OPERATIONS*MANUAL*

SUPERIOR *BOLTING SOLUTIONS*

LP SERIES
TORQUE WRENCHES

TITAN®
SUPERIOR *BOLTING SOLUTIONS*

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Safety Precautions

WARNING:

Titan Hydraulic Wrenches are power tools, as with any power tool, all precautions should be taken to avoid injury. Please follow the important precautions below. Failure to follow instructions may cause serious injury or death.

- Read all written instructions carefully! Most problems with new equipment are caused by improper operation or installation.
- Keep work area clean.
- Always operate tools in a well-lit area.
- Always use Personal Protective Equipment (PPE).
- Do not use power tools under the influence of drugs, alcohol, or any mind altering substances.
- Stay clear of tool during operation. NEVER hold, attempt to grab, or adjust the tool or reaction arm during operation.
- Ensure that all hydraulic connections are tight and there are no visible cracks in the tool or socket.
- Never use an ungrounded power supply with a pump.
- The pump must be compatible with existing line voltage.
- Never exceed the pressure rating on the pump nameplate. Do not tamper with the internal high pressure relief valve.
- Disconnect the pump from the power source before performing any maintenance or repair on the pump.
- If wires (internal or external) are frayed, cut, or exposed in any way, discontinue use and replace immediately.
- Do not attempt to replace a fuse with one of a higher voltage.
- Do not kink, curl, or bend a hose tightly, preventing oil from passing through.
- Do not expose hoses to hazards such as fire, sharp surfaces, extreme hot or cold, or heavy impact. If a hose is damaged in any way, destroy it and replace with a new hose.
- If a hydraulic hose or tool ever burst, rupture, or need to be disconnected, immediately shut off pump.
- Improper and lose fittings can become hazardous when pressurized. Never hold or grab a hydraulic pressure leak; hydraulic fluid is toxic and escaping oil can penetrate the skin and cause injury.
- Never move a tool or pump by pulling the hose, stress can damage the hose.
- Do not attempt to repair a tool or pump. Only certified Titan personnel may repair damaged pumps and tools. Any attempt to repair a pump or tool by persons other than qualified technicians may result in serious injury or death. Call Titan for service and repair.
- Failure to follow written instructions above will void the warranty.

Chapter 1: General Information

1.1 Inspection

Prior to use, inspect tool for any damage caused in the shipping process, if there is damage, contact your Titan sales representative immediately.

All Titan Products are supplied assembled and ready for immediate use. The use of Titan Power Pack is strongly recommended to provide the proper flow, speed and accuracy of your hydraulic tools.

The accuracy of your new Titan Hydraulic Torque Tools is ±3%. Titan Hydraulic tools may be calibrated by Titan or by any calibration facility that can be traced to the National Institute of Standards and Technology (N.I.S.T).

1.2 Hydraulics, Connections, and Safety Precautions

All Titan Hydraulic Torque Tools operate at 10,000 psi (700kg/cm^2)
Make sure all hoses are rated for 10,000 psi (700kg/cm^2)

Before connecting or disconnecting hydraulic hoses release any pressure by turning the pump off and double checking that the pressure gauge reads Zero (0). When connecting hose to the pump or tool, check fitting for cleanliness and ensure the fitting is engaged fully and hand tight.

WARNING:
Always ensure both hoses are securely connected.
Do not attempt to force the fitting using a wrench or any other means!

1.3 Electric Power Requirements and Safety Precautions

Check the specification plate (See Figure 10) located on the pump for proper power requirements. Operating the pump with the wrong power source will cause motor failure. If you are unsure of the power requirements in your facility, seek a qualified electrician for guidance.

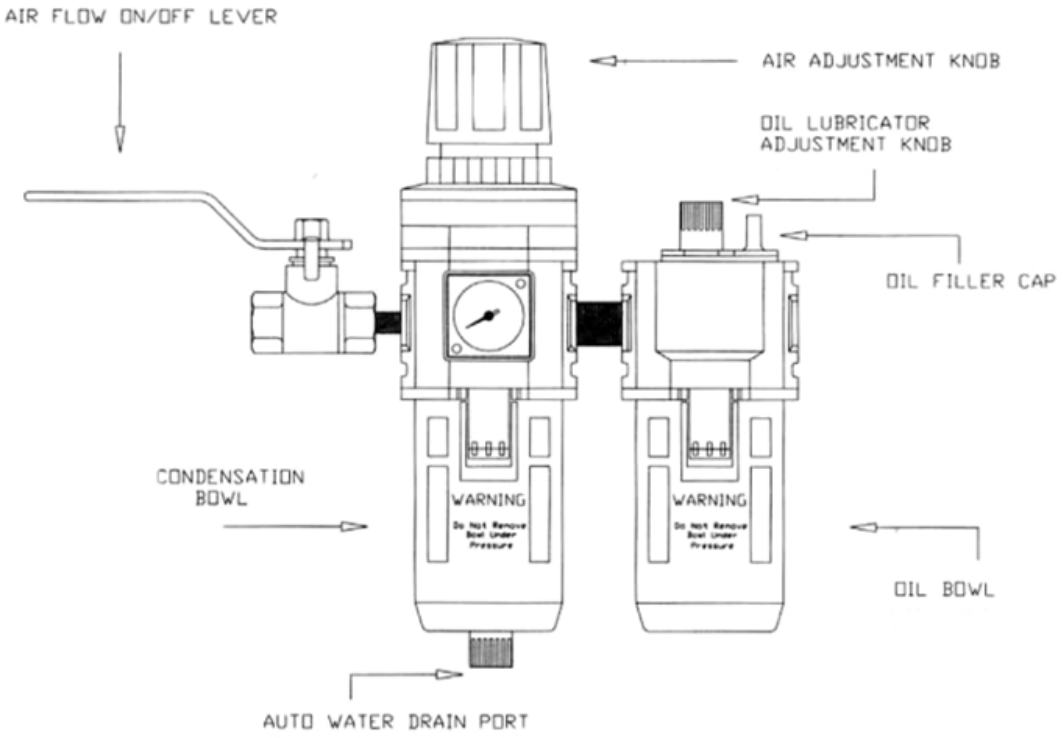
WARNING:
Do not remove the grounding prong from the electrical plug.
Electrical motors should not be used in volatile situations. Do not use an electrical pump in explosive atmospheres or in the presence of conductive liquids. In these situations a Titan Air Pump should be used. Contact your local Titan representative for a demonstration.

1.4 Air Connections

Please consult your compressor manufacturer's air flow rating (in cfm) prior to using and pressurizing your pump.

Improper airflow will damage the pump motor. Titan recommends an air-hose with a diameter greater than 3/4".

A filter lubricator regulator unit (FLR) should be used. An FLR will regulate flow and pressure as well as lubricate and remove water from compressed air to keep the air motor in your pump running properly.



Chapter 2: Tool Operation

2.1 Connecting the System

All hydraulic connections are rated for 10,000psi. Connect the couplers on the hose, tool, and pump as shown in Figure 2. Make sure male couplers are connected to female couplers and are fully engaged and hand tight.

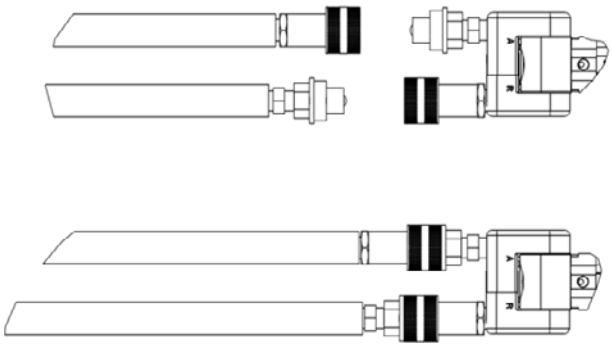


Figure 2 Hydraulic Connections on Tool

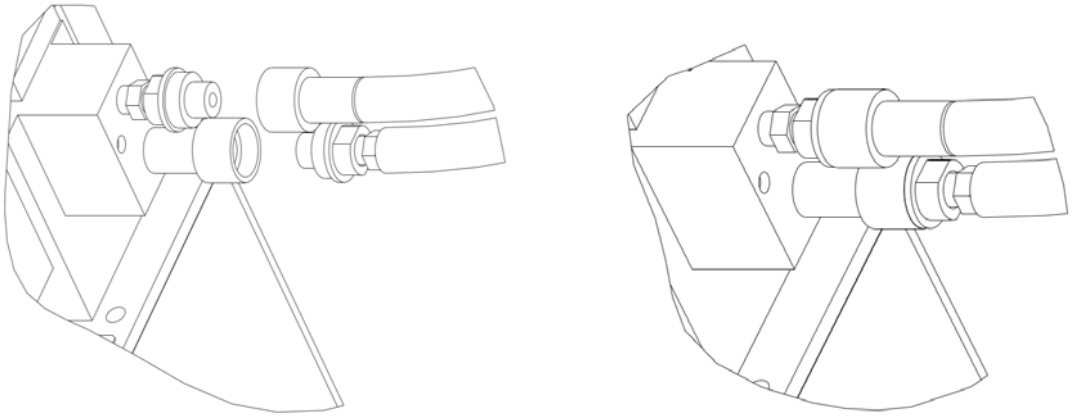


Figure 3 Hydraulic Connections on Pump

Warning:
Tightening fittings with a tool may cause permanent thread damage and will lead to failure of the fitting.
ALWAYS CONNECT BOTH HOSES!!!!
Failure to connect the retract fitting may result in tool failure, serious injury, or death.
To avoid tool malfunction do not reverse the connector on either the pump or the tool.

2.2 Assembling Cylinder and Link

1. Align Cylinder and Link as shown in Figure 4.
2. Rotate cylinder till flush with link as shown in Figure 5.
3. Insert mating pin till flush with the link as shown in Figure 6.

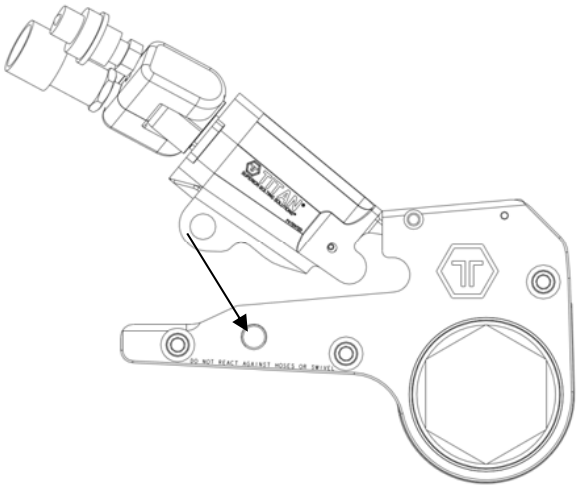


Figure 4 Cylinder and Link Assembly Step 1

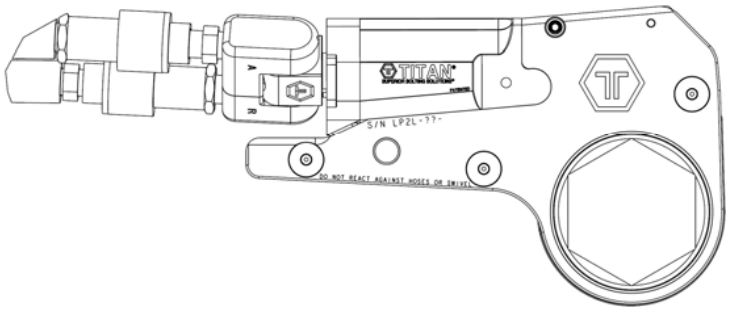


Figure 5 Cylinder and Link Assembly Step 2

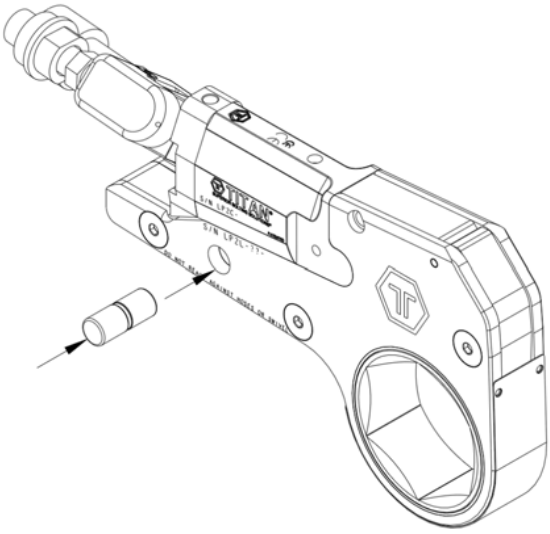


Figure 6 Cylinder and Link Assembly Step 3

2.3 Drive Direction

The direction the drive rotates in the LP-tool is determined by its orientation on the application. Refer to Figures 7 & 8 for drive directions based on right-hand threads.

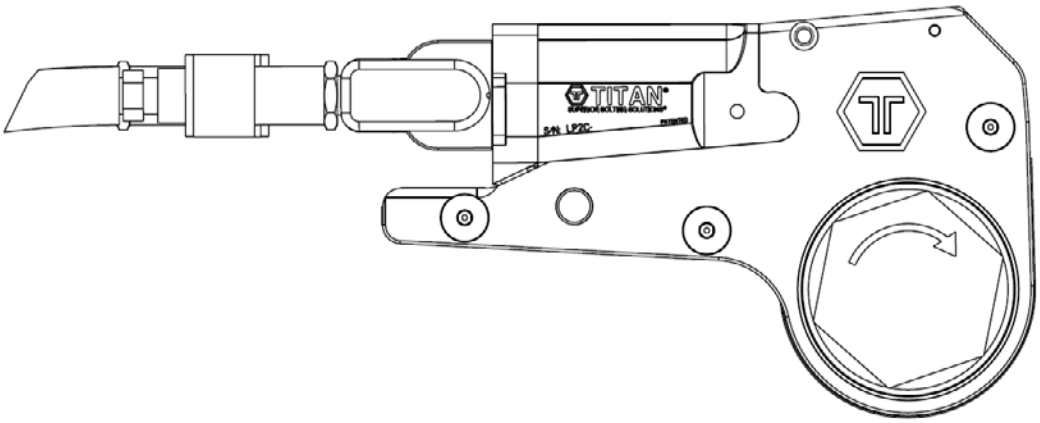


Figure 7 Tighten

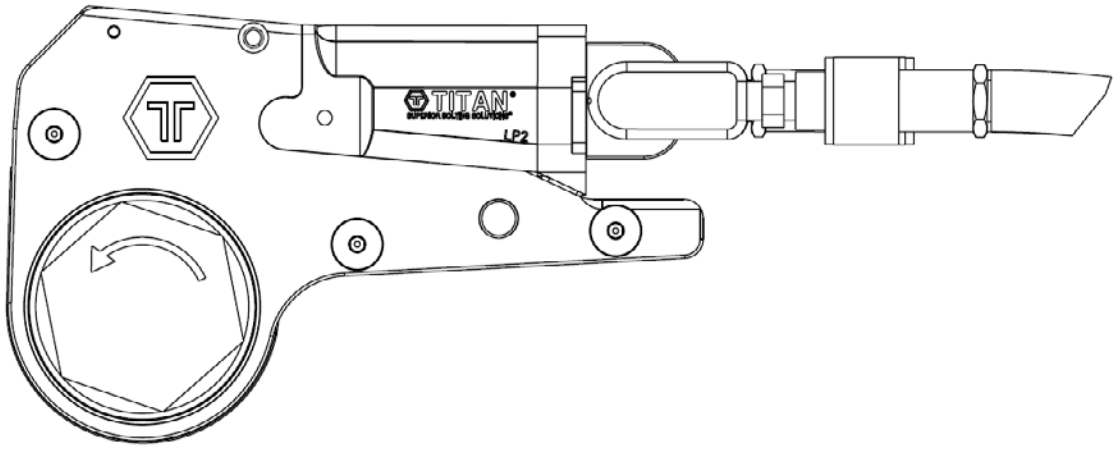


Figure 8 Loosen

2.4 Reaction

Every Titan LP-Series torque wrench is designed to react off the link. See Figure 9 for location of the reaction area. Ensure this area is abutted to a strong stationary object during operation.

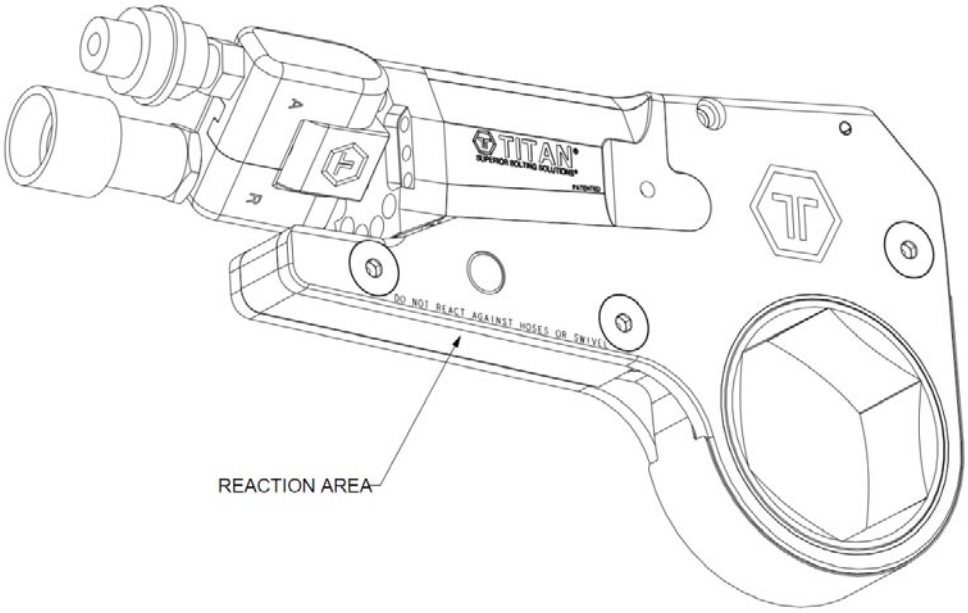


Figure 9 Reaction Area on Link

********** WARNING **********

DO NOT ATTEMPT TO REACT ON AN AREA OTHER THAN INDICATED IN FIGURE 9.
THIS CAN CAUSE SERIOUS INJURY OR DEATH TO THE OPERATOR AND DAMAGE TO THE TOOL OR APPLICATION.
CONTACT TITAN IF A CUSTOM REACTION PAD OR EXTENDED ARM IS REQUIRED.

2.5 Determining the Pump Pressure

The torque of your Titan LP-Tool is controlled via the pressure of the pump. Every Titan tool comes with a pressure to torque calibration chart that will help you determine the pump pressure settings for your torque requirements.

Refer to the torque requirements of the plant or equipment manufacturer before beginning the job.

1) Locate the torque chart (Figure 10) for your tool serial number and find the closest torque to your requirements. For this example, we will use a T3 to torque to 1,100 ft-lbs, this procedure applies to the LP-Tool as well.
2) For this example, the closest torque is 1089 ft-lbs (within +/- 3% of the tools accuracy) and the corresponding pressure is 3400 psi.
3) Set the pump to 3400 psi following the instructions in Section 2.4.

Torque nearest to required

Pressure Vs Torque Conversion Chart
Titan LP Series Tools

		LP-2	LP-4	LP-8	LP-16*	LP-32*
PUMP PSI Setting	**Pump BAR Setting**	***Torque - Ft. Lbs/ Nm***				
1500	**103**	268	568	1075	2400	5250
1600	**110**	286	606	1146	2560	5600
1800	**124**	322	682	1290	2880	6300
2000	**138**	360	758	1488	3200	7000
2200	**152**	396	833	1637	3520	7700
2400	**165**	431	909	1785	3840	8400
2600	**179**	467	985	1934	4160	9100
2800	**193**	503	1061	2083	4480	9800
3000	**207**	541	1136	2289	4800	10500
3200	**221**	577	1212	2442	5120	11200
3400	**234**	614	1288	2594	5440	11900
3600	**248**	650	1364	2747	5760	12600
3800	**262**	686	1439	2899	6080	13300
4000	**276**	724	1515	3028	6400	14000
4200	**290**	760	1591	3180	6720	14700
4400	**303**	796	1667	3331	7040	15400
4600	**317**	833	1742	3483	7360	16100
4800	**331**	869	1818	3634	7680	16800
5000	**345**	904	1894	3878	8000	17500
5200	**359**	940	1970	4033	8320	18200
5400	**372**	976	2045	4188	8640	18900
5600	**386**	1013	2121	4343	8960	19600
5800	**400**	1049	2197	4498	9280	20300
6000	**414**	1087	2273	4704	9600	21000
6200	**427**	1123	2348	4859	9920	21700
6400	**441**	1159	2424	5017	10240	22400
6600	**455**	1196	2500	5174	10560	23100

2.6 Adjusting the Pump Pressure

To set the pressure on your Titan Pump follow this procedure:

1. Locate and loosen the locking ring below the “T” handle on the pumps external pressure regulator. Then turn the “T” handle counter clockwise until it turns freely. (See Figure 11)
2. Turn the pump “on” using the pumps remote control, press and hold the advance switch (or button on air pumps). (See Figure 12)
3. While holding the switch in the advance position, slowly turn the “T” handle clockwise. You will notice the pressure on the pump gage rise.
4. When the needle reaches the desired pressure stop turning the “T” handle and let the pressure settle.
5. Release and then depress the advance button. If the pressure continues to rise, release the advance button and slowly turn the “T” handle counter-clockwise. Repeat this process till the target pressure is reached.
6. Tighten the knurled locking ring under the “T” handle.
7. Cycle your tool one more time to ensure you have the desired working pressure.

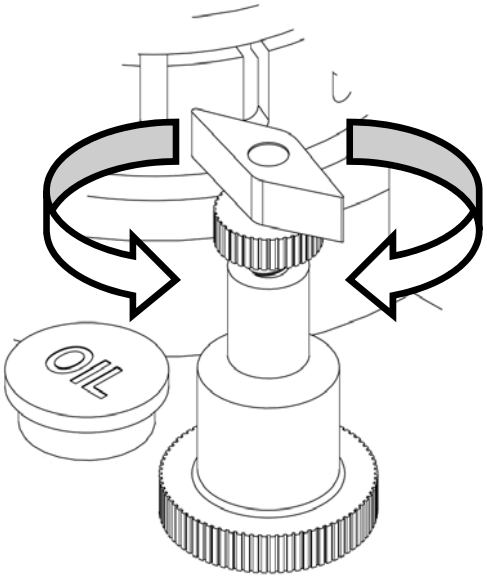


Figure 11 Manual Pressure Control Valve, Clockwise to Increase Pressure, Counter-clockwise to Decrease Pressure

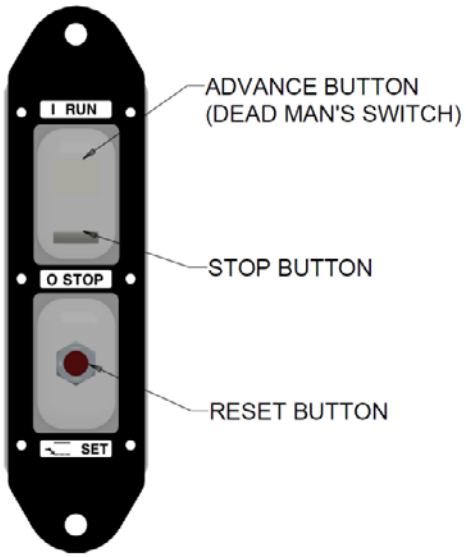


Figure 12 Control Pendant (Electric Pump)

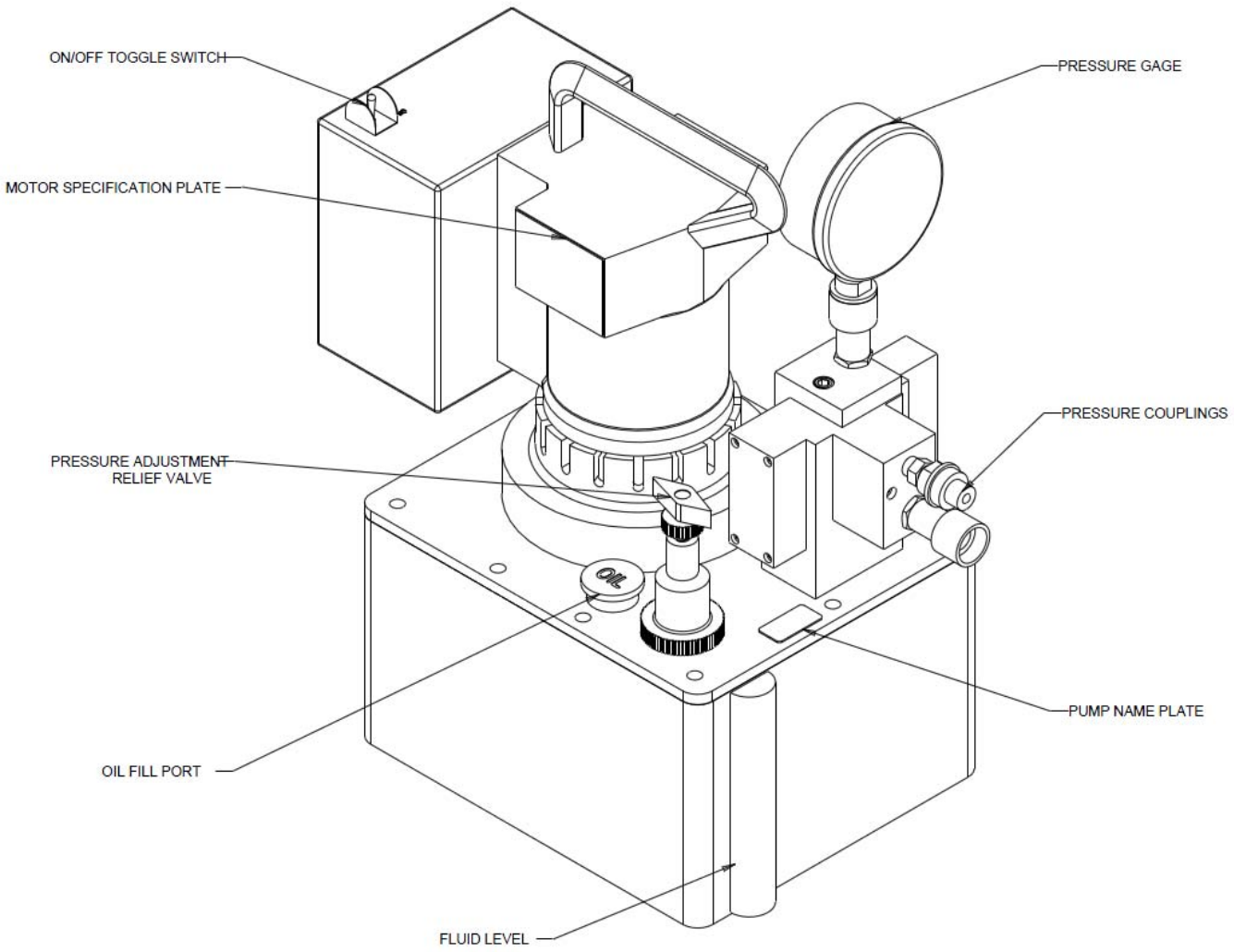


Figure 13 Electric Pump

2.7 Setup to Tighten Fasteners

1. Once you have set your target pressure, cycle the tool several times without load to ensure the system is operating properly and any air is out of the lines.
2. Place the tool on the nut in the direction for tightening (see figure 7 & 8)
3. Place the reaction area against a strong, stationary object (i.e.) an adjacent nut, flange, or equipment housing.

****NEVER HOLD THE TOOL DURING OPERATION****

4. Be sure all body parts are out of harm's way.
5. Make sure all hoses and electric cords are clear of obstructions and the tool.
6. Apply momentary pressure to ensure that the tool is properly placed and does not "ride up" or move on the application.

2.8 Operation

1. Depress the advance button on the remote control. The tool will spin slightly about the ratchet until the link contacts the reaction point. Figure 14 shows the tool at start position.

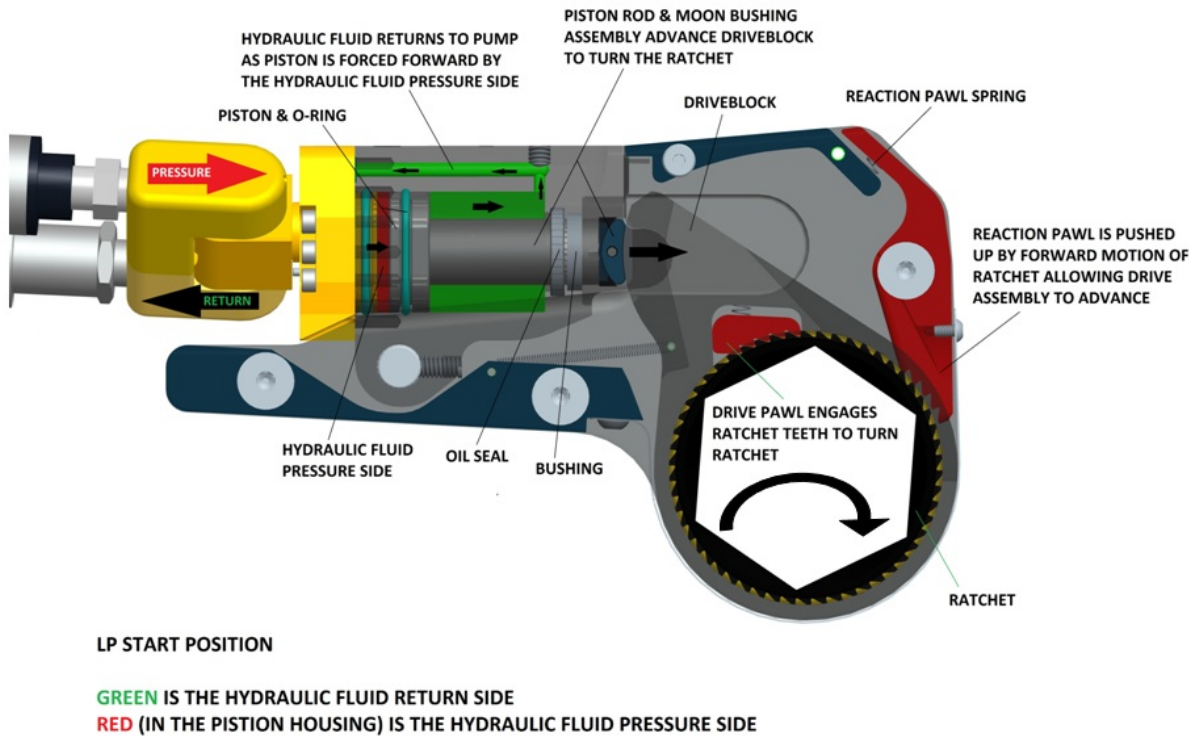


Figure 14 LP Tool Start Position

2. Continue to hold down the advance button as the ratchet turns. You will hear several audible “clicks” of the reaction pawl as the ratchet turns. When these “clicks” stop, the piston is at the end of the stroke and pressure will increase rapidly. Figure 15 shows the tool at the end of its stroke.

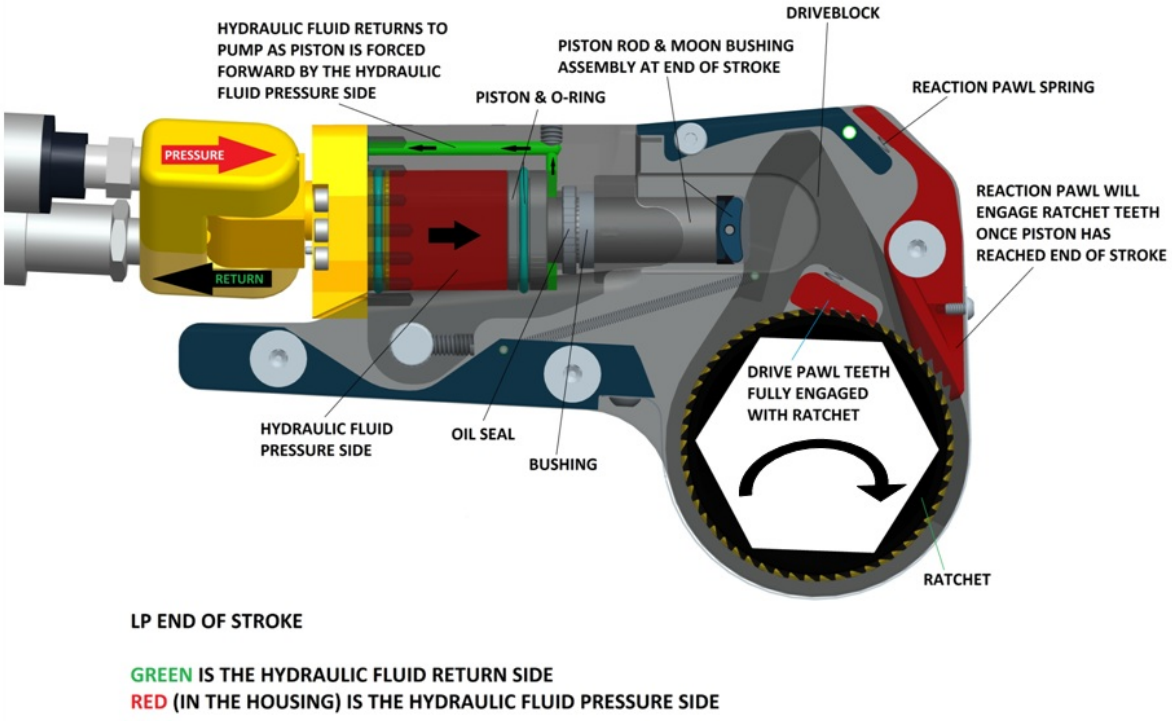


Figure 15 LP Tool at End of Stroke

Note: The reading of the preset pressure after the piston is extended DOES NOT indicate the set torque is applied to the bolt. This only indicates that the piston is fully extended and cannot turn the socket further.

3. Release the advance button on the remote control and the piston will retract. The tool will automatically reset itself and the operator will hear another set of “clicks”. When these “clicks” stop, the piston is fully retracted and another cycle can begin. Figure 16 shows the tool during the piston retraction process.

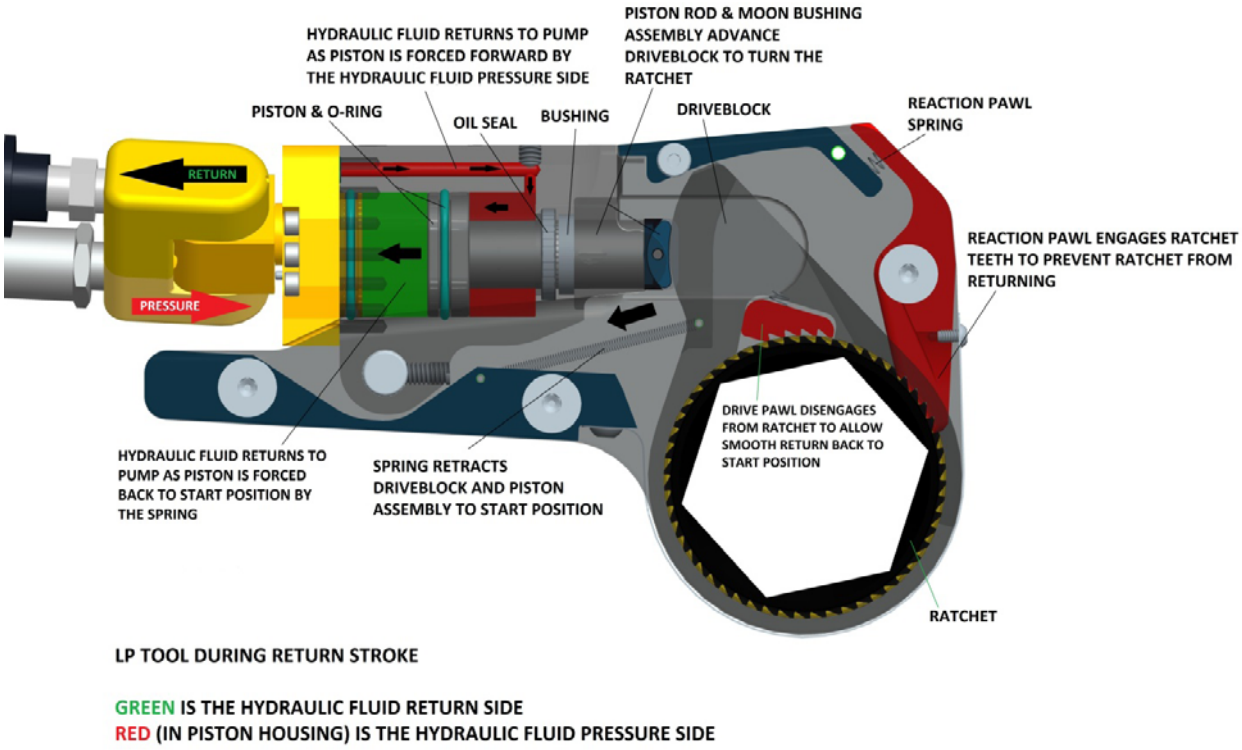


Figure 16 LP Tool During Return Stroke

4. Repeat steps 1-3 until the tool stalls.
5. To verify the set torque is reached, release the advance button and allow the piston to retract. Depress the advance button again, if the tool stalls and the pump pressure increases to the set pressure, the desired torque has been reached.

Note: Occasionally the tool will lock on the application and become difficult to remove. This usually happens when applying torque to long fasteners. To release the tool from the fastener:

1. Depress the advance button on the control pendant
2. Flip reaction pawl lever toward reaction arm (See Figure 14) and hold in position.
   *** Note: If the reaction lever does not move, increasing the pump pressure slightly may help. ***
3. Release the advance button and allow the piston to retract. The tool should be free and it can be removed from the application.

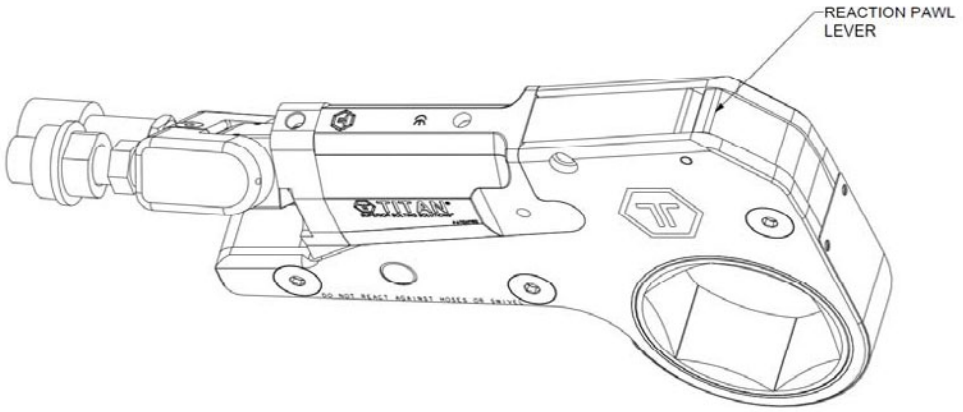


Figure 17 Reaction Pawl

2.9 Removing Fasteners

To remove fasteners, follow these steps:

1. Place the tool on the nut in the desired direction to loosen the fastener (see Figures 7 & 8.
2. Set the pump to pressure to 10,000PSI.
3. Place the reaction portion of the link against a strong, immovable surface.
4. Press and hold the advance button. The ratchet should begin to turn.
5. Cycle the tool until the fastener can be removed by hand.

More torque is required to remove a fastener than to tighten it. If the tool was near maximum capacity during fastening, a larger tool may be required to remove the fastener.

2.10 LP-Tool Care and Maintenance

1. Clean all dirt and grit from the link
   a. If tool is used in an underwater situation, especially sub-sea, remove all water. Dry and grease tool before storage.
2. Inspect the ratchet, link, and housing for cracks and other signs of wear. If one is present, discontinue use and contact Titan for a replacement part.
3. Store tool in a clean, dry area.

Note: Storage cases are available from Titan at an additional cost.

Following these simple procedures can extend the service life of your tool.

- RE-calibrate your tool periodically. Over time, internal components wear and can bring the tool out of calibration. Titan recommends a 6-12 month calibration cycle. Your work may require a different calibration cycle, check with your manager for this cycle.
- Periodically clean and lubricate internal parts in the tool with Dow Corning GN Metal paste. Call Titan to order this lubricant or send the tool to Titan for service.

Chapter 3: Hydraulic Pumps

Overview:

Titan pumps are designed to be powerful, portable and durable. Before use please note the following points:

- Titan pumps operate between 1500 psi to 10,000 psi. Use ONLY Titan hoses to ensure you and your co-workers safety.
- Make sure the reservoir is filled with oil and you can see the oil level through the clear indicator on the front of the pump.
- Ensure there is enough air pressure (100PSI) and flow(50CFM for 1 pump, 90 CFM for 2 pumps) from your air lines otherwise the pump will not operate properly.
- Inspect the gauge and make sure it is not damaged and is rated for 10,000PSI.
- Check to make sure the oil filler plug is completely sealed.

3.1 Filling the Pump

1. Clean the Area around the filler cap to remove all dust and grit. Grit and dust will damage components in the pump and tools.
2. Remove the filler cap and insert a clean funnel and filter. Fill with hydraulic oil, watching the oil level indicator on the pump.
3. Replace the filler cap
4. Cycle the pump (with wrench attached) several times. Retract the wrench(s), and check the oil level in the pump reservoir again.

3.2 Hydraulic Connections

1. Unplug the power cord and open all hydraulic controls to ensure that the tool is not pressurized. Make sure the gauge reads 0 (zero) to assure pressure has been released.
2. Never disconnect the hoses without first releasing the pressure from the system.
3. Screw the coupler to the nipple and tighten by hand.

3.3 Connecting the Electric Power

1. Check for the proper electrical power before you get started.
2. Locate the specification plate on the pump to ensure the proper electrical connection. Having the proper current will protect against dangerous overloading and motor burnout. See Figure 13 for location of specification plate.

DO NOT OPERATE IN VOLATILE OR EXPLOSIVE ATMOSPHERES OR IN THE PRESENCE OF COMBUSTIVE OR FLAMMABLE LIQUIDS!

3.4 Priming the Pump

When operating the pump for the first time:

1. Valve and hose connections must be tight and the reservoir must be filled to the proper oil level. Start the motor
2. Cycle the pump several times to build pressure. If the pump doesn't build pressure, it may not be primed. Disconnect a hose from the system and route it back to the pump reservoir. Run the pump till a steady flow of oil is observed free of suspended air bubbles. Reconnect the hose to the system.
3. Run wrench several times to eliminate air from the system. For more complete instructions, refer to the section titled "Bleeding Air from the System".
4. The pump is ready for regular operation.

IMPORTANT: After eliminating trapped air from a large work-holding system, retract the wrenches and refill the pump to the appropriate level. This is especially important when using a large tool(s) or long hose(s).

3.5 Bleeding Air from the System

Air may accumulate in the hydraulic system if the reservoir oil level is too low. This causes the wrench to respond in an unstable or slow manner. To remove air from system:

1. Plug in the pressure return line into the pump and connect the other side of the hose to the male-female quick connect.
2. Run the pump for at least 5 minutes through several cycles.

3.6 Operating the Pump

1. Before powering your pump, connect hoses to both the pump and the wrench.
2. Place the on/off toggle switch (Figure 13) to the on position and the rocker switch on the control pendant to the OFF position.
3. Push the rocker switch to advance and release. This will start your pump and place the piston in the retract position.
4. Your titan pump is equipped with an auto shut off system. The pump will shut off after approximately 30 seconds of non-cycling. This is necessary to prevent your pump from overheating and contribute to a longer life of the pump. To restart simply push the reset switch and then advance the pump.

3.7 Pump Preventative Maintenance

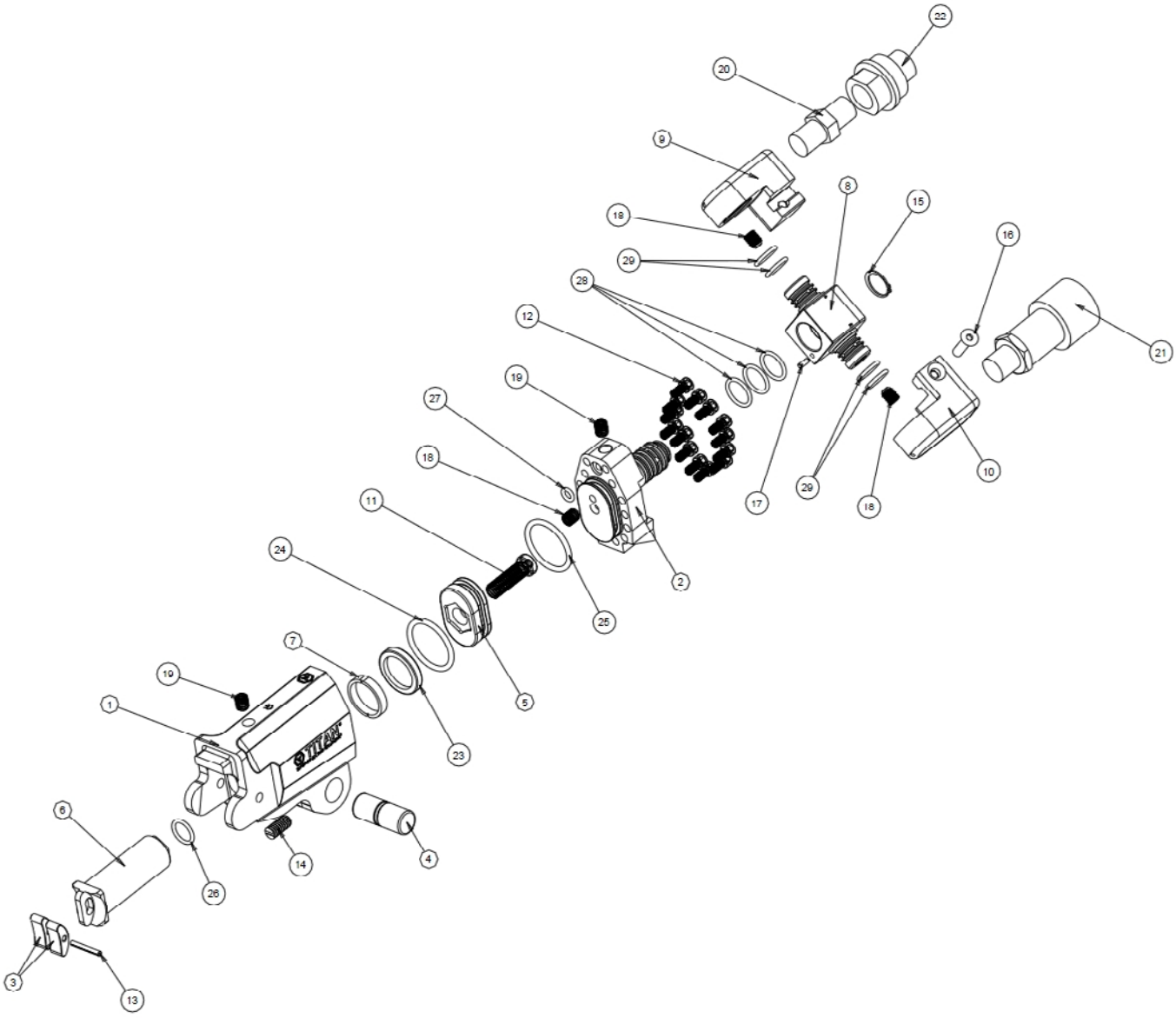
Following these simple procedures can extend the service life of your pump.

- Coupling Maintenance - Couplings should be checked periodically for wear. Keep all dirt and debris out of the couplings. Inspect O-rings for cuts and abrasion and replace as necessary.
- Hydraulic Oil – Check hydraulic oil before each use. Keep hydraulic oil clean, 75-80% of hydraulic component failures are due to dirty hydraulic oil. If dirt, grit, metal shavings, or any other debris is present in the oil, replace immediately. Hydraulic oil should be changed every 40 hours of operation. Use Titan hydraulic oil for best results.
- Hydraulic Gauge - Gauges are liquid filled. If the liquid level drops, discontinue use and replace gauge. Gauges should be calibrated periodically. Contact Titan to have your gauge calibrated.
- Control Pendant - Rocker switches on electrical pumps should be checked for signs of wear and replaced if necessary. Titan Air Pump pendants should be checked for leaks, kinks or any other obstructions.
- Hydraulic and Pneumatic hoses – Check hoses for signs of cuts, kinks, or other damage, if damage is present, destroy they hose and replace.
- Air Valve - The air valve should be checked at least 2 times a year.
- Brushes and Brush Holders - Check and replace if worn.

Trouble Shooting Guide

Problem	Probable Cause	Solution
Tool will not advance	1. Coupling not secure	1. Secure coupling
	2. Damaged coupling	2. Replace coupling
Tool will not retract	See above	See above
Tool cannot be removed	1. Reaction pawl is engaged	1. See Section 2.8
	2. Piston did not retract	2. Check couplings as described above
Tool will not build pressure	Gauge is not secured	Secure couplings on gauge
Tool leaks oil	Damaged seal(s) in tool	Replace seal(s)
Ratchet returns on retract stroke	Missing or broken reaction pawl and/or reaction pawl spring	Replace reaction pawl and/or reaction pawl spring
Tool will not cycle	1. Loose or defective coupling	1. Secure coupling
	2. Cycling tool too quickly	2. See Section 2.8
No pressure reading on gauge	1. Defective Gauge	1. Replace gauge
	2. Loose coupling	2. Secure coupling
Pump will not build pressure	1. Inadequate power supply	1. Use proper power source according to motor specification plate (plate location shown in Figure 11)
	2. Pump starved for air	2. Use minimum 1” diameter air hose attached to 100 psi/50cfm air source
	3. Defective gauge	3. Replace
	4. Dirty oil	4. Clean reservoir and replace oil
	5. Clogged oil filter	5. Replace filter
	6. Clogged FLR	6. Clean or replace FLR
Air pump sluggish	1. Pump starved for air	1. Use minimum 1” diameter air hose attached to 100 psi/50cfm air source
	2. Dirt in air motor	2. Flush motor with solvent, clean, dry and lubricate
Air motor frozen	1. FLR is missing or broken	1. Replace FLR
	2. Obstruction in Air valve	2. Inspect and clean
	3. Remote control hoses installed incorrectly	3. Install hoses correctly
	4. Defective remote control hoses	4. Replace
	5. Defective buttons	5. Replace
Tool pops off nut	Improper reaction	See Section 2.7

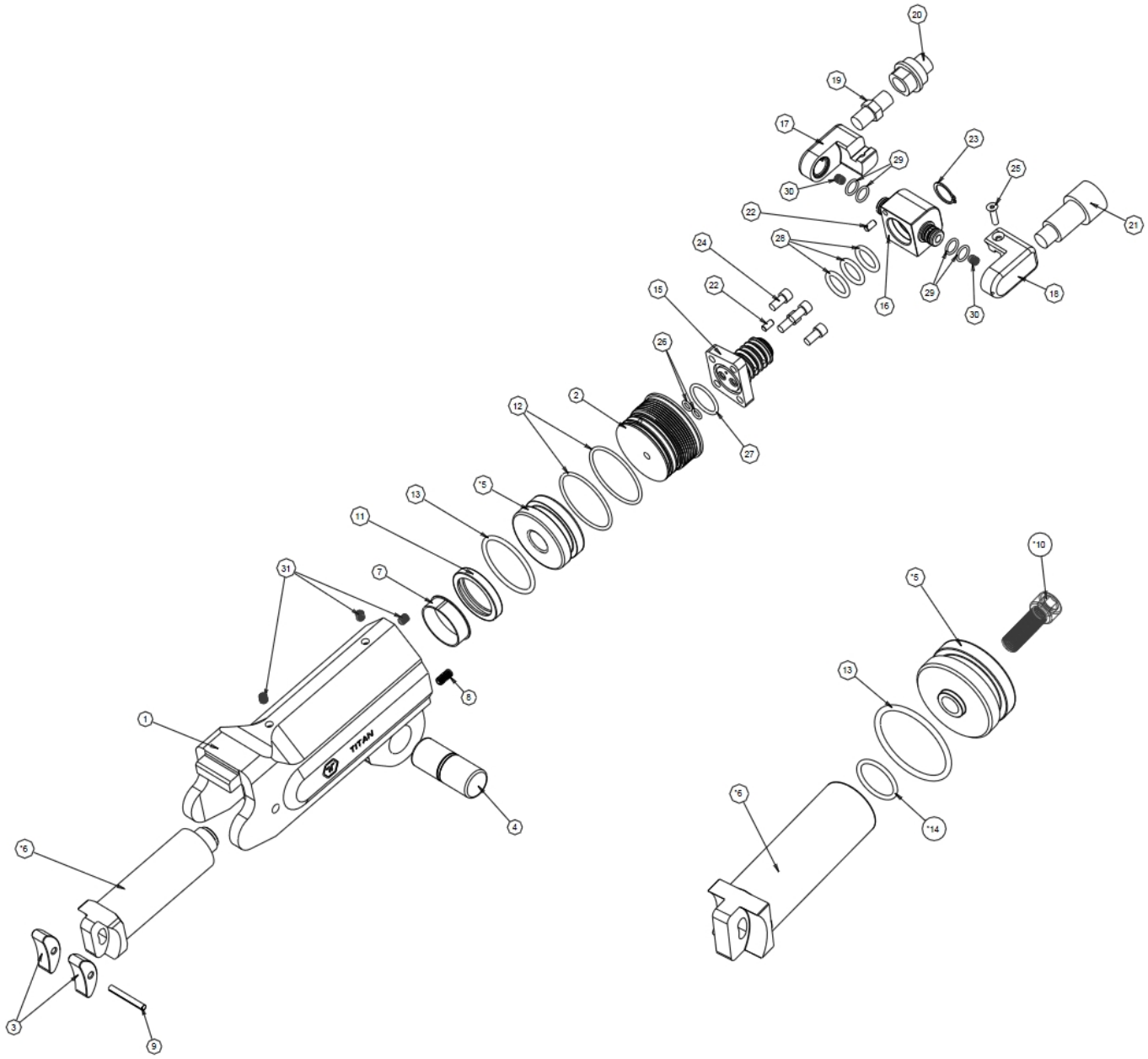
P 2, 4, and 8 Cylinder Exploded view



ITEM	DESCRIPTION		LP-2	LP-4	LP-8
1	HOUSING	1	TL2C-01	TL4C-01	TL8C-01
2	END CAP/SWIVEL POST	1	TL2C-03	TL4C-03	TL8C-03
3	MOON BUSHING	2	TL2C-04	TL4C-04	TL8C-04
4	MATING PIN	1	TL2C-05	TL4C-05	TL8C-05
5	PISTON	1	TL2C-06	TL4C-06	TL8C-06
6	ROD	1	TL2C-07	TL4C-07	TL8C-07
7	GLAND	1	N/A	TL4C-08	TL8C-08
8	SWIVEL BODY	1	T1-71	T3/25-71	
9	ADVANCE MANIFOLD	1	T1-72	T3/25-72	
10	RETRACT MANIFOLD	1	T1-73	T3/25-73	
11	PISTON TO ROD CONNECTOR SCREW	1	TL2C-25	TL4C-25	TL8C-25
12	END CAP SCREW	14	TL2C-20	TL4C-20	TL8C-20*
13	MOON BUSHING ROLL PIN	1	TL2C-21	TL4C-21	T10-40
14	MATING PIN BALL PLUNGER	1	TL2C-22	TL4/32C-22	
15	SWIVEL SNAP RING	1	T1-74	T3/25-74	
16	SWIVEL MANIFOLD SCREW	1	T1-76	T3/25-76	
17	SWIVEL DOWEL PIN	1	T1-81	T3/25-81	
18	HEX PLUG	3	T1/25-80		
19	HEX PLUG (TEFLON COATED)	2	T1/25-80TC		
20	ACTUATE MANIFOLD COUPLING	1	090103	090101	
21	RETRACT MANIFOLD QD	1	090156-1	090156	
22	ACTUATE MANIFOLD QD	1	090155		
23	ROD LIP SEAL	1	TL2C-01-N	TL4C-01-N	TL8C-01-N
24	PISTON O-RING	1	T3/25-70-120	TL4C-02-218	T5-25-223
25	END CAP O-RING	1	T3/25-70-120	TL4C-03-125	T5-25-223
26	ROD TO PISTON O-RING	1	T1/25-75-013	TL4/8C-07-016	
27	RETURN PORT O-RING	1	TL2C-03-007	T3/25-70-010	
28	SWIVEL POST O-RING	3	T1-70-014	T3/25-70-210	
29	SWIVEL BODY O-RING	4	T1/25-71-013		

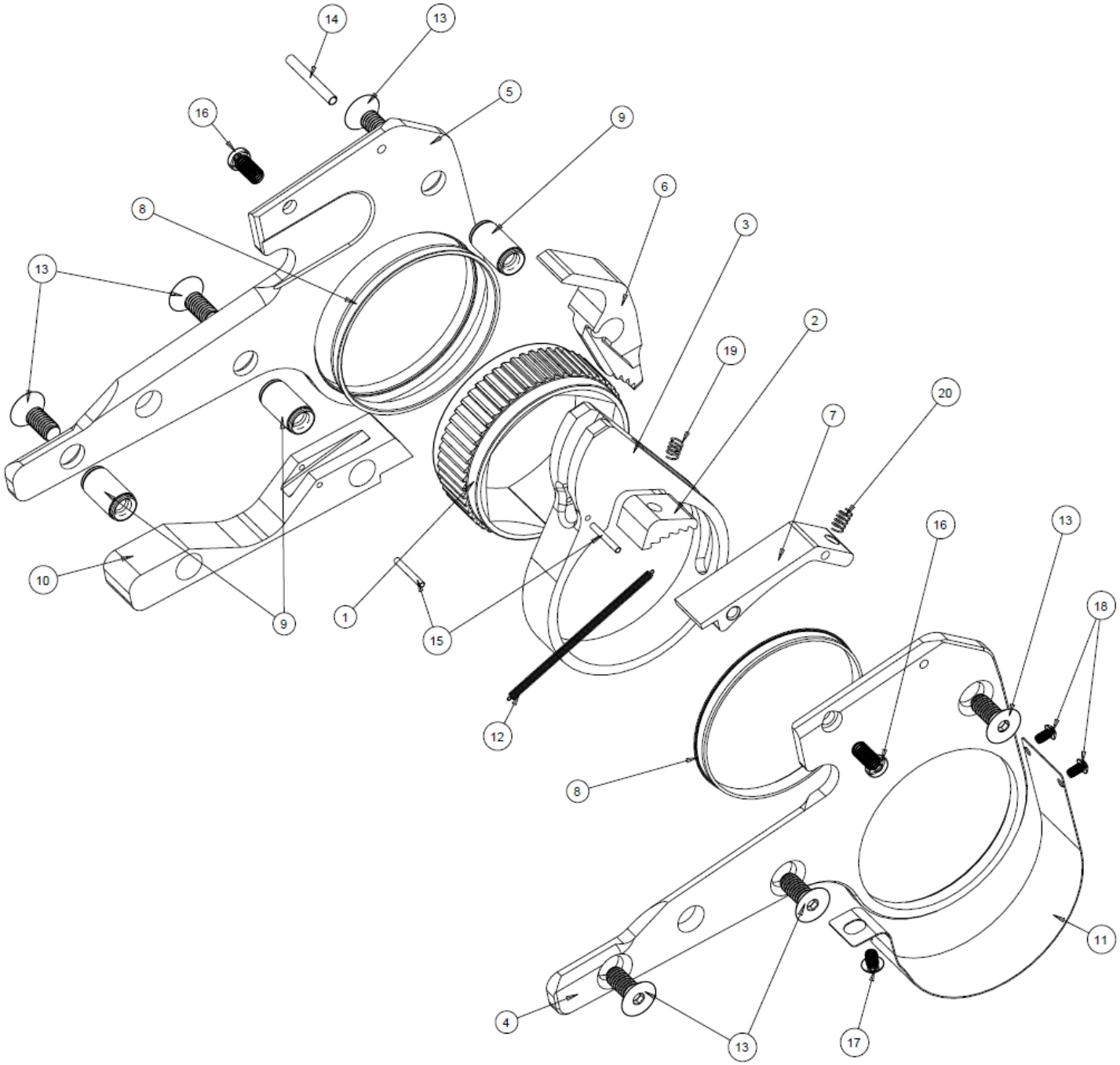
* LP-8 CYLINDER REQUIRES 16 END CAP SCEWS

LP 16-32 Cylinder Exploded view



ITEM	DESCRIPTION	QTY	LP-16	LP-32
1	HOUSING	1	TL16C-01	TL32C-01
2	END CAP	1	TL16C-03	TL32C-03
3	MOON BUSHING	2	TL16C-04	TL32C-04
4	MATING PIN	1	TL16C-05	TL32C-05
5*	PISTON	1	TL16C-06	TL32C-06
6*	PISTON ROD	1	TL16C-07	TL32C-07
7	GLAND	1	TL16C-08	TL32C-08
8	BALL PLUNGER	1	TL4/32C-22	
9	MOON BUSHING ROLL PIN	1	TL16C-21	TL32C-21
10*	PISTON TO ROD SCREW	1	TL16C-25	N/A
11	PISTON ROD LIP SEAL	1	TL16C-01-N	TL32C-01-N
12	END CAP O-RING	2	TL16C-03-137	TL32C-03-141
13	PISTON O-RING	1	TL16C-06-328	TL32C-06-330
14*	PISTON TO ROD O-RING	1	TL16C-07-214	N/A
15	SWIVEL POST	1	T3/25-70	
16	SWIVEL BODY	1	T3/25-71	
17	ACTUATE MANIFOLD	1	T3/25-72	
18	RETRACT MANIFOLD	1	T3/25-73	
19	ACTUATE MANIFOLD COUPLING	1	090101	
20	ACTUATE MANIFOLD QD	1	090156	
21	RETRACT MANIFOLD QD	1	090155	
22	SWIVEL DOWEL PIN	2	T3/25-81	
23	SWIVEL SNAP RING	1	T3/25-74	
24	SWIVEL POST SCREW	4	T3/25-75	
25	SWIVEL MANIFOLD SCREW	1	T3/25-76	
26	SWIVEL POST / HOUSING SMALL O-RING	2	T3/25-70-010	
27	SWIVEL POST / HOUSING LARGE O-RING	1	T3/25-70-120	
28	SWIVEL POST O-RING	3	T3/25-70-210	
29	SWIVEL BODY O-RING	4	T1/25-71-013	
30	HEX PLUG	3	T1/25-80	
31	TEFLON COATED HEX PLUG	3	T1/25-80TC	

LP-Link Exploded View



ITEM	DESCRIPTION	QTY.	LP-2	LP-4	LP-8	LP-16	LP-32
1	RATCHET	1	TL2L-01-XX-YYY	TL4L-01-XX-YYY	TL8L-01-XX-YYY	TL16L-01-XX-YYY	TL32L-01-XX-YYY
2	DRIVE PAWL	1	TL2L-02-XX	TL4L-02-XX	TL8L-02-XX	TL16L-02-XX	TL32L-02-XX
3	DRIVE BLOCK	1	TL2L-03-XX	TL4L-03-XX	TL8L-03-XX	TL16L-03-XX	TL32L-03-XX
4	RIGHT LINK PLATE	1	TL2L-04-XX-1	TL4L-04-XX-1	TL8L-04-XX-1	TL16L-04-XX-1	TL32L-04-XX-1
5	LEFT LINK PLATE	1	TL2L-04-XX-2	TL4L-04-XX-2	TL8L-04-XX-2	TL16L-04-XX-2	TL32L-04-XX-2
6	REACTION PAWL	1	TL2L-05-XX	TL4L-05-XX	TL8L-05-XX	TL16L-05-XX	TL32L-05-XX
7	TOP SPACER	1	TL2L-06	TL4L-06	TL8L-06	TL16L-06	TL32L-06
8	DRIVE BUSHING	2	TL2L-07-XX	TL4L-07-XX	TL8L-07-XX	TL16L-07-XX	TL32L-07-XX
9	LINK LOCATOR PIN	3	TL2L-08	TL4L-08	TL8L-08	TL16L-08	TL32L-08
10	REACTION SPACER	1	TL2L-10	TL4L-10	TL8L-10	TL16L-10	TL32L-10
11	SHROUD	1	TL2L-11-XX	TL4L-11-XX	TL8L-11-XX	TL16L-11-XX	TL32L-11-XX
12	RETRACT SPRING	1	TL2L-12	TL4L-12	TL8L-12	TL16L-12	TL32L-12
13	LINK LOCATOR SCREW	6	TL2L-20	TL4L-20	TL8L-20	TL16L-20	TL32L-20
14	TOP SPACER ROLL PIN	1	TL2L-21	TL4L-21	TL8L-21	TL16L-21	TL32L-21
15	RETRACT SPRING ROLL PIN	2	TL2C-21	TL4C-21	T10-40	TL16C-21	TL32C-21
16	TOP SPACER SCREW	2	TL2L-22	TL4/8L-22		TL16L-22	TL32L-22
17	LARGE SHROUD SCREW	1	TL2/32L-23				
18	SMALL SHROUD SCREW	2	TL2L-24	TL4L-24	TL8/32L-24		
19	DRIVE PAWL SPRING	2	TL2L-25*	TL4/8L-25		TL16L-25	TL32L-25
20	REACTION PAWL SPRING	1	TL2L-26	TL4L-26	TL8L-26	TL16L-26	TL32L-26
			*NOTE ONLY 1 SPRING IS REQUIRED PER ASSEMBLY FOR TL2L-25				

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