDK-570
16" Jaw Die Kit	1095-JDK-580
18 - 5/8" Jaw Die Kit	1095-JDK-585
20" Jaw Die Kit	1095-JDK-590
22" Jaw Die Kit	1095-JDK-592
24" Jaw Die Kit	1095-JDK-595
26" Jaw Die Kit	1095-JDK-597
28" Jaw Die Kit	1095-JDK-598
30" Jaw Die Kit	1095-JDK-600
Standard 5" Replacement Die	12-1005

TONG JAW REMOVAL/INSTALLATION

- *Support the jaw assembly from the bottom.*
- *Remove the Jaw Pivot Bolt, then remove the Jaw Assembly*
- *Re-install the new die holder set and if needed, replace the standard inserts. They are press-fitted in place, and a hammer may be needed to remove them from the holder. (See illustration below).*

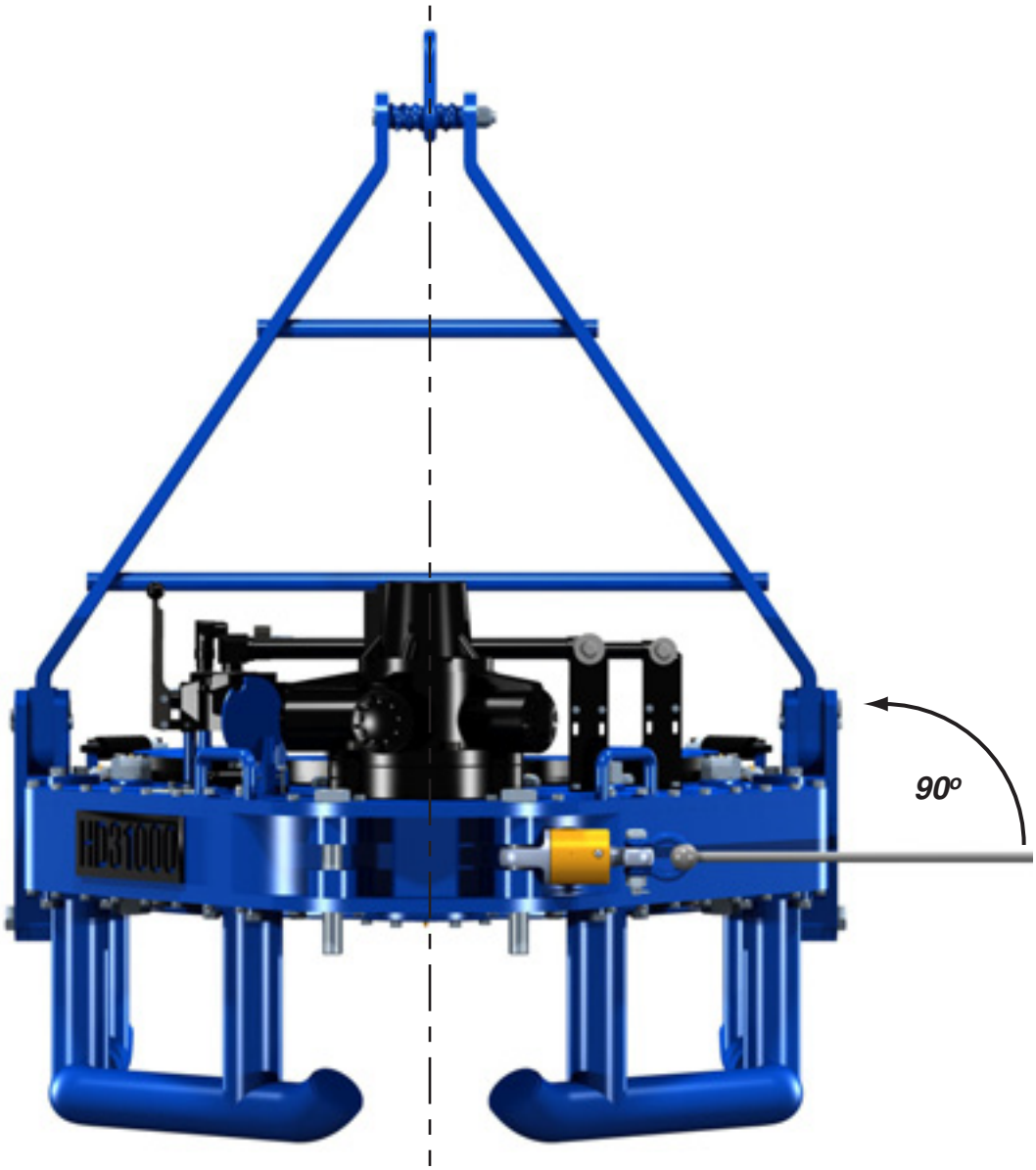


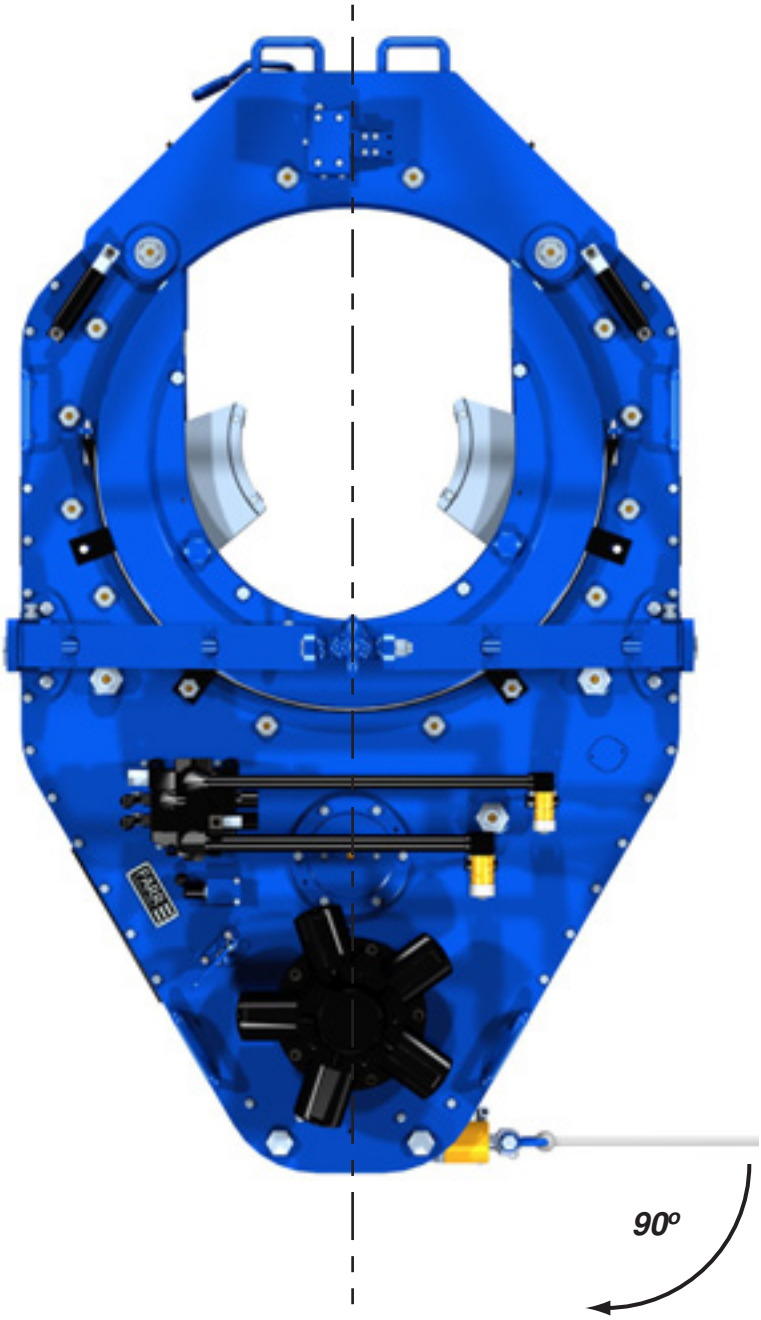
F. TONG RIG-UP & LEVELING

1. Suspension & Load Cell Tie-Off

The tong should be suspended by wire rope of sufficient strength to suspend the entire weight of the tong (6900 lbs. / 3105 kg.) with a minimum 10% safety margin, and from a location in the derrick high enough to assure easy handling and maneuvering of the tong. The hand line should be placed in a position as near the center of the rotary as possible without interfering with the movement of the hoisting equipment. This line may either be extended over a pulley and balanced by a counterweight equal to the weight of the tong (approximately 3000 - 3400 lbs.) or simply tied off in the derrick to form a dead line. In cases where the dead line arrangement is used, it is necessary to use a FARR spring hanger assembly. This spring hanger allows the tong to compensate for the downward movement of the casing as the thread is made-up.

Farr Canada recommends using a backup line of of sufficient strength to withstand the maximum applied torque of the tong (80,000 lbs.-ft.) plus a 10% safety margin. It must be securely connected to the load cell at the rear of the tong, and tied off to a suitable anchor. To ensure accurate torque measurement, the backup line must be connected perpendicular to the lengthwise axis of the tong, and perpendicular to the hang line (see illustrations below and next page).

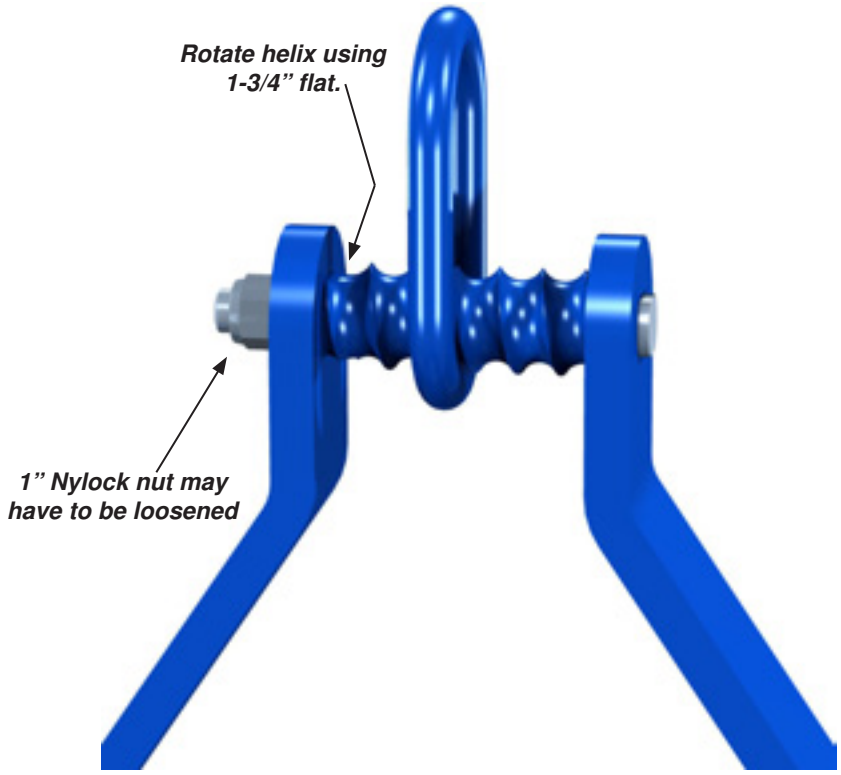




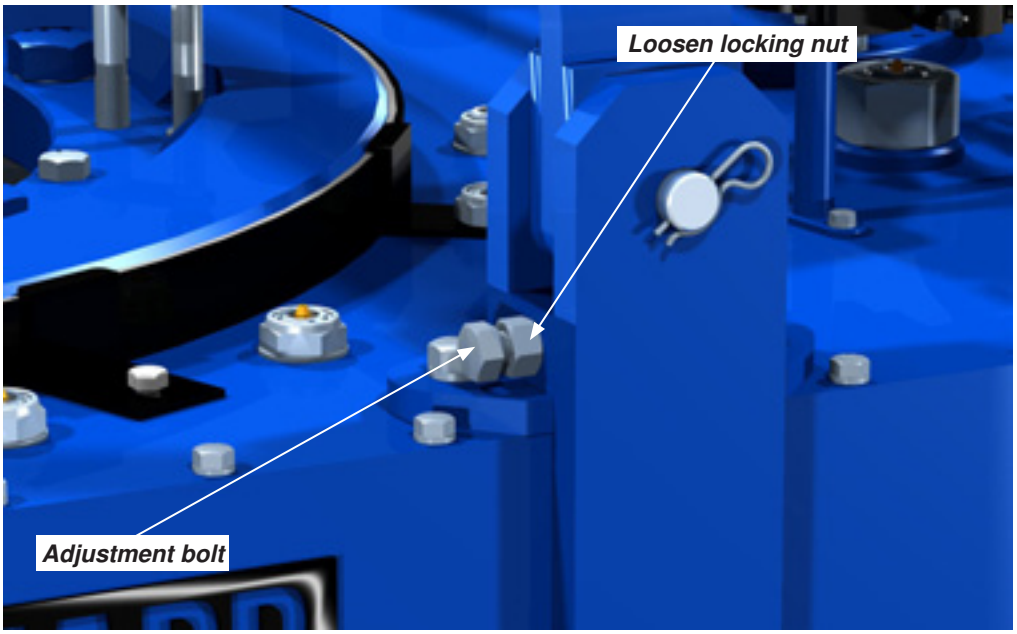
2. *Tong Leveling*

The tong must be leveled side-to-side and front-to-rear before placing into service. The following guidelines provide information for properly 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" nylock nut on the pin may have to be slightly loosened to allow the helix to rotate. Adjust the helix until the level shows that the tong is level side-to-side.*



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 each adjusting bolt equally until tong hangs level front-to-back. Lock adjusting bolts in place with the jam nuts.*



G. SYSTEM OPERATION

1. INITIAL START UP & BREAK-IN PROCEDURE

ALTHOUGH YOUR NEW EQUIPMENT HAS BEEN TESTED AND INSPECTED AT THE FARR FACTORY PRIOR TO SHIPPING, WE ADVISE THOROUGH TESTING OF YOUR NEW TONG AFTER YOU TAKEN POSSESSION IN ORDER TO ELIMINATE THE POSSIBILITY OF SHIPPING DAMAGE.

Ensure correct and secure connections of all hydraulic hoses. Secure all electrical lines to their appropriate connections.

Ensure adequate lube oil and hydraulic oil levels before starting power unit. 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. Perform a "walk-around" of the unit to ensure unobstructed operation, and check for hydraulic leaks or any equipment abnormalities.

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.*

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

Following inspection of the hoses, start the engine and allow it to idle until warm. Allow hydraulic fluid to circulate for approximately 10 minutes, then slowly close the Bypass Valve on the power unit to allow hydraulic fluid to circulate through the hoses and to the tong (circulating pressure should not exceed 200 psi). Note that attempting to operate the system with cold hydraulic fluid may affect the way the sequence valves in your system function.

***** ***ENSURE POWER UNIT AND HYDRAULIC FLUID ARE AT OPERATING TEMPERATURE BEFORE OPERATING SCISSORLIFT ASSEMBLY***

Place the tong gear shifter in low gear. 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.

Farr recommends that the following pre-operating tests be performed prior to releasing the tong assembly to an operational environment:

- *Operate the tong at full speed and in high gear for a duration of one-half hour.*
- *Switch to low gear and operate for an additional one-half hour at full speed.*

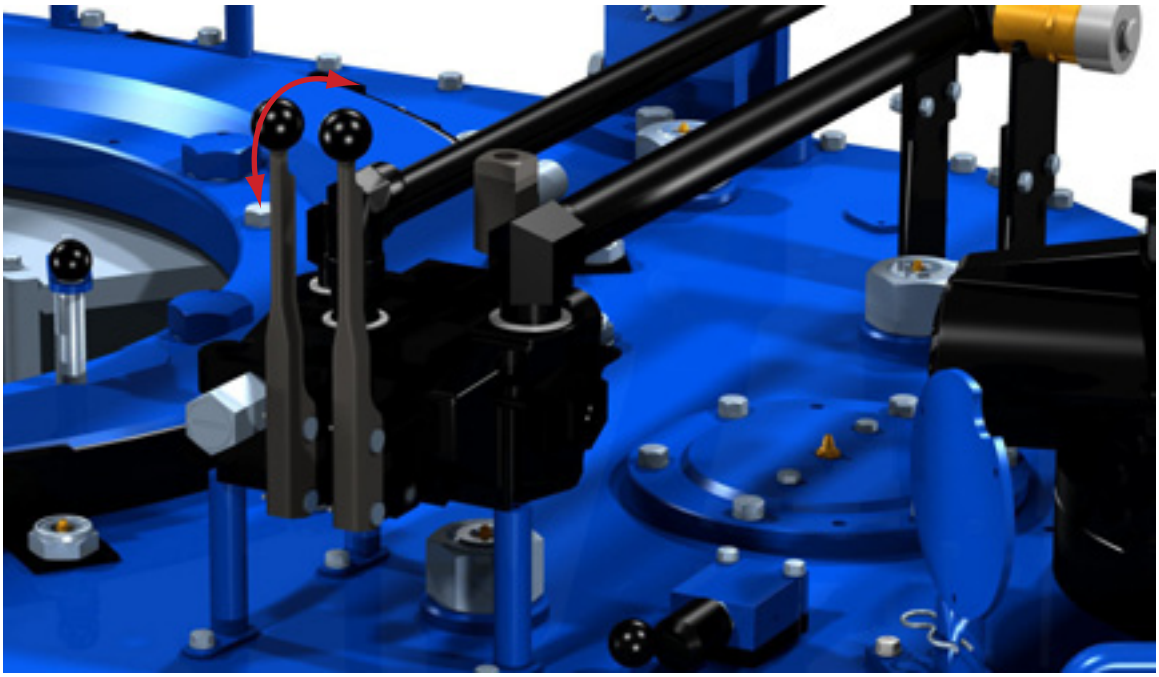
2. *VALVE OPERATION*

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

The following illustration demonstrates the type and effects of the hydraulic valves this tong is equipped with.

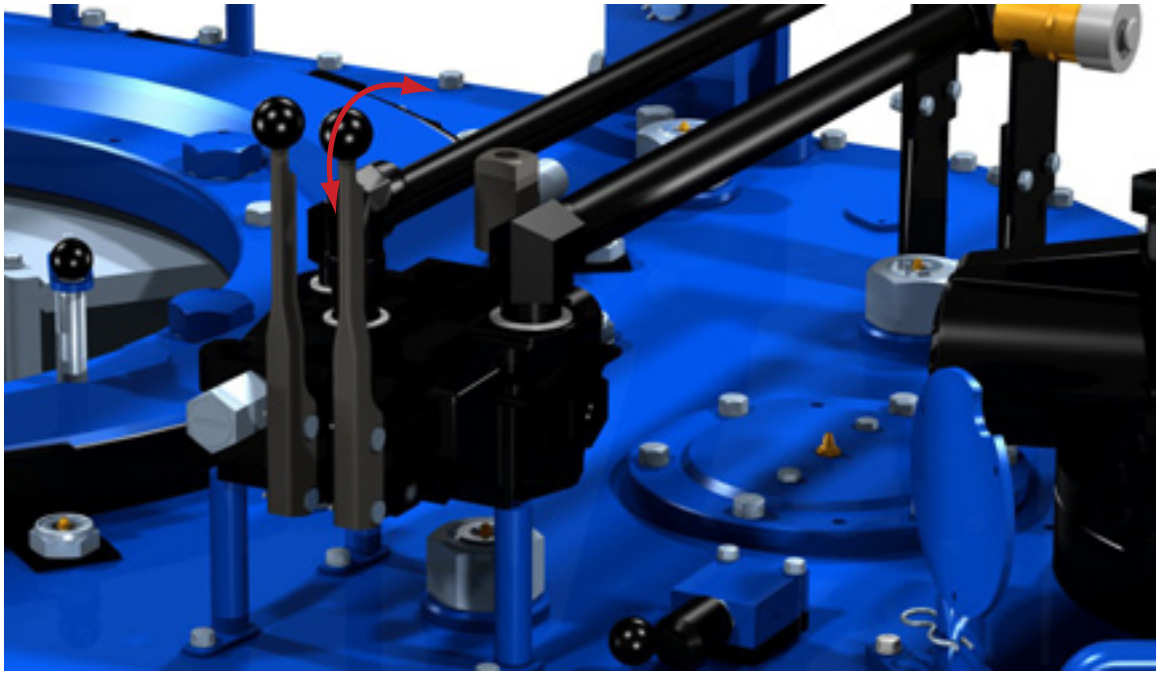
TONG MOTOR

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.



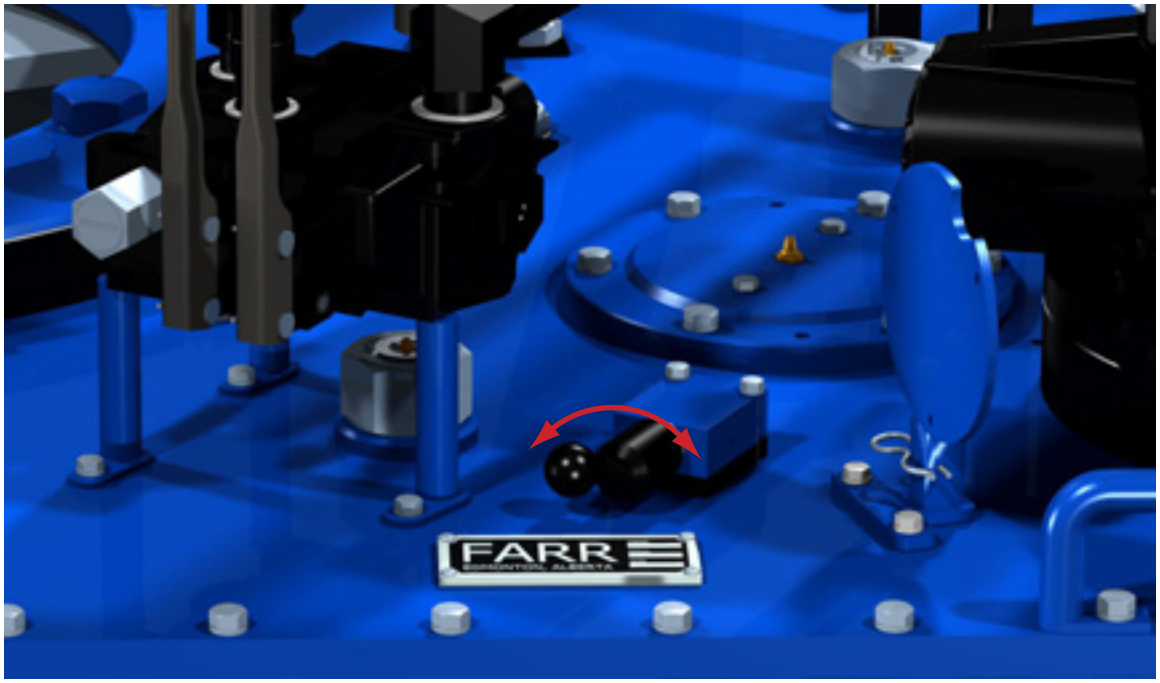
LIFT CYLINDER

This is a proportional 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.



MOTOR SPEED SHIFT

This is a two-way double-action valve, without proportional control. When the valve handle is in the "LO" position, the two-speed motor rotates at its slowest speed. Rotating the valve handle a quarter-turn clockwise to the "HI" position increases the motor to its HIGH speed. Note that maximum torque can only be applied with the tong motor rotating at its LO speed setting.



3. MAKING UP A PIPE OR CASING JOINT

a. *Position the tong around the pipe or casing.*

b. *Close and latch door completely.*

c. *Place the backing pin in the "make-up" position. When facing the front of the tong looking toward the rear, the "make-up" hole is to the left side of the backing pin pivot.*

d. *Adjust motor speed valve so that the motor will rotate at its lowest speed.*

e. *Push the "tong motor" handle slightly forward until the jaws "cam" with the pipe or casing, and then move the handle to its centre position so that the tong rotation stops.*

f. *Adjust motor speed so that the motor will rotate at its highest speed.*

g. *Push the tong motor handle forward to begin the rotation again, and rotate until the tong begins to "stall". Release the handle again to its centre position.*

h. *Adjust motor speed valve to its low speed setting to obtain highest torque. Use the tong motor valve to continue to rotate the pipe or casing until the desired make-up torque is achieved.*

i. *Once the joint has been made, pull the tong motor valve handle backwards to reverse the tong rotation and disengage the jaws and rotate the rotary gear until it aligns with the tong door opening.*

j. *Unlatch the door and remove the tong from the pipe or casing.*

4. BREAKING OUT A PIPE OR CASING JOINT

a. *Position the tong around the pipe or casing.*

b. *Close and latch door completely.*

c. *Place the backing pin in the "break-out" position. When facing the front of the tong looking toward the rear, the "break-out" hole is to the right side of the backing pin pivot.*

d. *Adjust motor speed valve so that the motor will rotate at its lowest speed.*

e. *Pull the "tong motor" handle slightly backward until the jaws "cam" with the pipe or casing, and then move the handle to its full reverse (backward) position to begin un-threading the joint. Under general "break-out" conditions Farr Canada recommends keeping the tong motor in its slowest speed until the joint is completely uncoupled.*

f. *When the joint is uncoupled reverse the rotation of the tong (push tong motor handle towards the tong) to disengage the jaws. Rotate the rotary gear until it aligns with the tong door opening.*

g. *Unlatch the door and remove the tong from the pipe or casing.*

5. GENERAL COMMENTS

a) *Position rotary gear in contact with both idler gears prior to 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. 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 OPERATING PERSONNEL

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.*

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Best By FAR™

FARR CANADA

A Division Of McCoy Corporation

Regular maintenance programs are necessary, and must be established to assure dependable and lengthy operation of your FARR Hydraulic Tubular Connection System. Use the following maintenance recommendations to enhance the life expectancy of the system and assure safety of operating personnel.

A. GENERAL MAINTENANCE SAFETY PRACTICES

All maintenance must be performed by trained and authorized personnel. Wear approved eye wear, and follow all of your company's safety guidelines.

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

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.

C. LUBRICATION

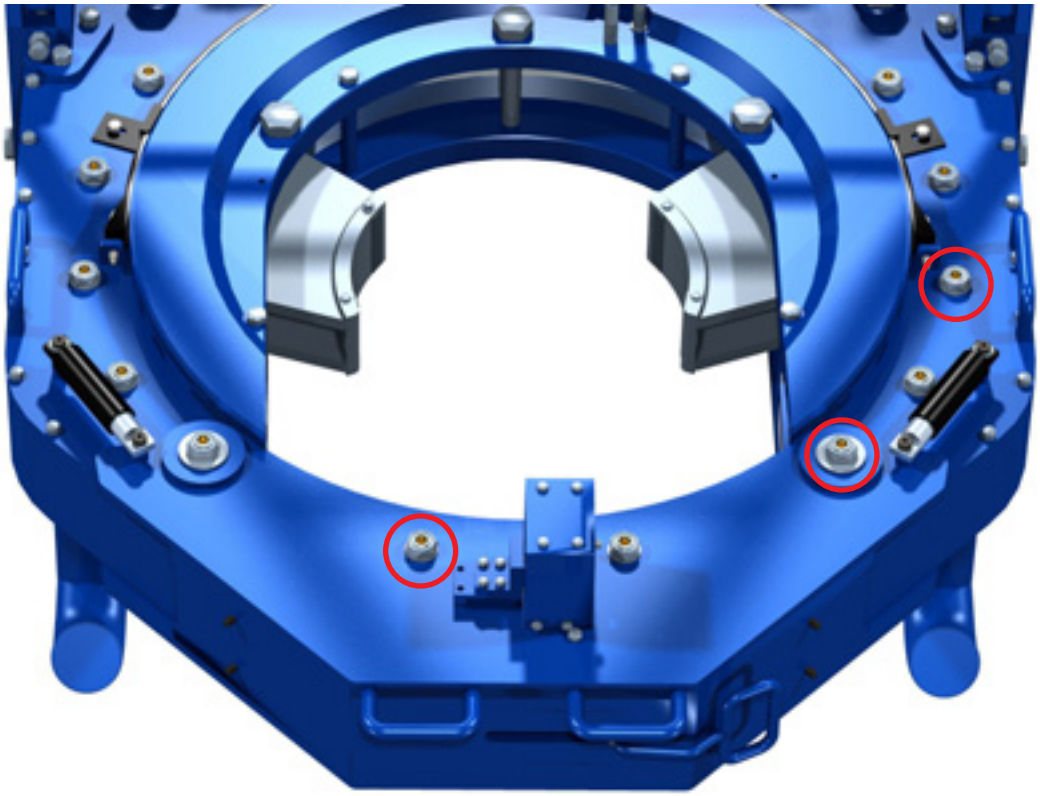
Use a quality multipurpose bearing lubricant that will remain within its viscosity range at expected operating temperatures. In addition, Farr recommends the following lubrication procedure at the completion of each job prior to storage.

1. Cage Plate Cam Followers

The cage plate cam followers are sealed units, and do not require lubrication.

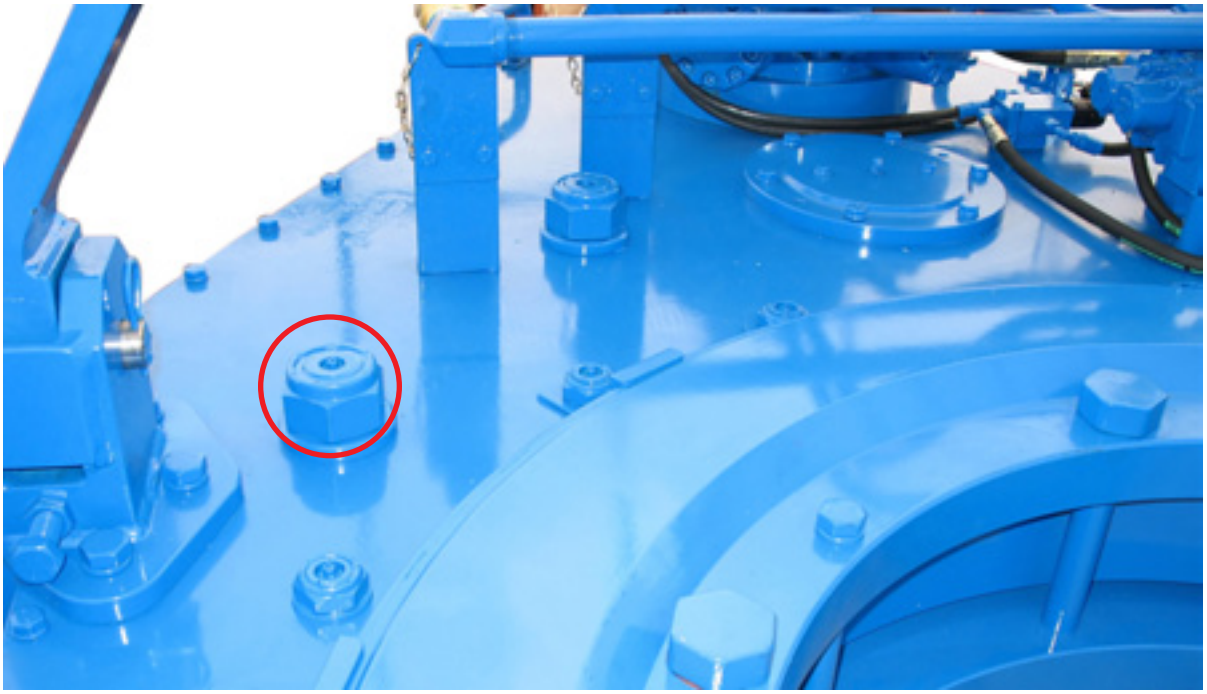
2. Support Rollers

Apply grease to the support roller bearings through the grease fittings recessed into the top and bottom of each support roller shaft 16 locations top, 16 locations bottom).



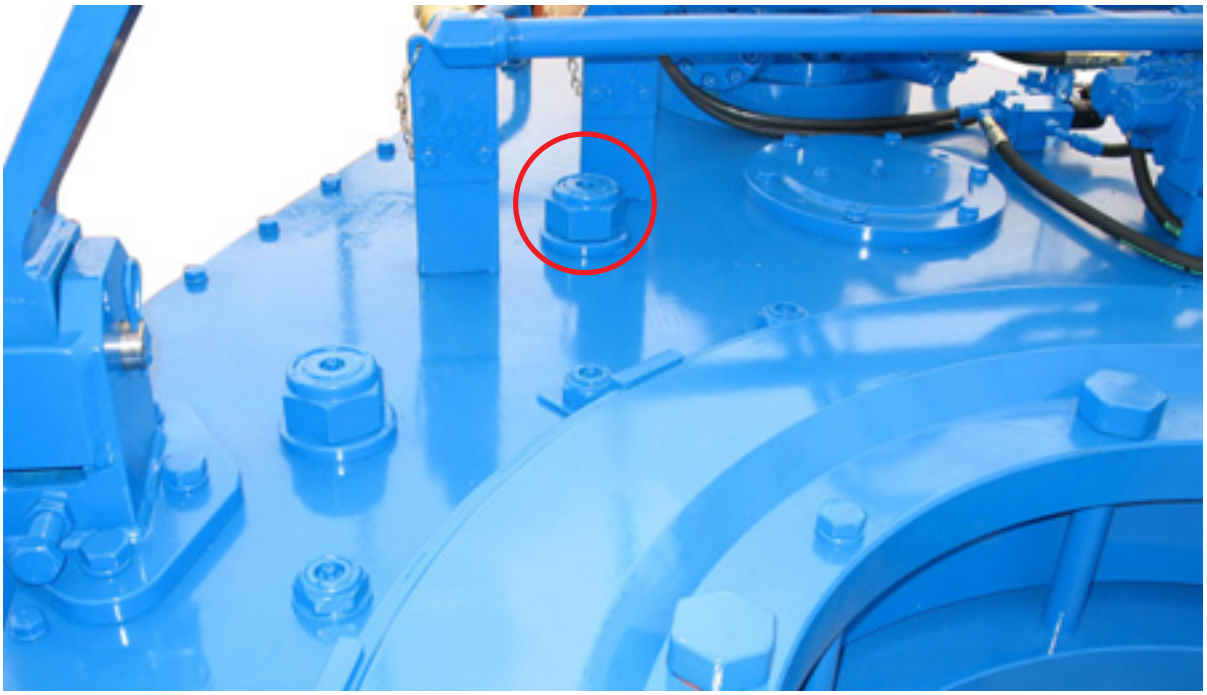
3. Rotary Idlers

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



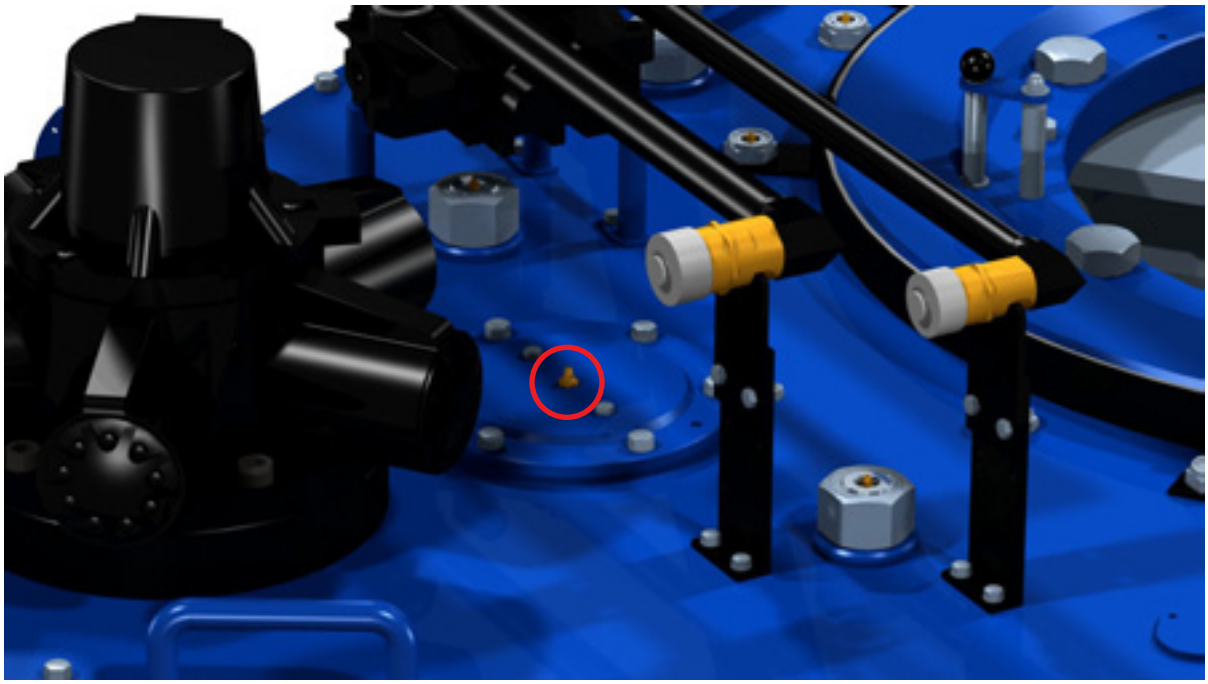
4. Pinion Idler

Apply grease to the pinion idler bearings through the grease fittings recessed into the tops of the half-shafts, located on the bottom face of the tong.



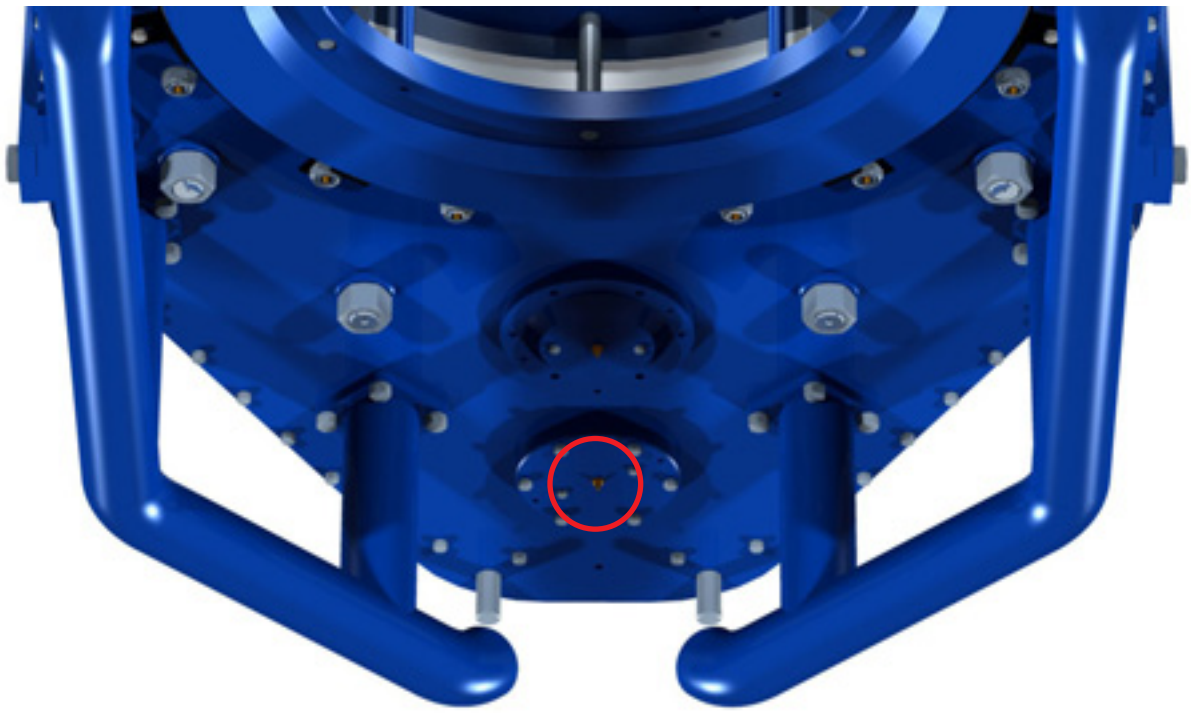
5. Pinion

Apply grease to the pinion bearings through the grease fittings located in the middle of the bearing caps on the top and bottom faces of the tong (one location top, one location bottom).



6. Motor / Drive Assembly Lubrication

Apply grease to the drive gear bearing through the grease fitting located in the center of the bearing cap on the bottom rear face of the tong.



Recommended lubrication amount at the completion of each job:

1.	*Rotary Roller Bearings (Upper and lower)*	*3 shots grease*
2.	*Rotary Idler Bearings*	*4 shots grease*
3.	*Pinion Idler Bearings*	*4 shots grease*
4.	*Pinion Bearings (Upper and lower)*	*2 shots grease*
6.	*Motor Mount Bearings*	*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.

C. ADJUSTMENTS

1. Brake Band Adjustments (See illustrations below)

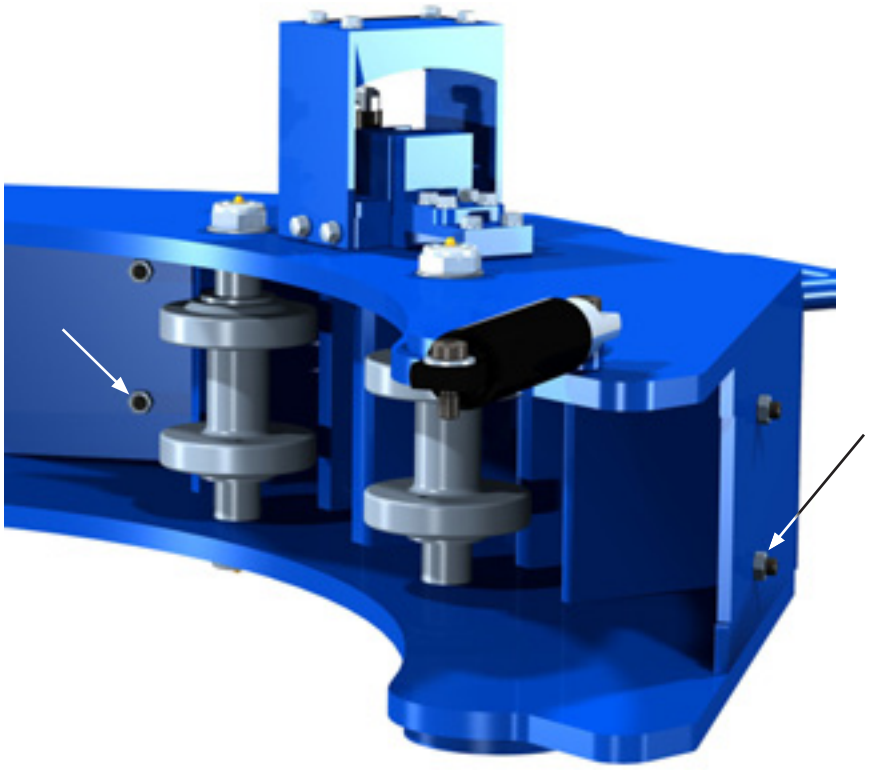
Brake bands must be periodically adjusted to continue to provide smooth and efficient jaw cam action. If the cage plate turns with the rotary gear, the jaws will not cam properly and, therefore, will not bite on the tubing or casing. Tightening the brake band against the cage plates will increase frictional 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. Do not over-tighten, as this causes excessive wear to the brake bands.

2. Tong Leveling

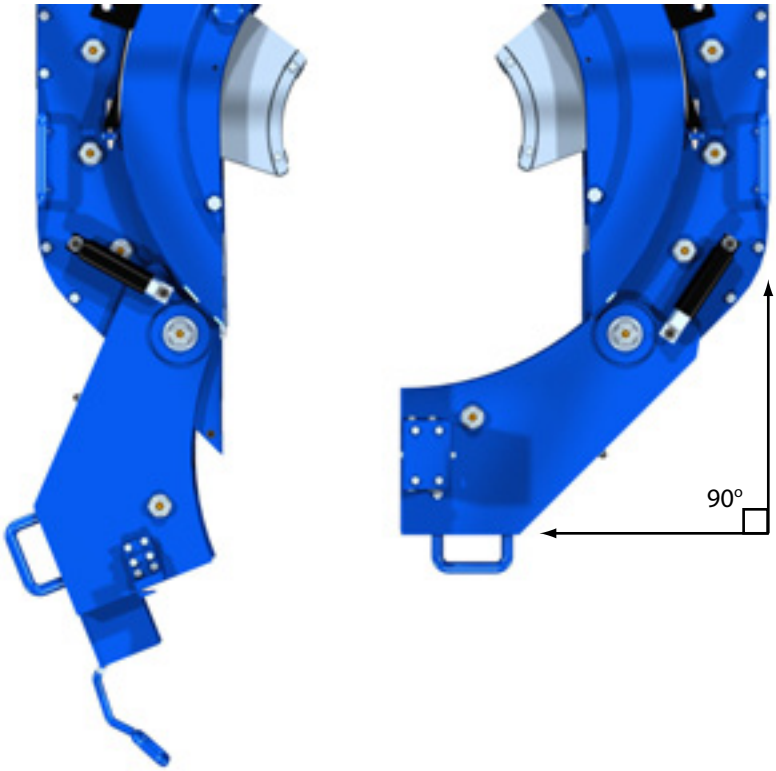
Periodic checks that the tong is hanging plumb and level are necessary to ensure accurate torque measurement. See Section 2.F.2 for detailed instructions for leveling the tong.

3. Tong Door Alignment Adjustments (See illustrations below)

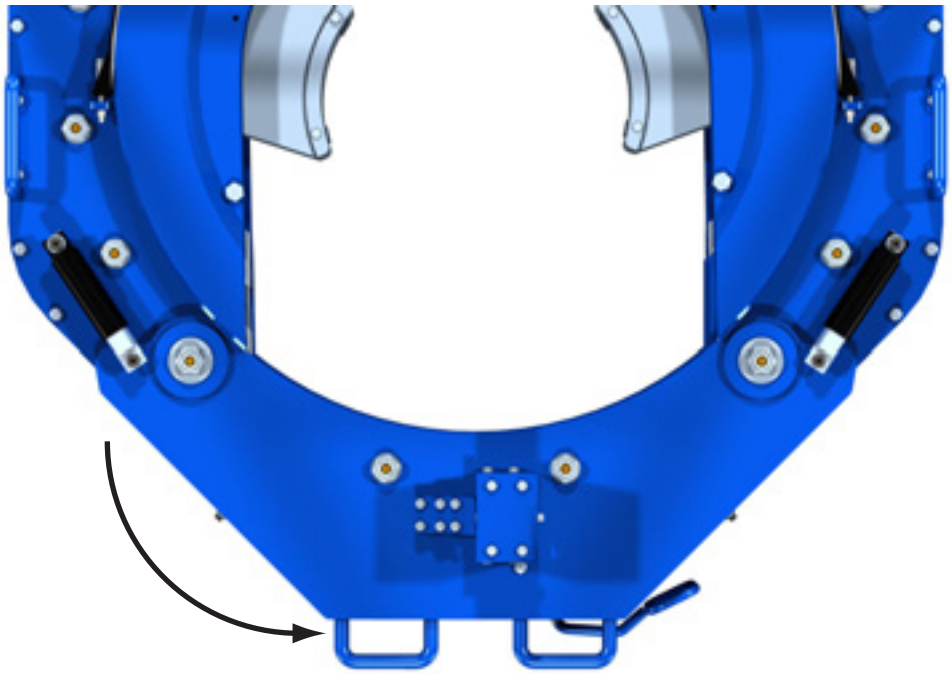
Open both doors, and loosen the jam nuts locking the door position set screws inside the front plates of the door assemblies (see illustration below) .



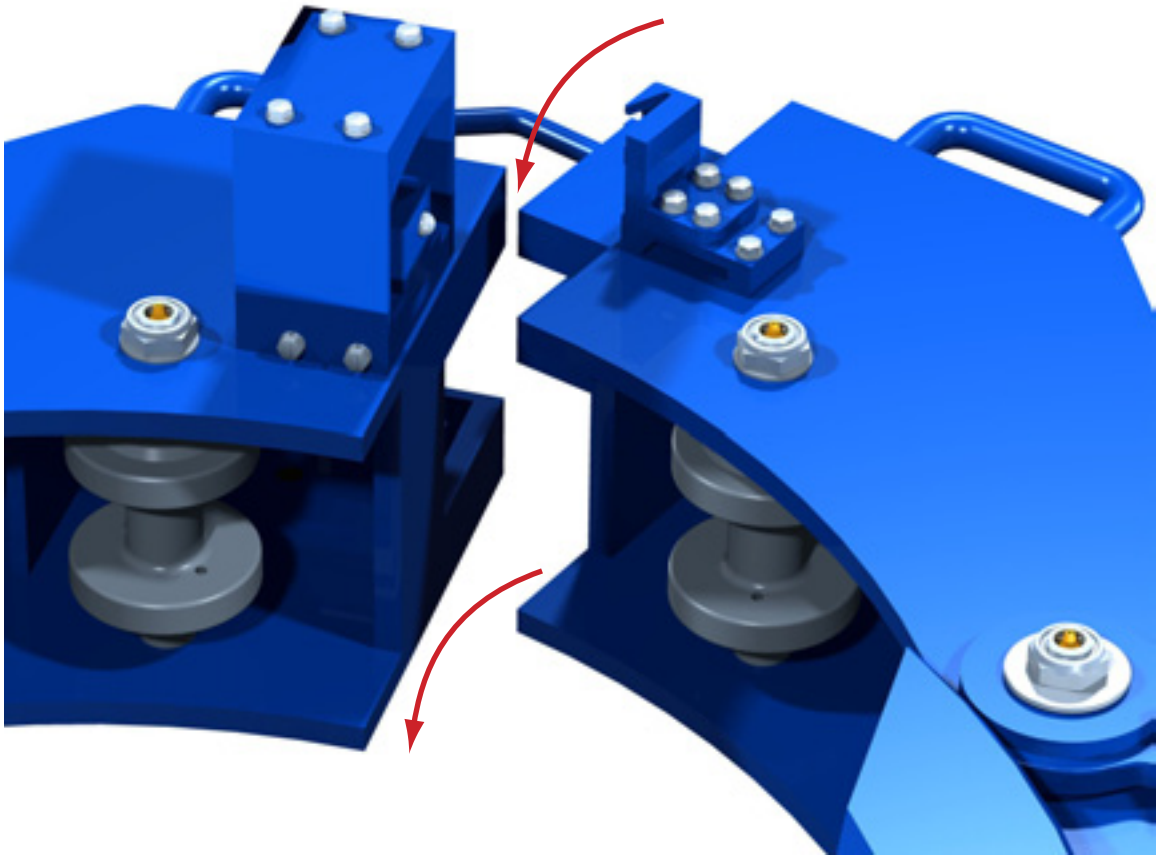
Close the LH tong door and, adjusting the set screws equally, adjust the door until it is perpendicular to the side body plate of the tong (see illustration below).



Close the RH tong door and, adjusting the set screws equally, adjust the RH door until the it is aligned to the LH door adjusted in the previous step. The locking cam on the RH door should lock smoothly with the locking pins in the LH door assembly.



Actuate the tong doors to ensure that there is no binding or other impediments to smooth operation. Grease the top and bottom locking pins on the LH door so that the locking cam on the RH door engages smoothly.



D. 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. 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. 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.

E. OVERHAUL PROCEDURES

Once the tong has been removed from frame assembly, it may be overhauled using the disassembly instructions specified in the following procedure. Access to the gear train is possible by removal of the top plate of the tong.

ALL MAINTENANCE AND OVERHAUL SHOULD BE PERFORMED FROM THE TOP. THEREFORE, THE BOTTOM PLATE OF THE TONG SHOULD NEVER BE REMOVED FROM THE GEAR CASE HOUSING.

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

! ***WHEN RE-ASSEMBLING LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) NOTE THAT THE ASSOCIATED FASTENERS MUST BE TIGHTENED TO THE CORRECT TORQUE SPECIFIED FOR THAT SIZE OF FASTENER. CHECK ALL CHAINS FOR DAMAGE BEFORE PLACING UNDER LOAD. ENSURE CHAINS ARE NOT KINKED BEFORE PLACING UNDER LOAD.***

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.

REMOVAL OF TOP PLATE:

1. *Remove load cell assembly and load cell pins while tong is suspended (if equipped).*
2. *Place the tong on its feet in the area in which the maintenance is to be performed.*
3. *Support the rigid sling to remove weight from the rigid sling hanger pins. Remove one hitch pin from each of the pins; remove both pins and the rigid sling assembly.*
4. *Disconnect the hydraulic connections from the motor. Undo the restraints securing the inlet and outlet lines from their supports, and remove the three 1/2" x 4-1/2" hex bolts securing the valve assembly to the support post weldments. Lift the hydraulic section away from the tong.*
5. *Remove the 1-1/4" x 5-1/2" hex bolts fastening the top sling hanger brackets to the bottom sling hanger brackets (one bolt and nut per side).*
6. *Remove the top sling hanger brackets on each side of the tong (three 3/4" x 2" hex bolts per side).*

7. *Remove the top and bottom brake band assemblies.*

8. *Remove the tong doors (one door at a time):*

   i. *Remove the door cylinders.*
   ii. *Remove the thin nylock nuts and large flat-washers from the top of the two door pivot roller shafts.*
   iii. *Ensure each door assembly is well-supported when performing this next step. Use a soft alloy material (e.g. brass rod, etc.) to lightly tap the shaft down through the support roller assembly until it drops out. Use caution that the threads on the ends of the support roller shafts are not damaged.*

10. *Remove the five 3/4" socket head cap screws securing the hydraulic motor to the motor mount, and remove the motor. Inspect the splined motor shaft for clashing or spline damage.*

11. *Remove the motor mount by removing the four 3/4" socket head cap screws. The motor mount can be lifted out of place.*

12. *Remove the jaw pivot bolts and the jaw assemblies.*

13. *Remove the 3/8" nylock nut connecting the backing pin to the backing pin pivot. Remove the backing pin and retainer - if desired, the pivot can be un-threaded from the top cage plate.*

! ***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. *Ensure the bottom cage plate is well supported. Remove the four 3/4" x 9" cage plate bolts. Pull the top cage plate straight up from the top plate - be very careful not to damage the cam follower array that is bolted to the top plate. Remove the bottom cage plate - also make sure that the bottom cam follower array is not damaged.*

15. *Pull the top bearing cap and spacer for the pinion gear by removing the six 1/2" bolts securing 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 SERVICE PERSONNEL RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.***

16. *Remove the top 1-3/4" nylock nuts and pads for the rotary and pinion idler gears.*

17. *Remove the top roller shaft thin nylock nuts and washers. Note that two of the top brake band lug weldments will be released - set them aside so they are not misplaced.*

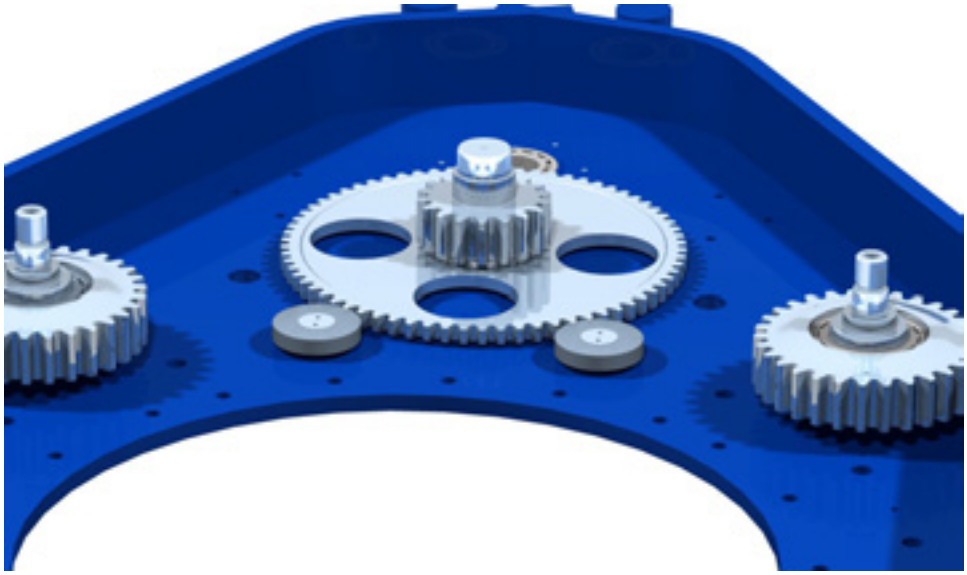
18. *Remove the top plate fasteners (hex head bolts & socket head cap screws) around the perimeter of the tong which secure the top plate to the gear case housing.*

19. *Use a soft alloy material (e.g. brass rod, etc.) to lightly tap the remaining support roller shafts down through the support roller assemblies until they are roughly flush with the bottom side of the top plate of the tong. Use caution that the threads on the ends of the support roller shafts are not damaged.*

20. *With all the above steps taken, the top tong plate can be lifted off providing access to the inside of the gear case. Use this opportunity to inspect the cam follower array mounted on the top and bottom plates - replace damaged cam followers where necessary.*

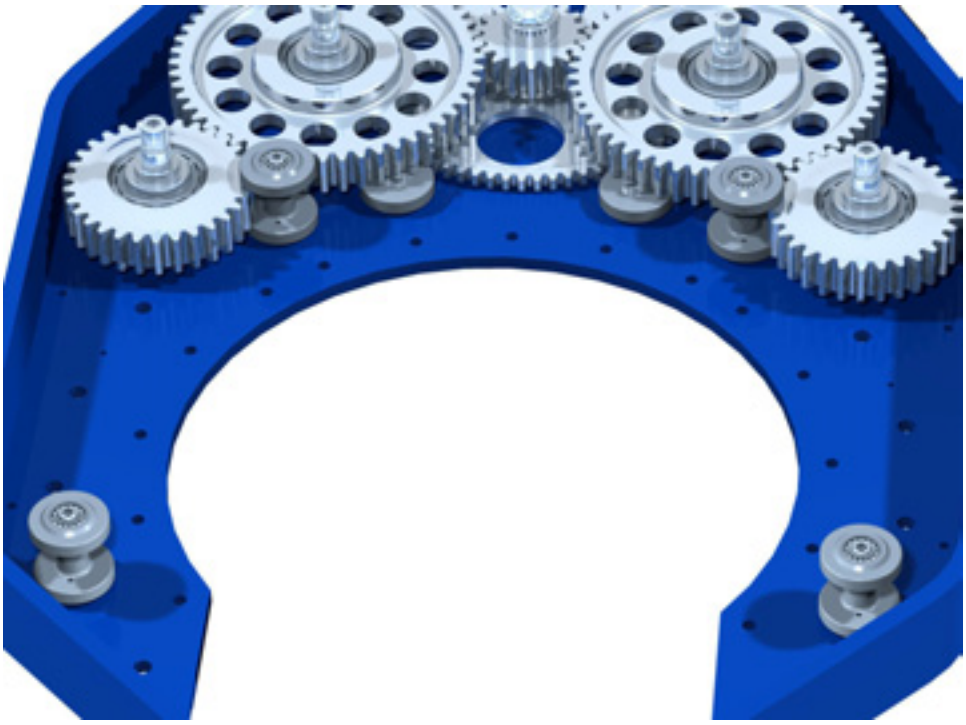
F. TONG MECHANICAL ASSEMBLY PROCEDURES

1. *Position the tong body gear case on a suitable stationary support such that the bottom body plate is accessible.*
2. *Press spherical roller bearing, PN 1095-105-50202, into bottom pinion bearing cap, and install bearing cap into bottom plate of tong.*
3. *Press spherical roller bearing, PN 1095-105-50202 into motor mount bearing cap, and install bearing cap onto the bottom plate of tong.*
4. *Install bearing retainer ring, PN 1095-105-50903 into one of the two rotary idler gears, PN 1095-510. Install a bearing seal, PN 1095-105-515 on the inside of the retainer ring (closer to centre of the gear). Position the gear with the retainer ring side down, and press a spherical roller bearing, PN 1095-105-50902 into the gear right up to the bearing seal.*
5. *Slide the assembly from step (4) over a rotary idler shaft, PN 1095-516, and place assembly into the proper position through the bottom plate. Loosely secure the bottom side of the shaft to the bottom plate with a pad, PN 1095-116, and a 1-3/4" hex nylock nut.*
6. *Repeat steps 4 & 5 for the remaining rotary idler assembly.*
7. *Each side of the pinion gear, PN 1095-504, has a shoulder. Centre the gear over the lower pinion bearing cap with the larger of the two shoulders facing up.*
8. *Liberally grease the lower pinion bearing in the bearing cap and insert the main pinion gear/shaft through the gear installed in (7) into the bearing. Ensure the splines on the pinion gear/shaft mesh properly with the pinion gear.*
9. *Install the two bottom rear half-roller support assemblies into the bottom plate of the tong.*

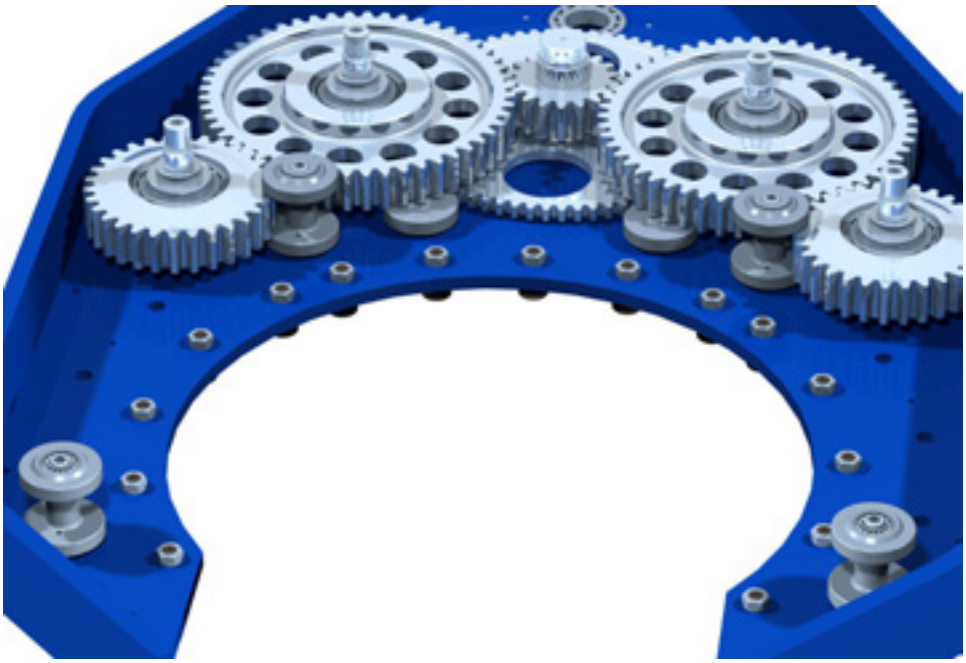


10. *Install bearing retainer ring, PN 1095-105-50903 into one of the two pinion idler gears, PN 1095-105-509. Install a bearing seal, PN 1095-105-515 on the inside of the retainer ring (closer to centre of the gear). Position the gear with the retainer ring side down, and press a spherical roller bearing, PN 1095-105-50902 into the gear right up to the bearing seal.*
11. *Slide the assembly from step (7) over a pinion idler shaft, PN 1095-516, and place assembly into the proper position through the bottom plate, meshing with the rotary idler and the pinion gear. Loosely secure the bottom side of the shaft to the bottom plate with a pad, PN 1095-116, and a 1-3/4" hex nylock nut.*
12. *Repeat steps 9 & 10 for the remaining pinion idler assembly.*
13. *Place two support roller assemblies, less the shafts and the top washers, near the front of the tong. Also install the two support roller assemblies next to where the pinion idler & rotary idler gears mesh. These, along with the half-roller assemblies installed in (9) will be used to support the initial installation of the rotary gear. Liberally grease the shafts for the support roller assemblies, and slide each shaft into a support roller assembly from the bottom. Insert shaft until the top of the shaft protrudes just above the support roller sleeve (see illustration next page). The shafts may have to be lightly tapped with a soft metal instrument.*

TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):

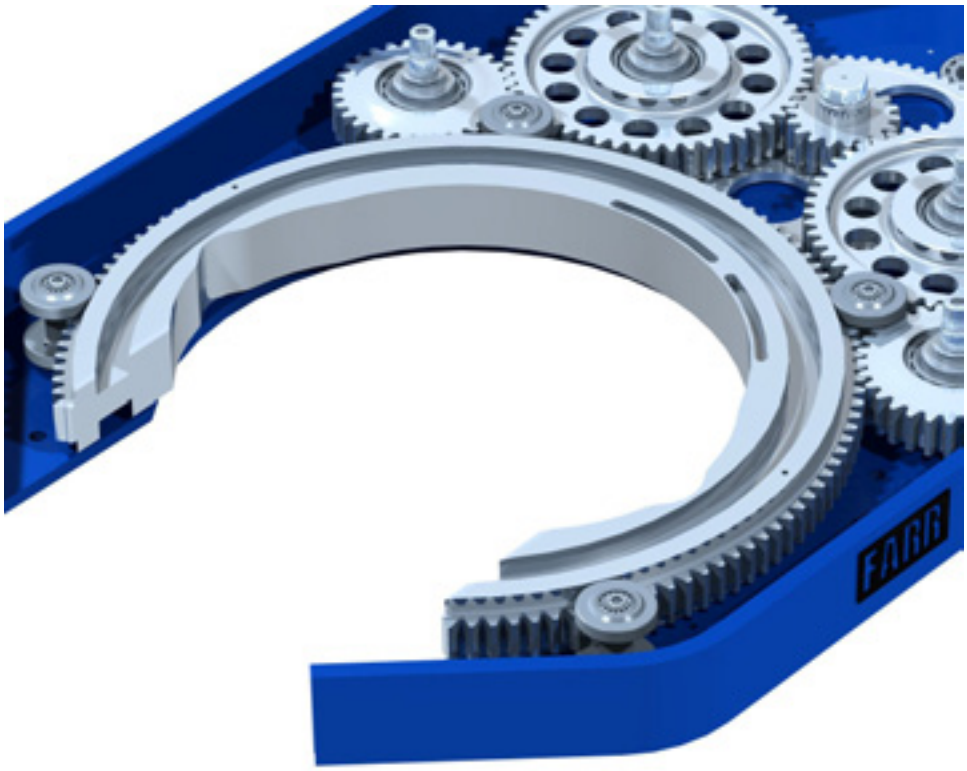


14. *Install the bottom cam follower array, ensuring the nuts and washers are on the top side of the bottom plate. Secure each cam follower, PN 101-3200, with a 7/8" lock-washer and a 7/8 UNC jam nut (15 locations on bottom plate). Note that the cam followers are sealed units and do not require lubrication.*



TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):

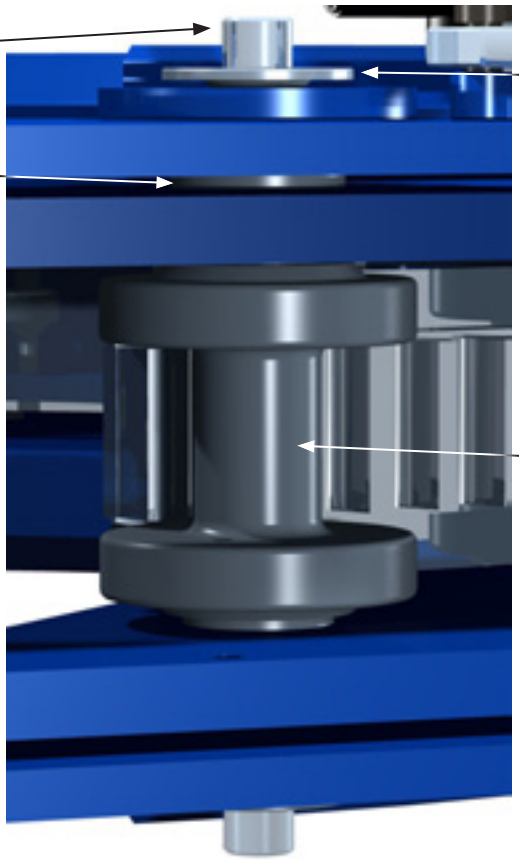
15. *Install rotary gear. Note that the backing pin grooves are in the top side of the rotary gear. Support the rotary gear using the previously placed support roller and half-roller assemblies.*



16. *Install the remainder of the support roller assemblies around the rotary gear, including the door pivot roller assemblies. Insert the remainder of the support roller shafts, except for the door pivot roller shafts, so that they protrude just above the top of the inner support roller sleeve.*
17. *Place an idler gear spacer, PN 1095-522, shoulder side up over each of the four pinion idler and rotary idler gears.*
18. *Liberally grease the lower motor bearing in the bearing cap, and place the drive gear into the bearing ensuring it meshes with the low pinion gear. Insert the gear spacer, PN 1095-105-517, inside the drive gear from the top ensuring it rests at the bottom of the splined inner surface of the gear.*
19. *Install cam follower array on the top plate of the tong, ensuring the nuts and washers are on the bottom side of the top plate. Secure each cam follower, PN 101-3200, with a 7/8" lock-washer and a 7/8 UNC jam nut (15 locations on top plate). Note that the cam followers are sealed units and do not require lubrication.*
20. *Install the two top rear half-roller support assemblies into the top plate of the tong, directly above where the bottom two half-roller assemblies were installed.*
21. *Position the top plate in its proper location and insert dowel pins. Use caution not to damage threads when aligning the top plate with the idler and support roller shafts.*
22. *Loosely install top plate fasteners except for those coincidental with the four body handles - tighten only finger-tight at this point.*
23. *Gently tap the support roller shafts from the bottom up through the top plate. Position shafts so that there is roughly the same amount protruding from the top plate as there is from the bottom plate.*
24. *Loosely install the nylock nuts and washers for the support roller shafts EXCEPT those two assemblies directly adjacent to the half-roller assemblies. These nylock nuts will be used in the future to secure the brake band retainers. Ensure the nylock nuts are only loosely tightened at this time.*
25. *Loosely install the remaining 1-3/4" nylock nuts and pads onto the rotary and pinion idler assemblies - ensure these nuts remain loosely tightened at this point.*
26. *Press the remaining bearing in the pinion assembly into the top pinion bearing cap. Liberally grease the bearing, and install the bearing cap in the top plate of the tong over the end of the pinion gear/shaft.*

TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):

27. *Position the top cage plate in place around the top cam follower array - use caution not to damage the cam followers when placing the top cage plate in position. Insert four 3/4" x 9" bolts through the top of the cage plate. Attach the bottom cage plate to the top cage plate, again using caution not to damage the lower cam followers (do not neglect to install the four cage plate spacers, PN 1095-38, over the shafts of the bolts, between the cage plates). Thread the bolts into the bottom cage plate until tight.*
28. *Install motor mount, and secure in place with four 3/4" NC x 1-1/2" socket head cap screws and lock-washers.*
29. *Lower Staffa motor onto motor mount ring, using extreme caution to ensure the splined shaft cleanly engages with the motor gear. Secure with five 3/4" NC x 2-3/4" hex cap screws and lock washers.*
30. *Press four door pivot bearings, PN 1095-103-318, into each door weldment (two per weldment).*
31. *If not already done, install locking pins and locking pin plates into the LH door weldment (See Pp. 6.32 - 6.33). Secure the locking pin plates with four each 1/2" NC x 3/4" hex socket head cap screws. Thread the locating bolts, PN 1095-403, into the ends of the lock pins through the top and bottom LH door plates.*
32. *If not already done, assemble the door lock handle assembly (See Pp. 6.33)*
33. *Mount one door support roller in each door assembly. Do not neglect to install the two roller cup spacers, PN 1095-105-527, between the support roller assembly and the insides of the door plates. Liberally grease the inside of the support roller assemblies, and insert the door roller shaft from the bottom. Push up through the door and support roller assemblies until there is roughly equal amounts of the shaft protruding from the top and bottom. The shafts may have to be tapped with a soft metal instrument - use caution not to damage the threads on the ends of the shaft. Secure with 1-1/8" UNF thin nylock nut and 1-1/8" narrow flat-washer on each side.*
34. *Liberally grease the door pivot bearings, and position each door half assembly over its respective door pivot roller. Do not neglect to install the door hinge spacers, PN 1095-105-528, between the outsides of the top and bottom door plates and the insides of the top and bottom body plate (two per assembly - see illustration below). Insert the pivot roller shaft from the bottom, push up through the door and support roller assemblies until there is roughly equal amounts of the shaft protruding from the top and bottom. The shafts may have to be tapped with a soft metal instrument - use caution not to damage the threads on the ends of the shaft. Place a door hinge washer, PN 1095-105-529 over the ends of the door pivot shafts before securing the doors with a 1-1/8" UNF thin nylock nut and 1-1/8" narrow flat-washer on each side. It is important to note that the shoulders on the door hinge spacers and the door hinge washers must face toward the bearings always, otherwise the doors will not operate smoothly and premature bearing failure will occur.*

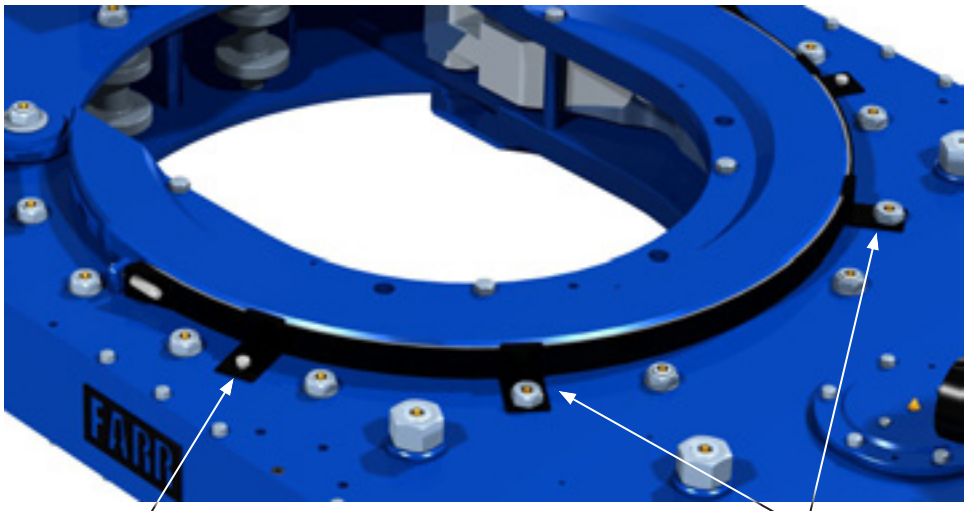


Shown with side body and door side removed for purposes of clarity.

TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):

35. *Install the two door cylinders, and secure with 5/8" x 3/4" shoulder bolts.*

36. *Install top and bottom brake band assemblies. Use two brake band retainers, PN 1095-138 on the top and two on the bottom, and secure them to the support roller shafts as noted in step (24). Secure in place with 1-1/8" thin nylock nuts. Note that flat-washers are not used at these four locations. Use two more retainers, PN 1095-137, per brake band assembly, and secure these retainers to the top plate with 1/2" NC x 1-1/4" hex bolts and lock-washers. Attach adjustment bolts, springs, and nuts to brake band assemblies.*



2 x Brake band Retainer PN 1095-137

2 x Brake band Retainer PN 1095-138

37. *Install backing pin assembly to top cage plate (see Pp. 6.20 - 6.21).*

38. *All top plate fasteners, all support roller fasteners, all gear bearing cap fasteners, and all other fasteners on the tong assembly may now be tightened.*

39. *Install lower rigid sling bracket weldments, PN 1095-224, onto the bottom plate of the tong and secure each with three 3/4" NC x 2" hex bolts and 3/4" lock-washers.*

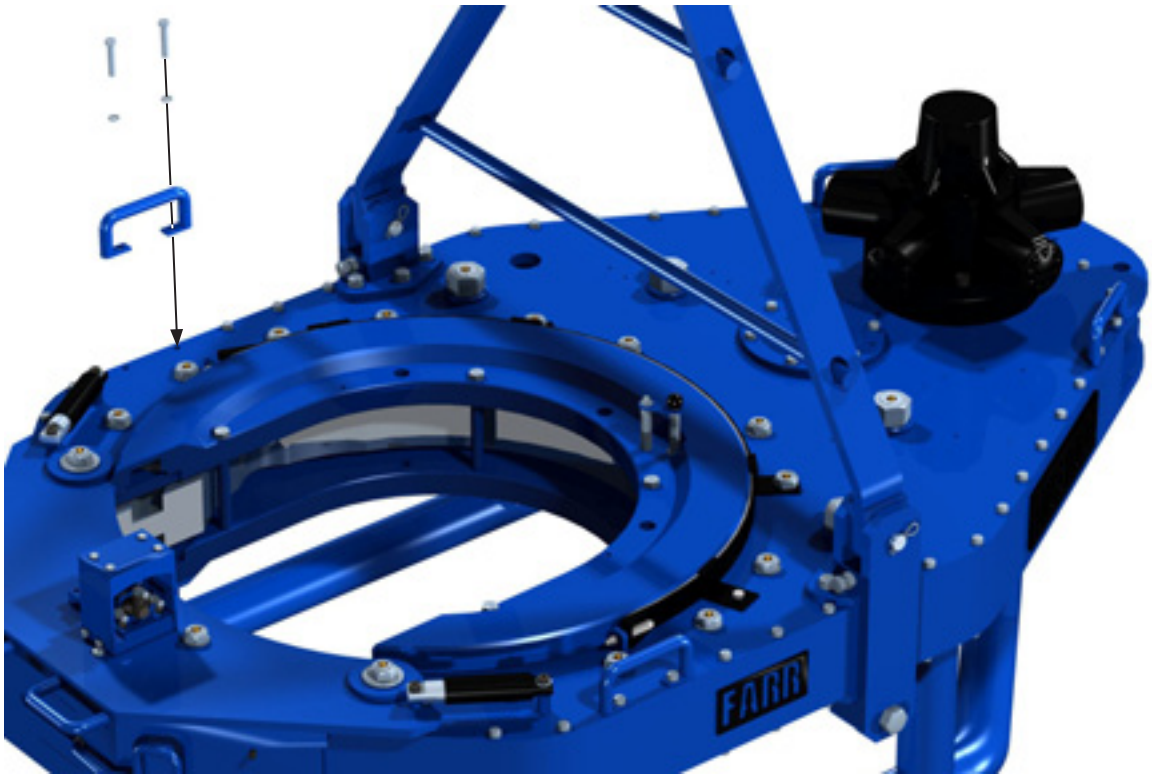
40. *Install a 3/4" NC x 3-1/2" hex bolt and 3/4" NC nut (tong leveling adjustments) into the upper rigid sling bracket weldments. Attach the upper rigid sling bracket weldments to the top plate of the tong with three 3/4" NC x 2" hex bolts and 3/4" lock-washers (ensure adjustment bolts face towards front of tong). Connect the upper and lower sling brackets on each side using a 1-1/4" NC x 5-1/2" heavy hex bolt and 1-1/4" nylock nut (see Pp. 6.28 - 6.29).*

TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):

41. *Attach the rigid sling to the brackets using two rigid sling pins, PN 1095-225-03. Secure each pin in place with two 0.148" x 2.938" hitch pins.*

42. *Suspend the tong using the sling, and attach the tong leg weldments. Secure each leg using twelve 3/4" NC x 2" hex bolts and 3/4" lock-washers. Set the tong down on its legs to complete assembly.*

43. *Attach four handle weldments to the top plate as shown in the following illustration.*



45. *Attach adjustable hydraulic support weldments, PN 101-1138, to the top plate of the tong using two 3/8" NC x 1-1/4" hex bolts and 3/8" lock-washers per weldment. Attach the adjusting plate to the support weldments using two 3/8" NC x 1" hex bolts, four 3/8" narrow flat-washers and two 3/8" NC nylock nuts per assembly (see Pp. 6.24 - 6.25).*

46. *Attach three hydraulic valve supports to the top plate using one 3/8" NC x 1-1/4" hex bolts and 3/8" lock-washers per support post (see Pp. 6.24 - 6.25).*

47. *Attach the hydraulic valve assembly to the three supports installed in (46), and secure to the posts using three 1/2" NC x 4-1/2" hex bolts and 1/2" narrow flat-washers.*

48. *Attach torque gauge mount holder, PN 101-0480, to the top plate of the tong using two 3/8" NC x 1-1/4" hex bolts and 3/8" lock-washers. Place the torque gauge mount, PN 1500-09-03A, into the torque gauge mount holder and secure with a 0.148" x 2.938" hitch pin.*

49. *If your tong is equipped with a safety door, follow this procedure to install the mechanical components (see Pp.6.34 - 6.35)*

    i. *Attach RH safety door latch plate, PN 101-0479, to the RH door weldment using two 3/8" NC x 1-1/2" hex bolts and lock-washers and two 3/8" NC x 1-1/2" flat head countersunk cap screws.*

    ii. *Attach RH safety door latch block, PN AE13-302M, to the RH safety door latch plate.*

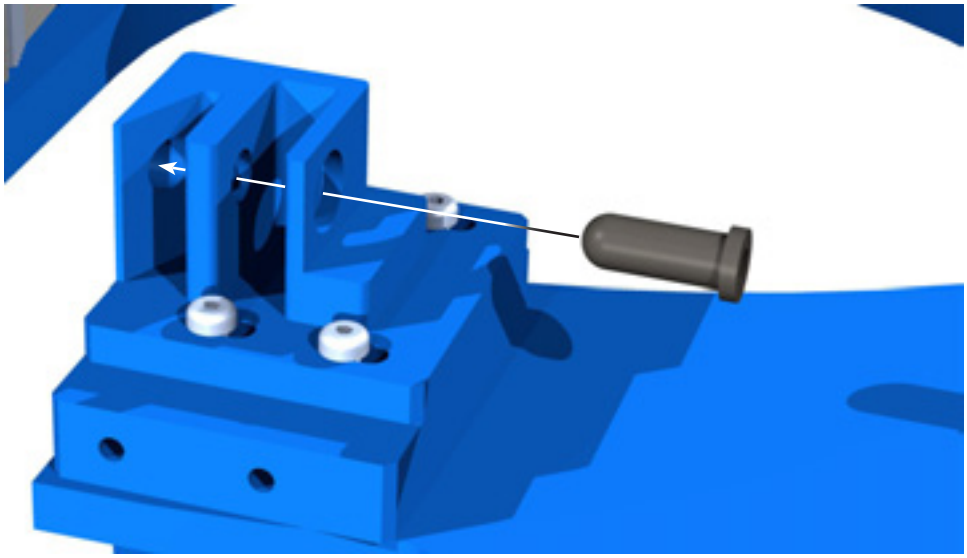
    iii. *Attach LH safety door latch plate, PN 101-0915, to the LH door weldment using three 3/8" NC x 1-1/2" flat head countersunk cap screws.*

    iv. *Attach LH safety door latch block, PN AE13-301S, to door latch plate # 2, PN AE13-311 using three 3/8" NC x 3/4" flat head countersunk cap screws.*

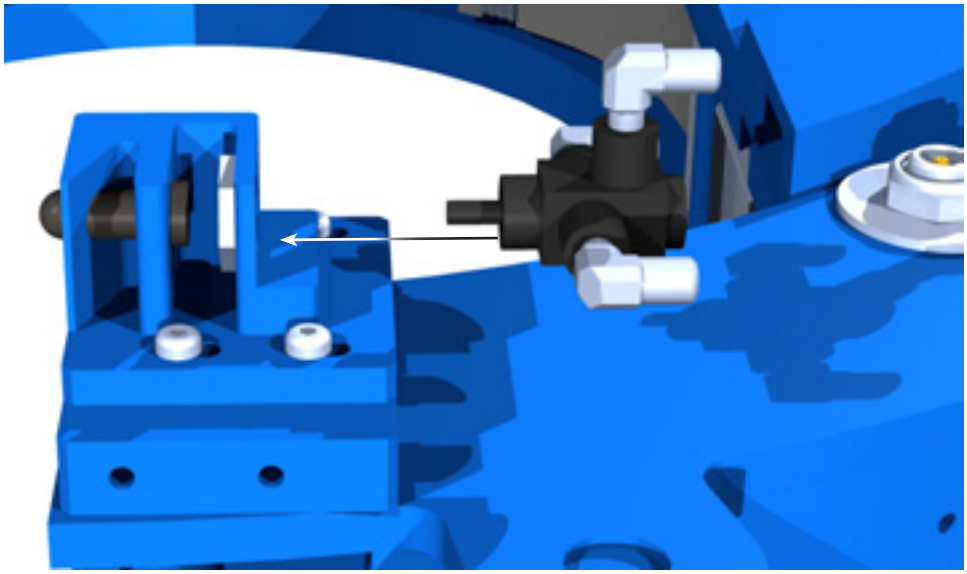
    v. *Attach LH safety door latch plate #2 to the LH safety door latch plate using four 5/16" NC x 3/4" head socket shoulder screws.*

    vi. *Insert load plunger, PN AE12-306, into LH safety door latch block (see illustration next page).*

TONG MECHANICAL ASSEMBLY PROCEDURES (continued...):



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 below, and secure the safety door valve to the LH safety door latch block using the valve lock nut.*



viii. *Attach the safety door protector weldment, PN 101-0450, to the LH safety door latch plate using four 3/8" NC x 1" hex bolts and lock-washers. Note that the protector has a removable top plate, PN 101-1238, that is attached to the protector weldment using four 3/8" NC x 3/4" hex bolts and lock-washers.*

50. *Install the desired size of jaws using the jaw pivot bolts. Note that there is no rear jaw used - the rear jaw pivot bolt is a "dummy".*

51. *Install the load cell pins, PN 101-2451, and, if prepared, the tension load cell assembly.*

Adequate maintenance and proper fluid selection should keep hydraulic problems to a minimum. If troubleshooting is necessary, ensure that the technician is well-trained in hydraulic systems, and familiar with the equipment design, assembly and operation. Knowledge of hydraulic circuits and components is essential in isolating trouble areas and pinpointing particular faults.

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

A. POWER UNIT PUMP MAKES EXCESSIVE NOISE

1. *POSSIBLE PROBLEM: Plugged or restricted intake line.*
   SOLUTION: Clean intake line.

2. *POSSIBLE PROBLEM: Plugged reservoir air vent.*
   SOLUTION: Clean or replace.

3. *POSSIBLE PROBLEM: Fluid viscosity too high due to low ambient temperature.*
   SOLUTION: Replace fluid with a type that maintains the proper viscosity range in the operating environment.

4. *POSSIBLE PROBLEM: Air leaking into system.*
   SOLUTION: Ensure oil pickup is well below oil surface level in reservoir. Check pump packing and line connections on intake side by pouring oil over the suspected leak. If the noise stops, the leak has been located. Tighten joints or change packing or gaskets where necessary.

5. *POSSIBLE PROBLEM: Loose or worn parts.*
   SOLUTION: Replace parts. NOTE: Improper selection of hydraulic fluid may result in premature wear.

6. *POSSIBLE PROBLEM: Pump misalignment with motor.*
   SOLUTION: Check alignment.

7. *POSSIBLE PROBLEM: Pump running in excess of rated speed.*
   SOLUTION: Check manufacturer's recommended speed. Check pulleys, gears, power takeoff, or drive motor.

B. HYDRAULIC SYSTEM OVERHEATING

1. *POSSIBLE PROBLEM: Excess discharge pressure (relief valve set too high).*
   SOLUTION: Reset relief valve in accordance with maximum pressure required. Check manufacturer's recommendations.

2. *POSSIBLE PROBLEM: Fluid viscosity too high or too low due to extreme ambient temperatures.*
   SOLUTION: Replace fluid. (Check pump and motor manufacturer's recommendations.)

3. *POSSIBLE PROBLEM: Excessive internal leakage.*
   SOLUTION: Repair or replace any worn parts (loose packing, etc.)

4. *POSSIBLE PROBLEM: Excessive friction.*
   SOLUTION: Check pump for part interference. Pump may be assembled too tightly.

5. *POSSIBLE PROBLEM: Leaks in pump check valve or relief valve.*
   SOLUTION: Repair or replace.

6. *POSSIBLE PROBLEM: Fluid level in reservoir too low for proper cooling.*
   SOLUTION: Maintain proper oil level.

7. *POSSIBLE PROBLEM: Pump discharge being restricted.*
   SOLUTION: Check operation of throttle valve. Check relief valve. Do not allow larger pump volumes to remain at high pressure for long periods of time. Check all self-sealing hose connections for proper engagement.

8. *POSSIBLE PROBLEM: Hydraulic system valves restricted.*
   SOLUTION: Clean valves and piping.

9. *POSSIBLE PROBLEM: Heat exchanger not cooling hydraulic fluid.*
   SOLUTION:
   - *Hydraulic circuit through heat exchanger is obstructed.*
   - *Cooling coils in heat exchanger may be coated with a layer of dust.*
   - *Airflow through heat exchanger may be obstructed.*
   - *Cooling fan may be malfunctioning*

C. EXCESSIVE WEAR OF MOVING PARTS

1. *POSSIBLE PROBLEM: Abrasive contaminants entrained in the fluid.*
   SOLUTION: Change fluid more frequently. Replace filter element. Be sure filter is proper size.

2. *POSSIBLE PROBLEM: Misalignment of moving parts.*
   SOLUTION: Inspect and realign.

3. *POSSIBLE PROBLEM: Operating pressure rises above manufacturer's recommendations.*
   SOLUTION: Check relief valve and reset.

4. *POSSIBLE PROBLEM: Viscosity of fluid too low at working temperature.*
   SOLUTION: Ensure fluid is compatible with operating temperature.

5. *POSSIBLE PROBLEM: Air in system.*
   SOLUTION: Bleed air and check for leaks in system.

6. *POSSIBLE PROBLEM: Excessive wear of bearings.*
   SOLUTION: Inspect alignment of moving parts, vibration or excessive side thrusts on shafts.

D. TONG RUNNING TOO SLOWLY

1. *POSSIBLE PROBLEM: Pump intake line plugged.*
   SOLUTION: Clean intake line.

2. *POSSIBLE PROBLEM: Reservoir oil level too low.*
   SOLUTION: Add oil.

3. *POSSIBLE PROBLEM: Air leak in pump intake line.*
   SOLUTION: Repair leak.

4. *POSSIBLE PROBLEM: Pump speed too slow.*
   SOLUTION: Check manufacturer's speed recommendations.

5. *POSSIBLE PROBLEM: Excessively worn or damaged pump or tong.*
   SOLUTION: Replace worn parts by following manufacturer's recommendations.

6. *POSSIBLE PROBLEM: Fluid viscosity too high.*
   SOLUTION: Some pumps will not prime if the fluid is too heavy.

* **BYPASS ALL TONG CIRCUITRY TO TEST PRESSURE AND VOLUME. IF FLOW AND PRESSURE ARE TESTED OFTEN, FARR RECOMMENDS CONSTRUCTION OF A TEST RIG THAT CAN EASILY BE CONNECTED TO THE PUMP SUCTION AND DISCHARGE PORTS**

7. *POSSIBLE PROBLEM: Restriction in line between power unit and tong.*
   SOLUTION: Check self-sealing couplings to insure they are properly engaged.

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

E. TONG WILL NOT DEVELOP SUFFICIENT TORQUE

1. *Malfunctioning relief valve on unit or tong.*

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

2. *POSSIBLE PROBLEM: Worn or damaged pump parts.*
   SOLUTION: Inspect and clean, replace all worn or broken parts.

3. *POSSIBLE PROBLEM: Pump speed too slow.*
   SOLUTION: Check motor speed.

4. *POSSIBLE PROBLEM: Fluid viscosity too high.*
   SOLUTION: Pump may not prime if fluid is too heavy. Replace with proper viscosity fluid.

5. *POSSIBLE PROBLEM: Viscosity of fluid too low.*
   SOLUTION: System may overheat. Replace with proper viscosity fluid.

6. *POSSIBLE PROBLEM: Fluid by-passed to reservoir.*
   SOLUTION: Check relief valve for proper operation. Check directional valve. Neutral position should return fluid directly to the reservoir.

7. *POSSIBLE PROBLEM: Worn or damaged tong motor causing slippage.*
   SOLUTION: Replace or repair worn or damaged parts.

8. *POSSIBLE PROBLEM: Damaged bearings or gears causing excessive drag.*
   SOLUTION: Repair or replace worn parts.

9. *POSSIBLE PROBLEM: Poor hydraulic pressure at the tong or excessive back pressure in the return line.*
   SOLUTION: Restriction in line between power unit and tong. Inspect integrity of self-sealing couplings.

10. *POSSIBLE PROBLEM: Defective torque gauge or load cell.*
    SOLUTION: Replace defective components. Ensure dampening screw has been adjusted. Ensure gauge has been calibrated to proper torque arm length.

F. FAILURE OF JAWS TO GRIP PIPE

1. *POSSIBLE PROBLEM: Dies have become too dull.*
   SOLUTION: Replace dies.

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

3. *POSSIBLE PROBLEM: Jaw roller broken or worn.*
   SOLUTION: Replace roller.

4. *POSSIBLE PROBLEM: Incorrect size jaws installed.*
   SOLUTION: Double-check that proper size jaws are installed..

G. GENERAL COMMENTS

The following factors contribute highly to inefficient hydraulic operation:

1. *Failure to change fluid frequently enough, or inadequate fluid filtration.*
2. *Unsuitable hydraulic fluid.*
3. *Defective packing or seals in components of the hydraulic system.*
4. *Poor or incomplete understanding of hydraulic system components and/or operation of the equipment.*
5. *Ensure hydraulic fluid is at operating temperature. Failure to do so may result in incorrect operation of sequenced valves and general inconsistent system operation.*

H. GENERAL COMMENTS

The following factors contribute highly to inefficient hydraulic operation:

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4. *Poor or incomplete understanding of hydraulic system components and/or operation of the equipment.*

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 Canada recommends that all hydraulic lines are fully disconnected, and residual hydraulic pressure is bled off. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid.

DEPRESSURIZATION PROCEDURE IN PREPARATION FOR STORAGE:

1) *Rotate the tong so that the opening in the rotary gear faces the gear train (towards the rear of the tong). Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder (if equipped). If mounted in a frame, retract the float cylinders (if equipped).*
2) *De-energize the power unit.*
3) *Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.*
4) *Remove the hydraulic SUPPLY line from the equipment.*
5) *Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.*
7) *Disconnect the hydraulic RETURN line from the equipment.*
8) *Disconnect remaining hoses such as case drains, or lines connected to the turns counter.*

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

1. ☐ *Perform an initial wash of the tool in order to remove the majority of dirt and grease build-up. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.*
2. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
3. ☐ *Clean the interior of the tong thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents. Make a note if any metal shavings or metal pieces are flushed out of the gear train cavity - if shavings or metal pieces are seen the tong must be overhauled before it is returned to service.*
4. ☐ *Clean the exterior of the tool thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents.*
5. ☐ *Inspect all fasteners and fastener safety wires. Replace any missing fasteners - use Grade 8 bolts only. Re-torque all external fasteners to SAE specifications.*
6. ☐ *Inspect lifting and support devices, including chain slings, rigid slings, legs, leg mounts, and lifting lugs. Refer to Section 2.A for proper inspection and quarantine, and repair guidelines.*
7. ☐ *Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.*
8. ☐ *Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.*
9. ☐ *Inspect all paint - locations in which the paint has been damaged must be repaired prior to storage. Prepare areas to be painted to ensure they are free of grease, dirt, or solvent. Touch up using a solvent-based acrylic paint - "Farr Canada Blue" is paint number RAL.5005. Allow sufficient time for paint to dry before proceeding.*
10. ☐ *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.*
11. ☐ *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.*
12. ☐ *Energize power unit.*

13. ☐ *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.*

14. ☐ *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.*

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

16. ☐ *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.*

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

18. ☐ *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.*

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

20. ☐ *Wipe all excess grease from outside of equipment. Replace the access door panel. Use a solvent-based cleaner on rags to wipe all external surfaces to remove residual grease or hydraulic fluid. Once the outside surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.*

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

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

23. ☐ *Farr Canada 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.

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

25. ☐ *Cover all exposed hydraulic fittings with plastic caps.*

26. ☐ *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 Canada 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 Canada 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.

Summary Of Revisions - De-Commissioning Checklist Only		
Date	**Step**	**Description Of Revision**
03-OCT-2008	N/A	Initial Release

TUBULAR CONNECTION EQUIPMENT RE-COMMISSIONING PROCEDURE

Perform the following re-commissioning 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 Canada 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.*

Summary Of Revisions - Re-Commissioning Checklist Only		
Date	***Step***	***Description Of Revision***
03-OCT-2008	*N/A*	*Intial Release*

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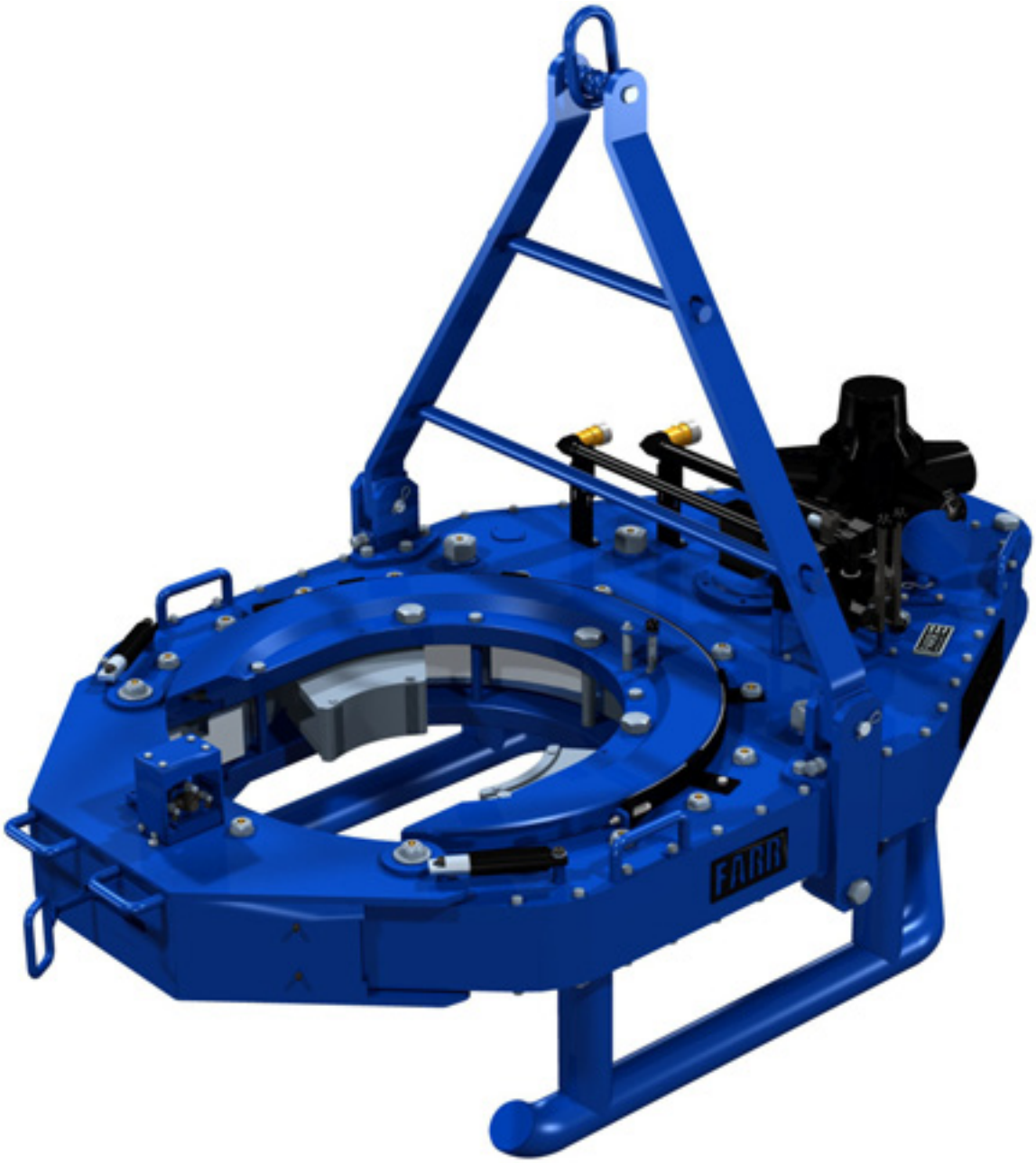
FARR CANADA

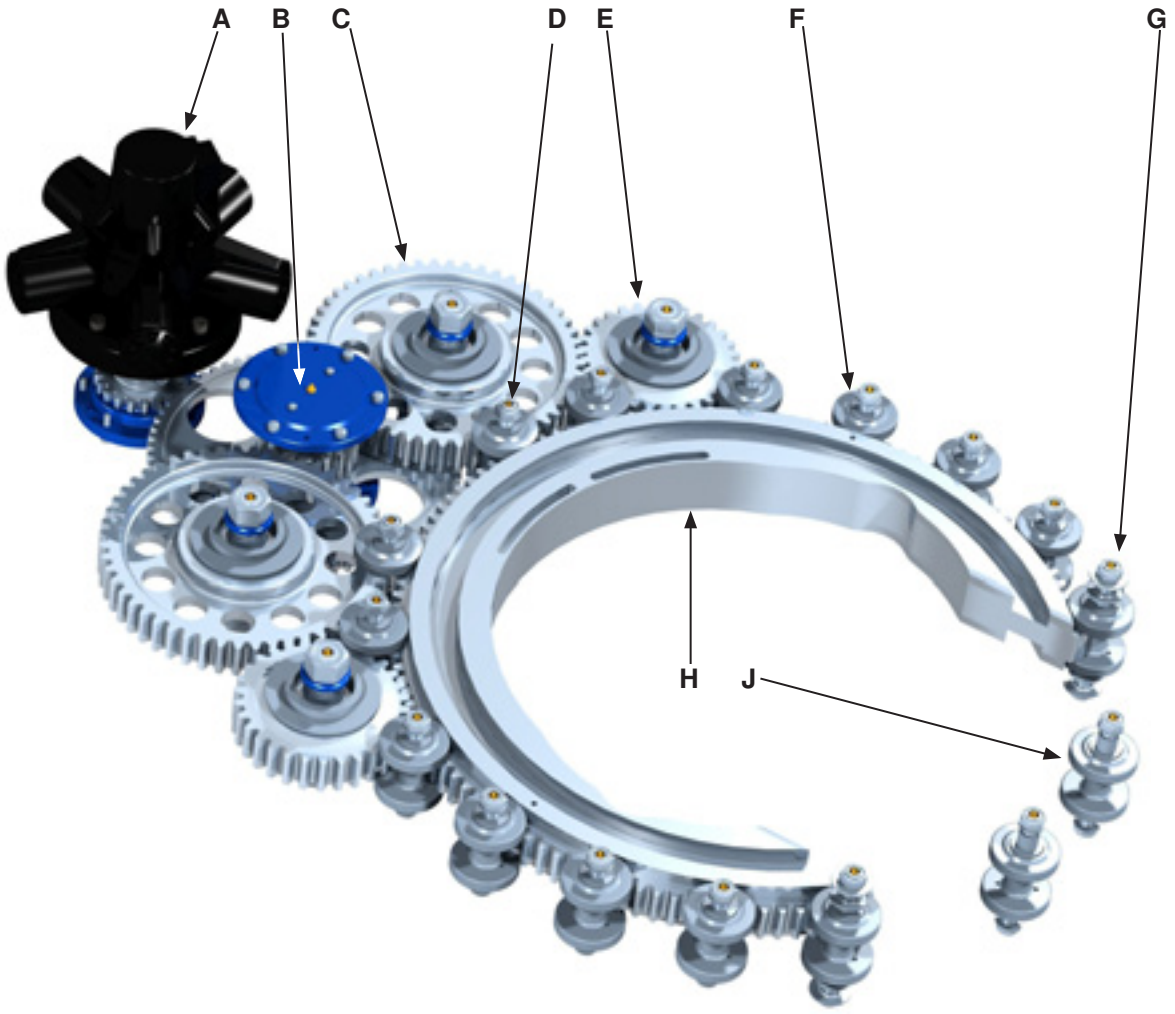
A Division Of McCoy Corporation

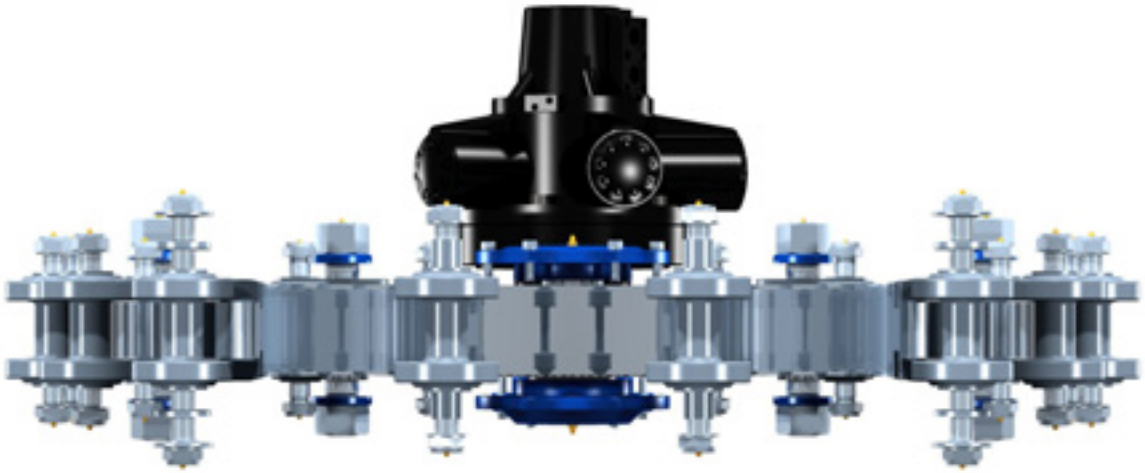
Parts & Assemblies

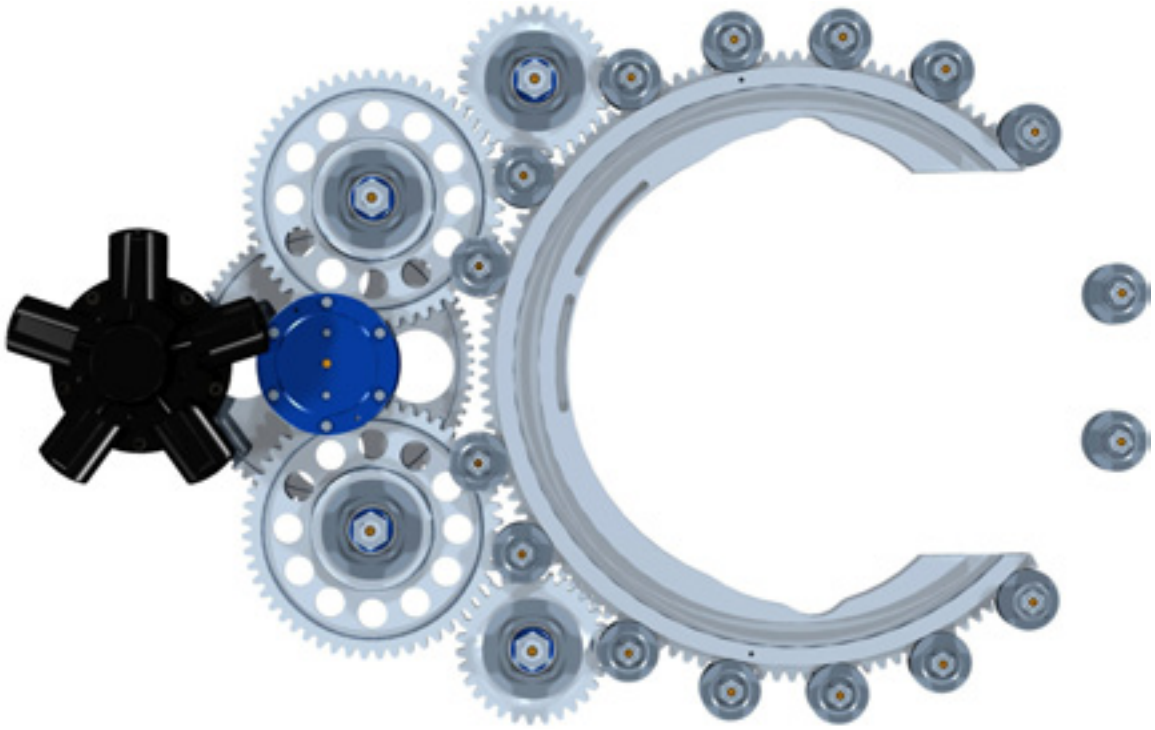


Best By FARR™

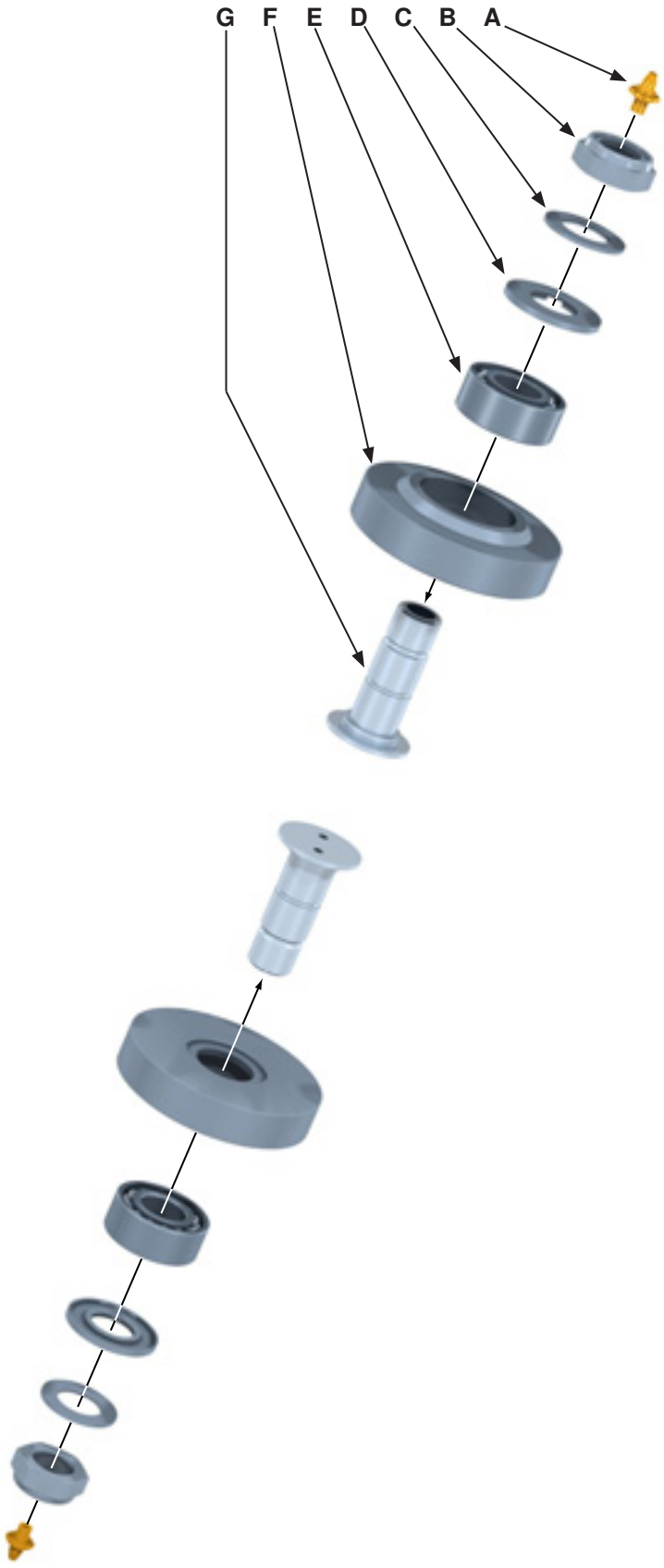
FARR CANADA
A Division Of McCoy Corporation

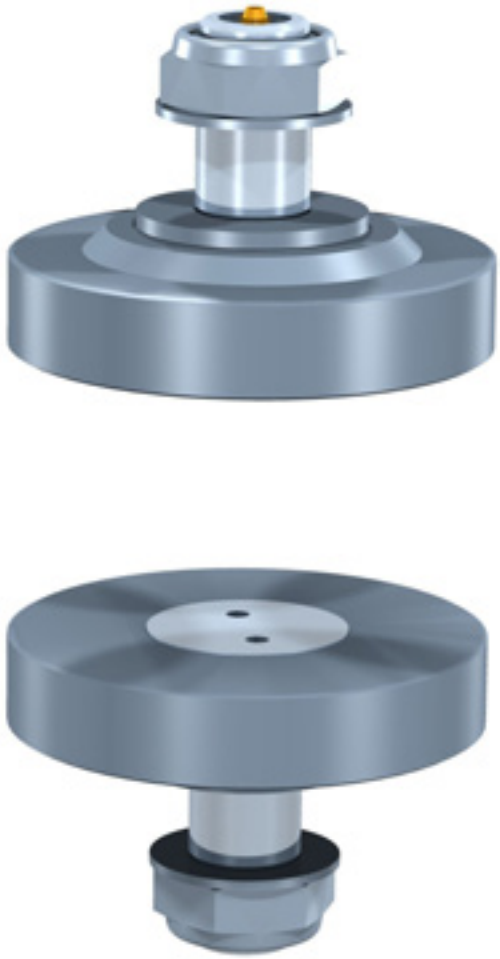




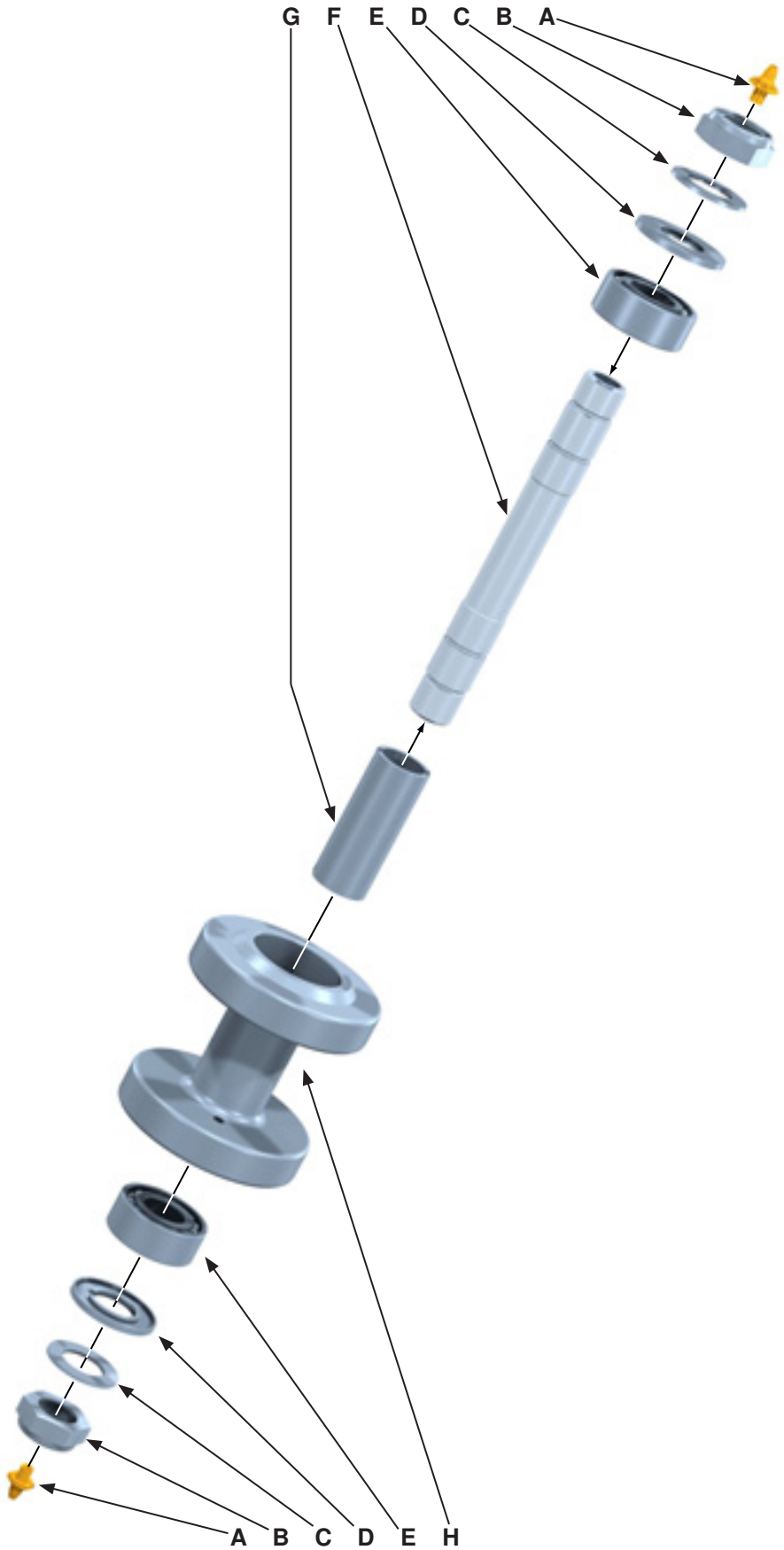


Item	Type	Description	Qty	Part Number
A	Part	Staffa HMBC080 Hydraulic Motor	1	87-0210
B	Assembly	Pinion Gear Assembly (Pp 6.16 - 6.17)	1	
C	Assembly	Pinion Idler Assembly (Pp. 6.14-6.15)	2	
D	Assembly	Half-Roller Assembly (Pp. 6.4 - 6.5)	4	
E	Assembly	Rotary Idler Assembly (Pp 6.12 - 6.13)	2	
F	Assembly	Support Roller Assembly (Pp. 6.6 - 6.7)	10	
G	Assembly	Door Pivot Roller Assembly (Pp. 6.10 - 6.11)	2	
H	Part	Rotary Gear	1	1037-D-46
J	Assembly	Door Support Roller (Pp. 6.8 - 6.9)	2	

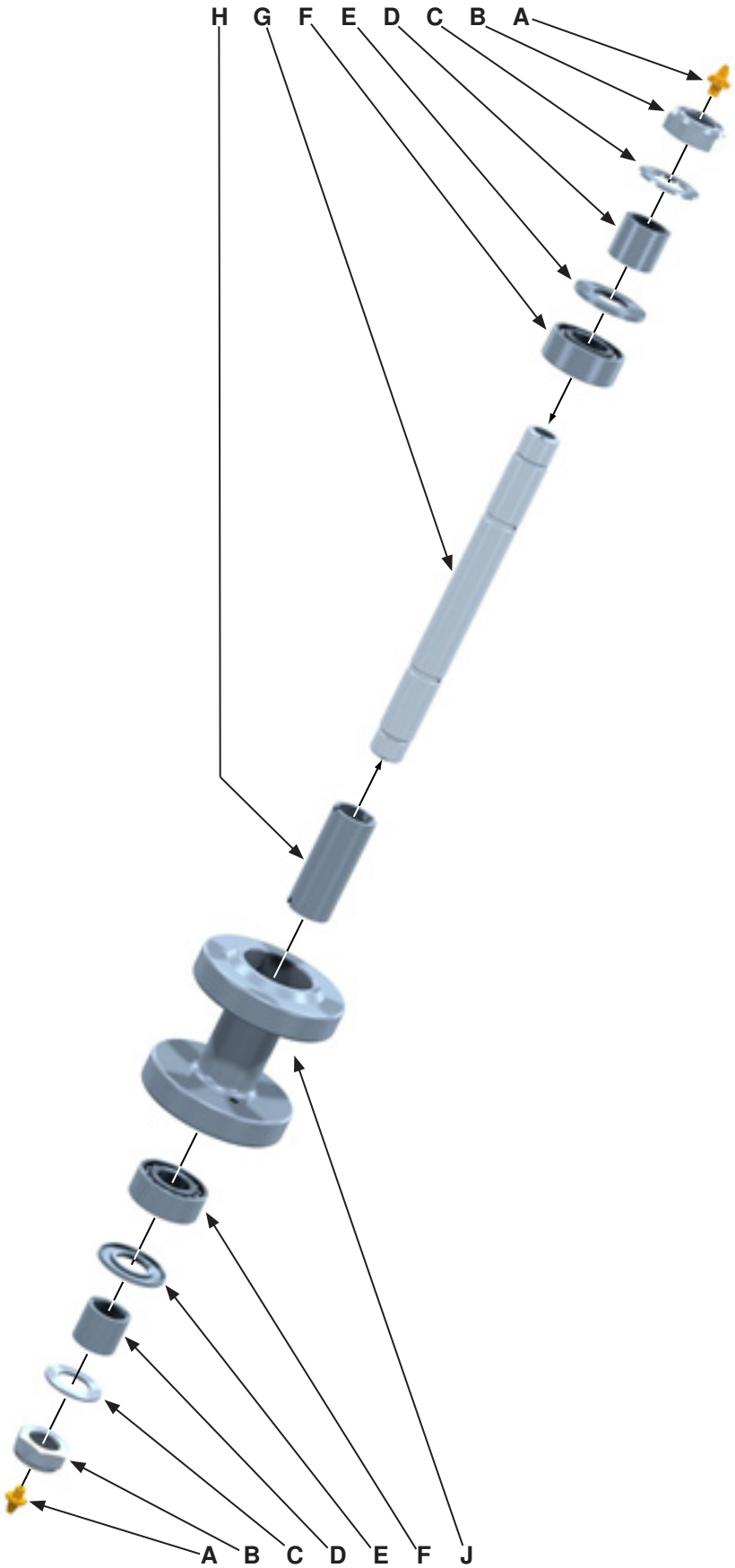




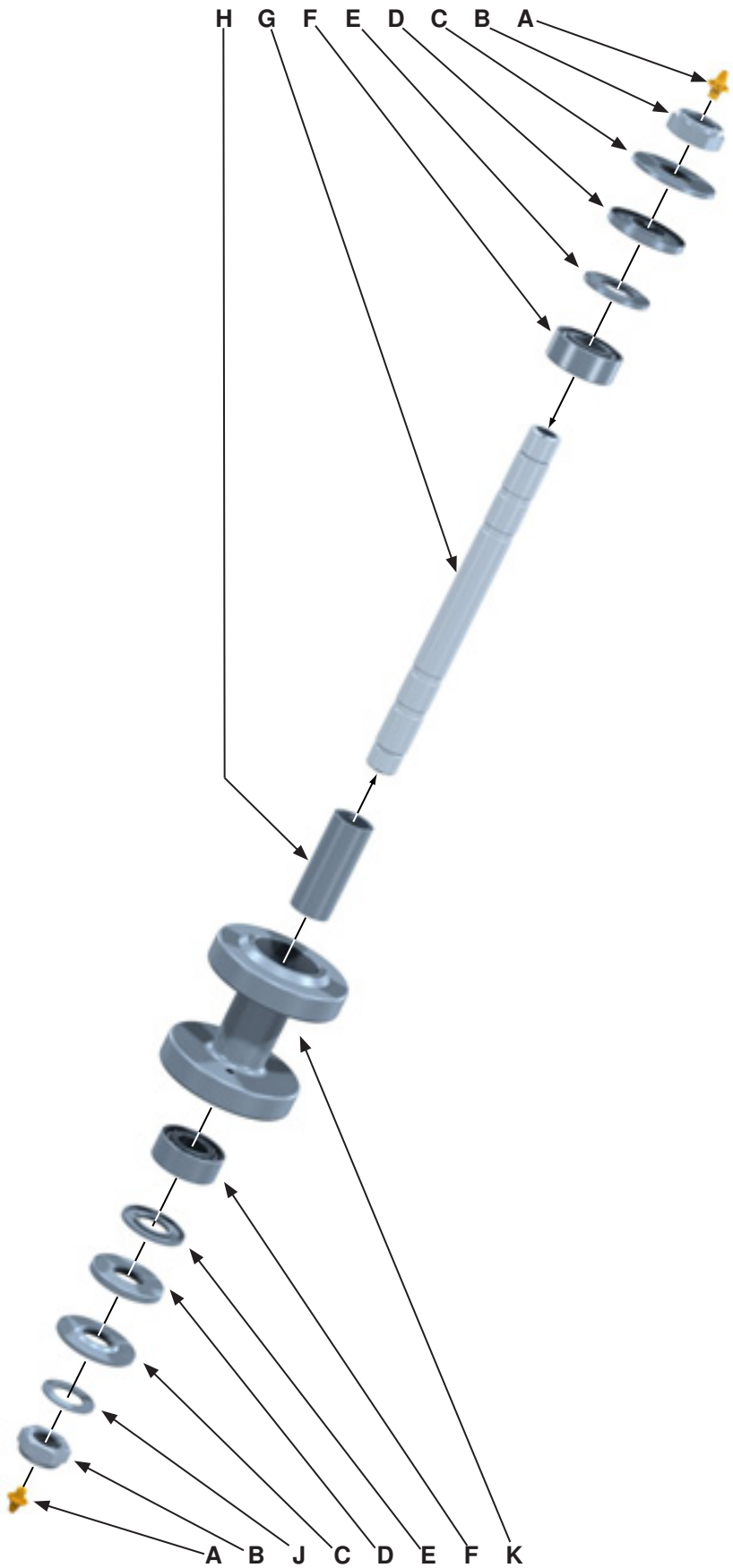
Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	1	02-0005
B	Part	1-1/8" UNF Thin Nylock Nut	1	09-5728
C	Part	1-1/8" Narrow Flat-washer	1	02-0471
D	Part	Roller Cup Spacer	1	1095-519
E	Part	Ball Bearing	1	1095-105-52003
F	Part	Roller Cup	1	1095-523
G	Part	Roller Half-Shaft	1	1095-524

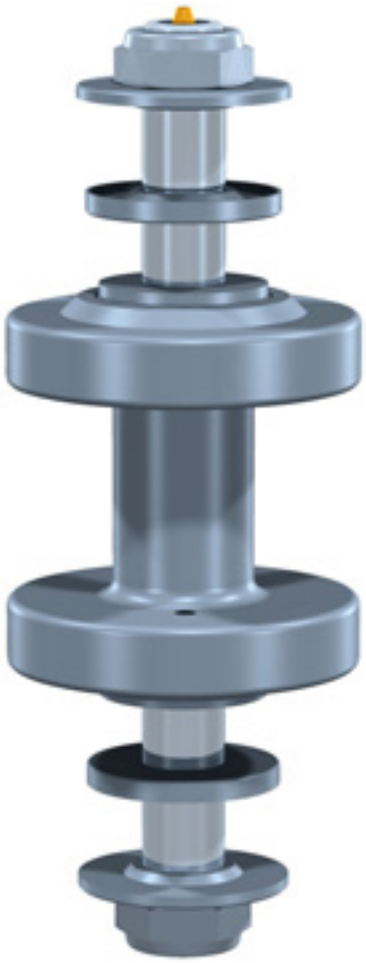


Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	2	02-0005
B	Part	1-1/8" UNF Thin Nylock Nut	2	09-5728
C	Part	1-1/8" Narrow Flat-washer	2	02-0471
D	Part	Roller Cup Spacer	2	1095-519
E	Part	Ball Bearing	2	1095-105-52003
F	Part	Support Roller Shaft	1	1095-518
G	Part	Inner Support Roller Spacer	1	1095-52002
H	Part	Support Roller	1	1095-52001

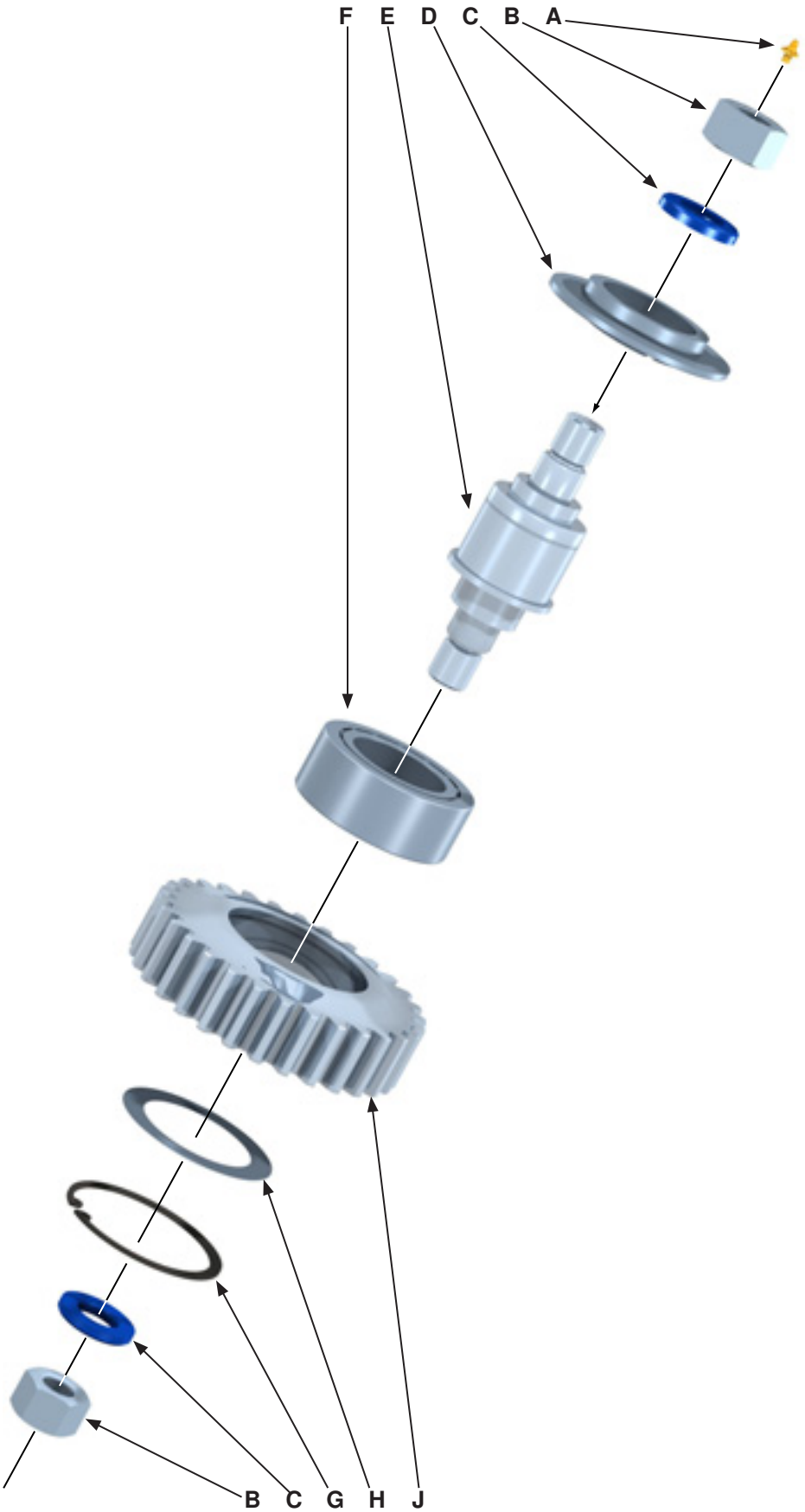


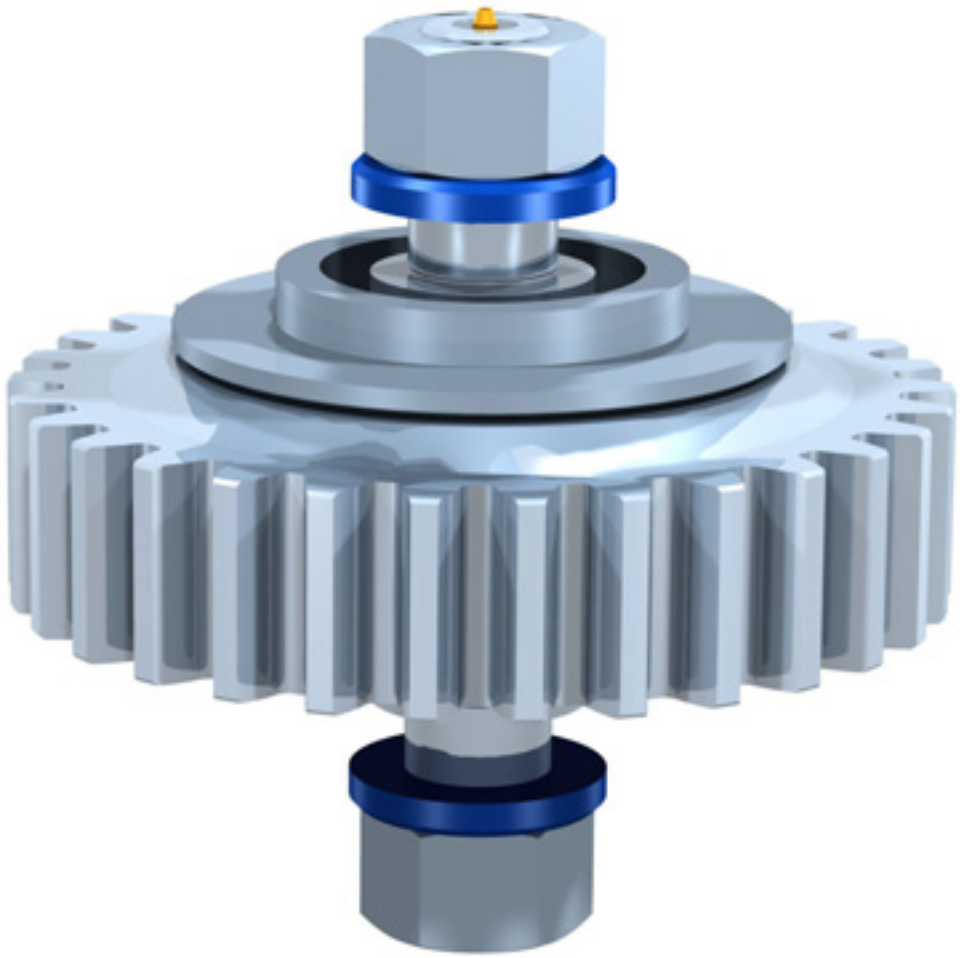
Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	2	02-0005
B	Part	1-1/8" UNF Thin Nylock Nut	2	09-5728
C	Part	1-1/8" Narrow Flat-washer	2	02-0471
D	Part	Door Roller Spacer	2	1095-105-527
E	Part	Roller Cup Spacer	2	1095-519
F	Part	Ball Bearing	2	1095-105-52003
G	Part	Door Support Roller Shaft	1	1095-105-525
H	Part	Inner Support Roller Spacer	1	1095-52002
J	Part	Support Roller	1	1095-52001



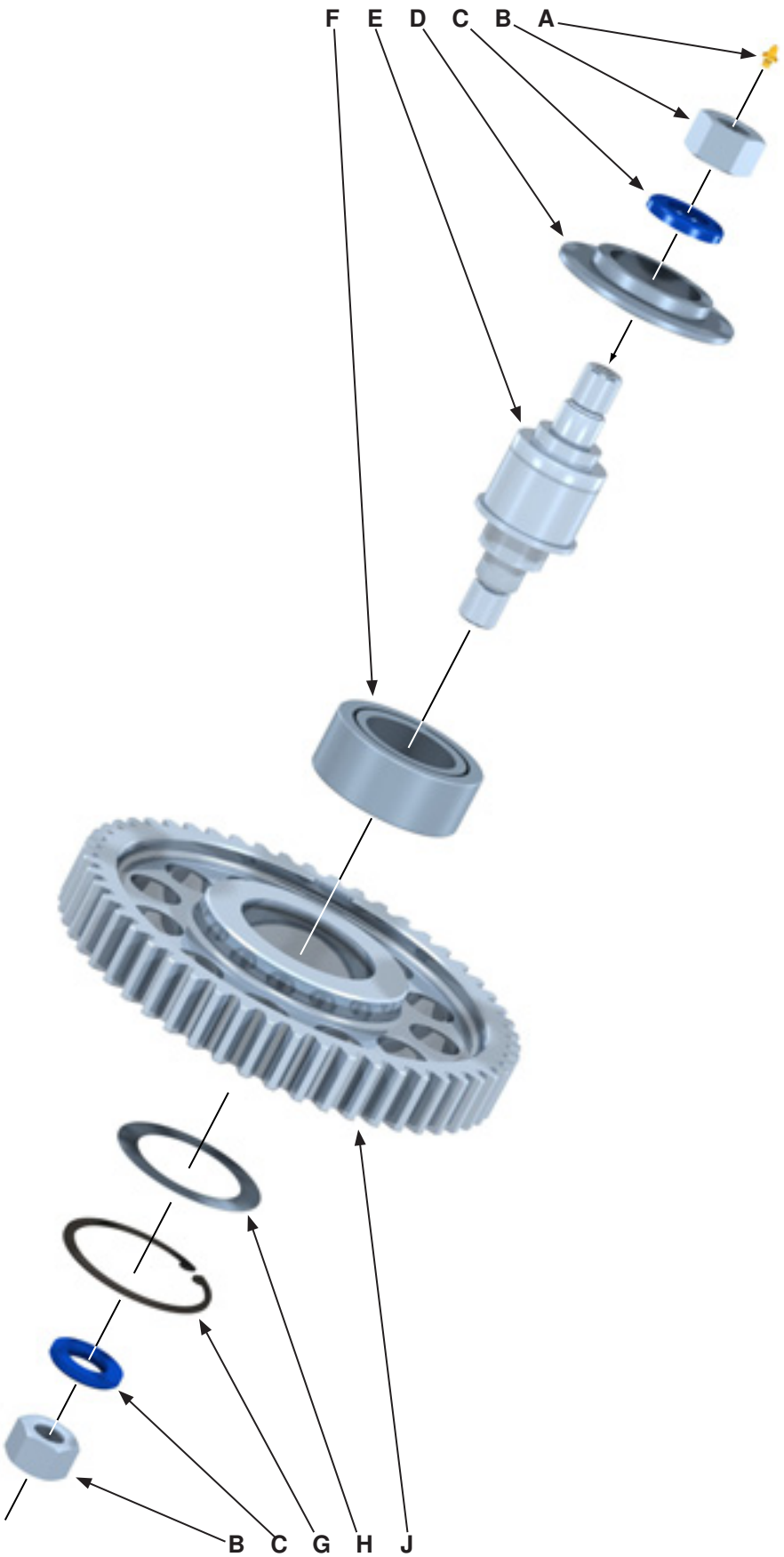


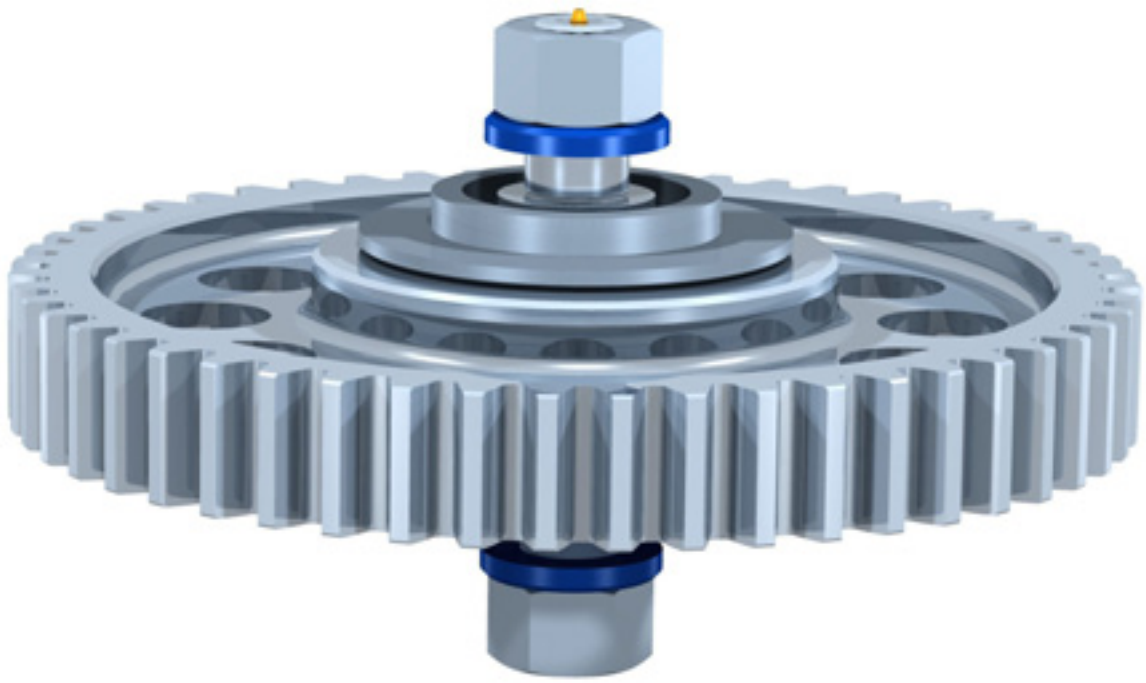
Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	2	02-0005
B	Part	1-1/8" UNF Thin Nylock Nut	2	09-5728
C	Part	1-1/8" Door Hinge Washer	2	1095-105-529
D	Part	Door Hinge Spacer	2	1095-105-528
E	Part	Roller Cup Spacer	2	1095-519
F	Part	Ball Bearing	2	1095-105-52003
G	Part	Door Pivot Roller Shaft	1	1095-105-526
H	Part	Inner Support Roller Spacer	1	1095-52002
J	Part	1-1/8" Narrow Flat-washer	1	02-0471
K	Part	Support Roller	1	1095-52001





Item	Type	Description	Qty	Part Number
A	Part	1/8" NPT Grease Fitting	2	02-0005
B	Part	1-3/4" UNC Nylock Jam Nut	2	09-9172
C	Part	Idler Gear Washer	2	1095-116
D	Part	Idler Gear Top Spacer	1	1095-522
E	Part	Idler Shaft	1	1095-516
F	Part	Spherical Roller Bearing	1	1095-105-50902
G	Part	Bearing Retainer	1	1095-105-50903
H	Part	Bearing Seal	1	1095-105-515
J	Part	Idler Gear	1	1095-510





Item	Type	Description	Qty	Part Number
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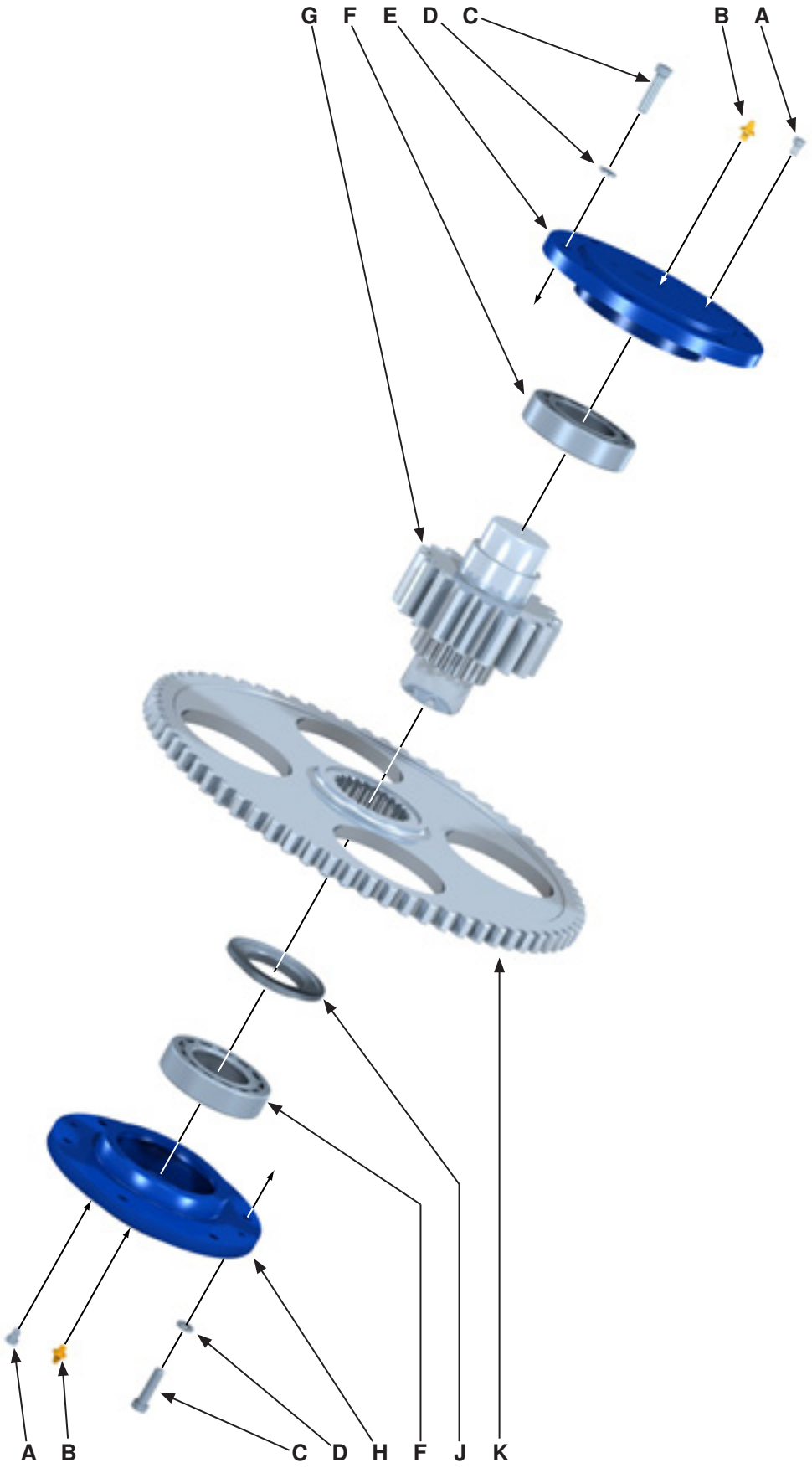
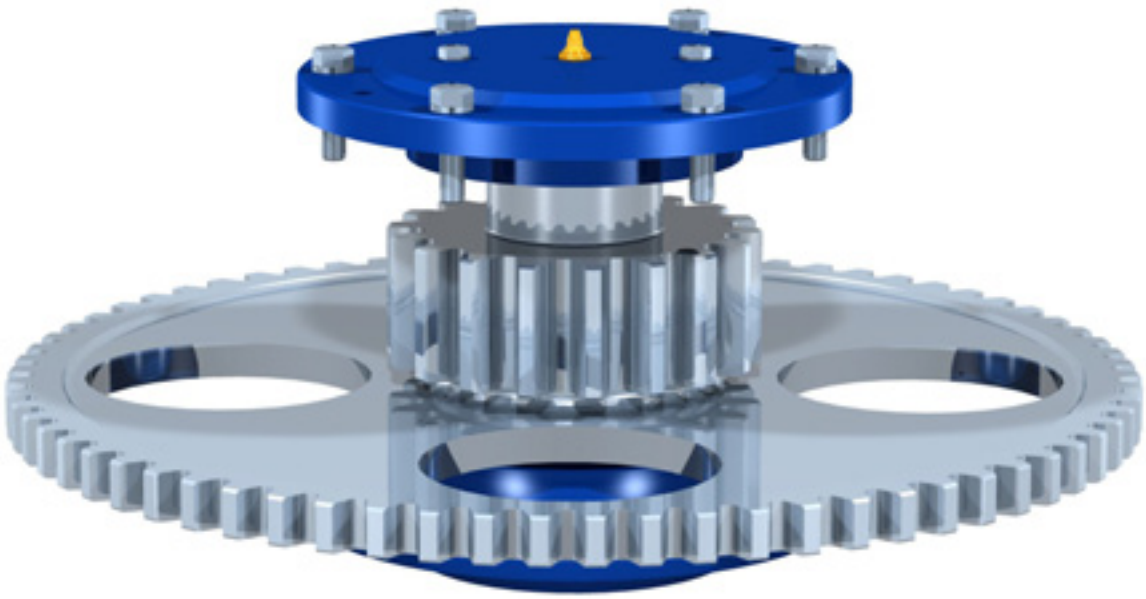
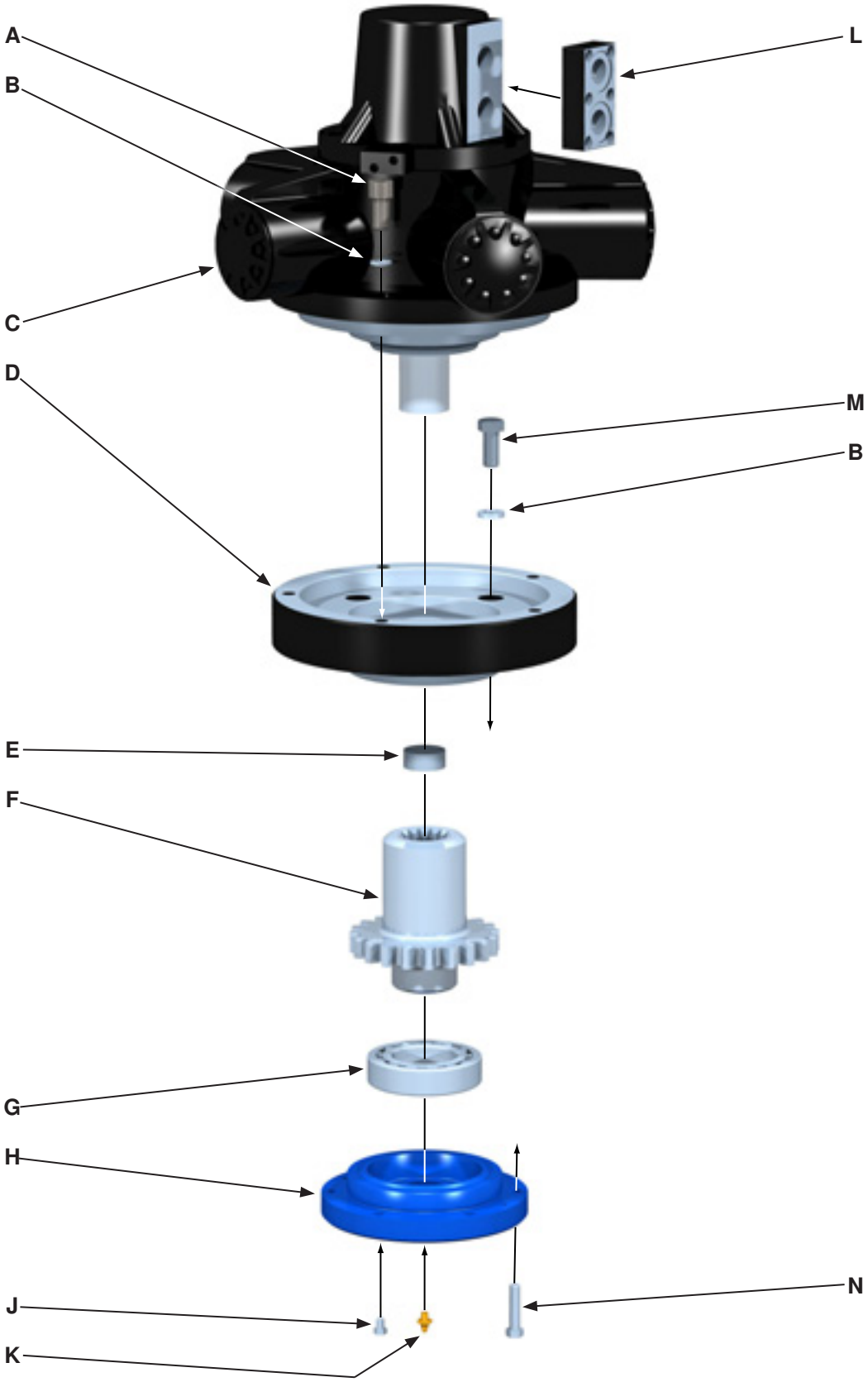
B	Part	1-3/4" UNC Nylock Jam Nut	2	09-9172
C	Part	Idler Gear Washer	2	1095-116
D	Part	Idler Gear Top Spacer	1	1095-522
E	Part	Idler Shaft	1	1095-516
F	Part	Spherical Roller Bearing	1	1095-105-50902
G	Part	Bearing Retainer	1	1095-105-50903
H	Part	Bearing Seal	1	1095-105-515
J	Part	Idler Gear	1	1095-105-509

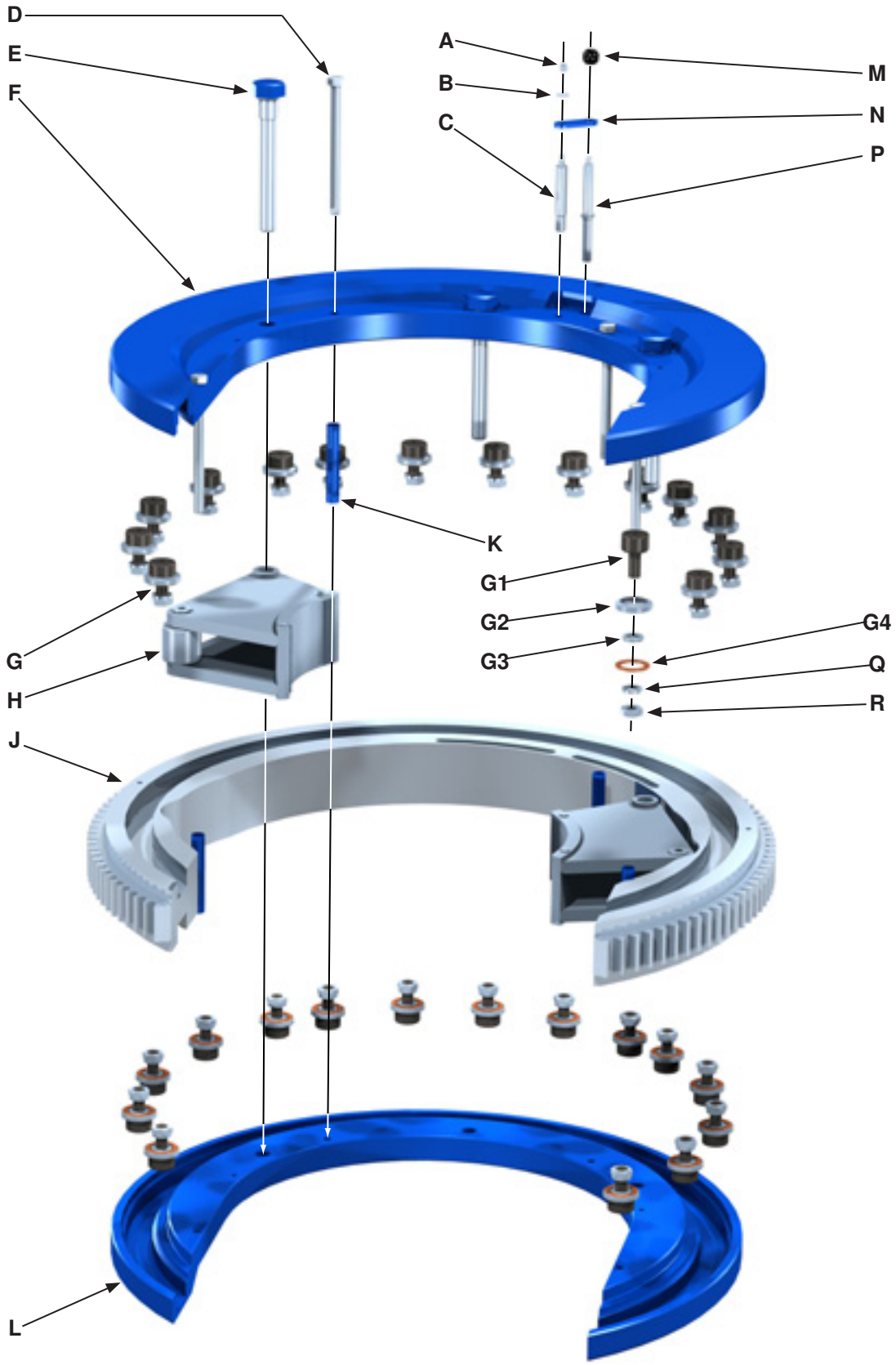


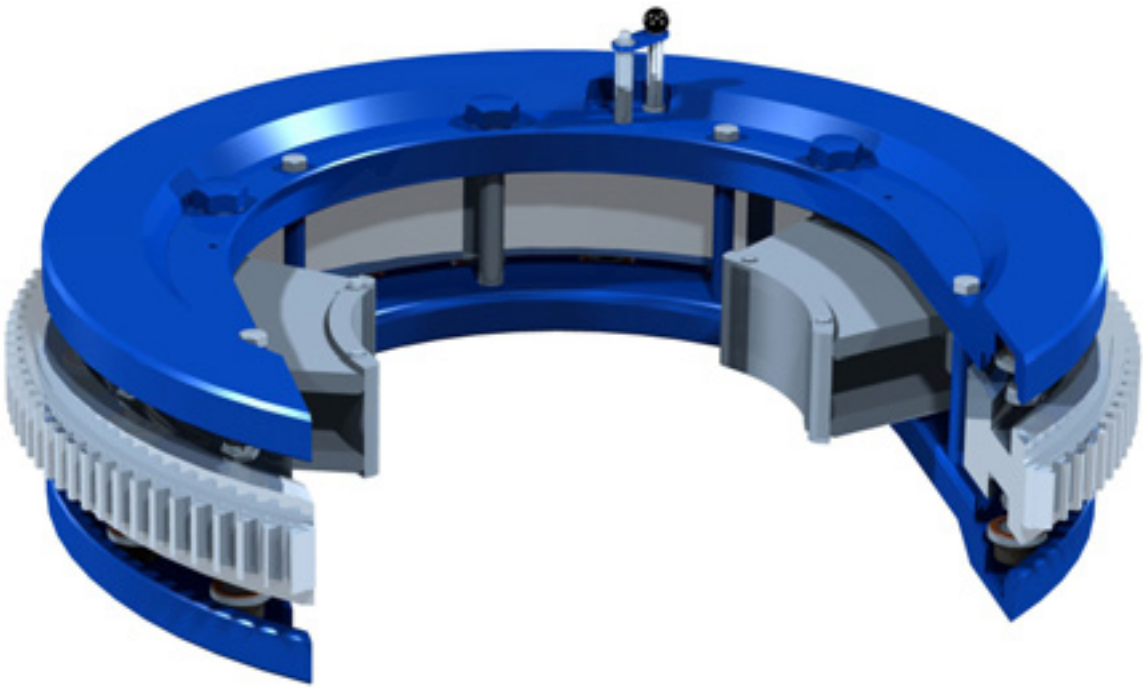


Item	Type	Description	Qty	Part Number
A	Part	3/8" NC x 1/2" Hex Bolt	4	09-1042
B	Part	1/8" NPT Grease Fitting	2	02-0005
C	Part	1/2" NC x 2" Hex Bolt	12	09-1174
D	Part	1/2" Carbon Steel Lock-washer	12	09-5110
E	Part	Top Pinion Bearing Cap	1	1095-50701
F	Part	Spherical Roller Bearing	2	1095-105-50902
G	Part	Pinion Gear	1	1095-105-503
H	Part	Bottom Pinion Bearing Cap	1	1095-50801
J	Part	Bearing Spacer	1	1095-505
K	Part	Low Pinion Gear	1	1095-504

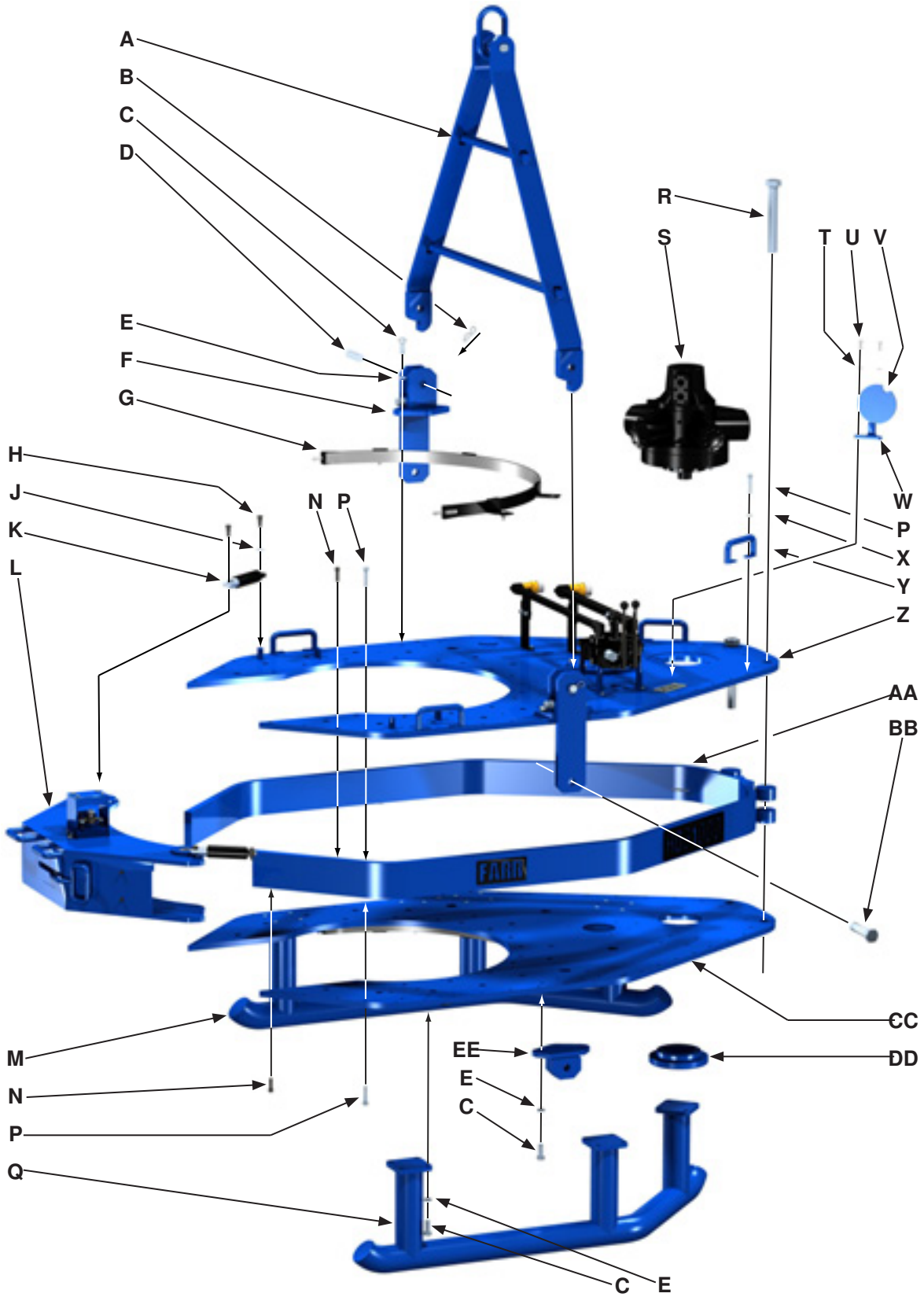


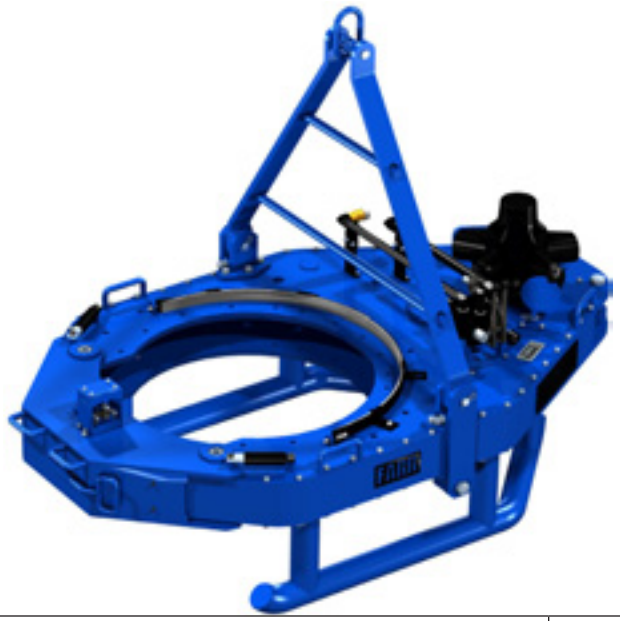
Item	Type	Description	Qty	Part Number
A	Part	3/4" NC x 1-1/2" Hex Socket Head Cap Screw	5	02-2290
B	Part	3/4" Carbon Steel Lock-washer	10	09-5118
C	Part	Staffa HMC-080-S-90 Hydraulic Motor	1	87-0210
D	Part	Motor Mount	1	1095-106B
E	Part	Gear Spacer	1	1095-105-517
F	Part	Splined Motor Gear	1	1095-501B
G	Part	Spherical Roller Bearing	1	1095-105-50202
H	Part	Bearing Cap	1	1095-50201
J	Part	3/8" NC x 1/2" Hex Bolt	4	09-1042
K	Part	1/8" NPT Grease Fitting	2	02-0005
L	Part	Manifold Block	1	87-0209
M	Part	3/4" NC x 1-1/2" Hex Bolt	5	09-1290
N	Part	1/2" NC x 2-1/4" Hex Bolt	6	09-1175
P	Part	1/2" Carbon Steel Lock-washer (Not Shown)	6	09-5110



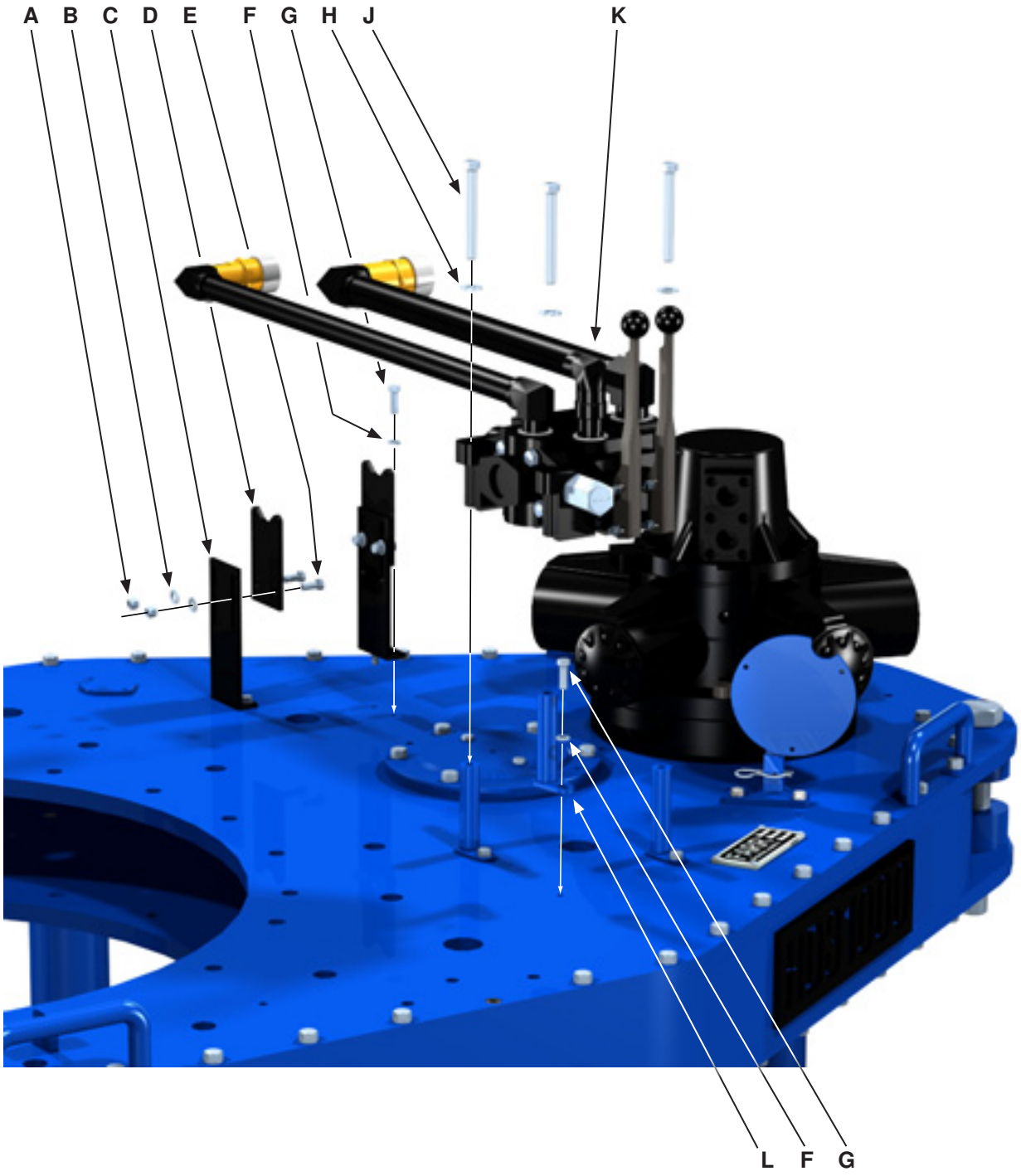


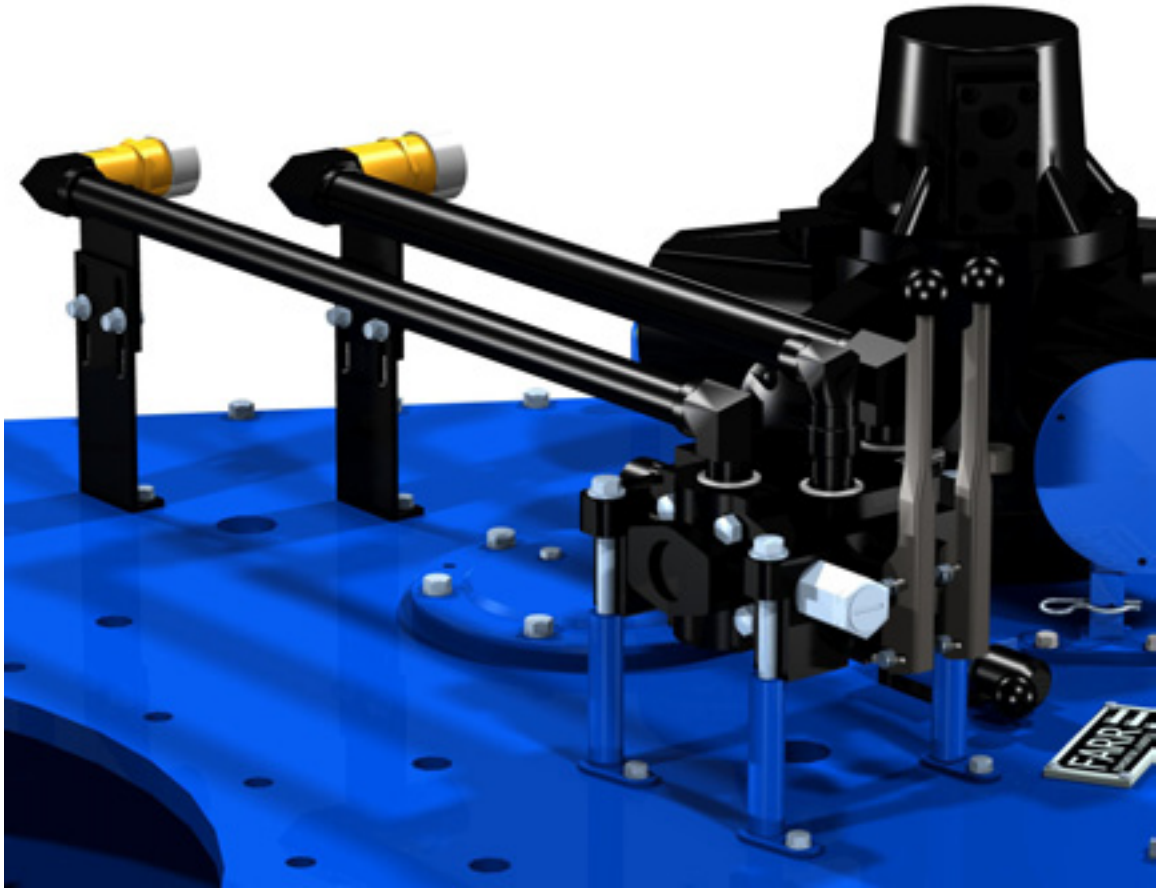
Item	Type	Description	Qty	Part Number
A	Part	3/8" NC Nylock Nut	1	09-5607
B	Part	3/8" Plain Flat-washer	1	09-5006
C	Part	Backing Pin Retainer Support	1	1095-123
D	Part	3/4" NC x 9" Hex Bolt	4	09-1322
E	Part	Jaw Pivot Bolt	4	1095-131
F	Part	Top Cage Plate	1	1095-105-512
G	Assembly	Cam Follower (includes the following items)	30	101-3200
G1	Part	Cam Follower Bearing	1	02-0107
G2	Part	Cam Follower Skirt	1	1095-120-01
G3	Part	Cam Follower Spacer	1	1095-120-03
G4	Part	Cam Follower Skirt Bearing	1	1095-120-02
H	Assembly	Jaw Die Kit Assembly (18-5/8" Shown - See Pg. 2.8)	2	
J	Part	Rotary Gear	1	1095-105-511
K	Part	Cage Plate Spacer	4	1095-38
L	Part	Bottom Cage plate	1	1095-105-513
M	Part	Backing Pin Knob	1	02-0017
N	Part	Backing Pin Retainer	1	1095-122
P	Part	Backing Pin	1	1095-12101
Q	Part	7/8" Carbon Steel Lock-washer	30	09-5122
R	Part	7/8" NC Heavy Jam Nut	30	09-5521



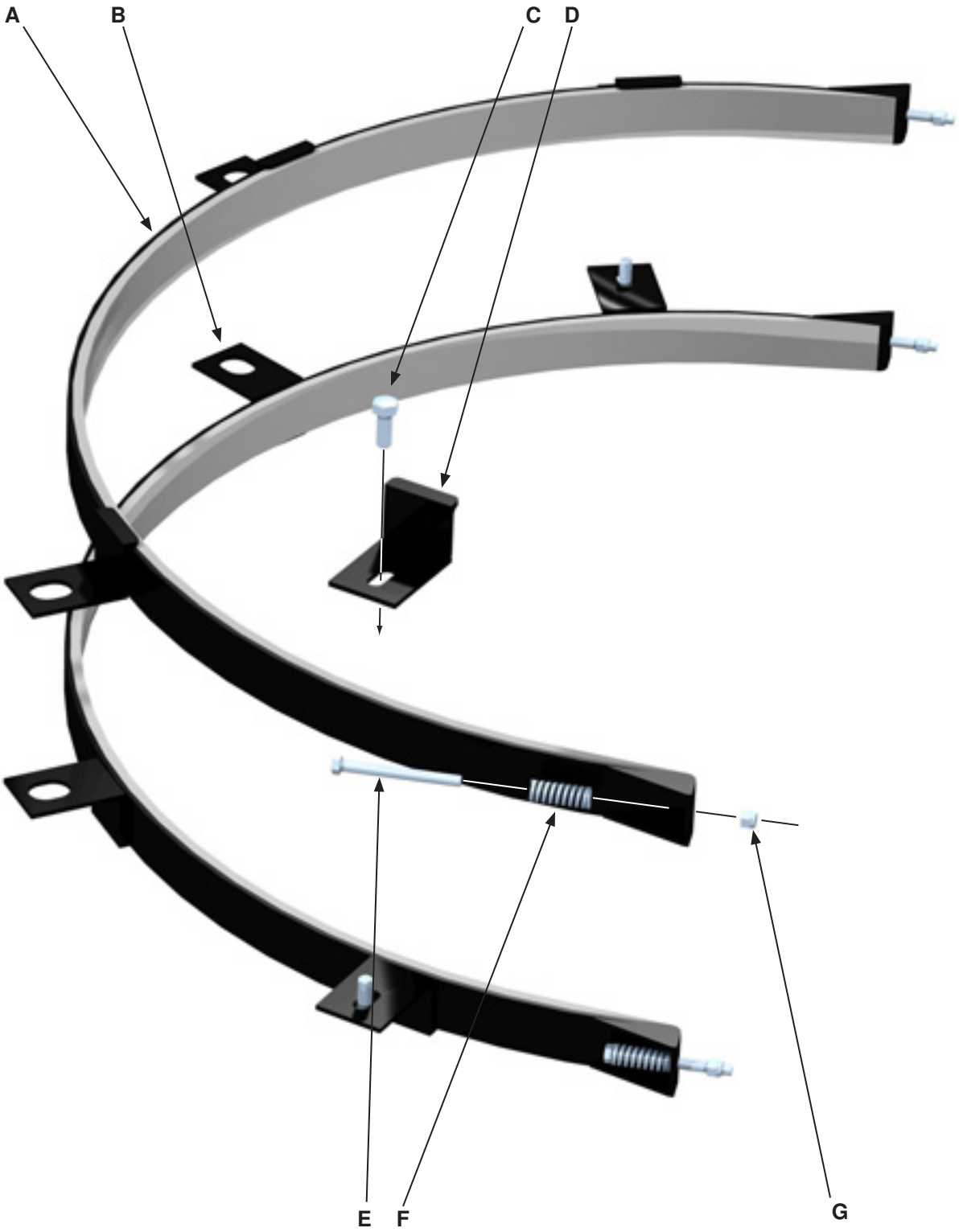


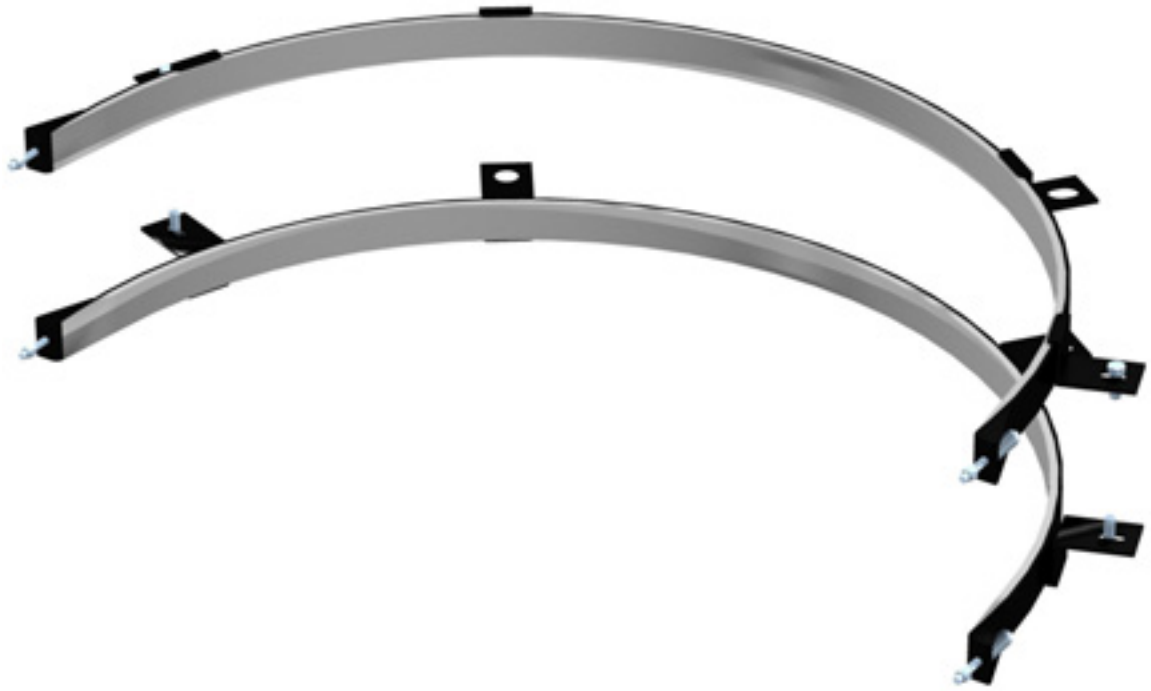
Item	Type	Description	Qty	Part Number
A	Assembly	Rigid Sling (See Pp. 6.28 - 6.29)	1	
B	Part	Hitch Pin	1	09-0090
C	Part	3/4" NC x 2" Hex Bolt	6	09-1294
D	Part	Rigid Sling Pin	2	1095-225-03
E	Part	3/4" Carbon Steel Lock-washer	6	09-5118
F	Assembly	RH Rigid Sling Hanger Bracket	1	1095-225
	Assembly	LH Rigid Sling Hanger Bracket	1	1095-225LH
G	Assembly	Brake band Assembly (See Pp. 6.29 - 6.27)	2	
H	Part	5/8" x 3/4" Hex Socket Shoulder Bolt	4	09-0049
J	Part	1/2" Plain Washer	4	09-5010
K	Part	Door Cylinder	2	1095-141
L	Part	Door Assemblies (Pp. 6.30 - 6.33)	1	
M	Weldment	RH leg Weldment	1	1095-212
N	Part	1/2" NC x 1/3/4" Hex SHCS	12	09-2172
P	Part	1/2" NC x 2-3/4" Hex Bolt	72	09-2177
Q	Weldment	LH leg Weldment	1	1095-213
R	Part	Load Cell Pin	2	101-2451
S	Part	Staffa HMC-080-S-90 Hydraulic Motor	1	87-0210
T	Part	3/8" Carbon Steel Lock-washer	2	09-5106
U	Part	3/8" NC x 1-1/4" Hex Bolt	2	09-1048
V	Weldment	1500-09-03A: Torque Gauge Mount Weldment	1	1500-09-03A
W	Weldment	1500-09-03A: Torque Gauge Holder Weldment	1	101-0480
X	Part	1/2" Carbon Steel Lock-washer	72	09-5110
Y	Weldment	Body Handle Weldment	4	1095-143
Z	Part	Top Body Plate	1	1095-102-201
AA	Weldment	Side Body Weldment	1	101-2083
BB	Part	1-1/4" NC x 5-1/2" Hex Bolt	2	09-9136
CC	Part	Bottom Body Plate (typically welded to side body)	1	1095-102-202
DD	Part	Motor Mount Bearing Cap	1	1095-50201
EE	Weldment	Rigid Sling Hanger Bracket Weldment	2	1095-224



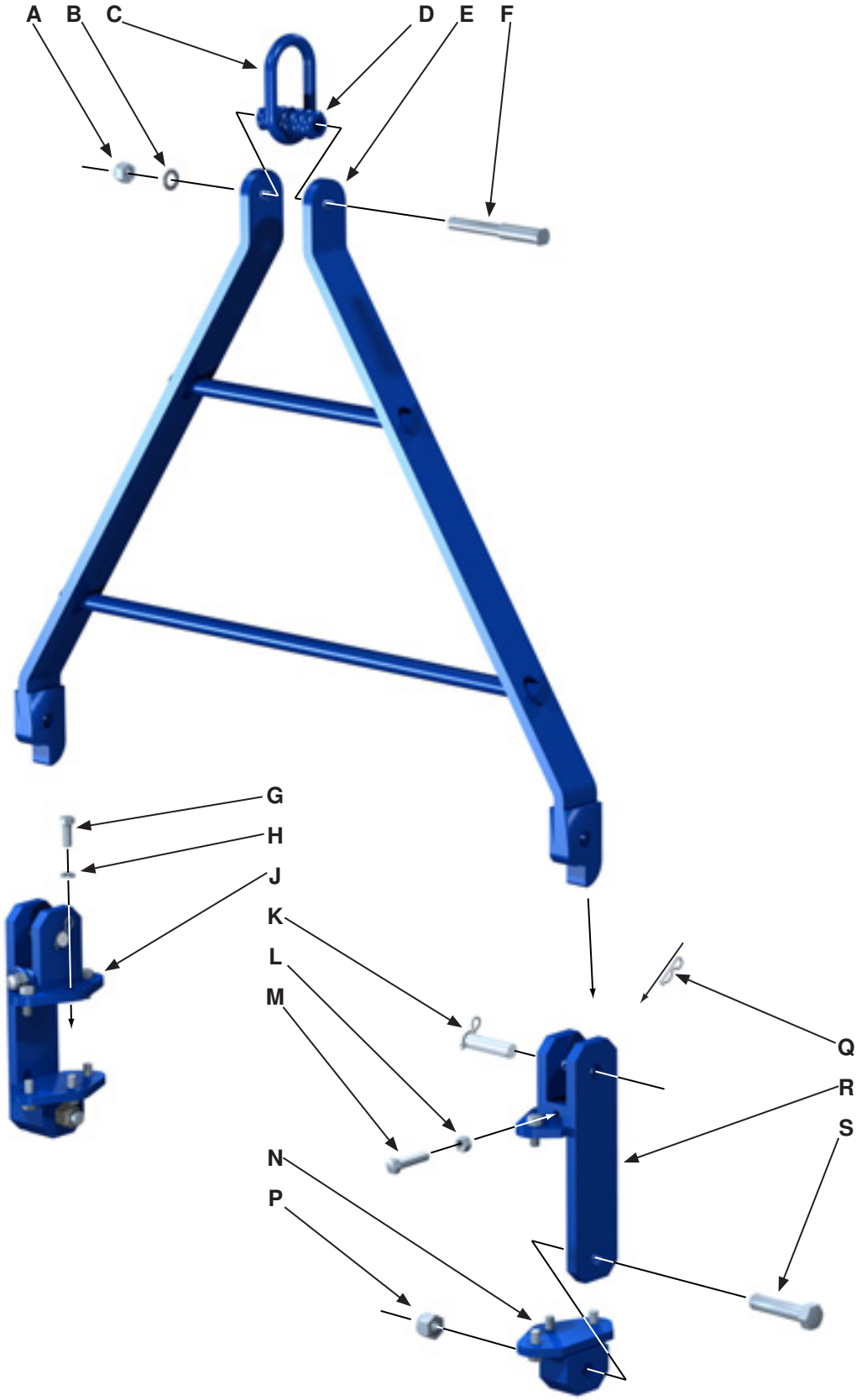


Item	Type	Description	Qty	Part Number
A	Part	3/8" NC Nylock Nut	1	09-5607
B	Part	3/8" Plain Narrow Flat-washer	1	09-5124
C	Weldment	Hydraulic Coupling Support Weldment	2	101-1138
D	Part	Adjustable Coupling Support	2	101-0022
E	Part	3/8" NC x 1" Hex Bolt	4	09-1046
F	Part	3/8" Carbon Steel Lock-washer	7	09-5106
G	Part	3/8" NC x 1-1/4" Hex Bolt	7	09-1048
H	Part	1/2" Plain Narrow Flat-washer	3	09-5119
J	Part	1/2" NC x 4-1/2" Hex Bolt	3	09-1184
K	Assembly	Hydraulic Valve Assembly	1	101-3501
L	Weldment	Hydraulic Valve Mount Post Weldment	3	101-1324

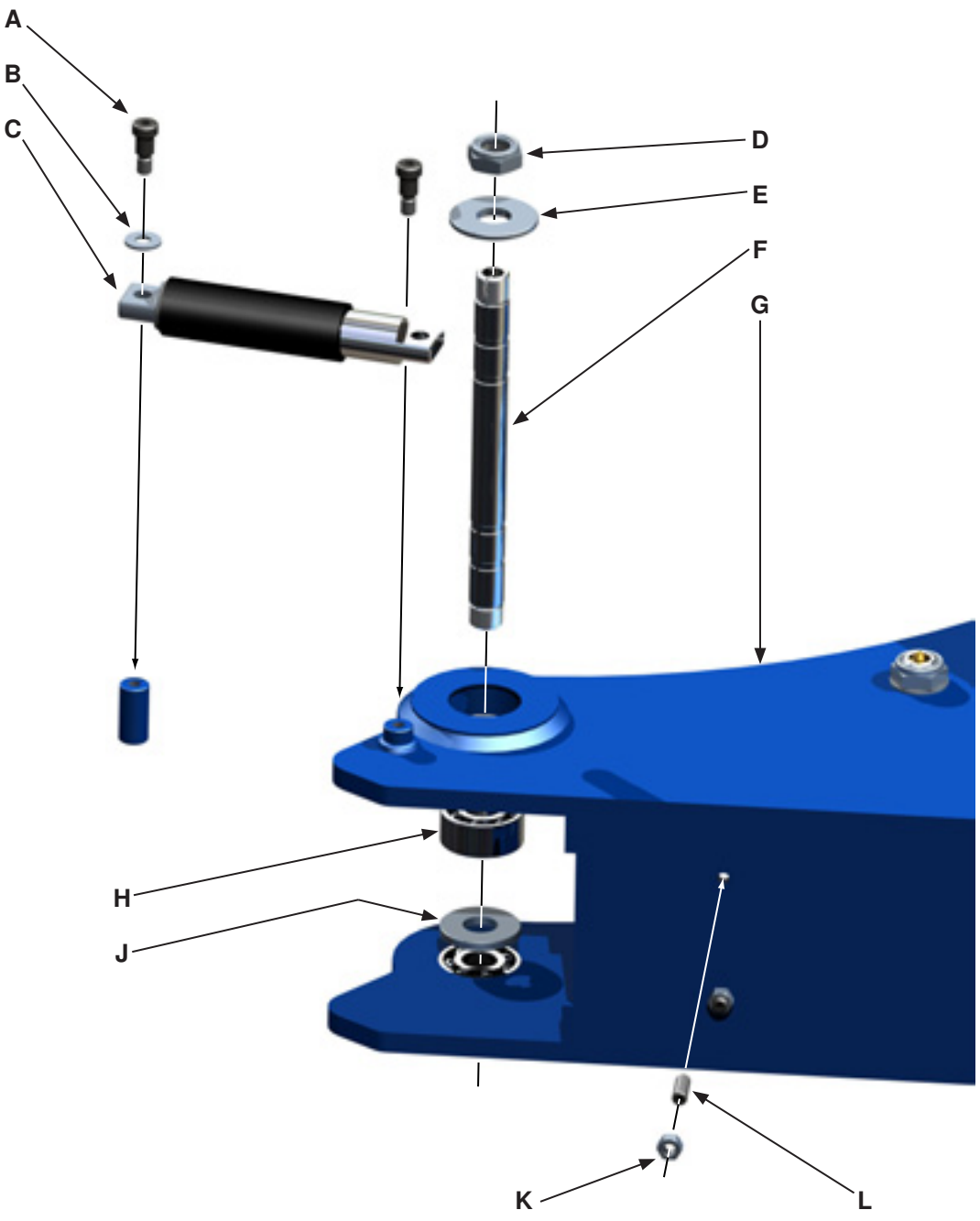


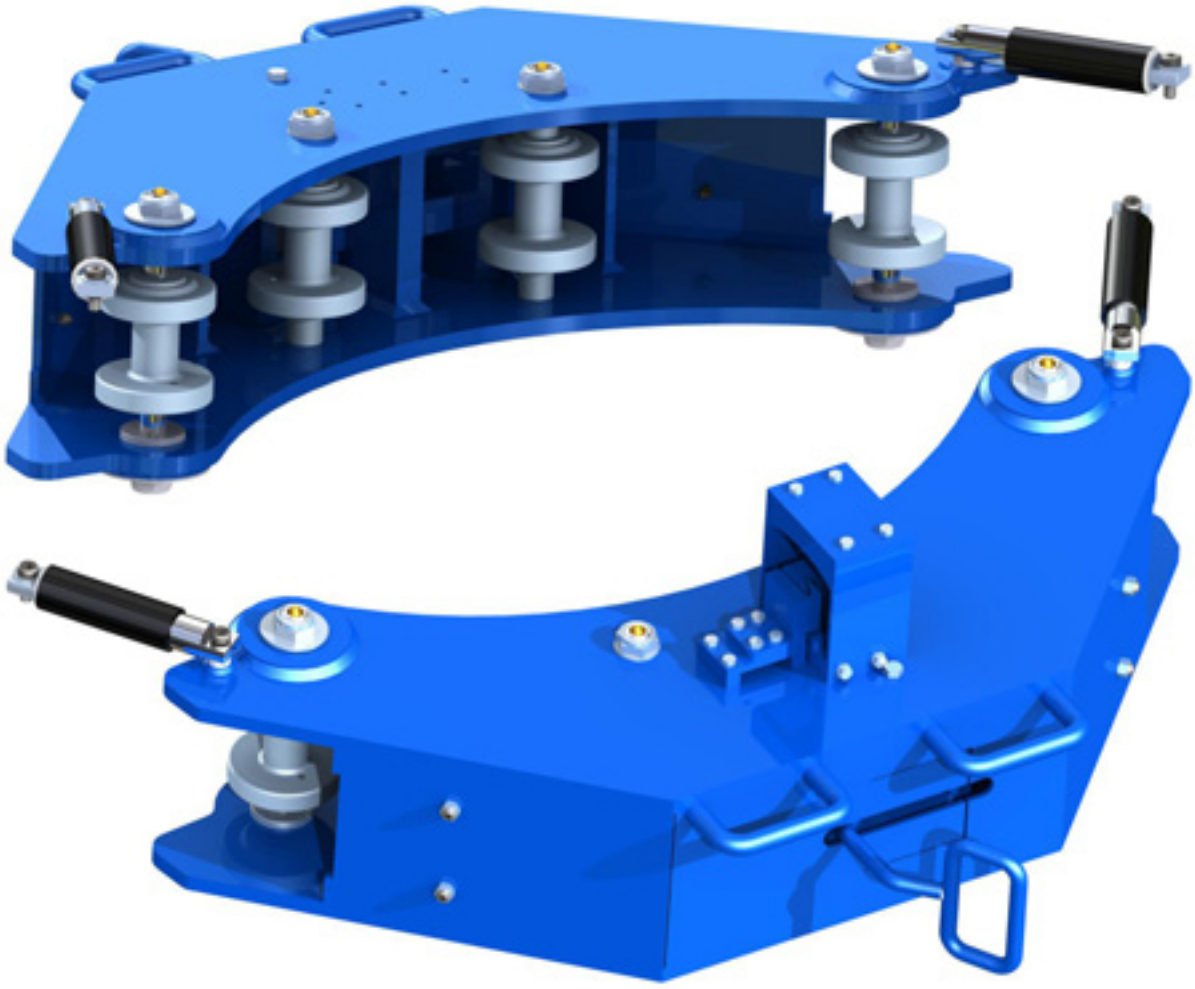


Item	Type	Description	Qty	Part Number
A	Weldment	Brake band Weldment	2	1095-126
B	Weldment	Brake band Retainer (Support Roller)	4	1095-138
C	Part	1/2" NC x 1-1/4" Hex Bolt	4	09-1168
D	Weldment	Brake band Retainer	4	1095-137
E	Part	3/8" NC x 4" Hex Bolt	4	09-1062
F	Part	Brake band Compression Spring	4	08-9264
G	Part	3/8" NC Hex Nylock Nut	4	09-5607

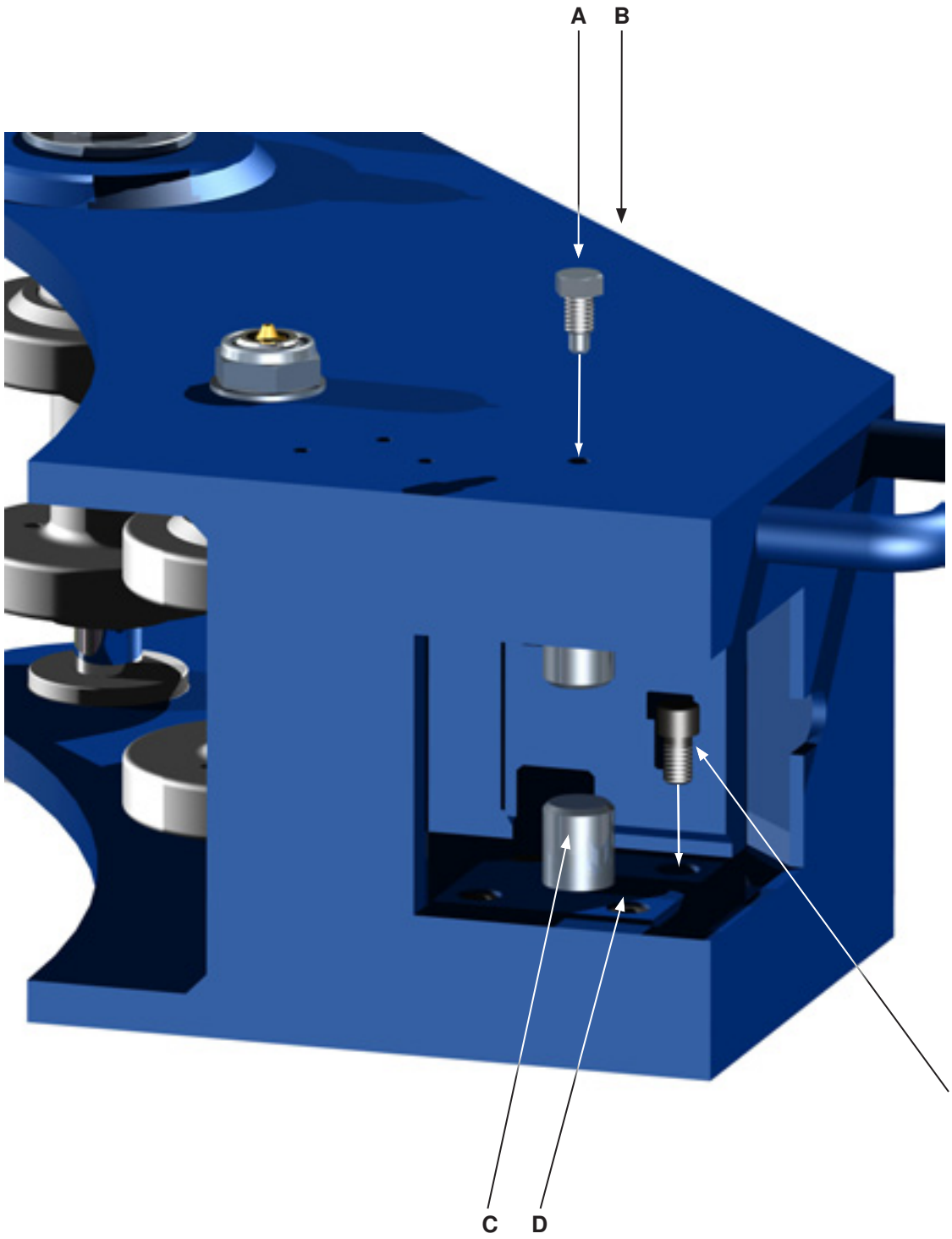


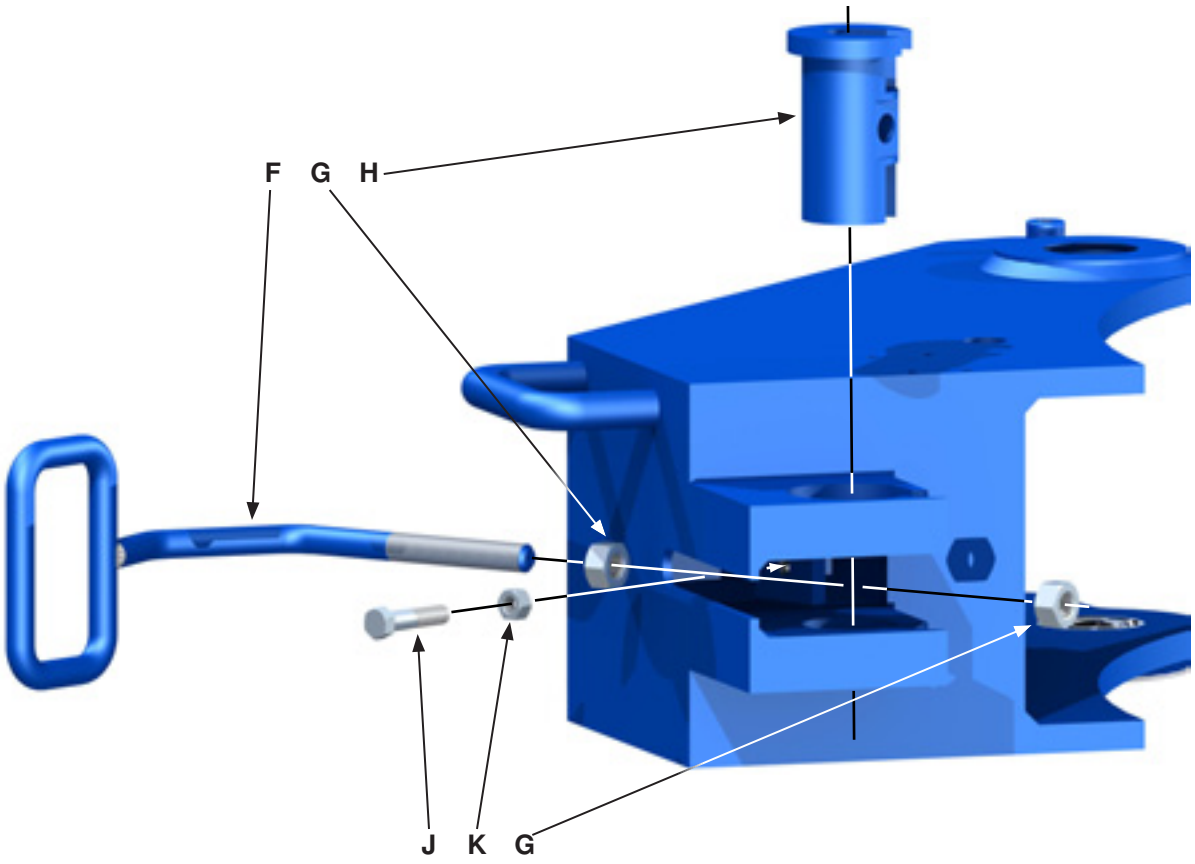
Item	Type	Description	Qty	Part Number
A	Part	1" NC Nylock Nut	1	09-5725
B	Part	1" Plain Narrow Flat-washer	1	09-5120
C	Part	Lifting Link	1	02-9128
D	Part	Adjusting Helix	1	1095-220
E	Part	Rigid Sling Weldment	1	1095-216
F	Part	Pin	1	1095-218
G	Part	3/4" NC x 2" Hex Bolt	12	09-1294
H	Part	3/4" Carbon Steel Lock-washer	12	09-5118
J	Weldment	RH Hanger Bracket Weldment	1	1095-225
K	Part	Hanger Pin	2	1095-225-03
L	Part	3/4" NC Hex Nut	2	09-5818
M	Part	3/4" NC x 3-1/2" Hex Bolt	2	09-1300
N	Weldment	Hanger Bracket Weldment	2	1095-224
P	Part	1-1/4" NC Nylock Nut	2	09-1484
Q	Part	Hitch Pin	1	09-0090
R	Part	LH Hanger Bracket Weldment	1	1095-225LH
S	Part	1-1/4" NC x 5-1/2" Hex Bolt	2	09-9136



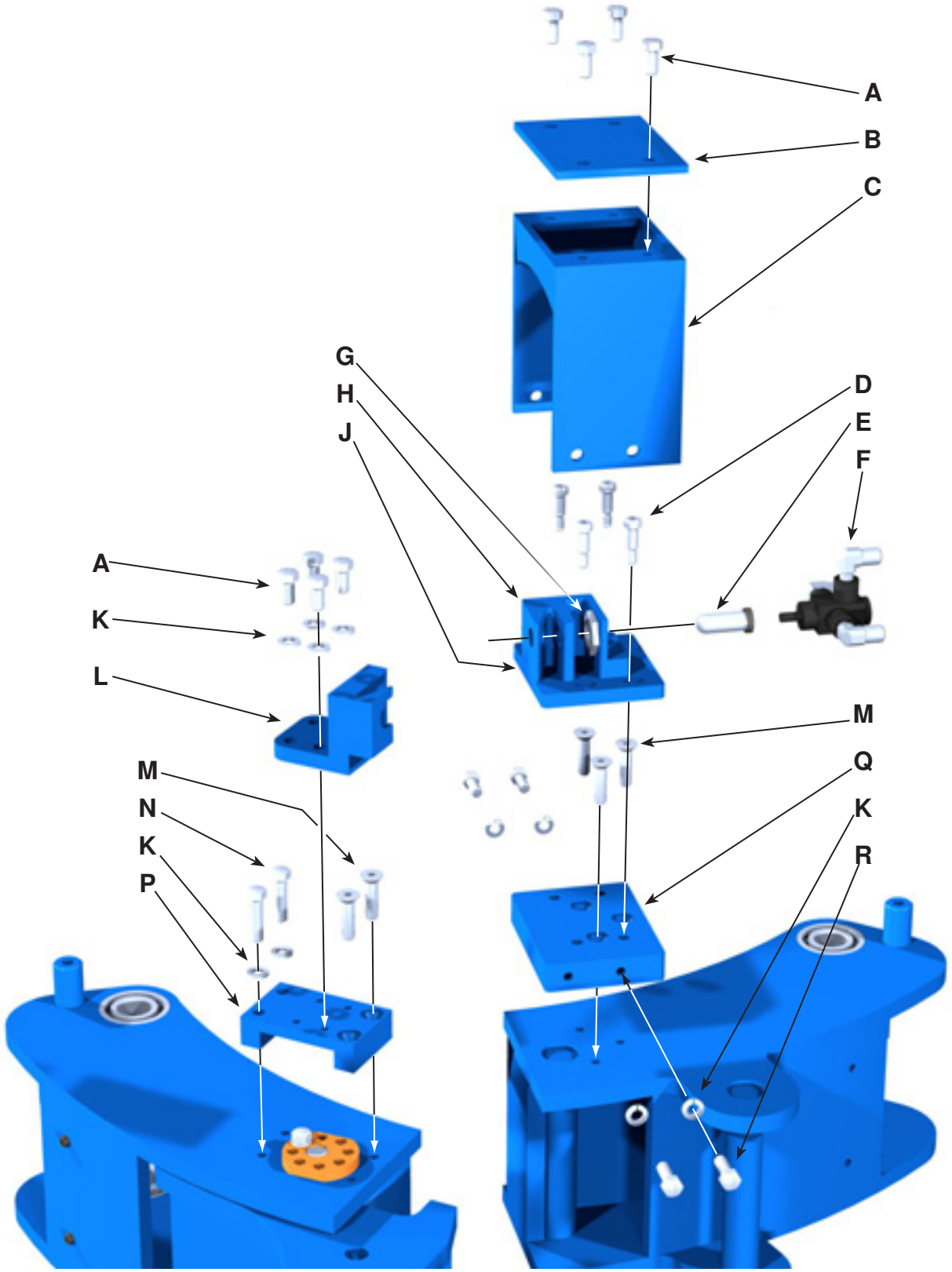


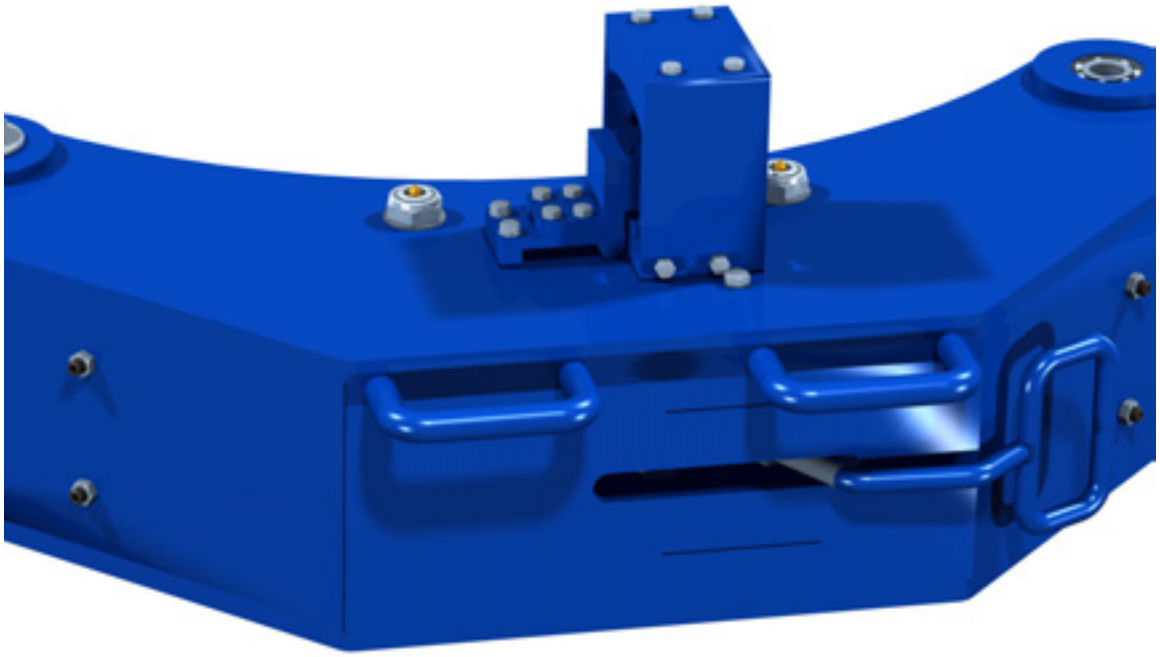
Item	Type	Description	Qty	Part Number
A	Part	5/8" x 3/4" Hex Socket Shoulder Bolt	4	09-0049
B	Part	1/2" Plain Washer	4	09-5120
C	Assembly	Door Cylinder	2	1095-141
D	Part	1-1/8" UNF Thin Nylock Nut (Door Pivot Roller)	4	09-5728
E	Part	Door Hinge Washer	4	1095-105-529
F	Part	Door Pivot Roller Shaft	2	1095-105-526
G	Weldment	RH Door Weldment	1	1095-105-526
H	Part	Door Bearing	4	1095-103-318
J	Part	Door Hinge Spacer	4	1095-105-528
K	Part	1/2" NC Jam Nut	4	09-5180
L	Part	1/2" NC x 1-1/2" Hex Socket Set Screw	4	





Item	Type	Description	Qty	Part Number
A	Part	Locating Bolt	2	1095-403
B	Weldment	LH Door Weldment	1	1095-416
C	Part	Locking Pin	2	1095-413
D	Part	Locking Pin Plate	2	1095-405-5
E	Part	1/2" NC x 3/4" Hex SHCS	8	09-2164
F	Weldment	Door Lock Lever	1	1095-308
G	Part	3/4" NC Hex Nut	2	09-5818
H	Part	Door Lock Bushing	1	1095-307
J	Part	1/2" NC x 2-1/4" Hex Bolt	1	09-1055
K	Part	1/2" NC Jam Nut	1	09-5180





Item	Type	Description	Qty	Part Number
A	Part	3/8" NC x 3/4" Hex Bolt	8	09-1044
B	Part	Safety Door Plate	1	101-1238
C	Weldment	Safety Door Protector Weldment	1	101-0450
D	Part	Unbrako 5/16" NC x 3/4" Hex Socket Shoulder Screw	4	09-0227
E	Part	Load Plunger	1	AE12-306
F	Part	Deltrol Gauge Isolator Valve GI21S	1	08-0337M
G	Part	15/16" Valve Lock Nut	1	09-0278
H	Part	LH Safety Door Latch Block	1	AE13-301S
J	Part	LH Safety Door Latch Plate #2	1	AE13-311
K	Part	3/8" Regular Carbon Steel Lock-washer	6	09-5106
L	Part	RH Safety Door Latch Block	1	AE-13-302M
M	Part	3/8" UNC x 1-1/2" Hex FHCS	5	09-4050
N	Part	3/8" UNC x 1-1/2" Hex Bolt	2	09-1050
P	Part	RH Safety Door Latch Plate	1	101-0479
Q	Part	LH Safety Door Latch Plate	1	101-0915
R	Part	3/8" UNC x 1" Hex Bolt	4	09-1170

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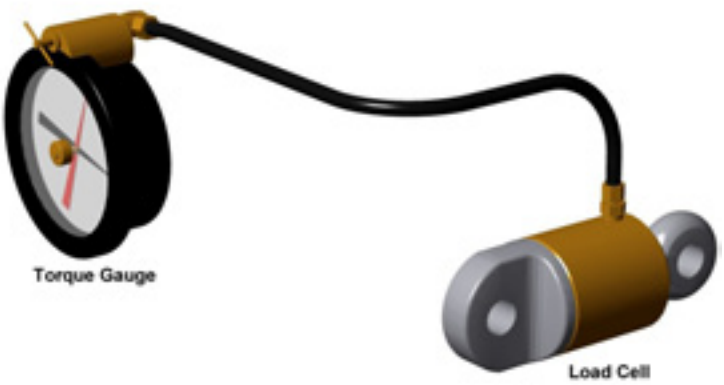
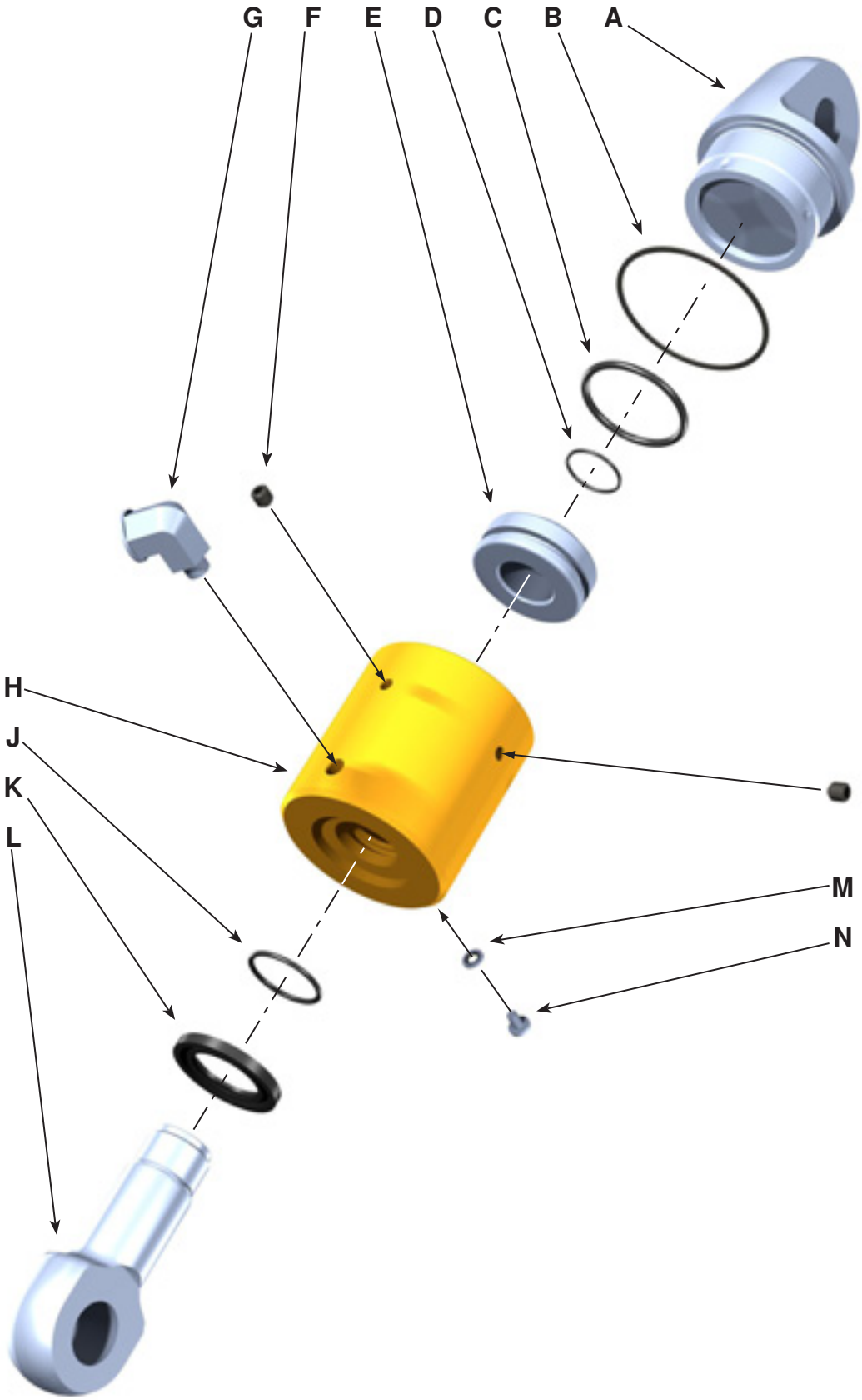
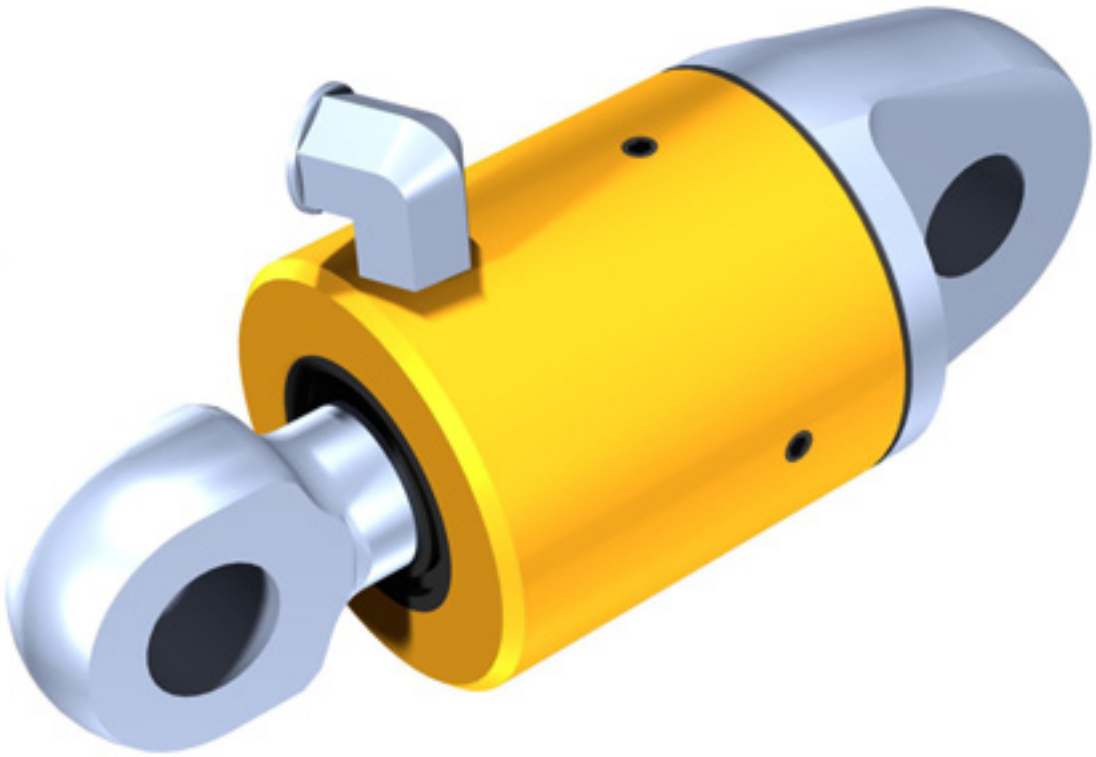


Type	Description	Qty	Part Number
Assembly	66" Arm 90K Tension Load Cell and Torque Gauge Assembly	1	10-0037T
Assembly	Tension Load Cell	1	10-0008T
Part	Torque Gauge, 90000 Lbs-Ft.	1	10-0037G
Part	Street Elbow	1	08-0304
Part	FPT Tee	1	08-0903
Part	Nipple Ext Pipe / Ext Pipe 4-4S	1	08-0190
Part	1" Plain Narrow Washer	1	09-5120
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	Load Cell End	1	LC99-003
B	Part	Flange Gasket	1	02-0073
C	Part	O-Ring	1	02-0350
D	Part	O-Ring	1	08-0596
E	Part	Load Cell Piston	1	LC99-101
F	Part	3/8" NC x 3/8" Cup Point Hex Set Screw	2	
G	Part	1/4" MNPT x 3/8" FNPT Street Elbow	1	08-0304
H	Part	Load Cell Body	1	LC99-104
J	Part	O-Ring	1	02-0800
K	Part	Wiper	1	08-1558
L	Part	Load Cell Rod	1	LC99-002
M	Part	Stat-O-Seal	1	02-0307
N	Part	1/4" NC x 1/2" Cross Recessed Binding Head Machine Screw		

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. *PROBLEM:* *No indication on gauge.*
   POSSIBLE SOLUTIONS: *Obstruction in hose.*
   Loss of hydraulic fluid.
   Gauge internal mechanism damaged.

2. *PROBLEM:* *Gauge indication too high.*
   POSSIBLE SOLUTIONS: *Excessive hydraulic fluid.*
   Internal mechanism of gauge is damaged.
   Gauge is out of tolerance and may require calibration

3. *PROBLEM:* *Gauge indication too low.*
   POSSIBLE SOLUTIONS: *Insufficient hydraulic fluid.*
   Gauge internal mechanism damaged.
   Gauge is out of tolerance and may require calibration

4. *PROBLEM:* *Erratic or sluggish gauge indication.*
   POSSIBLE SOLUTIONS: *Pointer rubbing glass or dial.*
   Insufficient hydraulic fluid.
   Dirty gauge movement.
   Improper pointer damper adjustment.
   Gauge internal mechanism damaged.
   Gauge is out of tolerance and may require calibration

PERIODIC INSPECTION AND MAINTENANCE

A. *Tong Torque Systems are built to give years of trouble-free service with minimum maintenance. Periodic inspections of the load cell, and 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.*

B. *Recharge hydraulic system with W15/16 fluid via the filling connection at the top of the indicating gauge. Recharging must only be performed when there is no load on the load cell.*

Procedure:

1. *Connect hand pump to filling connection on gauge.*
2. *Fill hand pump bowl with W15/16 hydraulic fluid and pump fluid into the system until the piston rod on the load cell extends no more than 1/2" from the body.*
3. *Loosen vent screw on load cell body to permit trapped air to escape during loading.*

* **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**

4. *Retighten load cell vent screw when the system has been adequately recharged*

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

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Kawasaki Motors Corp., U.S.A.
Precision Machinery Division

HMB 080

Staffa Fixed Displacement Hydraulic Motor

CONTENTS

1. GENERAL DESCRIPTION

The HMB080 fixed displacement motor is one of 12 frame sizes in the Kawasaki "Staffa" range of high torque, low speed radial piston motors which extends from 94 to 6800 cm^3/r (5.76 to 415 in^3/r) capacity. The rugged, well-proven design incorporates hydrostatic balancing techniques to achieve high efficiency, combined with good breakout torque and smooth running capability.

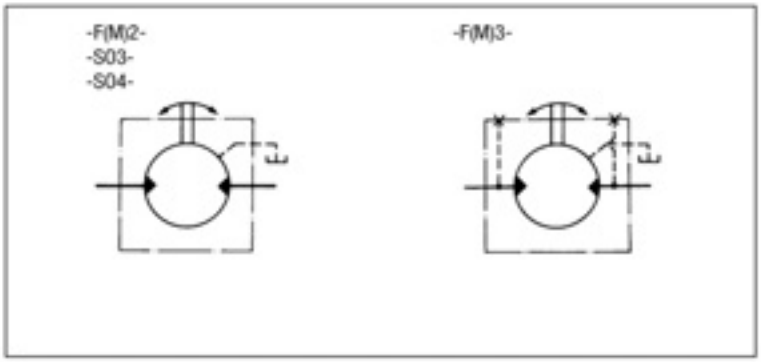
Various features and options are available including, on request, mountings to match competitor interfaces.

The HMB080 is capable of torque outputs up to 5950 Nm (4390 lbf ft) and speeds to 300 r/min with a continuous output of up to 100 kW (134 hp).

The Kawasaki "Staffa" range also includes dual and continuously variable displacement motors, plus matching brakes and gearboxes to extend the available torque range.

2. FUNCTIONAL SYMBOLS

All model types with variants in model code position **4**



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3. MODEL CODE

Features shown in brackets ( ) may be left blank according to requirements.
All other features must be specified.

(F)-HM(*)B080-(H)*(V)-**-(**)-3*-(PL**)**

1 **2** **3** **4** **5** **6** **7**

1 FLUID TYPE

Blank = Petroleum oil
F3 = Phosphate ester (HFD fluid)
F11 = Water-based fluids (HFA, HFB and HFC)

2 MODEL TYPE

Blank = Standard ("HMB")
M = To NCB (UK) specification 463/1981 ("HMMB")
R = Dual mount (front or rear)

3 SHAFT TYPE

Use "H" prefix code as noted to specify "hollow" shafts with through hole Ø 26,2 (1.03 dia).
Hollow shafts are available only with type "S04" main port connection.
(H)P* = Cylindrical shaft with key
(H)S* = Cylindrical, 14 splines to BS 3550
(H)Z* = Cylindrical shaft to DIN 5480 (W70 x 3 x 22 x 7h)
(H)Q* = Female, 24 splines to BS 3550
T* = Long tapered, keyed shaft
X* = Short tapered, keyed shaft

* *For installations where shaft is vertically upwards specify "V" after shaft type letter to ensure that additional high level drain port is provided.*

4 MAIN PORT CONNECTIONS

Models with 2¼" distributor valve▲
F2◆ = SAE 1", 4-bolt (UNC) flanges
FM2◆ = SAE 1", 4-bolt (metric) flanges
Models with 3" distributor valve
S03 = 6-bolt (UNF) flange (Staffa original valve housing)
F3 = SAE 1¼", 4-bolt (UNC) flanges
FM3 = SAE 1¼", 4-bolt (metric) flanges
Models with 4" distributor valve■
Must be specified when requiring hollow shafts, type HP, HS, HZ or HQ
S04■ = 6 bolt (UNF) flange (Staffa original valve housing)

▲ *Gives minimum overall length of HMB080 motor*
◆ *Max. inlet flow 200 l/min (53 USgpm); reduced max. continuous speed and output power, see "Performance Data", page 4.*
■ *Obligatory for hollow shafts. See increased installation dimensions with 4" valve.*

5 TACHO/ENCODER DRIVE

T = Staffa original tacho drive
T1 = Suitable for Hohner 3000 series encoders. (Encoder to be ordered separately)
Omit if not required and when specifying shaft types "H**"

6 DESIGN NUMBER, 3* SERIES

Subject to change. Installation and performance details remain unaltered for design numbers 30 to 39 inclusive.

7 SPECIAL FEATURES

PL** = non-catalogued features, e.g.:
Stainless steel shaft sleeves
Alternative encoder and tacho drives
Alternative port connections
Shaft variants
Alternative reduced capacities
Special mountings
Special paint

** *Number assigned as required to specific customer build.*

4. PERFORMANCE DATA

Performance data is valid for Staffa HMB080 motors fully run in and operating with petroleum oil. See separate table for pressure and speed limits when using fire-resistant fluids. Leakage values are at fluid viscosity of 50 cSt (232 SUS).

MOTOR DATA

		Port connection type, see model code 4	
		S03, F3, FM3, S04	F2, FM2
Geometric displacement▲	cm^3/r (in^3/r)	1344 (82)	1344 (82)
Average actual running torque	Nm/bar (lbf ft/psi)	19,9 (1.01)	19,9 (1.01)
Max. continuous◆speed	r/min	300	150
Max. continuous◆output	kW (hp)	100 (134)	77 (103)
Max. continuous◆pressure	bar (psi)	250 (3625)	250 (3625)
Max. intermittent◆pressure	bar (psi)	293 (4250)	293 (4250)

▲ *Other lower displacements are made available to special order*
◆ *See "Rating Definitions", this page*

LIMITS FOR FIRE RESISTANT FLUIDS

Fluid type	Pressure, bar (psi) Continuous	Intermittent	Max. speed r/min
HFA, 5/95% oil-in-water emulsion	103 (1500)	138 (2000)	50% of limits for petroleum oil
HFB, 60/40% water-in-oil emulsion	138 (2000)	172 (2500)	As for petroleum oil
HFC, water glycol	103 (1500)	138 (2000)	50% of limits for petroleum oil
HFD, phosphate ester	250 (3625)	293 (4250)	As for petroleum oil

RATING DEFINITIONS

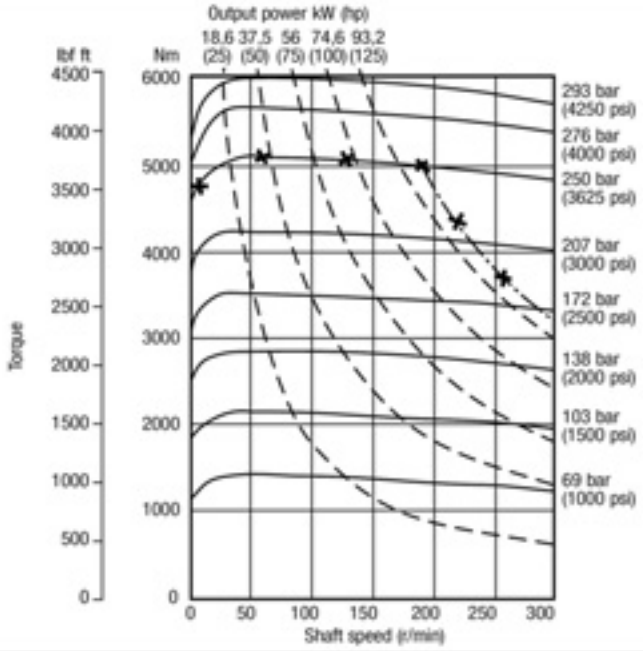
● CONTINUOUS RATING
For continuous duty the motor must be operating within each of the maximum values for speed, pressure and power.

● INTERMITTENT RATING
Operation within the intermittent power rating (up to the maximum continuous speed) is permitted on a 15% duty basis, for periods up to 5 minutes maximum.

● INTERMITTENT MAX. PRESSURE
Up to 293 bar (4250 psi) is allowable on the following basis:
(a) Up to 50 r/min: 15% duty for periods up to 5 minutes maximum.
(b) Over 50 r/min: 2% duty for periods up to 30 seconds maximum.

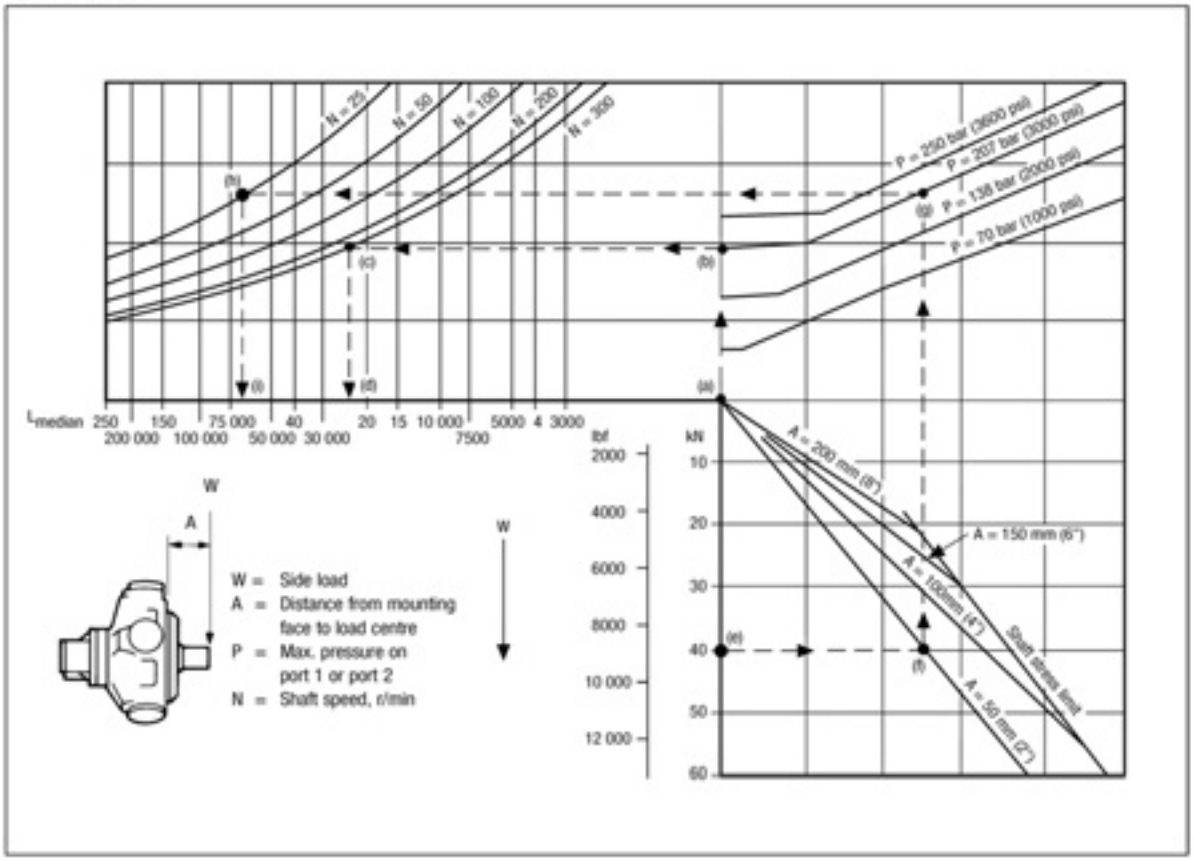
OUTPUT TORQUES

The torque curves indicate the maximum output torque and power of a fully run-in motor for a range of pressures and speeds when operating with zero outlet pressure on petroleum oil of 50 cSt (232 SUS) viscosity. High return line pressures will reduce torque for a given pressure differential.



–×–×–×– Upper limit of continuous rating envelope, see "Rating definitions" above.

BEARING LIFE



The nomograph allows the median ▲ bearing life to be determined for conditions of:
1. No side load and no axial thrust
2. Side load and no axial thrust

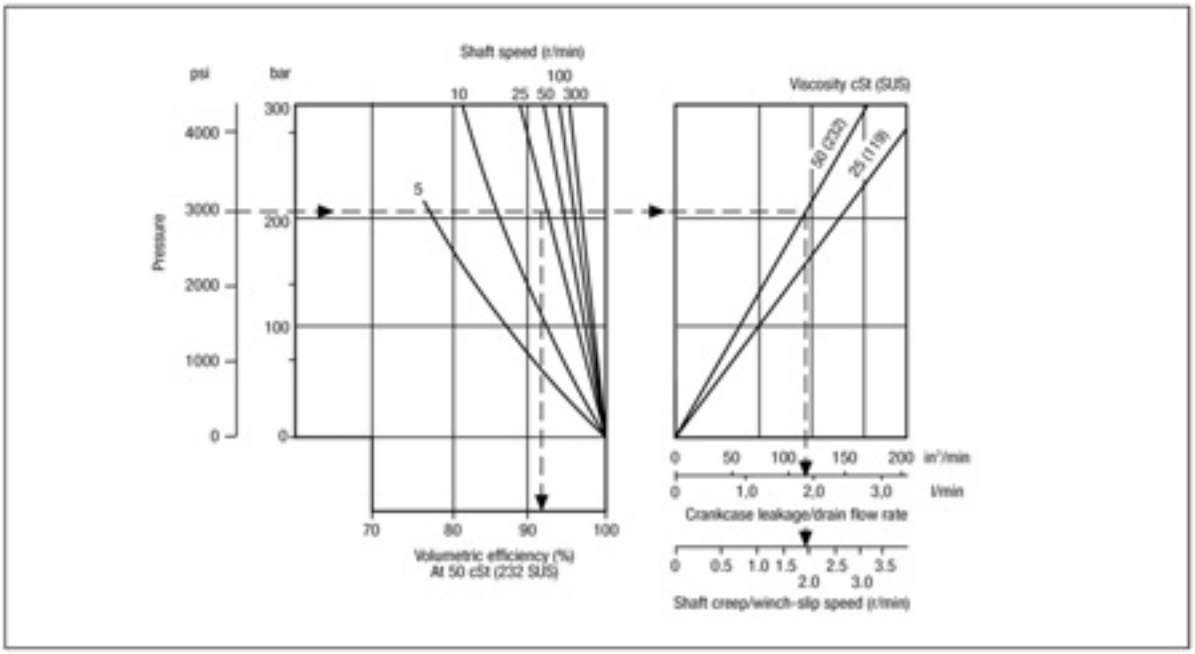
▲ *To determine L10 life predictions per ISO 281-1-1977 multiply the median figure by 0.2.*

	HMB080
Example 1 (follow chain dotted line):	
Side load (W)	a) 0
System pressure (P)	b) 207 bar (3000 psi)
Speed (N)	c) 300 r/min
Median bearing life	d) 23 000 hrs
L10 bearing rating = median x 0.2	4600 hrs
Example 2 (follow chain dotted line):	
Side load (W)	e) 40 kN (9000 lbf)
Load offset (A) from motor mounting face	f) 50 mm (2.0 in)
System pressure (P)	g) 207 bar (3000 psi)
Speed (N)	h) 25 r/min
Median bearing life	i) 62 000 hrs
L10 bearing rating = median x 0.2	12 400 hrs

For more precise life prediction, or where axial thrusts are incurred, a computer analysis can be provided by Kawasaki on receipt of machine duty cycle.

● SHAFT STRESS LIMIT
The shaft stress limit in the nomograph is based on the fatigue rating of shaft types "(H)S" and "(H)P". Infrequent loading above these limits may be permitted; consult Kawasaki.

VOLUMETRIC EFFICIENCY



This nomograph enables the average volumetric efficiency, crankcase (drain) leakage and "winch slip"/shaft creep speed to be estimated.

Example (follow chain dotted line):
Given:
1. Pressure ..... 207 bar (3000 psi)
2. Speed ..... 25 r/min
3. Viscosity ..... 50 cSt (232 SUS)

To obtain:
4. Volumetric efficiency 91.8%
5. Crankcase leakage ..... 1,9 l/min (115.0 in^3/min)
6. Shaft creep speed ..... 1.9 r/min

The shaft creep speed occurs when the load attempts to rotate the motor against closed ports as may occur, for example, in winch applications.

5. CIRCUIT AND APPLICATION NOTES

STARTING TORQUES
The starting torques shown on the graph on page 4 are average and will vary with system parameters.

LOW SPEED OPERATION
Minimum operating speeds are determined by load conditions (load inertia, drive elasticity, etc.). For operation at speeds below 3 r/min consult Kawasaki.

HIGH BACK PRESSURE
When both inlet and outlet ports are pressurized continuously, the lower pressure in one port must not exceed 70 bar (1000 psi). Consult Kawasaki on applications beyond this limit. Note that high back pressures reduce the effective torque output of the motor.

BOOST PRESSURE
When operating as a motor the outlet pressure should equal or exceed the crankcase pressure. If pumping occurs (i.e. overrunning loads) then a positive pressure, "P", is required at the motor inlet ports. Calculate "P" according to port connection type being used, from:

$$P\ (bar) = 1 + \frac{N^2}{D_{bar}} + C\ bar$$

$$P\ (psi) = 14.5 + \frac{N^2}{D_{psi}} + C\ psi$$

Where:
N = speed, r/min
C = crankcase pressure
D = see table

Port connection type	D value
F2 & FM2	$D_{bar} = 1500$ $D_{psi} = 103$
S03, S04 F3, FM3	$D_{bar} = 10\ 000$ $D_{psi} = 690$

The flow rate of oil needed for the make-up system can be estimated from the crankcase leakage figure (see Volumetric Efficiency graph above). Allowance should be made for other system losses and also for "fair wear and tear" during the life of the motor, pump and other system components.

COOLING FLOW
Operation within the continuous ratings does not require any additional cooling.

For operating conditions above "continuous", up to the "intermittent" ratings, additional cooling oil may be required. This can be introduced through the spare crankcase drain hole or, in special cases, through the valve spool end cap. Consult Kawasaki about such applications.

MOTOR CASING PRESSURE
With the standard shaft seal fitted, the motor casing pressure should not exceed 3,5 bar (50 psi). On installations with long drain lines a relief valve is recommended to prevent over-pressurizing the seal.

Notes:
1. *The casing pressure at all times must not exceed either the motor inlet or outlet pressure.*
2. *High pressure shaft seals are available to special order for casing pressures of:*
   Continuous: 10 bar (150 psi)
   Intermittent: 15 bar (225 psi)
3. *Check installation dimensions (page 8) for maximum crankcase drain fitting depth.*

6. HYDRAULIC FLUIDS

Dependent on motor (see Model Code position 1) suitable fluids include:
- Antiwear hydraulic oils
- Phosphate esters (HFD fluids)
- Water glycols (HFC fluids) ▲
- 60/40% water-in-oil emulsions (HFB fluids) ▲
- 5/95% oil-in-water emulsions (HFA fluids) ▲

▲ *Reduced pressure and speed limits, see page 4.*

Viscosity limits when using any fluid except oil-in-water (5/95%) emulsions are:

Max. off load	2000 cSt (9270 SUS)
Max. on load	150 cSt (695 SUS)
Optimum	50 cSt (232 SUS)
Minimum	25 cSt (119 SUS)

PETROLEUM OIL RECOMMENDATIONS
The fluid should be a good hydraulic grade, non-detergent petroleum oil. It should contain anti-oxidant, anti-foam and demulsifying additives. It must contain antiwear or EP additives. Automatic transmission fluids and motor oils are not recommended.

7. TEMPERATURE LIMITS

Ambient min.	-30°C (-22°F)
Ambient max.	+70°C (158°F)

Max. operating temperature range

	Petroleum oil	Water-containing
Min.	-20°C (-4°F)	+10°C (50°F)
Max.*	+80°C (175°F)	+54°C (130°F)

* *To obtain optimum service life from both fluid and hydraulic system components 65°C (150°F) normally is the maximum temperature except for water-containing fluids.*

8. FILTRATION

Full flow filtration (open circuit), or full boost flow filtration (closed circuit) to ensure system cleanliness of ISO 4406/1986 code 18/14 or cleaner.

9. NOISE LEVELS

The airborne noise level is less than 66,7 dB(A) DIN (70 dB(A) NFPA) throughout the "continuous" operating envelope.

Where noise is a critical factor, installation resonances can be reduced by isolating the motor by elastomeric means from the structure and the return line installation. Potential return line resonances originating from liquid borne noise can be further attenuated by providing a return line back pressure of 2 to 5 bar (30 to 70 psi).

10. POLAR MOMENT OF INERTIA

Typical data: 0,06 kg m² (210 lb in²).

11. MASS

Approx., all models: 144 kg (317 lb).

11. INSTALLATION DATA

GENERAL

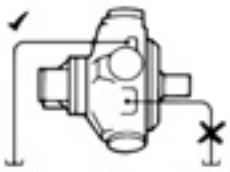
● Spigot
The motor should be located by the mounting spigot on a flat, robust surface using correctly sized bolts. The diametral clearance between the motor spigot and the mounting must not exceed 0,15 mm (0.006 in). If the application incurs shock loading, frequent reversing or high speed running, then high tensile bolts should be used, including one fitted bolt.

● Bolt torque
The recommended torque wrench settings for the mounting bolts are:
M20 bolts....407±14 Nm (300±10 lbf ft)
¾" bolts....393±14 Nm (290±10 lbf ft)

● Shaft coupling
Where the motor is solidly coupled to a shaft having independent bearings the shafts must be aligned to within 0,13 mm (0.005 in) TIR.

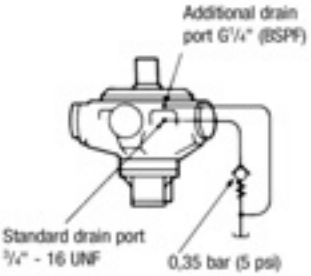
CRANKCASE DRAIN

Motor axis horizontal



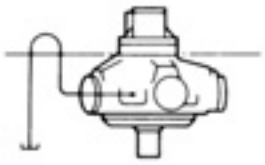
The crankcase drain must be taken from a position above the horizontal centre line of the motor.

Axis vertical, shaft up



An additional G¼" (BSPF) drain port is provided when the "V" (shaft vertically upwards) designator is given after the shaft type letter in position 3 of the model code. This additional drain should be connected into the main motor casing drain line downstream of a 0,35 bar (5 psi) check valve to ensure lubrication of the upper bearing, see above diagram.

Axis vertical, shaft down



Use any drain position. The drain line should be run above the level of the uppermost bearing; if there is risk of siphoning then a siphon breaker should be fitted.

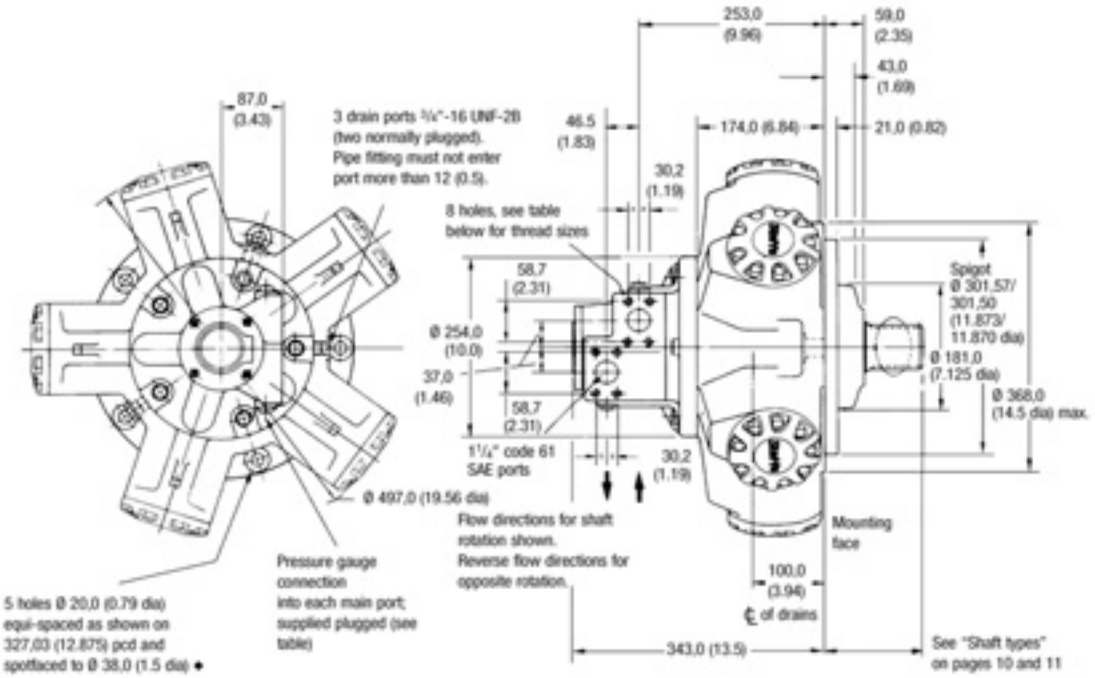
START-UP
Fill the crankcase with system fluid. Where practical, a short period (30 minutes) of "running-in" should be carried out.

13. INSTALLATION DIMENSIONS IN MM (INCHES)

FRONT-MOUNTING MODELS
HMB080 MOTORS WITH TYPE "F3"/"FM3" (1¼" SAE) PORT CONNECTION

3rd angle projection

See separate drawing for dual-mount model.
See additional views for shaft types and for types "S03" and "S04" port connection.
See drawing of dual-mount model for details of types "F2" and "FM2" port connection.

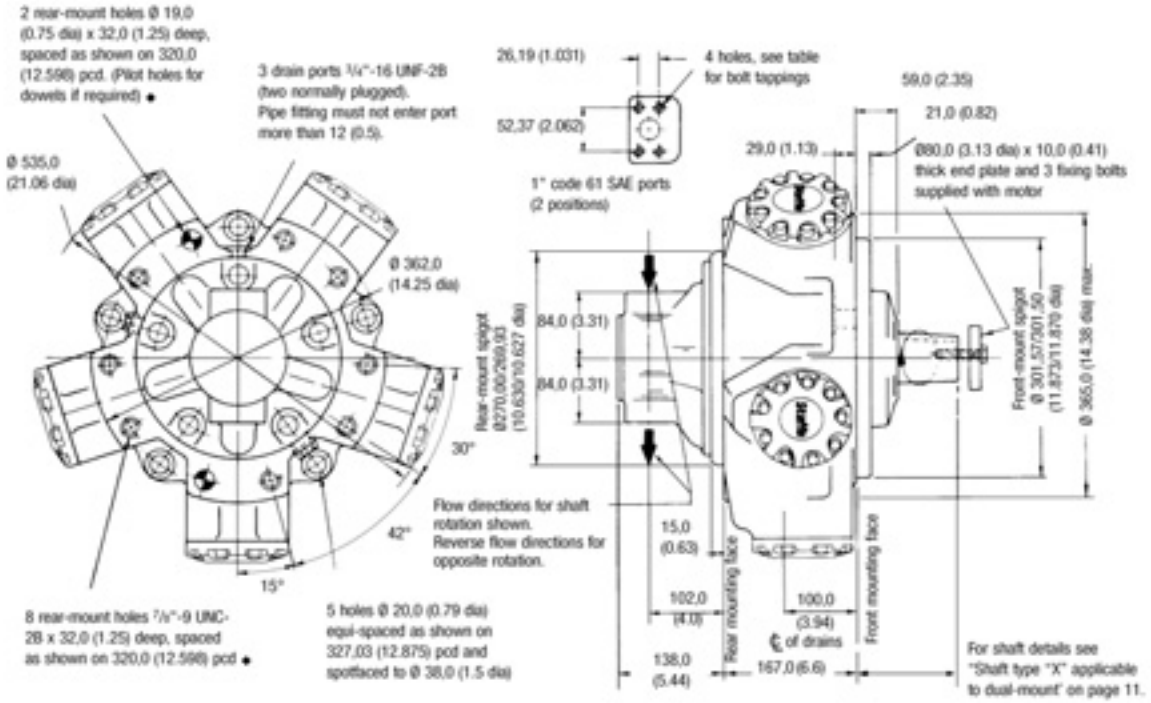


Port flange bolt tappings

Model code 4	Tapping size	Gauge connections
F3	7/16"-14 UNC-2B x 27,0 (1.06) full thread depth	9/16"-18 UNF-2B, SAE J475
FM3	M12 x P1.75 x 27,0 (1.06) full thread depth	G¼" (BSPF)

◆ ⌖ Ø 0,15 (0.006)

DUAL-MOUNT MODELS
HMRB080 MOTORS WITH TYPE "F2"/"FM2" (1" SAE) PORT CONNECTION
See additional views for shaft types and for types "S03" and "S04" port connection.
See drawing of front-mount model for details of types "F3" and "FM3" port connection.

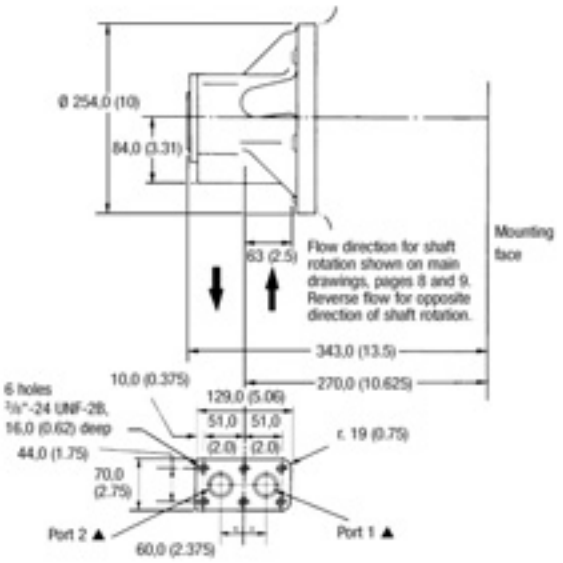


Port flange bolt tappings

Model code 4	Tapping size
F2	⅜"-16 UNC-2B x 22,0 (0.87) deep
FM2	M10 x P1.5 x 22,0 (0.87) deep

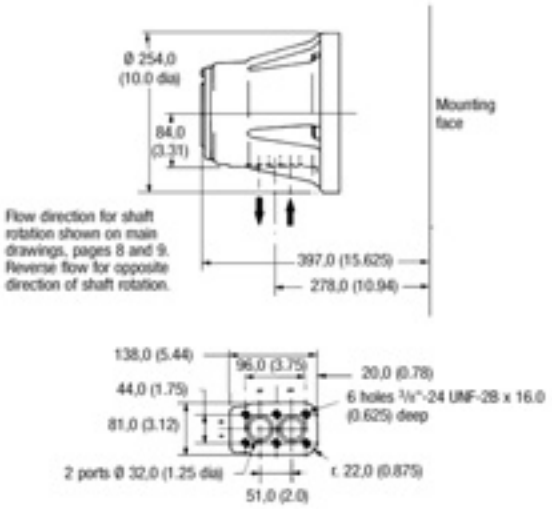
⌖ Ø 0,15 (0.006)

3" VALVE HOUSING WITH 6-BOLT FLANGE, "S03" IN MODEL CODE POSITION 4



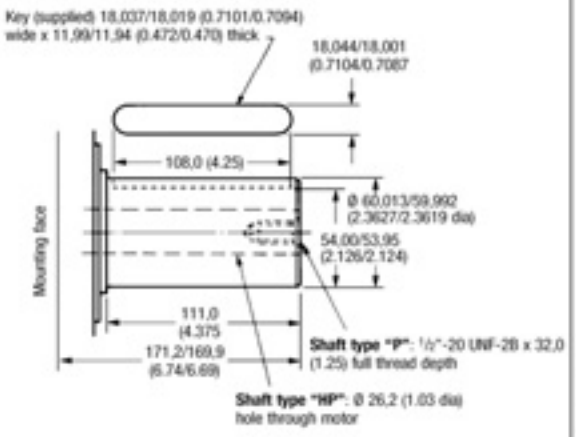
▲ *Ø 28 (1.125 dia) with recess for 31,0 (1.22) i/d x Ø 4 (0.157 dia) section O-ring*

4" VALVE HOUSING WITH 6-BOLT FLANGE, "S04" IN MODEL CODE POSITION 4



SHAFT TYPES "P" AND "HP", MODEL CODE POSITION 3

Cylindrical shaft with key

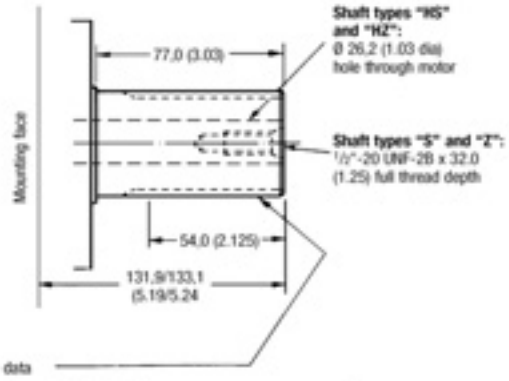


SHAFT TYPES "S" AND "HS", MODEL CODE POSITION 3

Cylindrical shaft with 14 splines to BS 3550-1963

SHAFT TYPES "Z" AND "HZ", MODEL CODE POSITION 3

Cylindrical shaft with splines to DIN 5480



For shaft types "S" and "HS"
to BS 3550/SAE J498c (ANSI B92.1 1970 class 5)
Flat root side fit, class 1

Pressure angle	30°
Number of teeth	14
Pitch	6/12
Major diameter	62,553/62,425 (2.4627/2.4577)
Form diameter	55,052 (2.1674)
Minor diameter	54,084/53,525 (2.1293/2.1073)
Pin diameter	8,128 (0.3200)
Diameter over pins	71,593/71,544 (2.8186/2.8167)

For shaft types "Z" and "HZ"
DIN 5480, W70 x 3 x 22 x 7h

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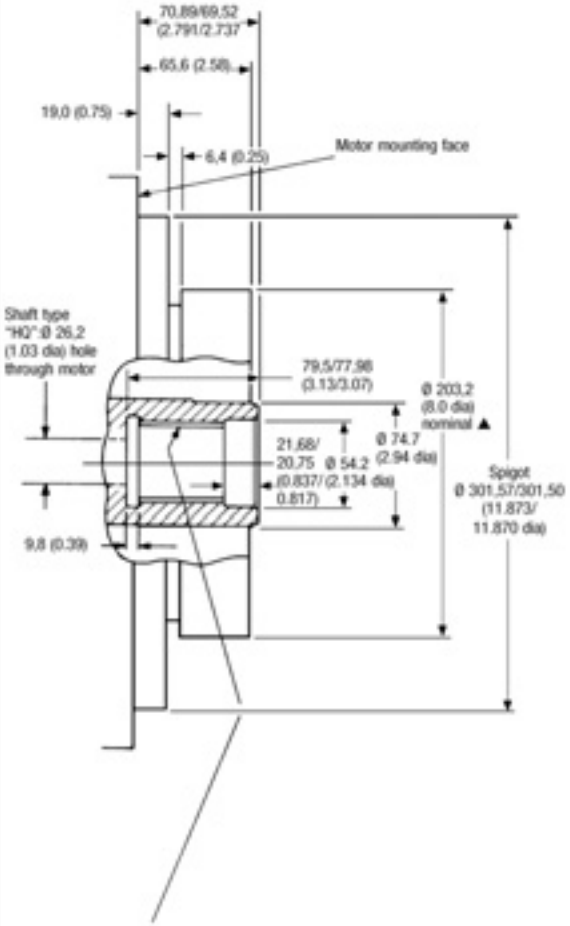
SHAFT TYPES "Q" AND "HQ", MODEL CODE POSITION 3

Female shaft with 24 splines to BS 3550

Note: The "Q" and "HQ" shafts will transmit the maximum torque given on page 4. However, customers should ensure that their own mating shaft will transmit the torque required in their application.



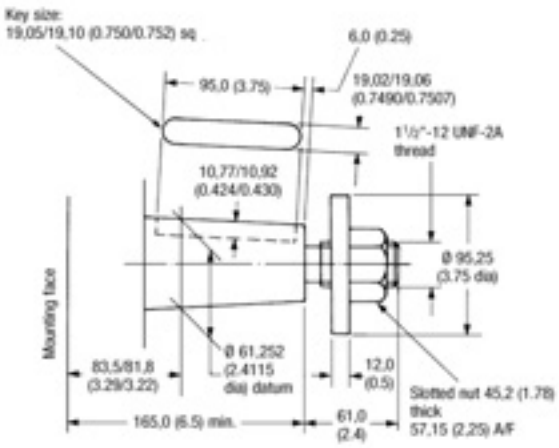
Spline data

To BS 3550	
Flat root side fit, modified	
Pressure angle	30°
Number of teeth	24
Pitch	12/24
Major diameter	53,246/52,916 (2.0963/2.0833)
Minor diameter	48,811/48,684 (1.9217/1.9167)
Pin diameter	3,658 (0.1440)
Pin flatted to	3,560 (0.1400)
Diameter between pins	45,626/45,550 (1.7963/1.7933)

▲ *Use mounting face spigot for motor location*

SHAFT TYPE "T", MODEL CODE POSITION 3

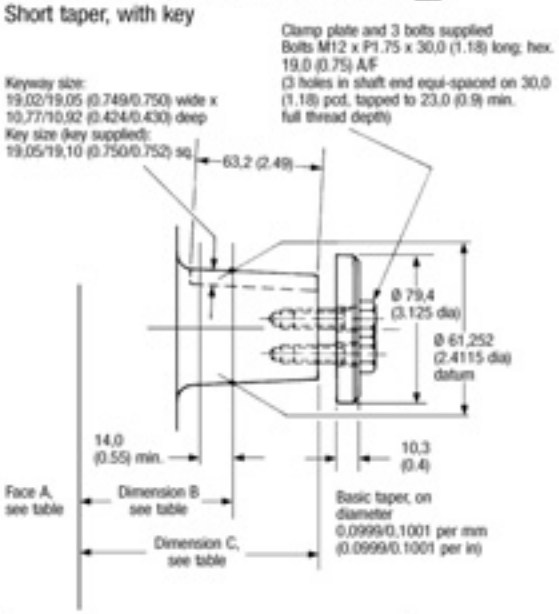
Long taper, with key



Basic taper, on diameter
0,0999/0,1001 per mm
(0.0999/0.1001 per in)

SHAFT TYPE "X", MODEL CODE POSITION 3

Short taper, with key



For front-mount models:		
Face A	=	Front mounting face
Dim. B	=	83,31/81,43 (3.280/3.206)
Dim. C	=	129,4 (5.09)
For dual-mount models:		
Face A	=	Rear mounting face
Dim. B	=	250,8/248,92 (9.874/9.800)
Dim. C	=	297,0 (11.69)

Inlets (3500 psi)

Code	End Port	Top Port
DVG35-A880	SAE-16	SAE-16
DVG35-A880-SM	SAE-16	SAE-16
	Machined for solenoid sections pilot supply. SAE-6 pilot port.	
DVG35-A980	SAE-20	SAE-16
DVG35-A990	SAE-20	SAE-16
DVG35-A000	NON-PORTED	SAE-20

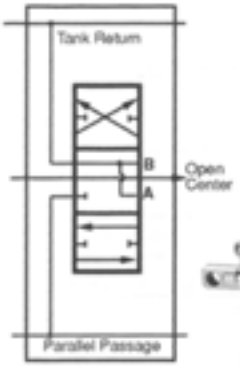
Note: Inlets are machined for a main R/V or R/V plug and are furnished with plastic closures .See Section G, Page 32 for inlet port plugs

Sections shown have main R/V

Outlets (Thru Stud Type)

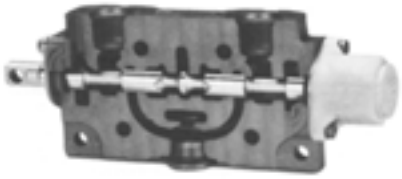
Tank Return Type

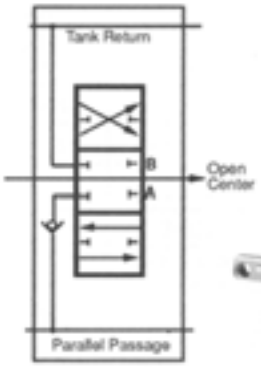
Code	End Port	Top Port
DVG35-TTR99	SAE-20	SAE-20
DVG35-TTR00	NON-PORTED	



MA8

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





DA8

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

Adjustable Relief Valves

Code	
DVG35-HMRV	Screw - adjusted main relief valve Pressure range 2800 - 3500 psi Factory set @ 3000 psi @ 30 gpm
DVA35-MRVP	Main relief valve plug

Brief Circuit Descriptions

Series Circuit

Available in DVA20 sections only.

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

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

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

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

Parallel Circuits

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

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

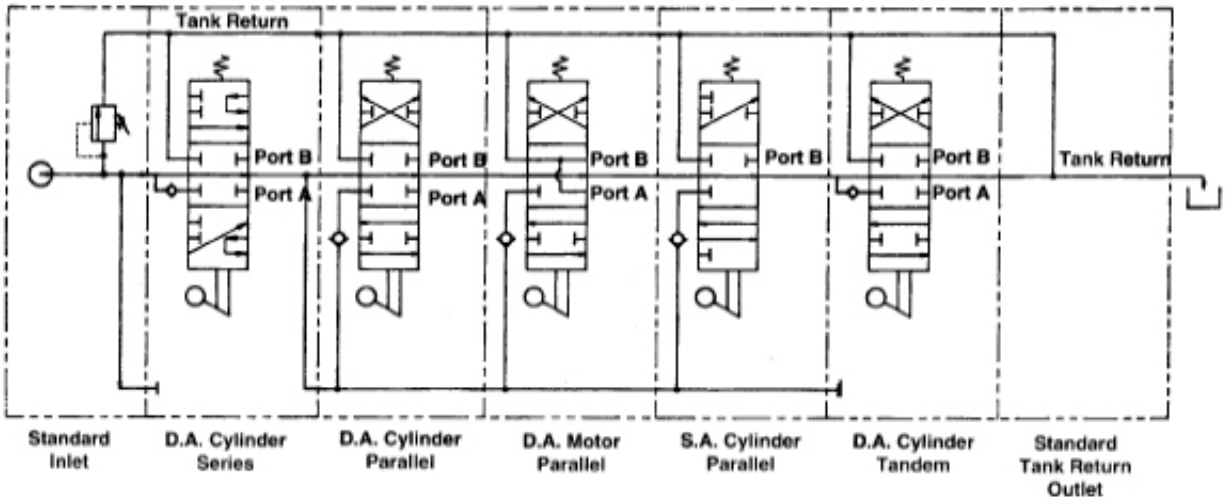
Tandem Circuits

(Not available in the program)

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

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

Typical Work Section Schematics



Parallel Circuits (3500 psi)

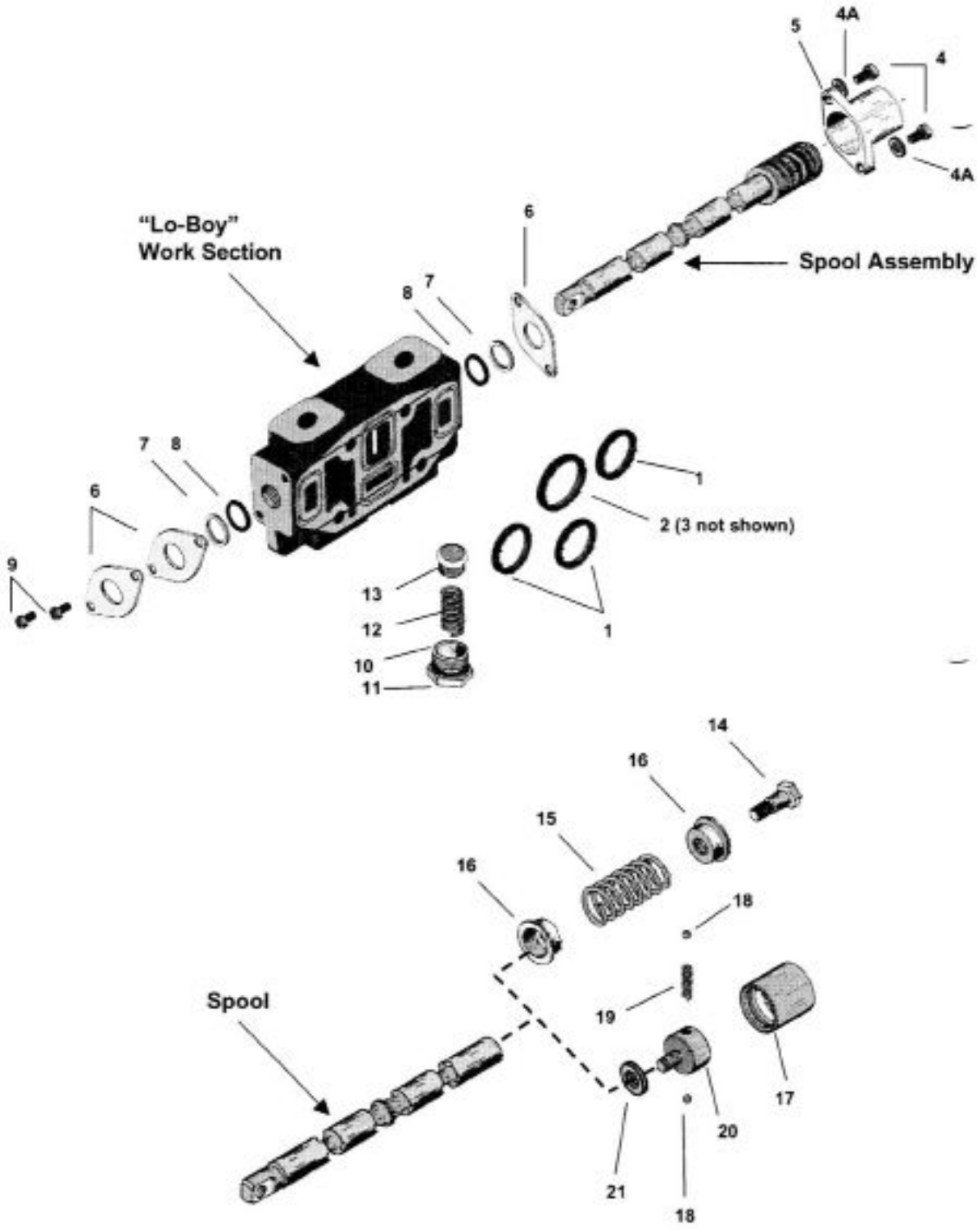
Low-boy Work Sections

CODE	4-Way 3-Pos Hold In Neutral	3-Way 3-Pos Hold In Neutral	4-Way 3-Pos Float In Neutral	Port Size	Work Port NOT Machined	Spring Return	3-Pos Detent	Metered Hydraulic Remote Control	Solenoid Operated	
DVG35-DA0	•				•	•				
DVG35-DA8	•			SAE-16		•				
DVG35-MA8			•	SAE-16		•				
DVG35-DX8	•			SAE-16				•		
DVG35-DK8	•			SAE-16					•	
DVG35-SA8		•		SAE-16		•				

Hi-boy Work Sections

CODE	4-Way 3-Pos Hold In Neutral	3-Way 3-Pos Hold In Neutral	4-Way 3-Pos Float In Neutral	Port Size	Work Port NOT Machined	Spring Return	3-Pos Detent	Metered Hydraulic Remote Control	Solenoid Operated	Air Shift	Port R/V Machined
DVG35-HA055	•				•	•					•
DVG35-LA055			•		•	•					•
DVG35-HA855	•			SAE-16		•					•
DVG35-HB855	•			SAE-16			•				•
DVG35-LA855			•	SAE-16		•					•
DVG35-LB855			•	SAE-16			•				•
DVG35-JA805		•		SAE-16		•					•
DVG35-HX855	•			SAE-16				•			•
DVG35-LX855			•	SAE-16				•			•
DVG35-HK855	•			SAE-16					• 12vDC		•
DVG35-LK855			•	SAE-16					• 12vDC		•
DVG35-HV855	•			SAE-16						•	•
DVG35-LV855			•	SAE-16						•	•

Note: See section G, pages 32 and 33, for section seal kits and R/V port accessories.
Codes outside the shaded area may require longer lead time.
Most codes outside the shaded area can be made from codes inside the area and the kits on page 33.
Solenoids are furnished with spade connectors.
Machining instructions for standard housings are included in solenoid kits.



VA20 / VA35 Valve Sections				
Parallel Section Seals				
Item	**Type**	**Description**	**Qty**	**Part Number**
1	Part	Square Seal For Parallel Lo-Boy Valve Section	1	02-0080
2	Part	Square Seal For Parallel Lo-Boy Valve Section	3	02-0081
PARALLEL SECTION COMPONENT PARTS - See figures 3 & 4				
4	Part	Back Cap Screw	2	02-0084S
5	Part	Back Cap	1	02-0084
6	Part	Retainer Plate	3	02-0086
7	Part	Back-Up Ring	2	02-0087
8	Part	Spool Seal	2	02-0088
9	Part	Retainer Plate Screw	2	02-0086S
10	Part	Check Valve Cap	1	
11	Part	Check Valve O-Ring Seal	1	
12	Part	Check Spring	1	
13	Part	Check Valve Poppet	1	
Parts 14 through 20 no longer available individually, must be ordered as a Spring Return kit				
	Kit	Spring Return Kit		02-0090K
14	Part	Stripper Bolt	1	
15	Part	Centering Spring	1	
16	Part	Spring Guide	2	
17	Part	Detent Sleeve	1	
18	Part	Detent Ball	2	
19	Part	Detent Spring	1	
20	Part	Detent Poppet Retainer	1	

Valve Disassembly Instructions

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

Step 1 - Valve Bank

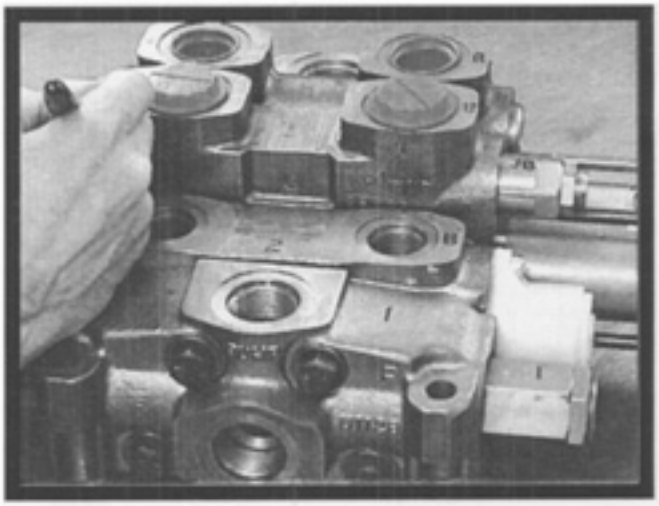
This step is the most critical in the disassembly procedure. It should be followed closely to ensure that the valve bank is properly reassembled after repairs have been made.

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).

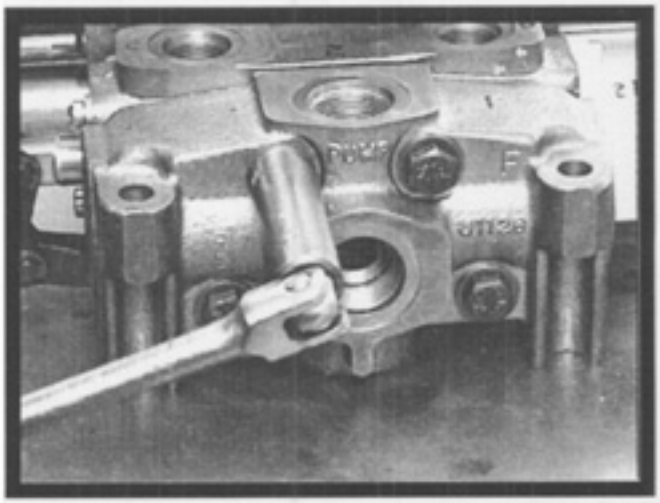
Finally, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they were removed. Inlet and mid-inlet relief valves are marked with a casting number only.



Step 2 - Tie Bolts

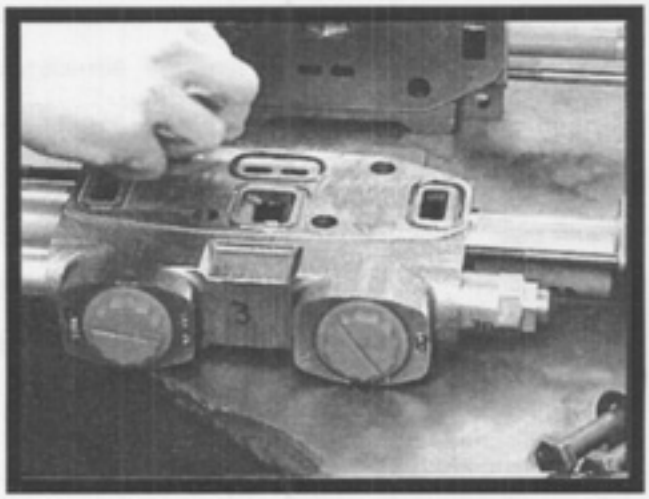
Remove the four, tie bolts that hold the bank together and separate the sections.

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.



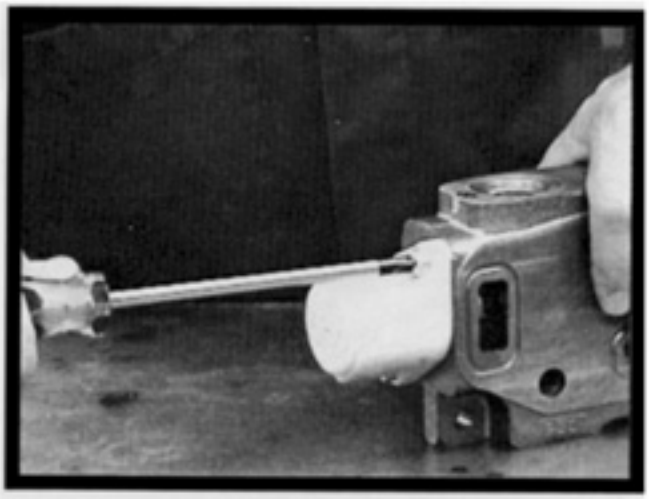
Step 3 - Section Seals

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

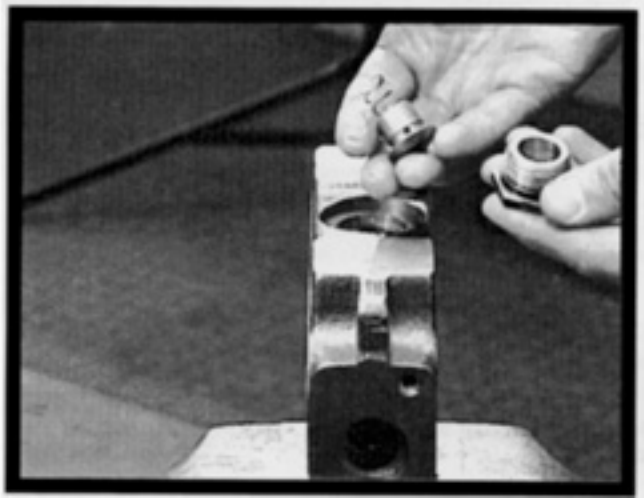
Using a large, Phillips-head screwdriver, remove the two, cap screws (Fig. 1, item 4) which fasten the back cap to the work section. Lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (Fig. 1, item 5).

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



Step 6 - Transition Check

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

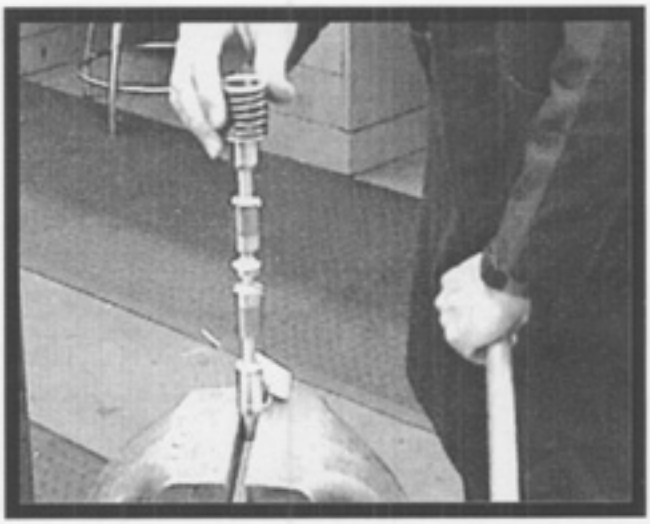
NOTE: Only cylinder work sections (ports blocked in neutral) have a transition check. Motor sections have only a cap plug.

Valve Disassembly Instructions

Spool Disassembly

Spring Centered Spool

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



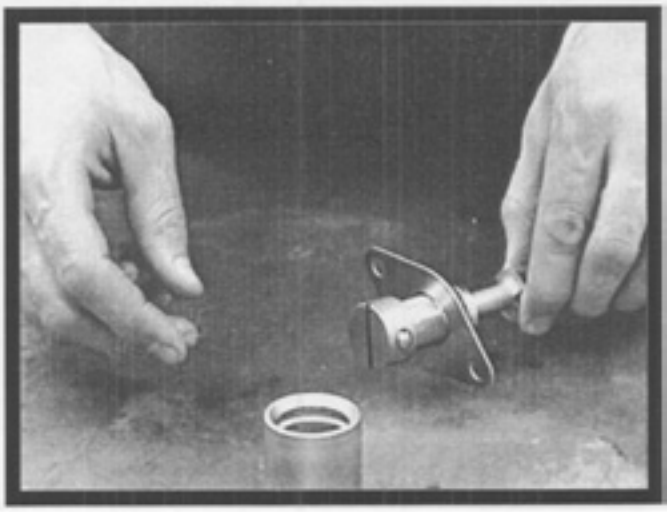
Lightly tap the stripper bolt with a hammer and a punch to help break the adhesive. Cautious application of heat may be required to free the stripper bolt, since an anaerobic thread adhesive was used during its assembly.

CAUTION: Too much heat may distort the spool.

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

Detent Spool

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



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

CAUTION: Too much heat may distort the spool!

CLEANING, INSPECTION, AND REPAIR

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

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

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

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

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

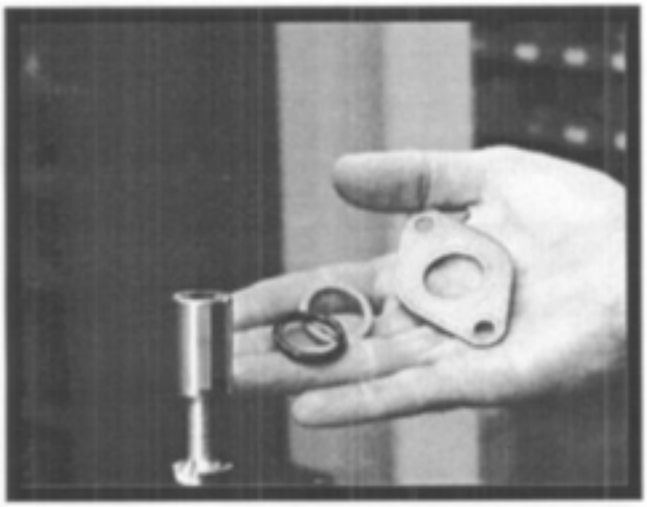
Valve Assembly Instructions

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.

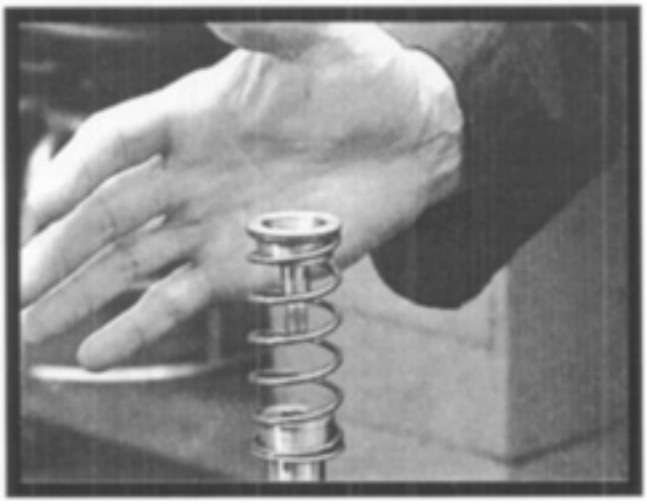
CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or product malfunction. Product should be thoroughly tested to ensure proper operation before the valve is placed back into service.

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.

Valve Assembly Instructions

Detent Spool Assembly

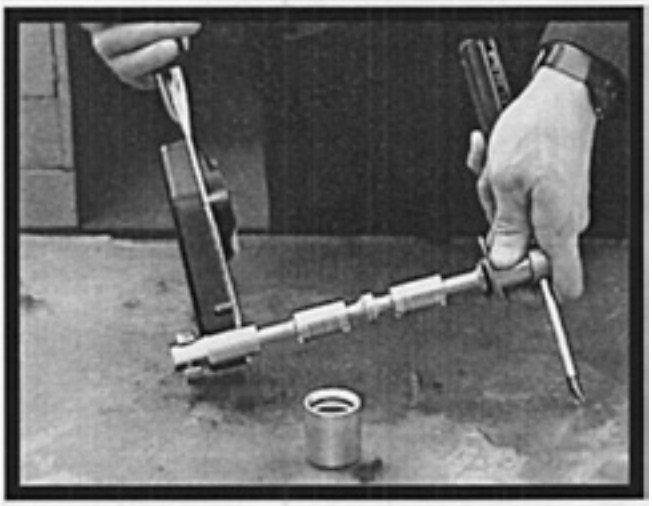
Step 1 - Spool Assembly-Detent

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

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

Step 2 - Spool Assembly-Detent

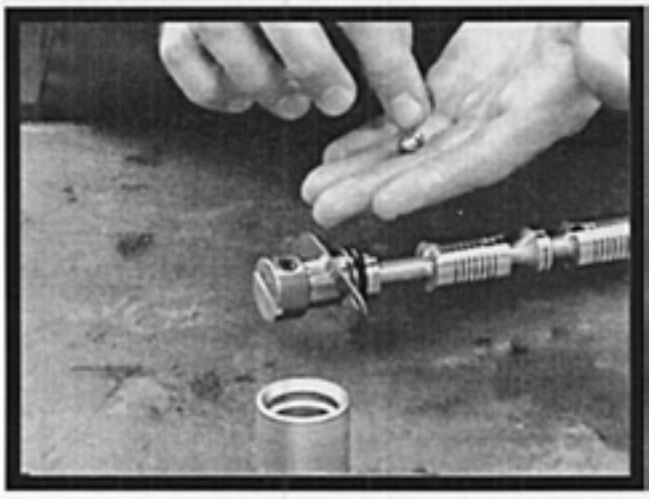
Thread the detent ball retainer (Fig. 2, item 20) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs., This can be accomplished by using a crows-foot socket on the flats of the clevis, and holding the spool by inserting a round, steel rod or screwdriver through the hole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



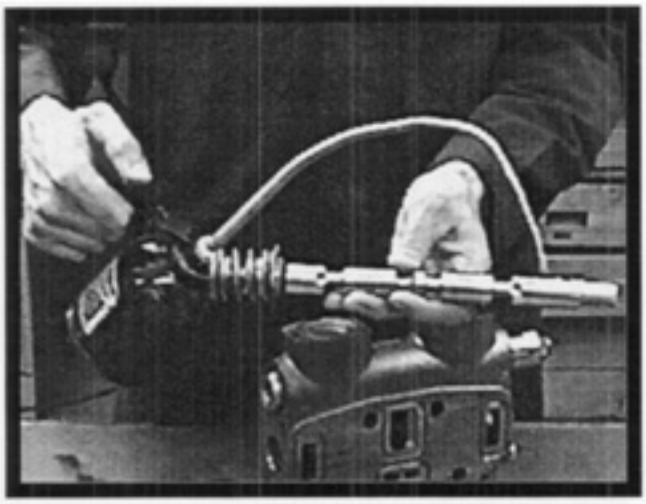
Step 3 - Detent Balls and Spring

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

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



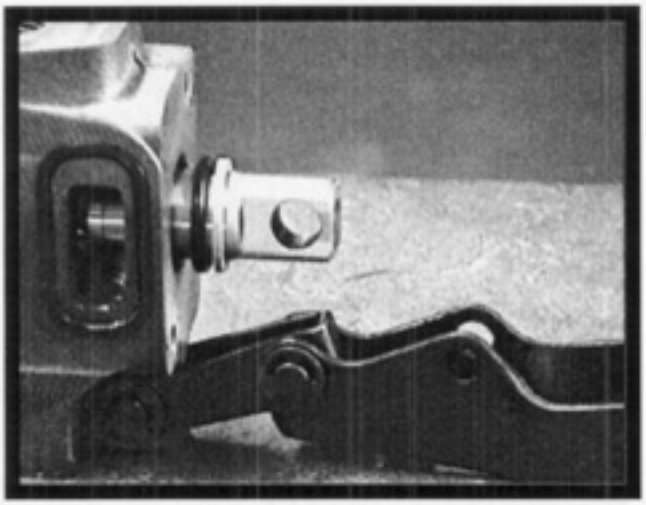
Valve Assembly Instructions



Step 1 - Spool Subassembly

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

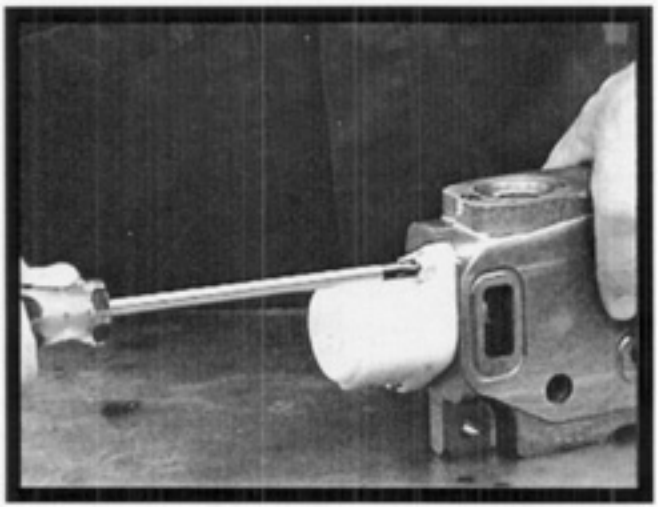
Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll or damage the seals. Make sure that the spool and housing are in the proper orientation (see Step 1, page 6 disassembly).



Step 2 - Spool Seal and Back up

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

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



Step 3 - Back cap

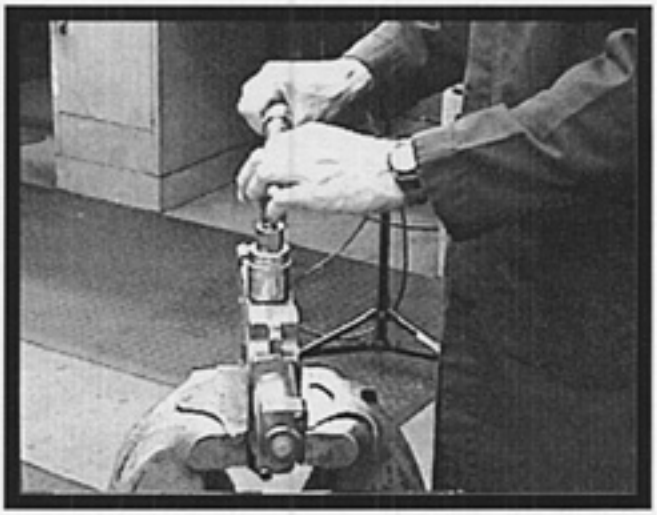
Install the back cap using the two, long, fillister screws (Fig. 1, item 4). Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs.

Caution: Excessive torque will damage the back cap ears!

Valve Assembly Instructions

Step 4 - Install Transition Check

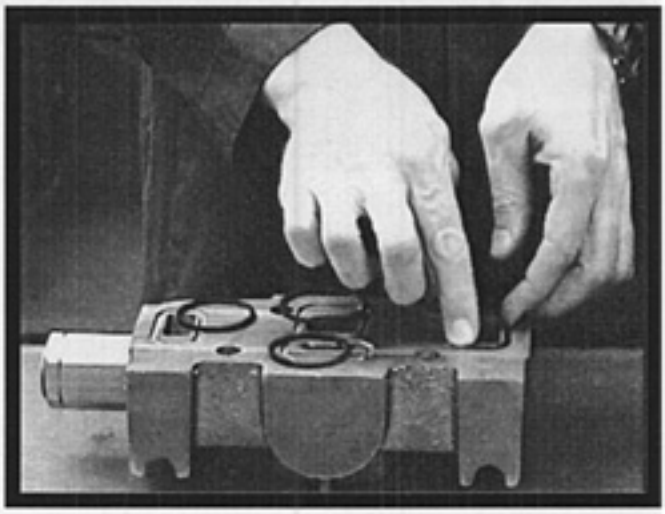
Inspect transition check components for cleanliness. Install check poppet (Fig. 1, item 13) into the transition check cavity. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 11) over the poppet and spring. Turning by hand, engage several 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.)

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

Best By FARR™

FARR CANADA
A Division Of McCoy Corporation

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

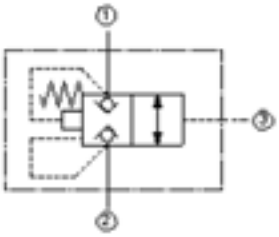
Capacity:
60 gpm (240 L/min.)

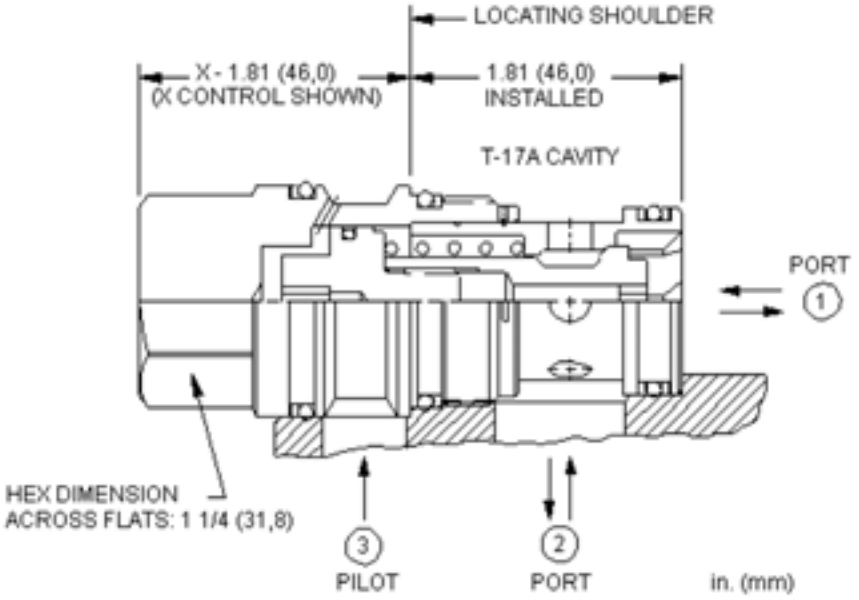
Functional Group:
Products : Cartridges : Corrosion Resistant : Logic Element : Unbalanced Poppet, Pilot-to-open, Switching Element, Spring biased closed, External Pilot Port 3 pilot source

Model:
LKHC

Product Description

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





Technical Features

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

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

Technical Data

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