



Operational, Training, and Maintenance Manual

Enerpac TL-Series

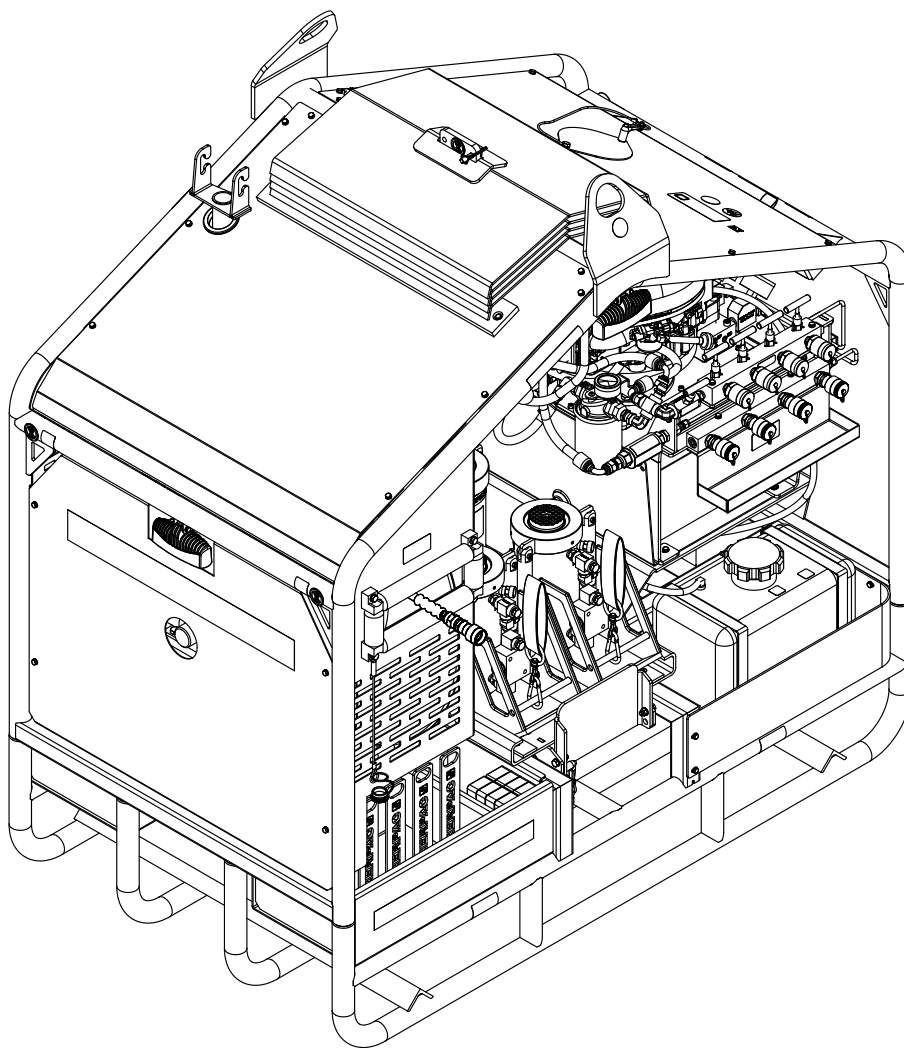
Track Lift Solution

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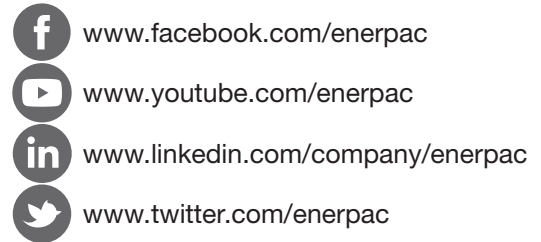
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To reduce the risk of injury, user must read and understand this document before use.

ABOUT US

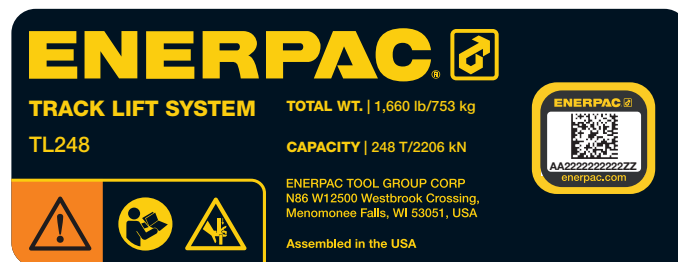
Enerpac is a global market leader in high pressure hydraulic tools, controlled force products, portable machining, on-site services and solutions for precise positioning of heavy loads. As a leading innovator with a 110-year legacy, Enerpac has helped move and maintain some of the largest structures on earth. When safety and precision matters, elite professionals in industries such as aerospace, infrastructure, manufacturing, mining, oil & gas and power generation rely on Enerpac for quality tools, services and solutions. For additional information, visit www.enerpac.com.



WARRANTY

Refer to the Enerpac Global Warranty document for terms and conditions of the product warranty. Such warranty information can be found at www.enerpac.com.

NAMEPLATE



AVAILABLE LANGUAGES

L4798 is available in the following languages, visit www.enerpac.com for a copy.

- Para otros idiomas visite www.enerpac.com.
- Pour toutes les autres langues, rendez-vous sur www.enerpac.com.
- Para outros idiomas consulte www.enerpac.com.

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1. Safety

Read all instructions carefully. Follow all recommended safety precautions to avoid personal injury as well as damage to the product and/or damage to other property. Enerpac cannot be responsible for any damage or injury from unsafe use, lack of maintenance, or incorrect operation. Do not remove warning labels, tags, or decals. In the event that any questions or concerns arise, contact Enerpac or a local Enerpac distributor for clarification.

Save these instructions for future use.

If you have never been trained on high-pressure hydraulic safety, consult your distributor or service center for information about Enerpac Hydraulic Safety Courses.

This manual follows a system of safety alert symbols, signals, words, and safety messages to warn the user of specific hazards. Failure to comply with these warnings could result in death or serious personal injury, as well as damage to the equipment or other property.



The Safety Alert Symbol appears throughout this manual. It is used to alert you to potential physical injury hazards. Pay close attention to Safety Alert Symbols and obey all safety messages that follow this symbol to avoid the possibility of death or serious injury.

Safety Alert Symbols are used in conjunction with certain Signal Words that call attention to safety messages or property damage messages and designate a degree or level of hazard seriousness. The Signal Words used in this manual are DANGER, WARNING, CAUTION, and NOTICE.

DANGER Indicates a hazardous situation that, if not avoided, will result in death or serious personal injury.

WARNING Indicates a hazardous situation that, if not avoided, could result in death or serious personal injury.

CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate personal injury.

NOTICE Indicates information considered important, but not hazard related (e.g. messages related to property damage). Please note that the Safety Alert Symbol will not be used with the signal word.

1.1 Safety Precautions

WARNING Failure to observe and comply with the following precautions could result in death or serious personal injury. Property damage could also occur.

- Do not operate in enclosed locations without proper ventilation.
- Personal Protective Equipment (PPE) must be worn at all times when using this equipment – this should include Safety Glasses, Gloves, Hearing Protection Safety Boots, High Visibility Clothing and Hard Hat.
- PPE must not interfere with safe operation of the tool or restrict the ability to communicate with co-workers.
- A Class B fire extinguisher should be kept with product.
- A full site briefing should be received and understood prior to going on or near the line
- Only trained and competent persons should operate this equipment
- The operator should be thoroughly familiar with the controls and the proper use of the tool.
- The operator must be of at least the minimum age required by applicable local regulations, laws and the standard operating procedures.
- Read and completely understand the safety precautions and instructions in this manual before operating the system or preparing it for use. Always follow all safety precautions and instructions, including those that are contained within the procedures of this manual.
- Ensure all hydraulic components are rated to a safe working pressure of 700 bar (10150 psi).
- Never set the relief valve to a higher pressure than the maximum rated pressure of the system. Higher settings may result in equipment damage and/or personal injury.
- Do not overload equipment. Never attempt to lift a load weighing more than the capacity of the system. Overloading causes equipment failure and possible personal injury.
- Be sure setup is stable before lifting load.
- Always perform a visual inspection of the system before placing it into operation.
- If any problems are found, do not use the tool. Have the tool repaired and tested by an Enerpac Authorized Service Center before it is returned to service.
- Never use a tool that is leaking oil. Do not use the equipment if it is damaged, altered or in need of repair.
- Never attempt to relieve hydraulic pressure by loosening a coupler.
- Never use force to unseat a coupler check ball that is under hydraulic pressure.
- Take every precaution to prevent oil leaks from occurring. High pressure oil leaks can result in Hydraulic Injection Injury.
- Do not over-tighten connections; connections need only be secure and leak free. Over tightening can cause premature thread failure.
- Loose or cross threaded fittings can be potentially dangerous if pressurized. Never stand directly in line with any hydraulic connection while pressurizing.
- Never strike the equipment while it is pressurized or moving load. Components under tension may become dislodged, allowing them to become dangerous projectiles. Uncontrolled release of pressurized hydraulic oil could also occur.

- Avoid striking the equipment at any time, even when it is not pressurized or moving load. Striking the tools may cause permanent damage to system components and may affect its functioning.
- Always maintain communication with the operator during procedure to avoid accidents. Use hand signals, two- way radios or other appropriate forms of communication (as required by applicable laws and regulations) if the load is not visible to the operator.
- Operate Track Lift System (TL248) as required to ensure that the load is moved evenly and at a controlled rate.
- Lift only dead weights. Avoid lifting live weight loads.
- Closely watch the load at all times during operation. Stop work immediately if the load becomes unstable or appears to be moving unsteadily.
- Do not use the cylinder(s) to lift people. Do not allow people to be on top of the load during lifting and lowering.
- Loads on railway must not be supported by hydraulics only. Once hydraulic lifting is complete, ensure the railway is properly supported by mechanical means (e.g. cribbing and ballast or other suitable method) before allowing any rail maintenance equipment to pass. Failure to do so may result in significant property damage, injury, or death.
- Immediately replace worn or damaged parts. Use only genuine Enerpac parts from approved distributors or service centers. Standard grade parts will break causing personal injury and property damage. ENERPAC parts are designed to fit properly and withstand high loads.
- To minimize risk of personal injury keep hands and feet away from the equipment and workpiece during operation.
- Do not breathe exhaust fumes. Toxic gases or fumes may be present. Follow approved procedures before operating or servicing. Use adequate ventilation to maintain safe occupational exposure limits. Do not use inside a closed environment.
- Do not leave the pump unattended in the workplace and take all reasonable precautions to avoid unauthorized use.
- Take precautions so that the pump is not switched on accidentally.

⚠ CAUTION Failure to observe and comply with the following precautions could result in minor or moderate personal injury. Property damage could also occur.

- Ensure components are protected from external sources of damage, such as moving machine parts, sharp edges, weld spatter, corrosive chemicals and excessive heat or flame.
- Keep hydraulic equipment away from flames and heat. Excessive heat will soften packings and seals, resulting in fluid leaks. Heat also weakens hose materials and packings.

- For optimum performance, do not expose hydraulic equipment to temperatures of 65°C [150°F] or higher. Protect all hydraulic equipment from weld spatter.
- Protect hoses and cylinders from weld spatter.
- Avoid damaging the hydraulic hose. Avoid sharp bends and kinks when routing hydraulic hoses. Using a bent or kinked hose will cause severe backpressure. Sharp bends and kinks will internally damage the hose leading to premature hose failure.
- Do not drop heavy objects on hose. A sharp impact may cause internal damage to hose wire strands. Applying pressure to a damaged hose may cause it to rupture.
- Do not lift hydraulic equipment by the hose or couplers. Use the lifting handles provided on cylinders and clamp assemblies.
- Do not pull on a hose that is connected. If pulling forces are exerted on a hydraulic coupling the hose and coupling interface will weaken which may result in the hose bursting out of the coupling.
- Always lift a hose by the hose itself, whilst supporting the coupling.
- Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin, causing serious injury. If oil is injected under the skin, see a doctor immediately.
- During assembly the hose must be supported by necessary use bend guides to prevent twisting of the hose.
- Change worn or damaged hoses immediately.
- Do not use dirty or corroded couplings.

NOTICE Failure to observe and comply with the following precautions could result in property damage and/or void the product warranty.

- In severe service conditions, be aware that the TL system must be inspected, cleaned and lubricated more frequently than normal.
- If oil leakage is present, replace seals as required before placing the tool back into service.
- If any tool is dropped from a significant height, have it inspected and checked for proper operation before placing it back into service.
- While moving the hoses, prevent the couplings being dragged over the ground.
- Always follow the inspection and maintenance instructions contained in this manual. Perform maintenance and inspection activities at the specified time intervals.
- Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Enerpac Authorized Service Center in your area.
- To help ensure proper operation and best performance, use of Enerpac oil is strongly recommended.
- All oil or fuel spills should be cleaned up in accordance with all applicable laws and regulations.

2. Introduction

2.1 Overview

Enerpac is a global market leader in high pressure hydraulic tools, controlled force products and solutions for precise positioning of heavy loads.

The TL248 is a portable and self-powered system designed for easy transport to remote locations. This innovative and patented hydraulic lifting device is specifically engineered to raise track from below, diamonds, switches, retarders, and bridge ends in place, allowing work to be completed more efficiently and with greater precision than traditional methods.

2.2 Delivery Instructions

Upon delivery all components must be inspected for damage incurred during shipping. If damage is found the carrier should be notified at once.. Shipping damage is not covered by the Enerpac warranty. The carrier is responsible for all repair and replacement costs resulting from damage in shipment.

3. Transport

The frame has forklift truck pockets for forklift lift, and two lifting eyes for lifting from overhead.

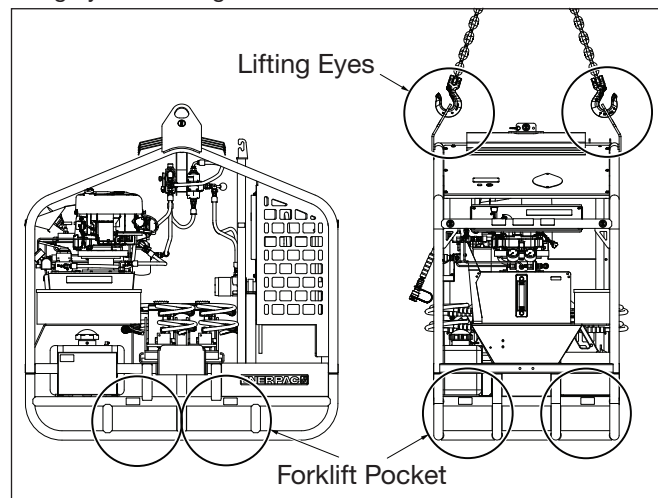


Figure 1: Transport Frame

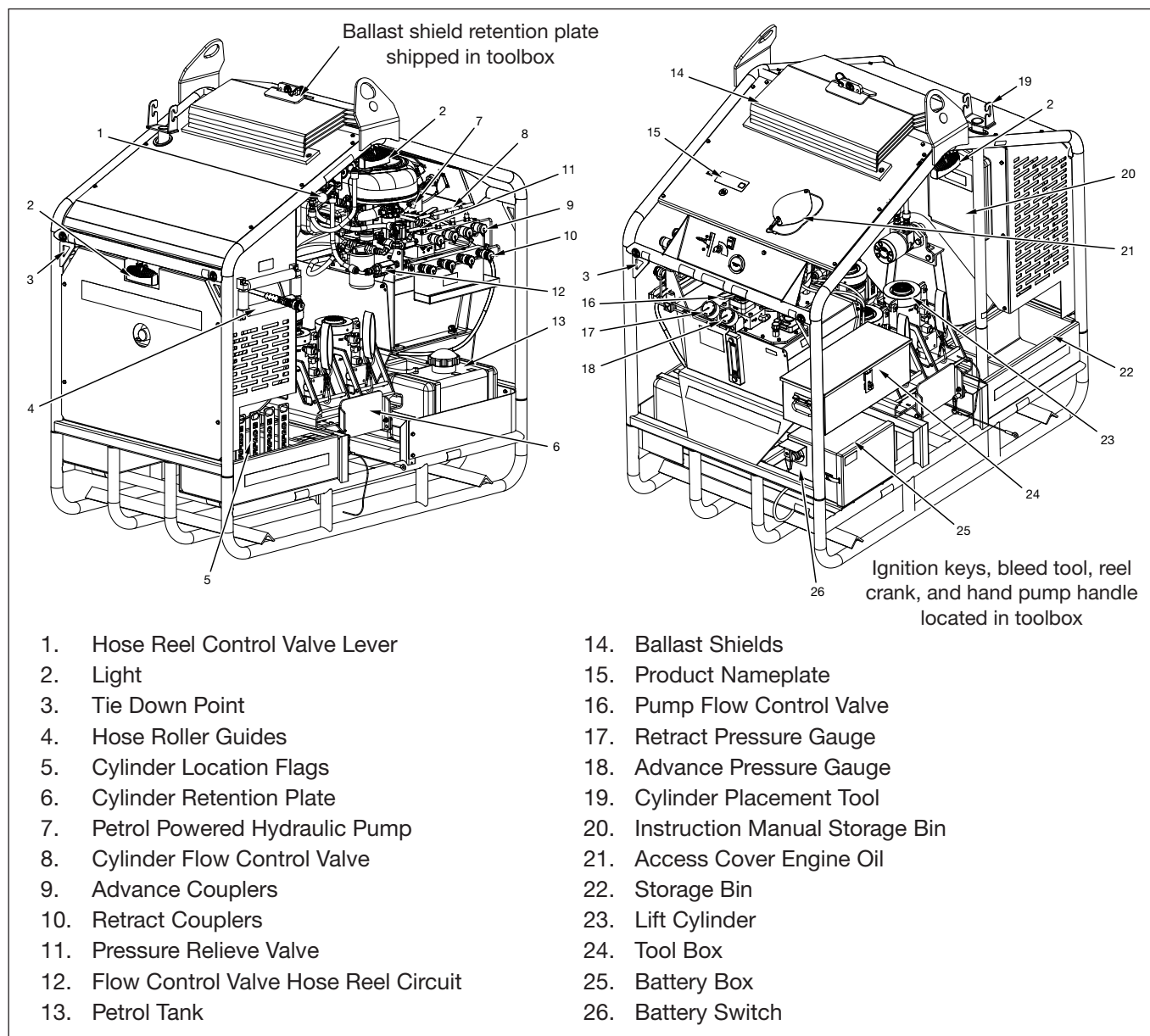


Figure 2: Features and Components

4. Technical Product Data

4.1 Dimensions

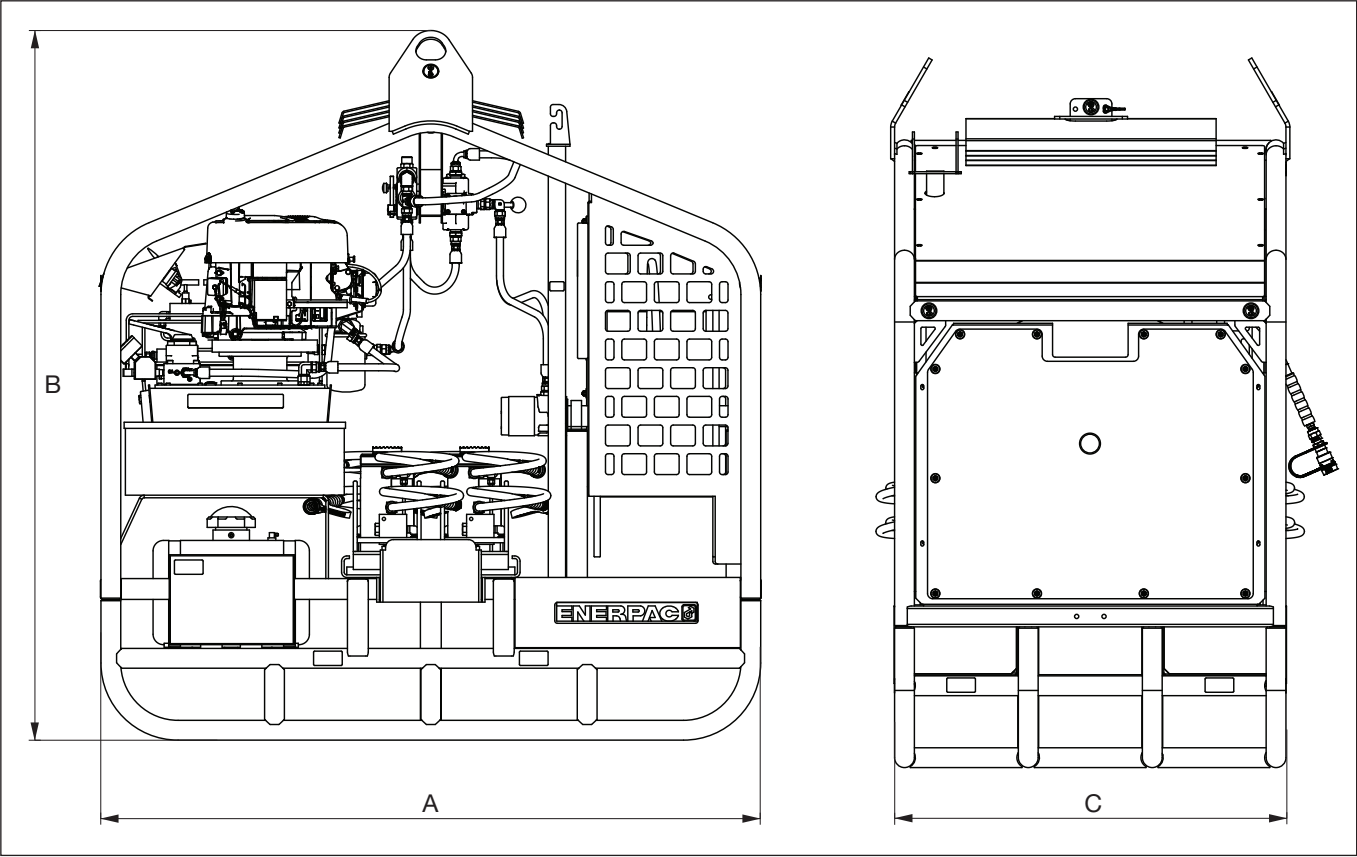


Figure 3: System Dimensions

System Dimensions (Figure 3)		
A	63.4 in	1610 mm
B	68.1 in	1730 mm
C	37.6 in	955 mm
Weight	1660 lbs	753 kg

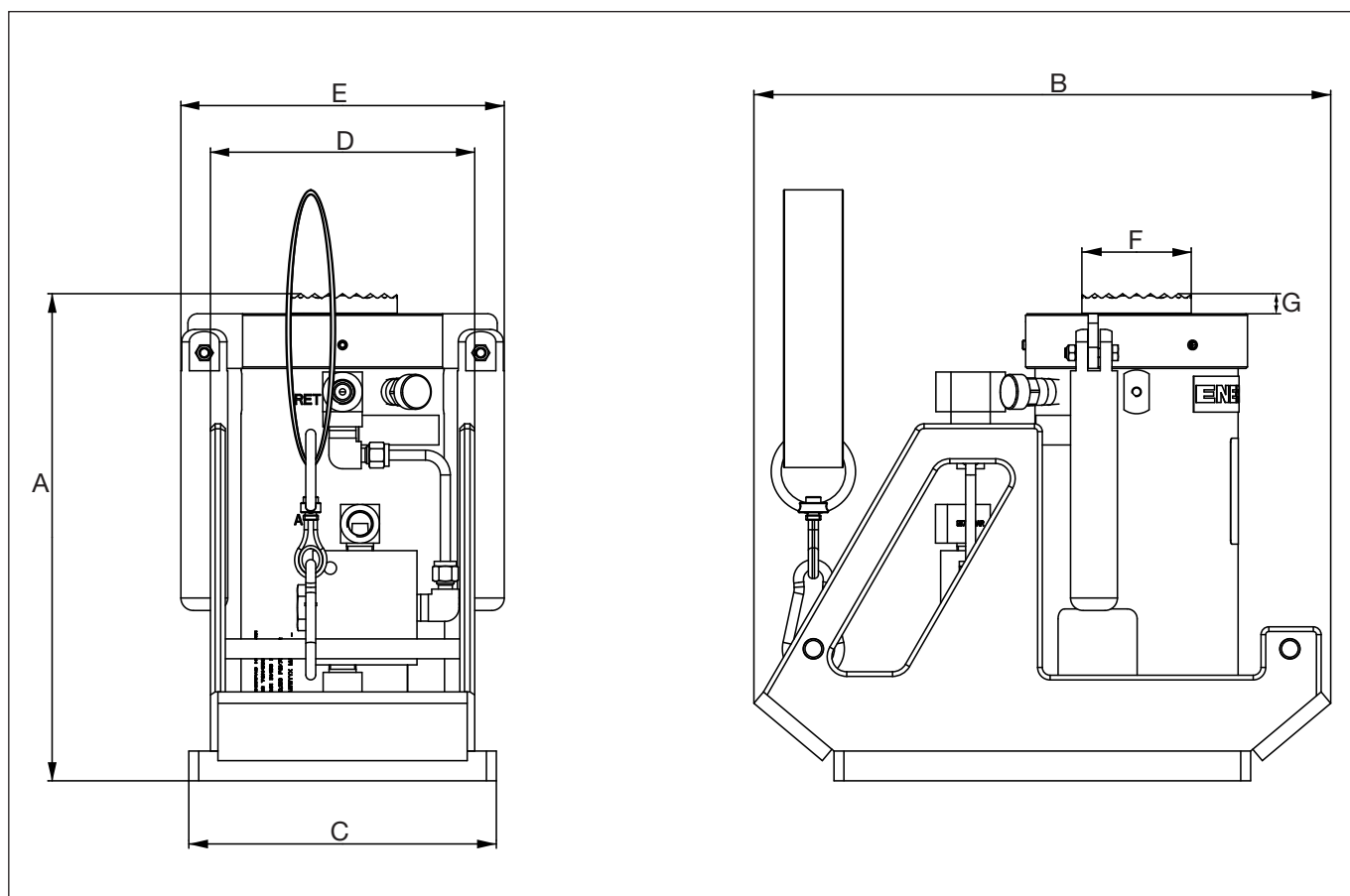


Figure 4: Cylinder Dimensions

Cylinder Dimensions (Figure 4)		
A (collapsed)	12.28 in	311.9mm
A (extended)	18.19 in	462.0 mm
B	14.54 in	369.3 mm
C	7.75 in	196.9 mm
D	6.50 in	165.1 mm
E	8.15 in	207.0 mm
F Ø	2.76 in	70.1 mm
G	0.51 in	12.9 mm

4.2 Capabilities

The TL248 uses a petrol pump to drive a hydraulic pump with outlets to control 4 double-acting hydraulic cylinders.

NOTICE Ambient operating temperature range at 85% relative humidity -10 to 50 C (14 to 122 F).

Pump Characteristics			
Manufacturer		Briggs & Stratton	
Size		10.5 hp	7.8 kW
Output Flow Rate	100 psi 7 bar	900 in ³ /min	14.7 l/min
	700 psi 48 bar	885 in ³ /min	14.5 l/min
	5,000 psi 345 bar	225 in ³ /min	3.7 l/min
	10,000 psi 700 bar	200 in ³ /min	3.3 l/min
Sound Level		91-95 dBA	

Cylinder Characteristics		
	Metric	Imperial
Capacity	550 kN	62 Tons
Stroke	150 mm	5.91 in
Effective Area	78.5 cm ²	12.17 in ²
Oil Weight	1178 cm ³	71.89 in ³
Weight	36.6 kg	80.8 lbs.
Total Capacity	2206 kN	248 Tons

5. Initial Setup

5.1 Fluid Level

Check the oil level of the pump prior to start-up, if necessary add oil by removing the SAE #10 plug from the cover plate (see Fig. 5). The reservoir is full when the oil level reaches the top of the sight glass.

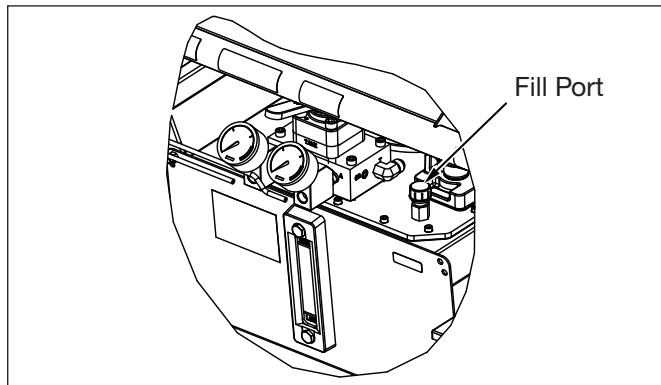


Figure 5: Fluid Level

NOTICE Always make sure that all cylinders are fully retracted before adding fluid to the reservoir.

5.2 Setup

1. Identify cylinder locations.
2. Position the TL248 within 50 feet (15.24 m) of cylinder locations.
3. Dig out 8x13 in (20x33 cm) tapered holes for cylinder placement.
4. If present unlock the locks for the toolbox and for the cylinders on both sides.

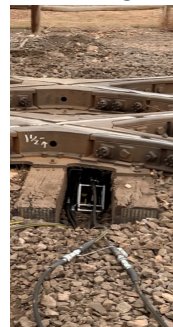


5. Remove all 4 cylinders from the storage in the skid.

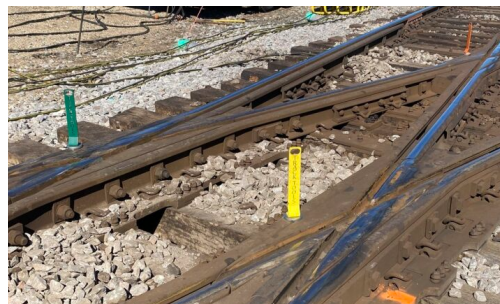


WARNING 36.6 kg/ 80.8 lbs, Two persons lift.

6. Place cylinders in the dug out holes.



7. Place magnetic colored flags on top of the rail with the corresponding cylinder and valve.



8. Manually pull hoses from the hose reel.



9. Connect the hoses to the cylinders couplers and to the manifold valves.
 - Make sure that hoses are connected in pairs to the corresponding cylinders.



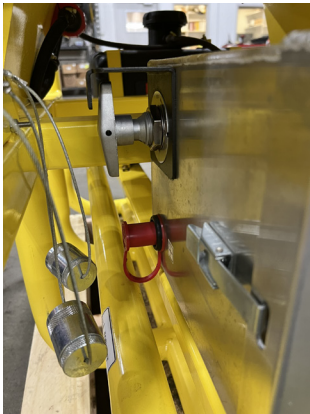
- Make sure that the hoses go under the rail.
- Hydraulic operation is not required at this moment. All hoses, quick disconnects, and cylinders should be free of hydraulic pressure.

5.3 Startup

1. Check the engine oil. Access to the oil cap is through the hole on the top of the unit.
 - Refer to engine operators manual for instructions and fluid recommendation if oil is needed.
2. Check that the directional control lever is centered, in neutral position, between pressure gauges.



3. If present unlock the lock from the battery switch.
4. Turn the battery switch to ON, located on the left side of the battery box.



5. Raise the throttle lever (Item 1) up to choke.
6. Turn the ignition key switch (Item 2) to ON and then to Start.



7. Let the engine warm up for 2 minutes.

NOTICE In cold weather, let the engine warm up longer. In low light conditions, a light switch is located at the instrument panel.

5.4 Air Removal

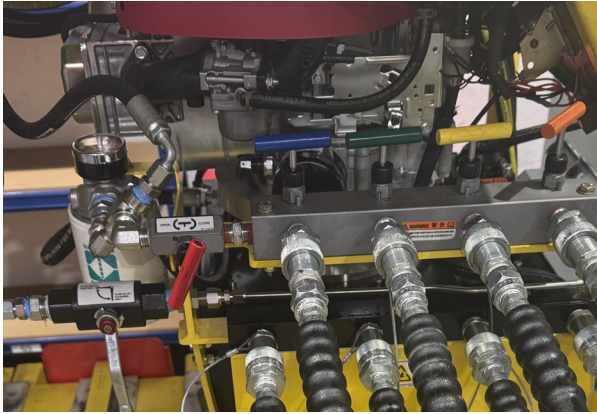
Trapped air must be removed from the hydraulic cylinder and hose before placing the system into operation. If multiple cylinders are to be used, it is recommended that air be removed from each cylinder individually. Refer to the following procedure:

1. Position the pump so it is located higher than the cylinder.
2. Place the cylinder in the vertical position, with the base located on a flat and level surface. Be sure that there is no load on the plunger.
3. Using the hydraulic pump and valve, advance and retract the plunger as required to remove trapped air. Fully advance and retract the plunger, being careful to avoid pressure build-up at full extension and full retraction. Repeat this process until plunger motion is smooth in both directions.
4. Fully retract the plunger after completing air removal procedures. Check oil level in pump hydraulic reservoir.
Add oil if oil level is low.
5. Repeat steps 1 through 4 for all cylinders to be used in the hydraulic circuit

6. Operation

6.1 Lifting the structure

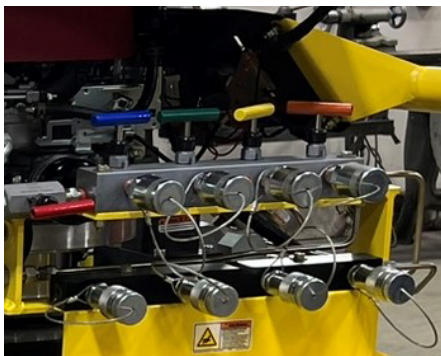
1. Close the return-to-tank valve (red valve) by turning clockwise until it gets tight.
 - The red valve is used to relieve hydraulic pressure during quick couplers disconnection, tamping and stone dumping operations.



2. Turn the silver flow control lever counterclockwise until pointing downwards to keep the flow at the manifold.



3. Close the colored valves (green, yellow, orange and blue) by turning clockwise until they get tight.
 - Do not overtighten the valves.



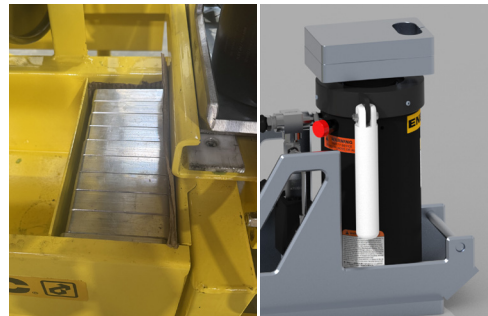
4. Lift the structure.
 - a. Select a single cylinder represented by the colored flags on top of the rail.
 - b. Open the matching colored valve in the manifold by turning counterclockwise 1-2 turns. Adjust valve handle clockwise to decrease the rate of travel and counter clockwise to increase the rate of travel once pump valve has been shifted.

- c. Shift the directional control lever to extend position (right).



- d. Make sure that the pressure indicated in the pressure gauge on the right does not exceed 620 bar (9000 psi).
- e. Lift the cylinder to the required height.
- f. Turn the directional control lever to neutral position (center).
- g. Close the colored valve in the manifold by turning clockwise until it gets tight.
- h. Repeat steps **a** to **g** for each remaining cylinder until the structure is lifted, cross-leveled and held.
 - If structure cannot be leveled due to the cylinders stroking out or exceeding maximum pressure, retract affected cylinder and insert aluminum shims located in the cart and repeat operation.

NOTICE Center the aluminum shims on the cylinder load cap.



5. Turn the ignition key switch to OFF.
6. Open the colored valves in the manifold by turning counterclockwise 1-2 turns.
7. Open the return-to-tank valve (red valve) by turning counterclockwise 1-2 turns.
8. Shift the directional control lever to extend and retract positions to release the pressure from the system.
9. Make sure that there is no pressure in the system and return the directional control lever to neutral position.
10. Place ballast shields (if applicable) to cover the open cribs where cylinders are placed.

WARNING Stay clear of loads supported only by hydraulics. As required, follow the lifted load with cribbing. If the lift is properly cribbed, production crews or maintenance of way (MoW) equipment such as tamping machines can be used.

6.2 Lowering the Structure

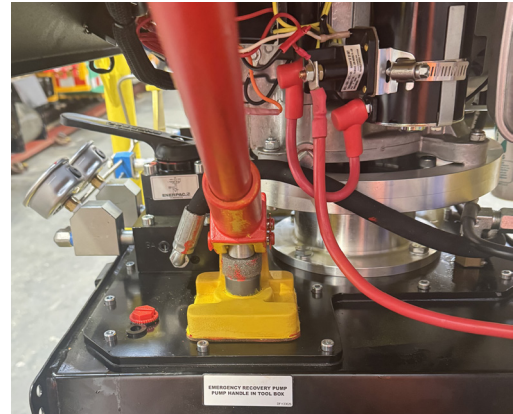
1. Turn the ignition key switch (Item 2) to ON and then to Start. If the pump won't start, then go to section 6.3.
2. Let the engine warm up for 2 minutes.
3. Remove ballast shields (if applicable).
4. Close the return-to-tank valve (red valve) by turning clockwise until it gets tight.
5. Make sure that the silver flow control lever is pointing downwards.
6. Close the colored valves (green, yellow, orange and blue) by turning clockwise until they get tight.
7. Lower the structure.
 - a. Select a single cylinder represented by the colored flags on top of the rail.
 - b. Open the matching colored valve in the manifold by turning counterclockwise 1-2 turns. Adjust valve handle clockwise to decrease the rate of travel and counter clockwise to increase the rate of travel once pump valve has been shifted.
 - c. Shift the directional control lever to retract position (left).



- d. Fully retract the cylinder.
 - e. If there is still pressure in the system, shift the directional control lever briefly to the right to release the pressure from the hoses.
 - f. Make sure that there is no pressure in the system and return the directional control lever to neutral position.
 - g. Close the colored valve in the manifold by turning clockwise until it gets tight.
 - h. Repeat steps **a** to **g** for each remaining cylinder until the structure is lowered.
8. Turn the ignition key switch to OFF.
 9. Open the colored valves in the manifold by turning counterclockwise 1-2 turns.
 10. Open the return-to-tank valve (red valve) by turning counterclockwise 1-2 turns.
 11. Shift the directional control lever to extend and retract positions to release the pressure from the system.
 12. Make sure that there is no pressure in the system and return the directional control lever to neutral position.

6.3 Manually Recovery of Jacks

1. Install pump handle located in the toolbox onto the socket on the pump.



2. Remove ballast shields (if applicable).
3. Close the return-to-tank valve (red valve) by turning clockwise until it gets tight.
4. Make sure that the silver flow control lever is pointing downwards.
5. Close the colored valves (green, yellow, orange and blue) by turning clockwise until they get tight.
6. Lower the cylinder.
 - a. Select a single cylinder represented by the colored flags on top of the rail.
 - b. Open the matching colored valve in the manifold by turning counterclockwise 1-2 turns.
 - c. Shift the directional control lever to retract position (left).
 - d. Pump the handle to retract the cylinder enough so that it can be removed from under the load.
 - e. If there is still pressure in the system, shift the directional control lever briefly to the right and pump handle to release the pressure from the hoses.
 - f. Make sure that there is no pressure in the system and return the directional control lever to neutral position.
 - g. Close the colored valve in the manifold by turning clockwise until it gets tight.
 - h. Repeat steps a to g for each remaining cylinder until the jacks are retrieved.
7. Open the colored valves in the manifold by turning counterclockwise 1-2 turns.
8. Open the return-to-tank valve (red valve) by turning counterclockwise 1-2 turns.
9. Shift the directional control lever to extend and retract positions to release the pressure from the system.
10. Make sure that there is no pressure in the system and return the directional control lever to neutral position.

7. Storage

7.1 Tear Down

1. Disconnect all hoses from the cylinder whip lines.
2. Connect male and female hoses ends to make a single line.
3. Reel hoses in the hose reel.
 - a. Turn the silver flow control lever clockwise until parallel to the ground.



- b. Make sure that the return-to-tank valve (red valve) is closed.
- c. Make sure that the colored valves (green, yellow, orange and blue) are closed.
- d. Disconnect the hoses from the manifold.
- e. Connect male and female hoses ends to make a single line.
- f. Connect the male end of the hoses line to the female coupler of the hose reel.
- g. Turn the ignition key switch to ON and then to Start. If the pump won't start, then go to section 7.2.
- h. Turn the directional control lever to extend position (right).
- i. Push the hose reel control handle to reel in the hoses.
 - Keep the hoses line in tension to avoid tangling the hoses.
 - Guide the hoses line to left and right to distribute evenly across the hose reel.

⚠ WARNING Watch that the hoses being reeled into the hose reel do not get hung up on any obstacle while reeling the hoses in.

NOTICE

4. Cap off all cylinder whip lines, manifold valves and final hose end.
5. Tie up cylinder whip lines with velcro straps.
6. Place cylinders in the storage in the skid.
7. If present lock the toolbox and the cylinders on both sides.
8. Place colored flags, shims, ballast shields and all tools in the corresponding storage in the skid.

7.2 Manual Hose Recovery

1. Reel hoses in the hose reel.
 - a. Install hose reel crank into hose reel.



- b. Turn crank counterclockwise.

Keep the hoses line in tension to avoid tangling the hoses.

Guide the hoses line to left and right to distribute evenly across the hose reel.

⚠ WARNING Watch that the hoses being reeled into the hose reel do not get hung up on any obstacle while reeling the hoses in.

7.3 Shut Down

1. Turn the ignition key switch to OFF.
2. Turn the battery switch to OFF.
3. If present lock the battery switch.
4. Check the work area and make sure that all accessory item are stored.
5. Secure all components in the skid.

8. Relieving Trapped Pressure

Hydraulic pressure can sometimes become trapped within a hydraulic cylinder or hose. This condition can occur in both single and double-acting cylinders, but is most likely to happen in a double-acting cylinder that has been exposed to changing ambient temperatures.

A common indication of trapped pressure is when mating hose and cylinder couplers will not engage, or are unusually difficult to engage.

If a trapped pressure condition is suspected, always use the Enerpac model CT-604 coupler bleed tool to safely relieve any remaining pressure.

⚠ WARNING Never attempt to relieve trapped hydraulic pressure within the cylinder by loosening a coupler on the cylinder base.

Trapped hydraulic pressure can cause a loosened coupler to dislodge unexpectedly with great force. Serious personal injury or death will result if the coupler becomes a projectile and strikes persons working in the area.

A sudden escape of pressurized hydraulic oil may also occur if a coupler is loosened while trapped hydraulic pressure is present. Serious personal injury or death could result if a high pressure oil stream penetrates the skin.

Use only the Enerpac CT-604 coupler bleed tool to relieve trapped hydraulic pressure within the cylinder.

⚠ WARNING Never use a hammer and punch (or other similar method) to unseat a coupler check ball that is under pressure. Serious personal injury or death could result due to the sudden and uncontrolled escape of high pressure oil. Use only the Enerpac CT-604 coupler bleed tool to relieve trapped pressure within the cylinder.

9. Maintenance

In order to prevent any kind of breakdown, it is necessary to carry out preventive maintenance, forecasting the wear and tear of the basic elements. The most important points to take into account when performing preventive maintenance are:

9.1 Inspection & Storage

- Periodically check the hydraulic system for loose connections, leaks and obvious problems. Replace any damaged components immediately.
- Periodically lubricate the directional control lever.
- Monitor the oil temperature during operation. Do not exceed oil temperature above 150°F [65°C].
- Install dust caps and plugs after the hydraulic hoses are disconnected.
- Keep all hydraulic components clean.
- Store cylinders in the upright position in a clean, dry and secure location. Keep stored cylinders and hoses away from heat and direct sunlight.
- If repairs are required, refer to the Enerpac website for the repair parts sheet applicable to cylinder model.

NOTICE Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Enerpac Authorized Service Center in your area.

9.2 Check Oil Level

Check oil level of pump prior to start-up. If necessary, add oil by removing the fill port cap. Always make sure that all cylinders are fully retracted before adding fluid to the reservoir.

9.3 Change Oil and Clean Reservoir

Enerpac HF oil is a crisp blue color. Frequently check oil condition for contamination by comparing pump oil to new Enerpac oil. Replace oil and return filter cartridge when return filter is clogged.

Enerpac recommends to completely drain and clean the reservoir every 250 hours, or more frequently if used in dirty environments.

NOTICE Indicates Work on a clean bench and dispose of used oil according to local codes.

1. Unscrew the 13 bolts holding the coverplate to the reservoir and lift the pump unit out of the reservoir. Be careful not to damage the filter screen.
2. Pour all oil out of the reservoir.
3. Thoroughly clean the reservoir and reservoir magnet with a suitable cleaning agent.
4. Remove the pick-up filter screen for cleaning. (Do not pull on the screen or the bottom of the intake to avoid possible damage.) Clean the screen with solvent and a soft brush. Reinstall.
5. Reassemble the pump and reservoir, installing a new reservoir gasket.
6. Fill the reservoir with clean Enerpac hydraulic oil. The reservoir is full when oil level is in middle of the sight gauge.

9.4 Hydraulic Oil Requirements

Use of Enerpac HF Series ISO 32 hydraulic oil is recommended. Enerpac HF oil is available at your local Enerpac Distributor or Authorized Service Center:

- Failure to use the correct oil type (high-quality ISO 32 hydraulic oil) may result in damage to hydraulic components and will void the product warranty.
- Be sure that oil is clean. The oil cleanliness should be maintained to a maximum level of 18/16/13 per the ISO4406 standard. If oil develops a milky, cloudy or dark appearance, it should be changed immediately.
- To avoid overfilling and possible equipment damage, add oil to the pump reservoir only after all cylinder plungers are completely retracted and system pressure is released.

9.5 Filter Element Replacement

The filter element must be replaced every 250 hours or more frequently in dirty environments.

The filter is equipped with a 25 psi (1,7 bar) bypass to prevent over pressure rupture if filter plugging occurs and with a small gauge that shows the pressure when the filter is clogged.

NOTICE Dispose of used filter element in accordance with all applicable laws and regulations.

9.6 Check Engine Operation

Refer to the Briggs & Stratton Owner's Manual and follow the Maintenance Schedule to keep the engine in proper operating condition.

10. Safe Disposal Procedure

When tool has reached the end of its useful life, dispose of as described in the following steps:

1. Drain all hydraulic oil from the pump hydraulic reservoir as described in Section 9.3 of this manual. Dispose of used oil in accordance with all applicable laws and regulations.
2. Remove battery from the tool. Dispose of battery in accordance with all applicable laws and regulations.
3. Take the tool to an approved industrial recycling facility for disposal.

11. Troubleshooting

11.1 Pump Troubleshooting

Only qualified hydraulic technicians should service the pump or system components. A system failure may or not may be the result of a pump malfunction. To determine the cause of the problem, the complete system must be included in any diagnostic procedure.

The troubleshooting guide is not all-inclusive, and should be considered only as an aid to help diagnose the most common problems. For repair service, contact your local Authorized Enerpac Service Center.

Pump Troubleshooting Guide		
Symptom	Possible Cause	Solution
1. Engine does not start.	Battery low voltage.	a. Charge or replace the battery. b. Refer to Operator Manual.
	Fuse Blown.	Replace the fuse. Fuse is located behind the battery in the battery box.
2. Pump fails to build pressure or less than full pressure.	a. Low oil level.	Add oil.
	b. External system leak.	Inspect and repair or replace.
	c. Internal leak in pump.	Contact Authorized Enerpac Service Center.
	d. Internal leak in valve.	Contact Authorized Enerpac Service Center.
	e. Internal leak in system component.	Contact Authorized Enerpac Service Center.
	f. Return to tank is not closed.	Close the return-to-tank valve (red valve) by turning clockwise until it gets tight.
	g. Silver flow control valve is open.	Shift the silver flow control lever counterclockwise until perpendicular to the ground.
3. Pump builds full pressure, but load does not move.	a. Load greater than cylinder capacity at full pressure.	Insert aluminum shims.
	b. Flow to cylinder blocked.	Check hydraulic couplers for full engagement..
4. Cylinder drifts back on its own.	a. External system leak.	Inspect hydraulic connections and repair or replace.
	b. Internal leak in system component.	Contact Authorized Enerpac Service Center.
5. Pump runs hot.	Advance or retract flow restricted.	Check couplers for full engagement.
6. Double acting cylinder will not return.	Return flow restricted or blocked.	Check couplers for full engagement and check to make sure the valve handle is open on the manifold.
	Valve malfunction.	Contact Authorized Enerpac service center.

11.2 Cylinder Troubleshooting

Refer to the troubleshooting guide when diagnosing cylinder operational problems. Please note that the troubleshooting guide is not all-inclusive, and should be considered only as an aid to help diagnose the most common possible problems.

For repair service, contact your nearest Enerpac Authorized Service Center. As required, also refer to the troubleshooting information provided with your hydraulic pump or power unit.

Cylinder Troubleshooting Guide		
Symptom	Possible Cause	Solution
1. Plunger does not advance.	a. Pump release valve open.	Close pump release valve.
	b. Directional control valve not in proper position.	Shift directional control valve to proper position.
	c. Coupler not fully tightened.	Tighten coupler.
	d. Pump oil level is low.	Add oil to pump reservoir as required. See Section 9.2.
	e. Pump malfunctioning.	Repair or replace pump as required.
	f. Cylinder load rating too low for application.	Use a cylinder with a higher load rating.
	g. Cylinder seals leaking.	Repair or replace cylinder.
	h. Return to tank is not closed.	Close the return-to-tank valve (red valve) by turning clockwise until it gets tight.
	i. Silver flow control valve is open.	Shift the silver flow control lever counterclockwise until perpendicular to the ground.
	j. Manifold valve not open	Turn valve handle 1 or 2 turns counterclockwise.
2. Plunger advances only part way.	a. Oil level in pump is low.	Add oil to pump reservoir as required. See Section 9.2.
	b. Coupler is not fully tightened.	Tighten coupler.
	c. Cylinder plunger binding.	Repair or replace cylinder.
3. Plunger advances erratically.	a. Air in hydraulic system.	Remove air from hydraulic system. See Section 5.4.
	b. Cylinder plunger binding.	Repair or replace cylinder.
4. Plunger advances more slowly than normal.	a. Leaking connection.	Repair leaking connection.
	b. Coupler not fully tightened.	Tighten coupler.
	c. Pump malfunctioning.	Repair or replace pump as required.
5. Plunger advances, but will not hold.	a. Pump malfunctioning.	Repair or replace pump as required.
	b. Leaking connection.	Repair leaking connection.
	c. Incorrect system set-up.	Check hose connections at pump and cylinders.
	d. Cylinder seals leaking.	Repair or replace cylinder.
6. Cylinder leaks oil.	a. Worn or damaged cylinder seals.	Repair or replace cylinder.
	b. Internal cylinder damage.	Repair or replace cylinder.
	c. Loose connection.	Tighten or repair connection.
7. Plunger does not retract or retracts more slowly than normal.	a. Pump release valve closed.	Open pump release valve.
	b. Directional control valve not in proper position.	Shift directional control valve to proper position.
	c. Pump reservoir is overfilled.	Drain oil from pump reservoir as required.
	d. Improper hose connections.	Check hose connections.
	e. Narrow hose restricting oil flow.	Replace with larger diameter hose.
	f. Internal cylinder damage.	Repair or replace cylinder.
	g. Manifold valve not open	Turn valve handle 1 or 2 turns counterclockwise.
8. Oil leakage from external relief valve.	a. Coupler not fully tightened.	Tighten coupler.
	b. Restriction in return line.	Remove restriction from return line.
	c. Relief valve setting incorrect.	Check relief valve setting.
	d. Relief valve damaged or contaminated.	Repair or replace relief valve.

12. Parts List

Date Code B

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NOTE: SERVICE INSTRUCTIONS: These Service instructions are intended to be used by qualified personnel at Authorized Enerpac Service Centers. Users of Enerpac equipment should see the pump Instruction Sheet for installation, operation, and maintenance information.

NOTICE Dispose of serviceable/replacement items in accordance with all applicable laws and regulations.

12.1 ZG6 Petrol Pump

12.1.1 Main Assembly

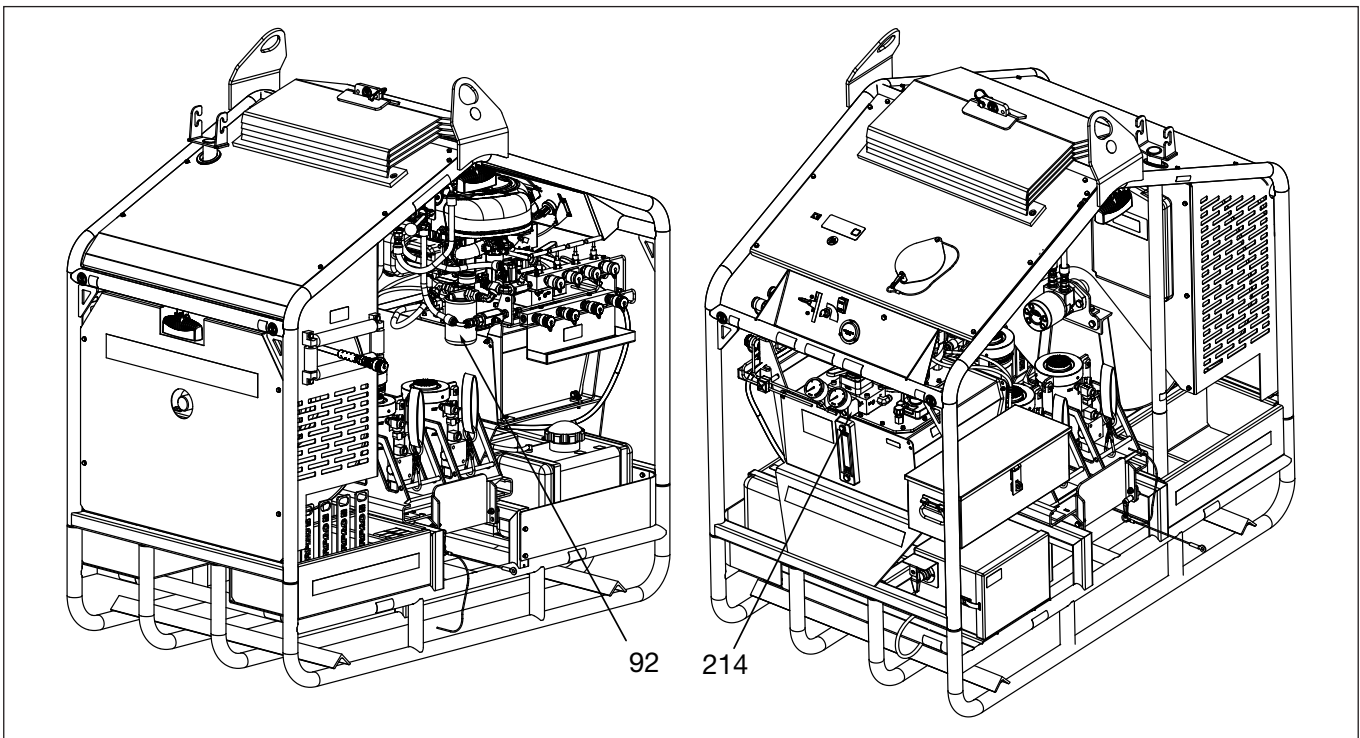


Figure 6: ZG6 Petrol Pump Main Assembly

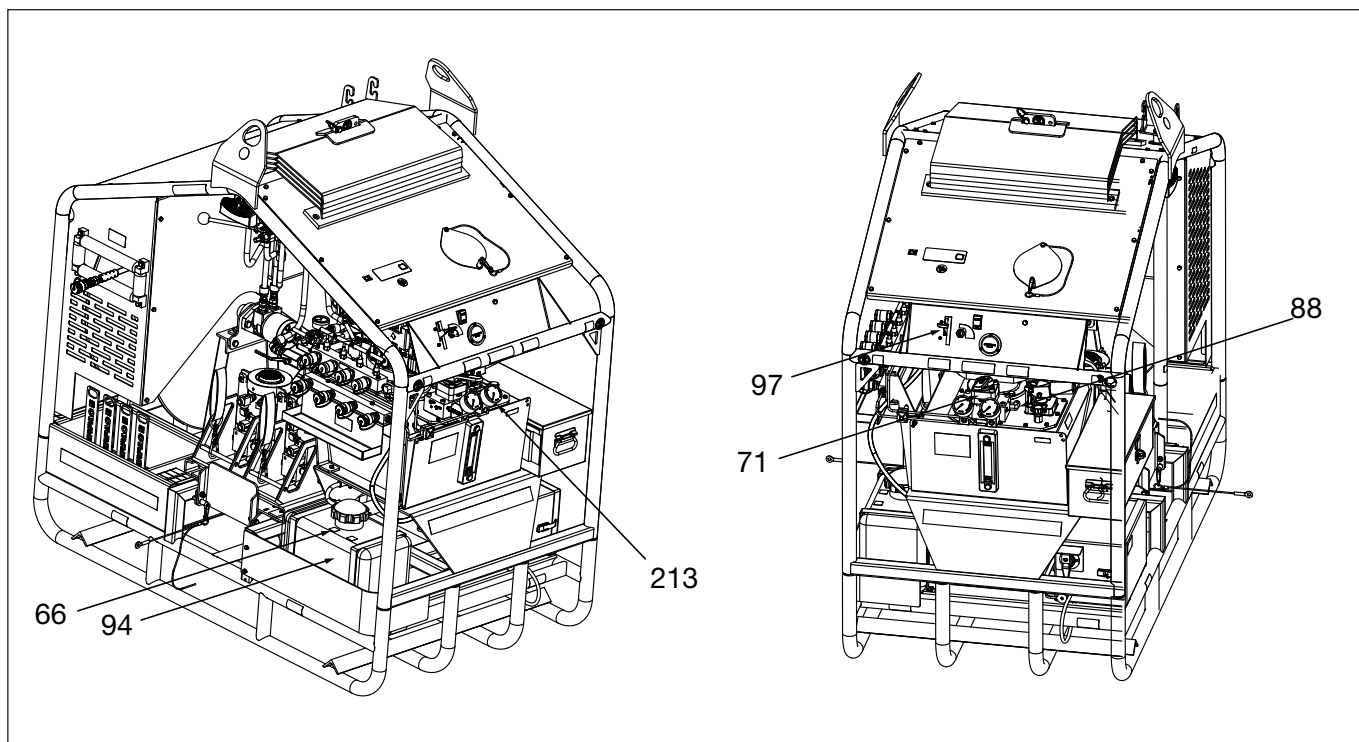


Figure 7: ZG6 Petrol Pump Main Assembly

Repair Parts List for ZG6 Petrol Pump Main Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
66	◆DA12185026	1	Decal, Flammable	123	CCE1080108-6A	2	Lockwasher M8 (not shown)
71	Section 10.3	1	Valve Assembly	124	CBE1080120-1D	2	Nut M8 (not shown)
88	F100094-19	1	FTG-37 M, 0.375, 0.375, 1.430, STL, CAD	130	DC9876647	13	Cable Tie. Black, 6 Inch (not shown)
92	Section 10.1.6	1	Filter Sub Assembly, ZG-6	135	CU876028	1	Screw 10-24 (not shown)
93	DC8196020	1	Vinyl Cap (not shown)	136	DA15066	1	Lockwasher, M5 (not shown)
94	DC8133025	1	Petrol Tank	210	DC5901098	1	Terminal Cover Positive (not shown)
97	Section 10.1.5	1	Control Panel, ZG6	211	DD4380646	1	ZG6 Fume Hose 1/4" ID (not shown)
110	DC8189646	1	Hose, Rubber 1/4 x 26 (not Shown)	212	DD4381646	1	ZG6 Fume Hose 3/16" (not shown)
111	CB949299	2	Hose Clamp (not shown)	213	G2538R	2	Gauge Glycerine 15,000 PSI 2.5 IN
121	CU100377	1	Battery (not shown)	214	GA45	2	Gauge Adapter
122	CBE819028-1E	2	Capscrew, BHCS, M8 (not shown)	◆ Items included in Decal Kit TL248014.			

12.1.2 Pump and Reservoir Assembly

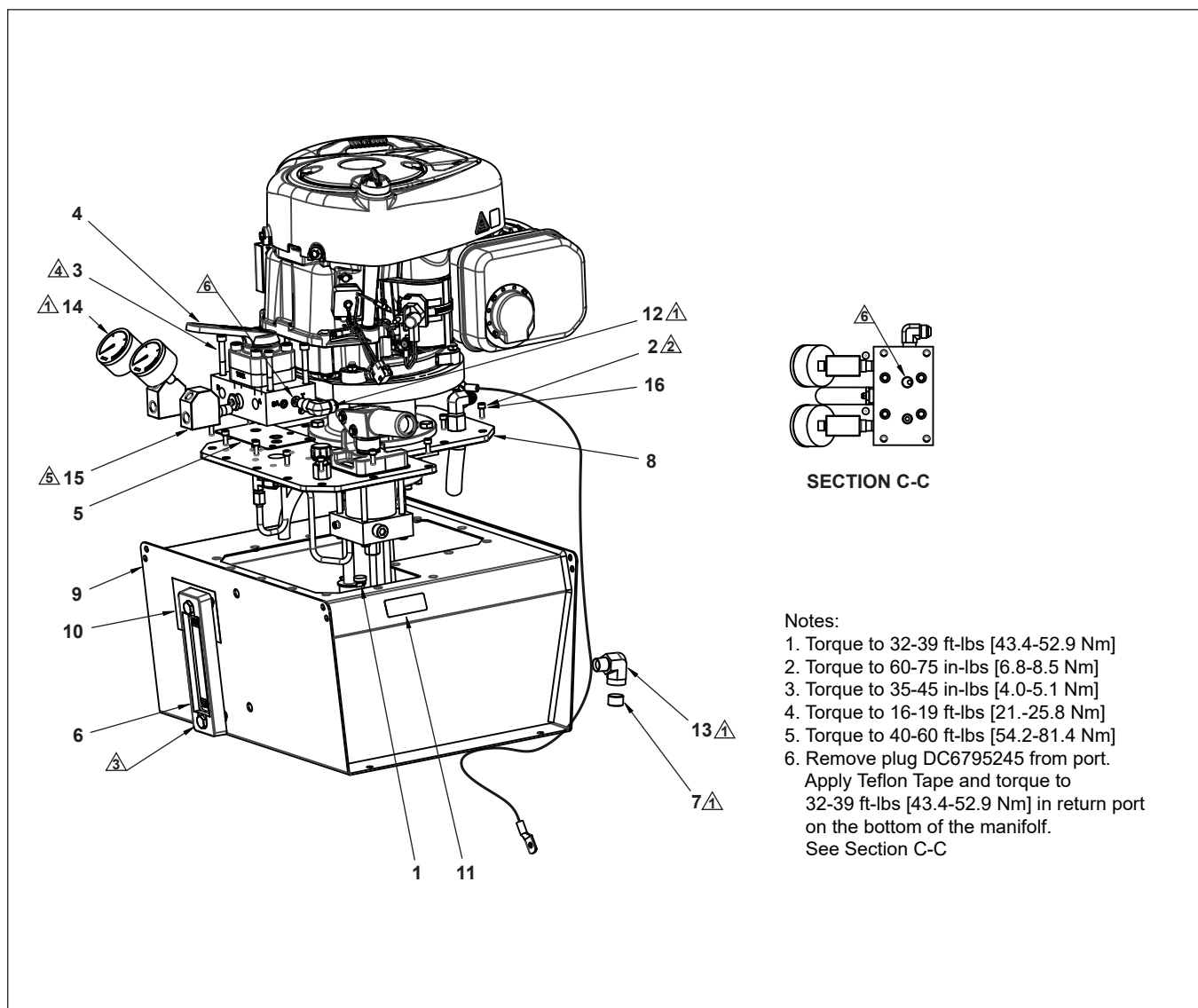


Figure 8: ZG6 Petrol Pump - Pump and Reservoir Assembly

Repair Parts List for ZG6 Petrol Pump - Pump and Reservoir Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	C187018	1	Magnet	9	DF1038025-P01	1	40L Reservoir
2	CBE619028-1A	15	Screw, SCHS M6	10	◆ DF1130026	1	Decal, ZG6 Product Specification
3	CBE837028-1A	4	Screw, SCHS M8	11	◆ DF1133026	1	Decal, Emergency Recovery Pump
4	DC5190950	1	VM43 4-Way Manual Valve	12	DF100094-86	1	M90 Fitting
5	DC9356037	1	Gasket Valve	13	F100095-45	1	Fitting, Street Elbow
6	DC9969223	1	Sight Glass, 7 Inch	14	G2538R	2	Gauge
7	DD1425245	1	Plug, 1/2" Flush w/ Sealant	15	GA45	2	Gauge Adaptor
8	DF1036900	1	ZG6 Coverplate Assy	16	S3037	15	Gasket
◆ Items included in Decal Kit TL248014.							

12.1.3 Pump Assembly (basic)

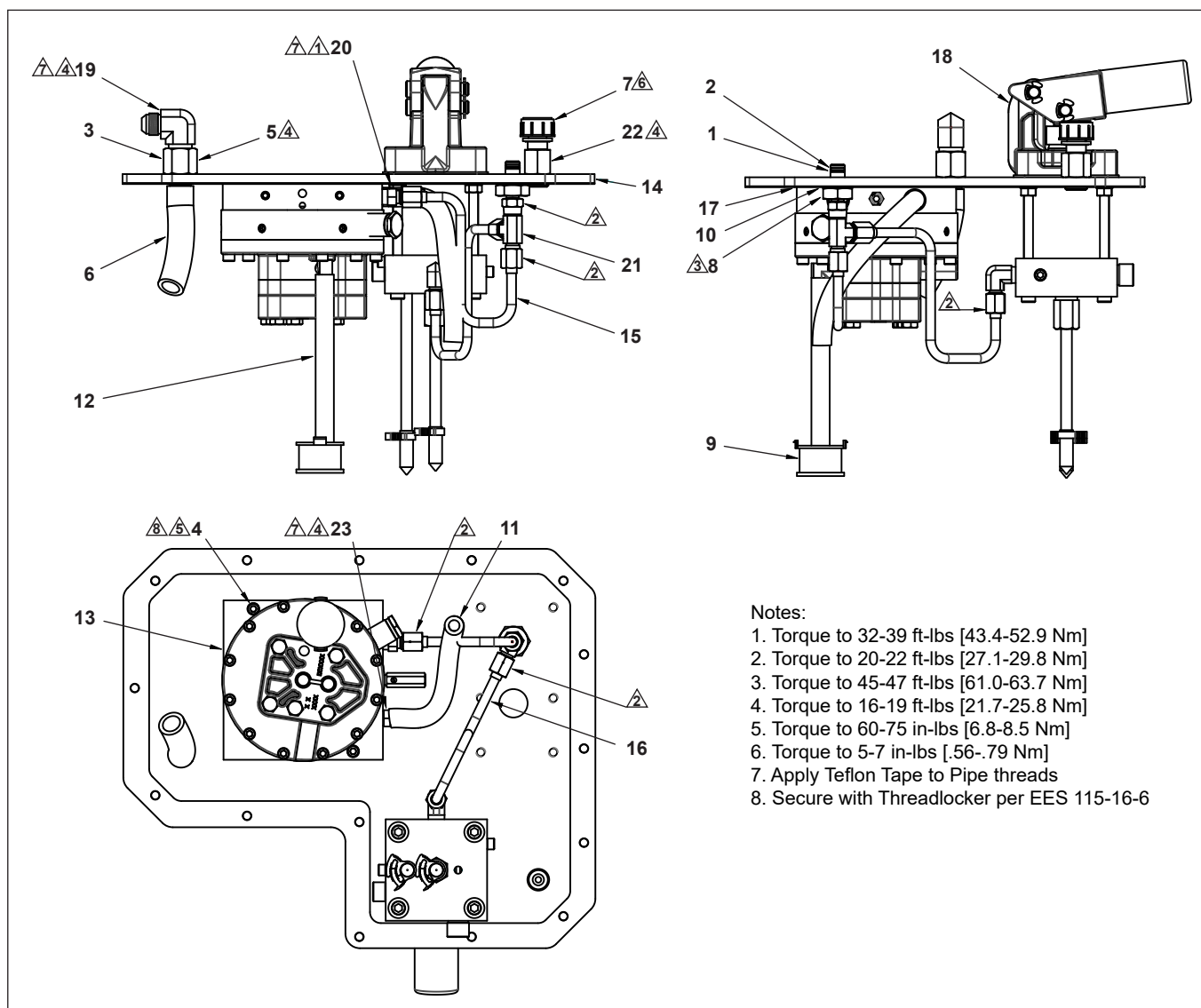


Figure 9: ZG6 Petrol Pump - Pump Assembly

Repair Parts List for ZG6 Petrol Pump - Pump Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	B1012566	1	Back-up	13	DC9715900	1	MPE IND Steel 6P-10K 2225
2	B1012803	1	O-Ring	14	DF1037101-P01	1	Coverplate Z-Class
3	B1908503	1	O-Ring	15	DF1040268	1	Tube Assembly
4	CBE621028-1A	2	SHCS M6 x 20	16	DF1041268	1	Tube Assembly
5	DC8035038	1	Fitting, Heat Exchanger	17	DF1089990	1	Gasket Rservoir and Motor Kit
6	DC8046646	1	Heat Exch. Return Hose	18	DF1115900	1	Handpump Sub-Assy
7	DC8250006	1	Breather Assembly	19	F100094-87	1	Fitting, Standard Pump
8	DC9173690	1	Connector Fitting	20	F100094-246	1	Fitting 5-4 FTX-S
9	DC9178118	1	Intake Filter	21	F100094-281	1	Swivel Nut
10	DC9271167	1	Copper Gasket	22	F100096-38	1	Adapter Fitting
11	DC9335646	1	Hose, Bypass 8"	23	F100097-16	1	Hose Pipe
12	DC9603268	1	Intake Tube 6.5" 40L				

12.1.4 Engine Assembly (Briggs & Straton)

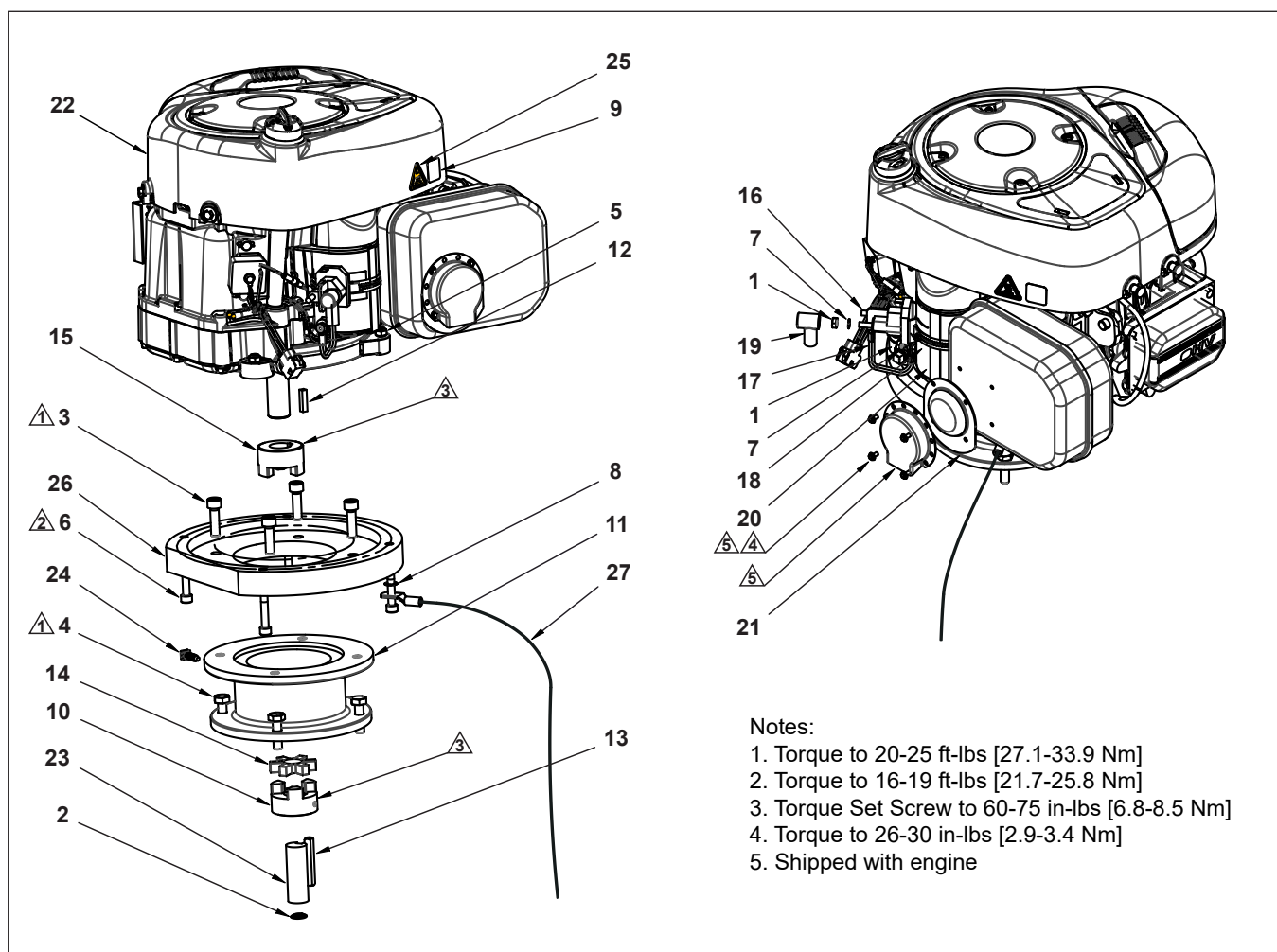


Figure 10: ZG6 Petrol Pump Engine Assembly

Repair Parts List for ZG6 Petrol Pump Engine Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	B1001122	2	Nut .25-20 Zinc	15	DC8090034	1	Coupler
2	BSS5509D	1	Spring	16	DC8151720	1	Starter Solenoid
3	CBE1027028-1A	4	Screw, SHCS M10 x 35	17	DC8152960	1	Cable, Red
4	CBE1027046-1B	4	Bolt, Hex Hd. M10 x 35	18	DC8153299	1	Clamp, Hose
5	CBE1080120-2A	4	Locknut, M8	19	DC8155378	1	Insulation Boot, Red
6	CBE837028-1A	4	Screw, SHCS M8x1.25x60	20	DC8158960	1	Strap, Grounding
7	CCE1060108-6A	2	Starwasher, 6MM	21	DC8190298	1	Spark Arrestor
8	CCE1080108-6A	1	Lockwasher, M8	22	DC8512259	1	Engine 10.5 HP Briggs
9	◆DA12183026	1	Decal, Inhalation	23	DC9079104	1	Shaft Adapter
10	DC2380034	1	Coupler	24	DC9741017	1	Mount, Cable Tie
11	DC2639004	1	Flange, Adapter	25	◆DC9921026	1	Decal, "HOT SURFACE"
12	DC5611251	1	Key .25 x 1.00	26	DC9999101	1	Motor Plate
13	DC8087251	1	Key, 5/16	27	DF1099647	1	ASM Cable
14	DC8089234	1	Spider	◆ Items included in Decal Kit TL248014			

12.1.5 Control Panel Assembly

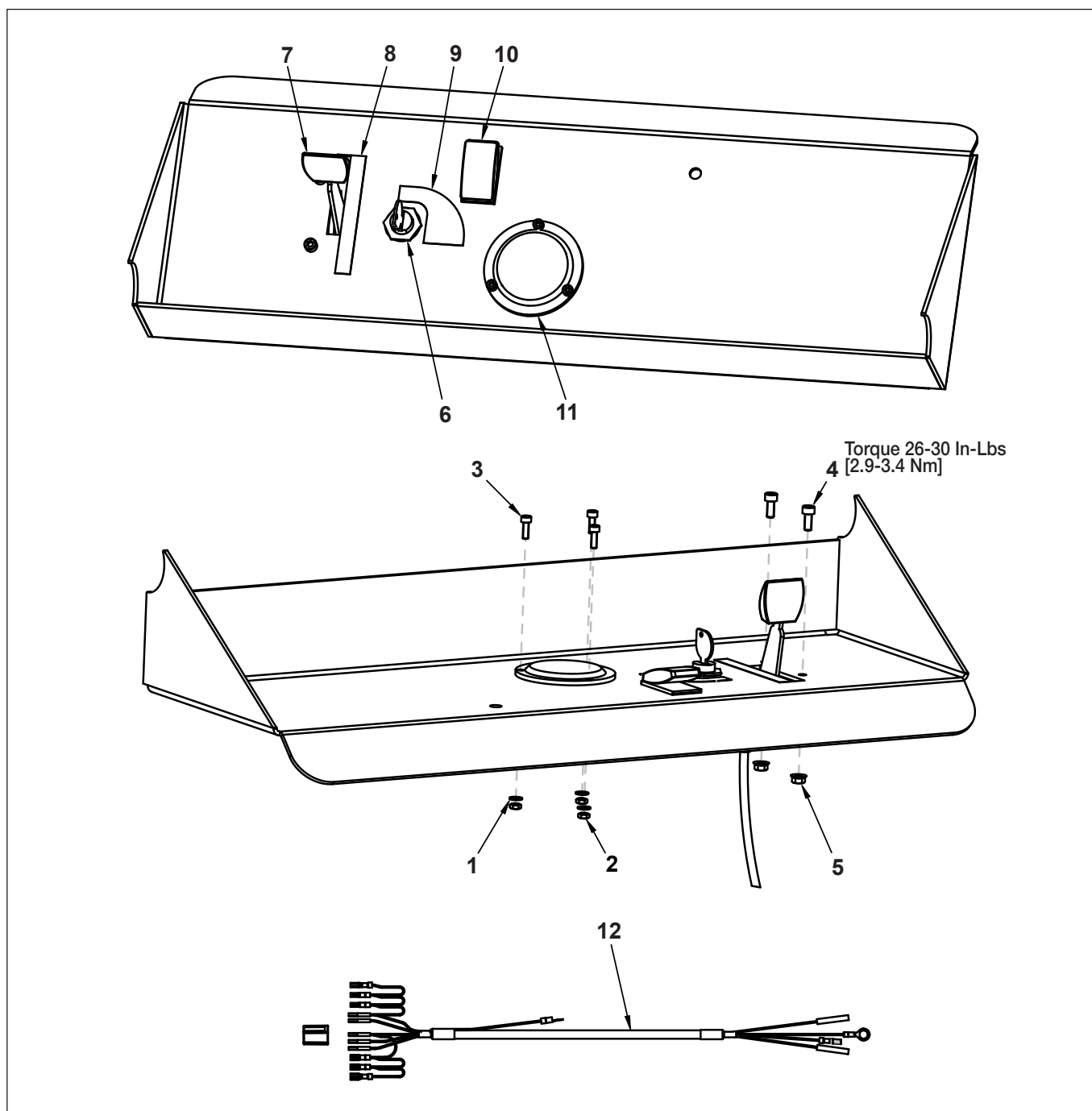


Figure 11: ZG6 Petrol Pump Control Panel Assembly

Repair Parts List for ZG6 Petrol Pump Control Panel Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	CAE1040108-1A	3	Washer	7	DC2578142	1	Throttle Cable
2	CBE1040120-1D	3	M4 Nut	8	◆DC5279026	1	Throttle Decal
3	CBE417028-1A	3	Screw, SHCS, M4 x 12	9	◆DC5280026	1	Decal Off-On-Start
4	CBE517028-1A	2	Screw, SHCS, M5 x 12	10	DD9976372	1	Switch, LED Rocker SPST 20A
5	CCA1005120-2B	2	M5 Lock Nut	11	DD9978750	1	Meter, Hour 10-80 VDC
6	DC5254372	1	Switch Off-On-Start	12	DF1079910	1	Wire Harness, Starter Control

◆ Items included in Decal Kit TL248014.

12.1.6 Oil Fliter Assembly

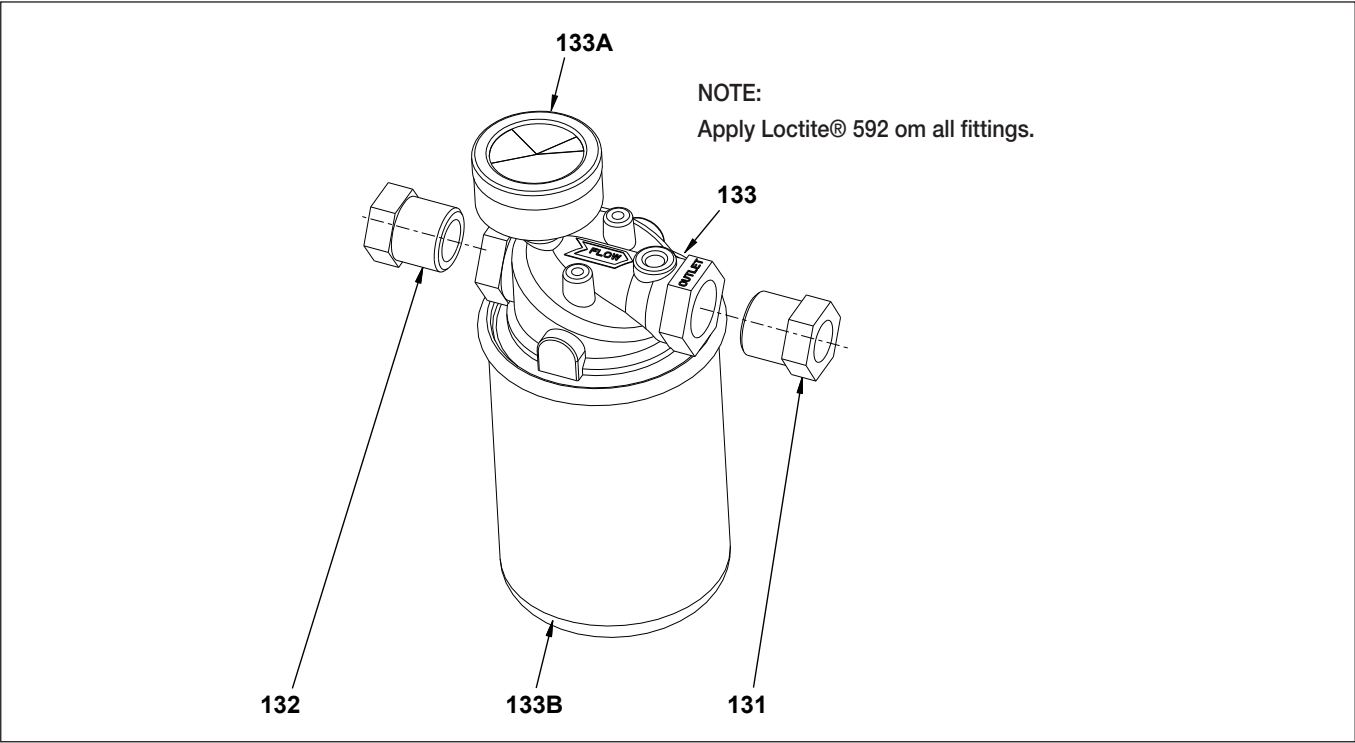


Figure 12: ZG6 Petrol Pump Oil Filter Assembly

Repair Parts List for ZG6 Petrol Pump Oil Filter Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
131	F100095-50	1	Reducer, 3/4 NPT to 1/2 NPT	133A	★ DC3075223	1	Gauge
132	F100095-26	1	Reducer, 3/4 NPT to 3/8 NPT	133B	★ DC3076118	1	Element, Filter
133	DC3077900	1	Filter Head Assembly	★ Items 133A and 133B are included with item 133.			

12.2 Z-Class Pump Element

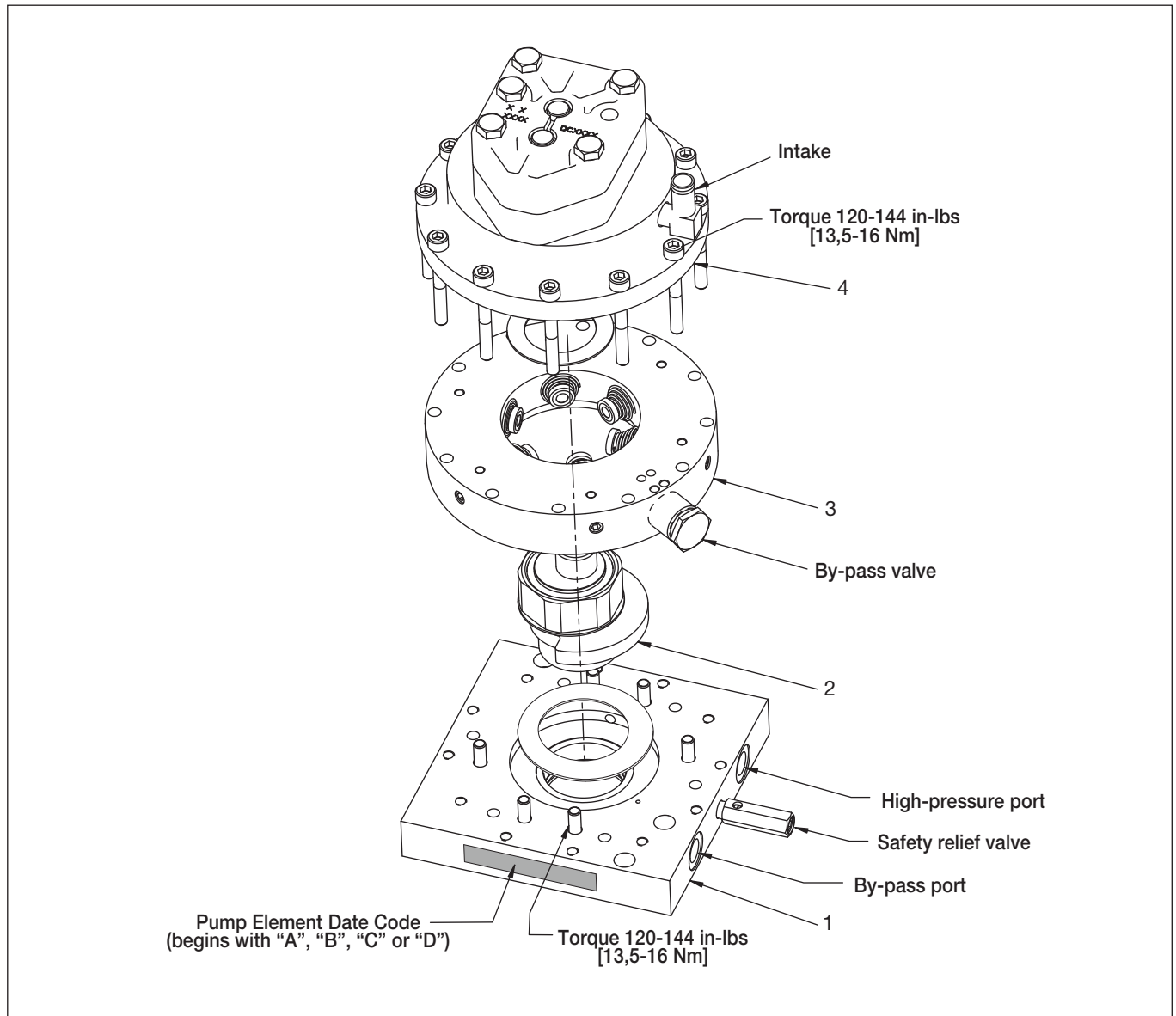


Figure 14: Z-Class Pump Element Top Level

Z-Class Pump Element Top Level	
Item	Description
1	Top Plate Assembly
2	Eccentric Assembly
3	Piston Ring Assembly
4	Gear Pump Assembly

12.2.1 Top Plate Assembly

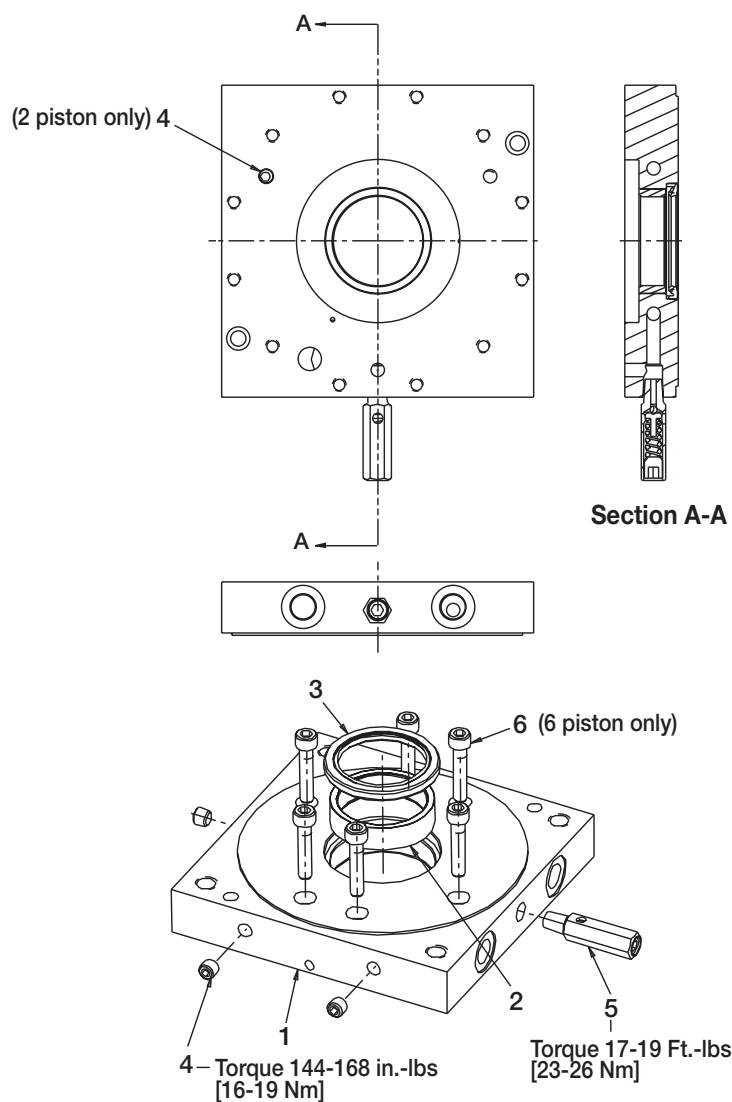


Figure 16: Z-Class Pump Element Top Plate Assembly

Repair Parts List for Z-Class Pump Element Top Plate Assembly			
Item	Part Number	Qty.	Description
1	◆ DC8350101	1	Top Plate 6 Piston (steel)
2	◆ DC9026155	1	Bearing, Needle 40x47x12
3	◆ DC9027776	1	Oil Lip Seal 40x52x5
4	◆ A1006245	3	1/16 Flush Plug (for 6 piston)
5	◆ DA5999900SR	1	1/8 NPT Relief Valve
6	◆ CCA625028-1A	6	SHCS M6x1.0x30
◆ Items included in Repair Kit DC9278900SR.			

12.2.2 Eccentric Assembly

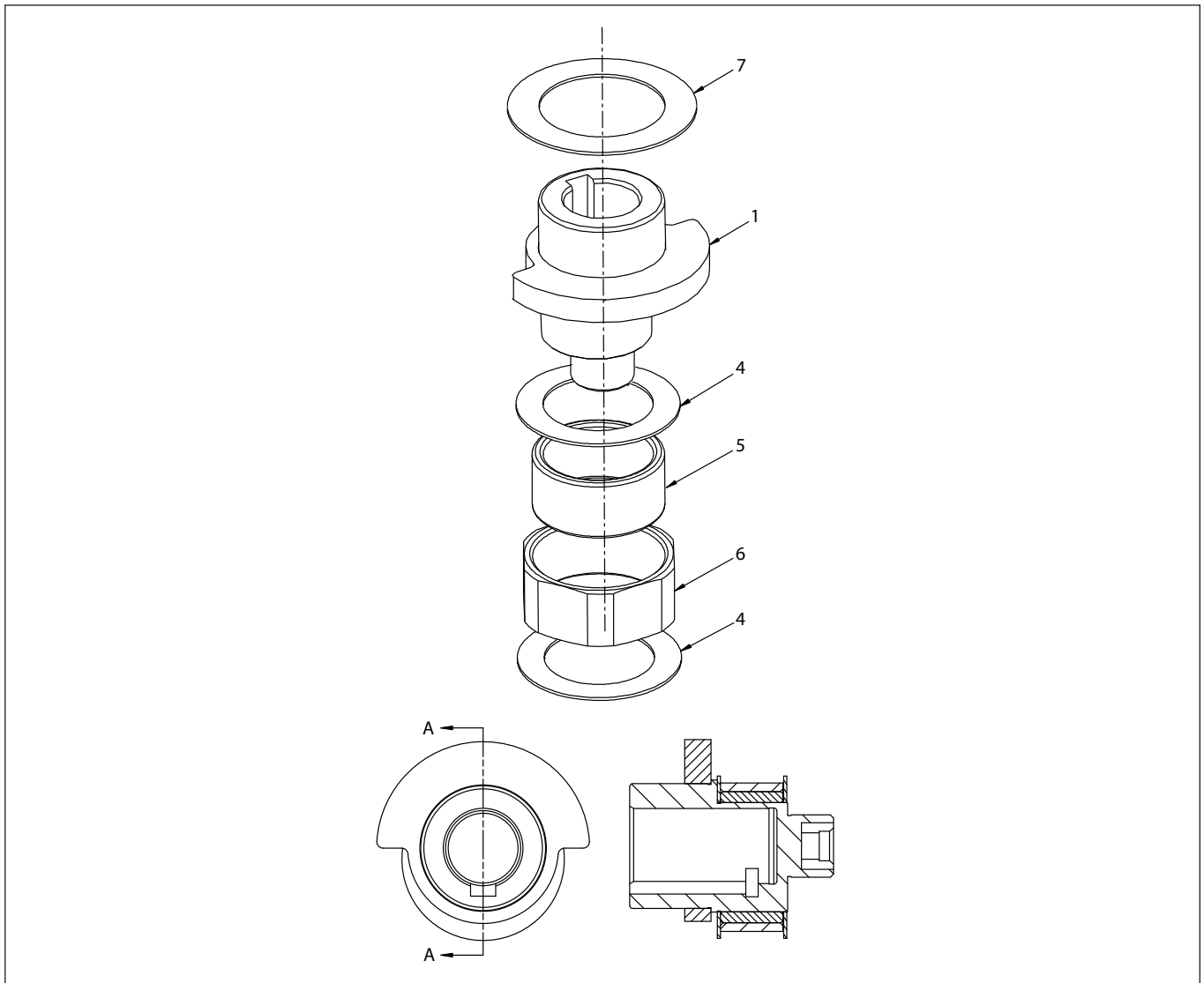


Figure 17: Z-Class Pump Element Eccentric Assembly

Repair Parts List for Z-Class Pump Element Eccentric Assembly			
Item	Part Number	Qty.	Description
1	★ DC9214537	1	Eccentric, Induction
4	★ BSS4725D	2	Ring
5	★ DC4107155	1	Bearing, Needle 35 x 42 x 20
6	★ DC4328350	1	Hex Cam
7	★ DD1277108	1	Locating Washer
★ Items available as part of Eccentric Assembly kit DC9215900SR.			

Note: Locating washer (item 7) is larger in diameter than rings (item 4). Be sure to install parts in proper locations.

12.2.3 Piston Ring Assembly

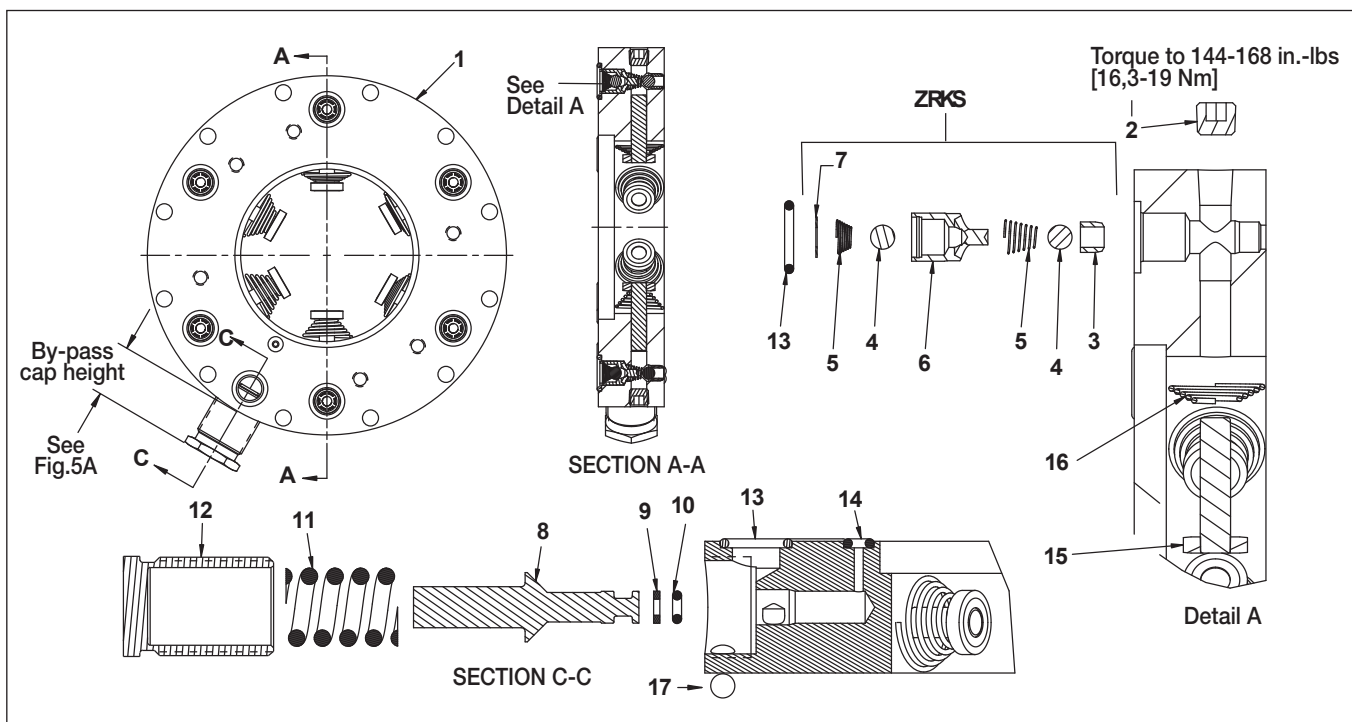


Figure 18: Z-Class Pump Element Piston Ring Assembly

Repair Parts List for V42 Valve							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	DC9216101	1	Piston Ring 6 Piston	10	▲ B1006803	1	O-ring, 0.25" O.D.
2	A1006245	6	1/16 Flush Plug	11	DC394110	1	Spring
3	● BSS5358D	6	Seat, Piston Inlet	12	(See 10.2.5)	1	Bypass End Cap
4	● B1005016	12	3/16" Diameter Ball	13	▲ B1013203	7	O-ring, Viton, 0.56" O.D.
5	● BSS5809D	12	Spring	14	▲ B1005203	1	O-ring, Viton
6	● BSS5357D	6	Seat, Piston Outlet	15	DC9244920	6	Piston Assembly
7	● BSS5356D	6	Retaining Ring	16	BSS5509D	6	Spring
8	DC9292051	1	Piston Bypass	17	▲ DC9293016	2	Ball Nylon 3/16"
9	▲ B1006564	1	B/U Washer				

● Items included in and available only as a part of Piston Check Kit ZRKS. Each kit includes three sets of components. Order two kits for six piston pumps.

▲ Items included in and available only as a part of Seal Kit ZRK

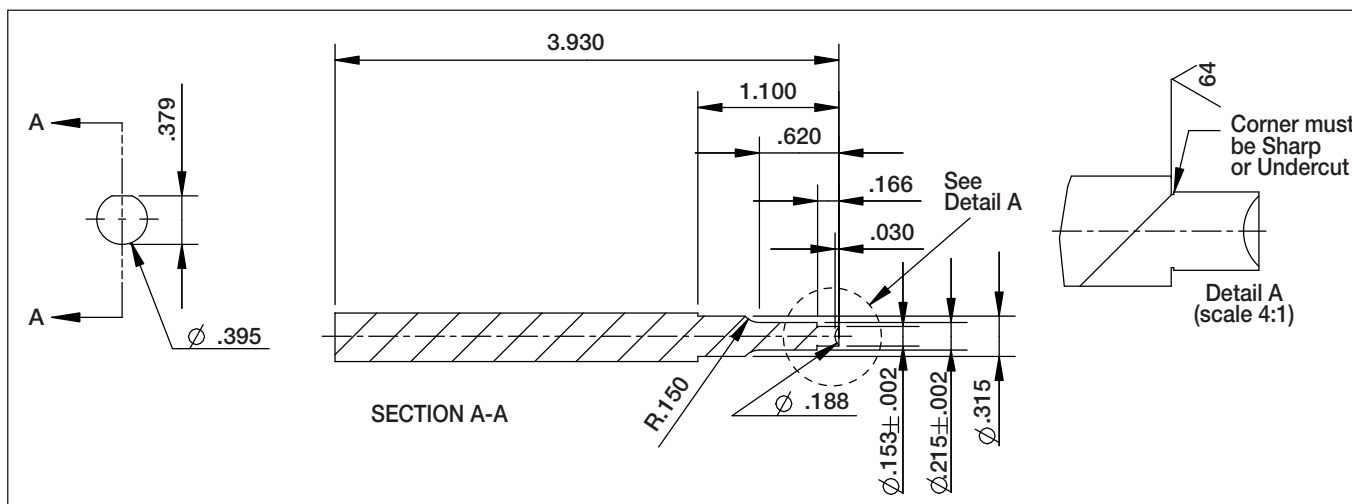


Figure 19: Seat Tool Drawing

12.2.4 Gear Pump Assembly

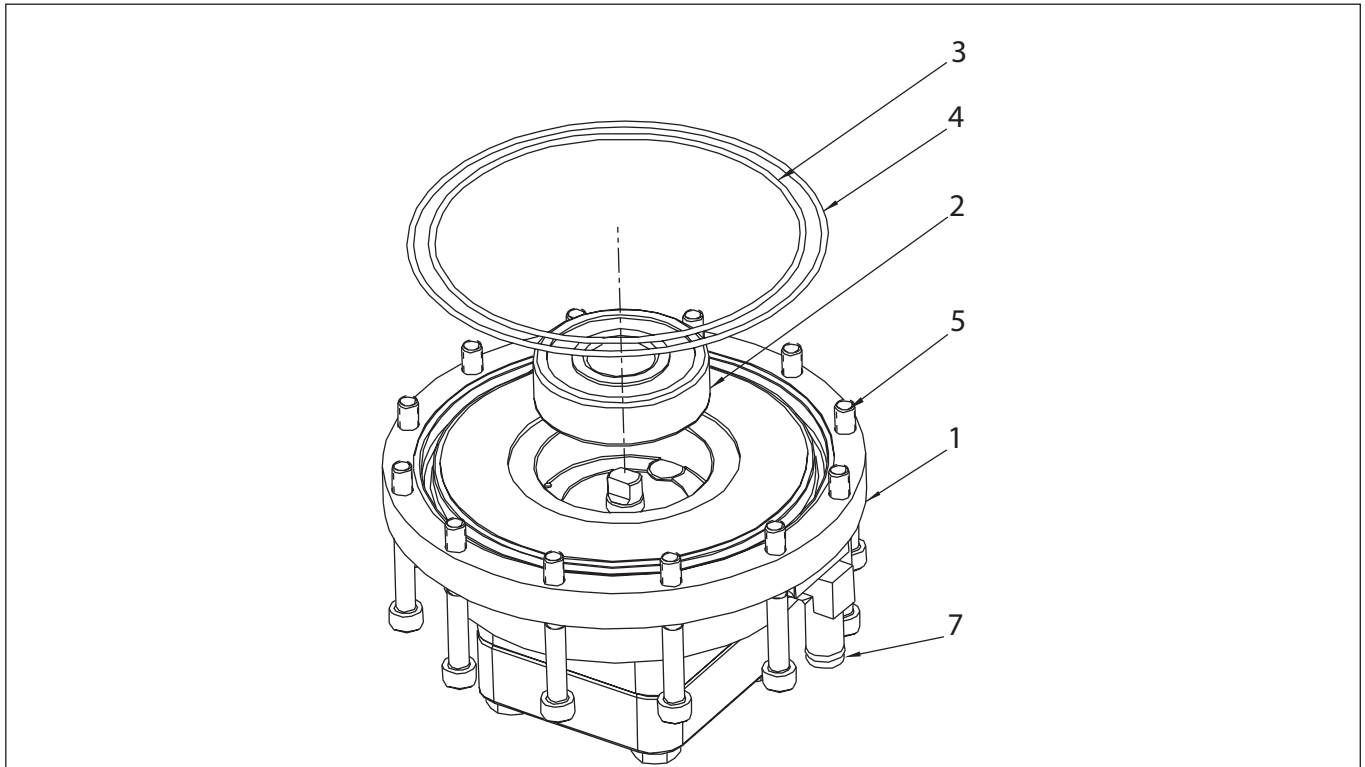


Figure 20: Z-Class Pump Element Gear Pump Assembly

Repair Parts List for Z-Class Pump Element Gear Pump Assembly			
Item	Part Number	Qty.	Description
1		1	Gear Pump
2	✚ DC9219155	1	Bearing Ball 20 x 52 x 15
3	▲ ✚ B1400503	1	O-Ring
4	▲ ✚ B1402503	1	O-Ring
5	★ DD1277108	12	SHCS M6 x 1.0 x 50
7	DC9642097	1	Intake Elbow
▲ Items included in and available only as a part of Seal Kit ZRK.			
✚ Items included in complete gear pump replacement kit. See chart in Section 10.2.5.			

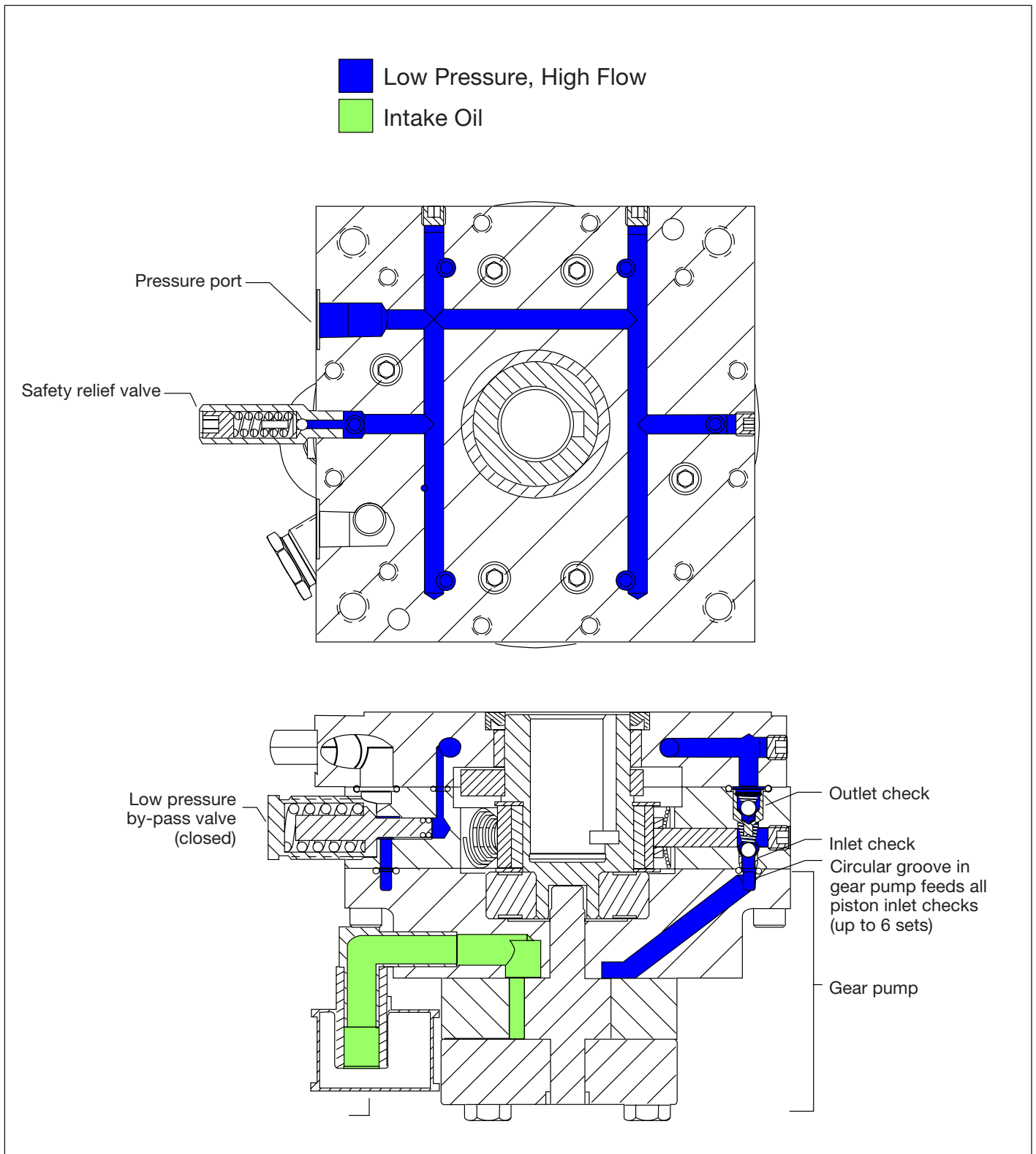
12.2.5 Specifications, Settings and Repair Kits

Pump Model	Pump Element Replacement Kit	Gear Pump Replacement Kit	Piston Ring Replacement Kit	By-Pass Setting (PSI)	By-Pass End Cap Height	Relief Valve Setting (PSI)
ZG6xxxxx	DC9715900SR 10KPSI	DC9299920SR	DC9217900SR	2400 - 2450	0.85" (21.6 mm)	10300 - 10800
By-Pass End Cap Height: Use bypass end cap DC9208020 (Section 10.2.3, Item 12).						

12.2.6 First Stage, Low Pressure - High Flow

1st stage = low pressure – high flow

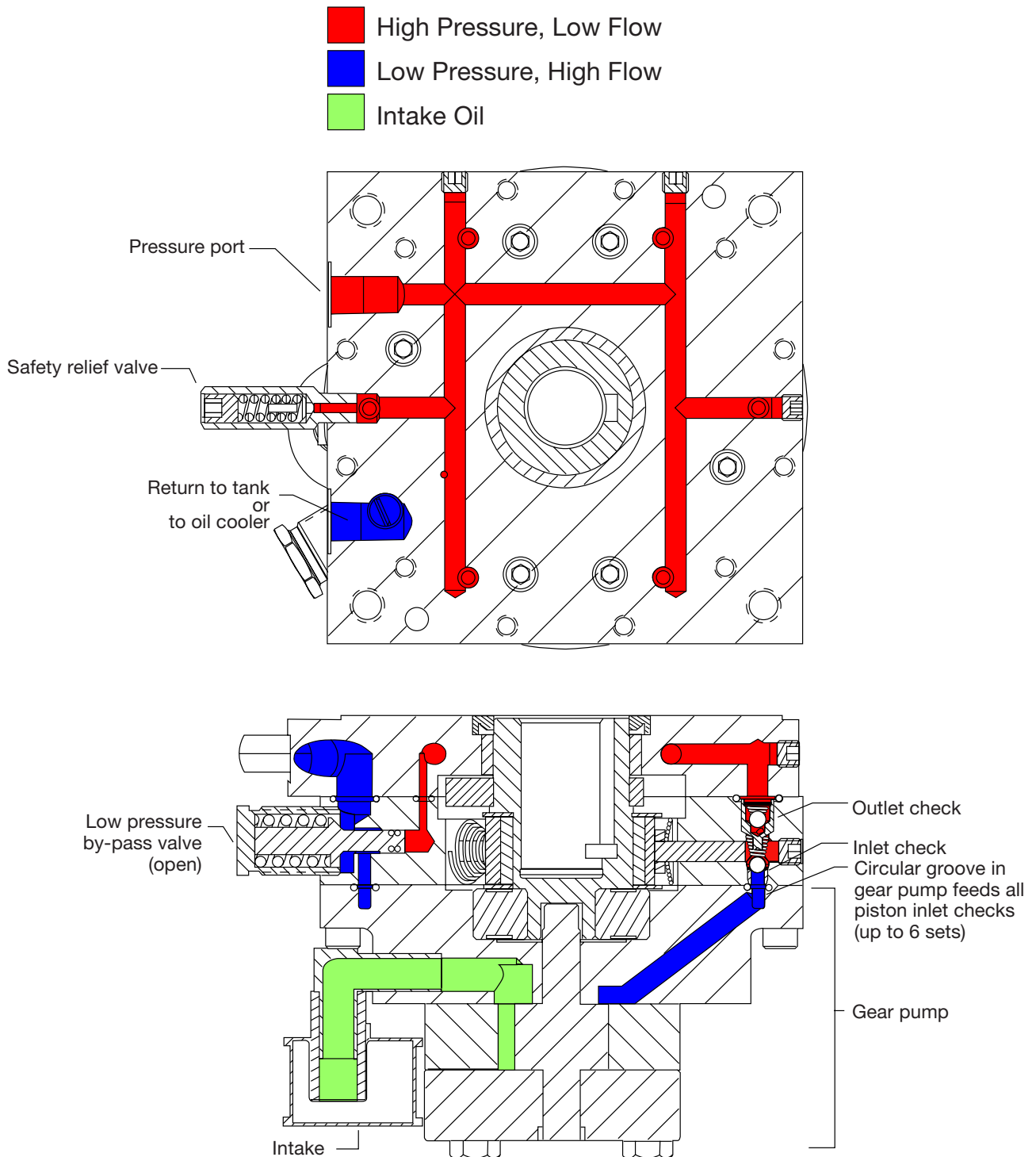
- By-pass valve is closed.
- All low-pressure gear pump flow is routed through the high-pressure pistons inlet and outlet checks, (up to six sets) and then out the pressure port.



12.2.7 Second Stage, High Pressure - Low Flow

2nd stage = high pressure – low flow

- By-pass opens at pre-set pressure.
- Low pressure, gear pump flow, supercharges high pressure pistons. Remaining gear pump oil returns to tank via the by-pass valve.
- Eccentric driven piston reciprocates to build high pressure.



12.2.8 Z-Class Pump Service Instructions

■ REQUIRED TOOLS AND TEST EQUIPMENT:

- ✓ Hydraulic hand pump capable of 10,000 psi
- ✓ Test bench with sump, ammeter, V152 valve, flow meter, and test cylinder
- ✓ High pressure gauge (0-15,000 psi)
- ✓ High pressure hose (10,000 psi working pressure rating)
- ✓ Torque wrench (torque rating)
- ✓ Magnet to remove check balls
- ✓ O-ring pick
- ✓ Flat bottom punch 5/32"
- ✓ Flat bottom punch 11/64"
- ✓ White Assembly grease
- ✓ Allen wrench 5 mm
- ✓ Enerpac Hydraulic Oil
- ✓ VM2, 3 way, 2 position, directional control valve
- ✓ Hydraulic press
- ✓ Seat assembly tool #DC9505816 (drawing available from Enerpac)
- ✓ Retaining Ring Tool #AT0229 (drawing available from Enerpac)

A Troubleshooting

Problem	Possible Cause	Action
Motor current draw is excessive or trips circuit breaker.	a. Low voltage at pump. b. Defective motor. c. Bypass valve malfunction. d. Damaged or worn gear pump. e. Power cord damaged or wiring incorrect.	a. Check voltage at pump while pump is at operating pressure. If below 90% of rated line voltage replace extension cord with heavier gauge and/or move to another electric circuit. b. Remove the motor. Test and replace if necessary. c. Inspect, test, and adjust the bypass valve. Replace or rebuild if required. d. Remove and inspect the gear pump. Replace if necessary. e. Replace or repair as necessary.
Pump runs and delivers flow, but will not build pressure.	a. Defective or misadjusted external relief valve. b. Oil leaks from one or more components within the reservoir c. Valve malfunction or improper adjustment. d. Bypass valve worn.	a. Inspect the relief valve. Reset or replace if required. b. Perform the back-pressure test. c. Adjust or repair. d. Remove and inspect the bypass valve. Rebuild or replace if necessary.
Low or no flow at 0 psi.	a. Motor rotation reversed (3-phase only). b. Bypass valve is malfunctioning. c. Pump component parts are leaking. d. Oil intake screen is clogged with debris. e. Gear pump malfunction. f. Direction valve malfunction or improper adjustment.	a. Reverse 2 of 3 motor wire connections. b. Remove and inspect the bypass valve. Rebuild or replace if necessary. c. Perform the backpressure test to isolate leaks. d. Remove the pump from the reservoir and inspect the intake screen. Flush components of contamination. Replace damaged components and hydraulic oil. e. Disassemble the pump and inspect the gear pump. Replace if necessary. f. Adjust or repair.
Pump fails to maintain pressure.	a. Defective directional valve. b. Defective final outlet check. c. Oil leaks from one or more components within the pump assembly or valve assembly.	a. Repair or replace. b. Repair or replace. c. Remove the pump from the reservoir and perform the back-pressure test outlined in test procedure.



IMPORTANT: To avoid unnecessary service, the pump should be tested prior to any service work. Please refer to Test Procedures and Troubleshooting sections.

These service instructions only cover the basic pump portion of the entire pump assembly and are not all-inclusive. Certain assumptions are made throughout the document, that the technician is capable of identifying worn parts and has the proper equipment to perform the required repairs and tests.

For information regarding the rest of the pump assembly, please refer to the repair parts sheet for your specific unit.

B Disassembly

B.1 Disassemble Hydraulic Pump Assembly

1. Be sure pump is disconnected from power source before disassembling.
2. Remove pump from the cover plate.
3. Remove the intake filter by pulling on the end closest to the pump. Be careful not to pull on the mesh screen or it may be damaged.
4. If the pump is a 6-piston pump (note the number of flush plugs in the piston ring) you will first need to remove the 6 screws (Section 10.2.2, item 6) that are on the top of the pump with a 5 mm Allen wrench.
5. Now remove the 12 screws (Section 10.2.4, item 5) on the bottom of the pump using a 5 mm Allen wrench.
6. Pull up on the gear pump assembly (Section 10.2, item 4) to remove it from the piston ring. Check the condition of the two O-rings that are between the gear pump and the piston ring.
7. Remove the top ring (Section 10.2.2, item 4).
8. Pull up on the piston ring assembly (Section 10.2.2, item 3) to remove it from the pump. Note: The hex cam may come off with the assembly. This will hold the pistons in if you do not need to service them
9. Remove the eccentric assembly (Section 10.2, item 2) from the top plate. Check for signs of wear on the eccentric. If there is material missing from the bearing areas the eccentric assembly needs to be replaced. Also check the ID of the hex cam for wear.
10. If present, remove locating washer (Section 10.2.2, item 7).

B.2 Disassemble Piston Ring Assembly (Refer to Section 10.2.3.)

1. Remove the hex cam (Section 10.2.2, item 6) from the piston ring assembly (Section 10.2, item 3). Note: Be careful, since the pistons are spring loaded and they may come out abruptly.
2. Remove pistons (item 15) and spring (item 16).
3. Disassemble the bypass valve by removing the bypass end cap (item 12) with a 13/16 inch [21 mm] wrench. Once the bypass end cap is removed pull out the spring (item 11) and piston (item 8).

Note: If piston cannot be removed with fingers try using pliers (use soft jaws so the piston does not get damaged).

4. Check to make sure that the back-up (item 9) and O-ring (item 10) on the bypass piston (item 8) are both in good condition.
5. Before the check valves are disassembled there are some checks that should be done to determine if the check valves are bad.

This is quick way to verify the integrity of your check valves.

The piston ring assembly (Section 10.2, item 3) should still have oil on it from the disassembly. If the piston ring is dry you should insert oil into the piston bores before putting the piston into the bore. With the piston ring assembly (Section 10.2, item 3) in your hands, install one piston (item 15) and spring (item 16) into a piston bore. While covering the outlet O-ring (item 13) with your thumb slowly push the piston (item 15) into the bore. Watch the intake seat (item 3) to see if oil and air are bubbling out. If the intake seat is good you will not notice anything coming out of the intake seat (item 3) and you will have a high pressure trying to push your thumb off of the outlet o-ring.

To check the outlet seat (item 6), cover up the inlet seat (item 3) with your thumb. Slowly push the piston (item 15) into the piston bore, the outlet seat (item 6) may spray oil so take care to point it away from you. Once the piston is pushed all the way in let go of the piston. Watch the outlet seat (item 6) to see if oil and air are bubbling around the ball (item 4). If the outlet seat is working correctly there should be no oil/air movement around the outlet ball and the intake seat should create a strong vacuum on your thumb.

This is the more detailed way to verify the integrity of your check valves and should only be performed by an experienced technician. These operations are time consuming and difficult and should be performed only if absolutely necessary.

Remove all the pistons from the piston ring. Remove the eccentric assembly from the top plate. Install the piston ring onto the top plate with 12, M6x1.0x35, bolts (Enerpac P/N CCA627028-1A). Torque the bolts to 120-144 in-lbs (13.5-16 Nm). If this is a 6 piston pump turn the pump over and reinstall the 6 bolts (Section 10.2.1, item 6) into the top plate at 120-144 in-lbs (13.5-16 Nm). Run a back pressure test up to 5,000 psi and watch to see if any oil comes out of the piston bores. This will show if you have any bad outlet checks that need to be replaced.

The check for the inlet seats is complicated and should be avoided. The eccentric assembly (Section 10.2, item 3) needs to be installed in the top plate assembly (Section 10.2, item 1). All of the pistons (item 15) need to be installed in the piston ring (item 1). Install the piston ring assembly (Section 10.2, item 2) onto the top plate with 12, M6x1.0x35, bolts (Enerpac P/N CCA627028-1A). Leave the gear pump assembly (Section 10.2, item 4) off so that the intake seats are visible. Torque the bolts to 120-144 in-lbs (13.5-16 Nm). If this is a 6 piston pump turn the pump over and reinstall the 6 bolts (Section 10.2.1, item 6) into the top plate at 120-144 in-lbs (13.5-16 Nm). The plug on the outside of the piston ring needs to be removed with a 5/32nd [4 mm] Allen wrench. A 1/16th NPT fitting needs to be installed in the port and hooked to a hand pump, Enerpac P/N CK911032 can be used in conjunction with a 10,000 psi hose. Turn the eccentric so that the piston that is going to be tested is in the bore as deep as possible. The outlet from the pump assembly needs to be plugged. Back pressure into the port at 5000 psi and check to see if oil comes out of the inlet check. This process needs to be repeated for all of the pistons. When the testing is done for one of the ports the plug needs to be reinstalled at 144-168 in-lbs [16.3-19 Nm].

If a check valve is damaged it can be replaced.

Check Valve Removal

1. Set piston ring assembly in a bench press with the o-ring grooves on the bottom. Make sure that there is clearance in the bench vice support for the check valve to be pushed out.

2. Insert a punch that is 5/32nd (4 mm) or smaller into the intake hole. The punch should go through the intake seat and rest on the check ball. Push on the punch with a maximum of 2000 lbs [907 kg]. This will push the outlet check assembly out in one piece and will push out the ball and spring for the inlet check valve.
3. Instead of removing the intake seats the damaged seats can be reworked using methods such as a ball hone.
4. Remove the inlet seat (Section 10.2.3, item 3) by using a 11/64" flat bottom punch. This operation can damage the piston ring if the punch is not the correct diameter. Place the punch on the inlet seat and apply a maximum of 2000 lbs [907 kg] with a bench press to drive the punch down.

Note: With this procedure both seats will likely be damaged and will need to be replaced.

B.3 Disassemble Gear Pump

Note: Only disassemble the gear pump as a last resort, after all other options have been tried. Contamination and damage to the internal parts of the gear pump can cause the pump to fail. Parts are not sold separately for the gear pump. If the pump is damaged, the complete assembly has to be changed.

1. Remove the 5 hex screws with a 1/2 inch [13 mm] socket. It is recommended that the gear pump be taken apart while the rest of the pump is assembled so there is a way to secure it.
2. Remove the end plate from the gear pump. Check for signs of wear or contamination.
3. The gears can be removed from the gear pump to check for wear but note the orientation of the gears for re-assembly.

C Assembly

C.1 Assemble Gear Pump

1. Insert drive gear and driver gear into gear pump assembly, make sure tang drive is protruding in the middle of the bearing.
2. Position the top gear pump housing and secure with 5 hex cap screws at 13 ft-lbs. Tighten in an alternating sequence.
3. Install oil in the O-ring grooves on the bottom of the gear pump to help hold the O-rings in place. Place the two O-rings (Section 10.2.4, item 3, 4) into the grooves.

C.2 Assemble Piston Ring Assembly

1. Insert inlet seat (Section 10.2.3, item 3) into piston ring assembly (Section 10.2.3, item 1) by using tool DC9505816 and a hydraulic press. Use a maximum force of 1500 pounds—



WARNING If this force is exceeded the piston ring will be damaged.

2. Place check ball (Section 10.2.3, item 4) onto inlet seat (Section 10.2.3, item 3) and apply a maximum of 1500 lbs. of force by using tool DC9505816 and a hydraulic press to coin the seat.
3. Next insert spring (Section 10.2.3, item 5) on top of ball (Section 10.2.3, item 4). Make sure the small end of the spring rests on the ball. (See Section 10.2.3.)
4. Place upper check valve (Section 10.2.3, item 6) into piston ring (Section 10.2.3, item 1).
5. Place check ball (Section 10.2.3, item 4) on outlet seat (Section 10.2.3, item 6) and apply 1500 lbs. of force by using tool DC9505816 and a hydraulic press. Note: This will install and coin the outlet seat in one operation.

6. Place spring (Section 10.2.3, item 5) on outlet check ball (Section 10.2.3, item 4). Make sure the small end of the spring rests on the ball. (See Section 10.2.3). Repeat this 2, 3 or 6 times as required.
7. The retaining ring (Section 10.2.3, Item 7) is slightly convex and should be installed with the concave side on top. Carefully compress the spring with the retaining ring making sure to keep the spring in the upper check. Press the retaining ring in with the retaining ring tool. The retaining ring tool will set the depth of the retaining ring. If the retaining ring is installed too deep or at angle it may need to be lightly pried out to make it even. When installed properly the retaining ring should rotate in the outlet check.
8. Place back-up washer (Section 10.2.3, item 9) onto the by-pass piston (Section 10.2.3, item 8). Next install the O-ring (Section 10.2.3, item 10) onto the bypass piston. This order is critical to the operation of the bypass, see Section 10.2.3 for reference. Make sure the back-up washer is tightly wrapped around the piston so that it does not get damaged when installing it in the piston ring.
9. Lube the o-ring and backup, then carefully insert by-pass piston (Section 10.2.3, item 8) with back-up washer and O-ring into by-pass hole in piston ring assembly. Place spring (Section 10.2.3, item 11) over the by-pass piston. Next thread by-pass end cap (Section 10.2.3, item 12) into the piston ring. Install by-pass end cap to the depth specified in the Test Specification Table (see page 11).
10. Insert piston (Section 10.2.3, item 15) assembly into narrow end of piston spring (Section 10.2.3, item 16).
11. Insert piston (Section 10.2.3, item 15) and spring into piston ring (Section 10.2.3, item 1). Repeat this 2, 3 or 6 times as required.
12. Install O-rings (Section 10.2.3, item 13) into piston ring outlet holes. Repeat this 3, 4 or 7 times as required.
13. Place small O-ring (Section 10.2.3, item 14) into by-pass pilot hole.
14. Place two nylon balls (Section 10.2.3, item 17) into piston ring assembly.

C.3 Assemble Hydraulic Pump Assembly

1. Place fully assembled top plate assembly on table with shaft seal on the bottom.
2. If used, place locating washer (Section 10.2.2, item 7) into recessed area of top plate (Section 10.2, item 1). Align center hole with bore.

IMPORTANT:

Locating Washer (Section 10.2.2, item 7) must be installed on:

- ZG pump elements with date code D.
- ZG Series pump elements (date code A, B or C) that are being updated from the original aluminum top plate to the new steel top plate.

DO NOT install Locating Washer (Section 10.2.2, item 7) on:

- ZG Series pump elements (date code A, B or C) with the original aluminum top plate that are NOT being updated to the new steel top plate.
3. Carefully insert eccentric (Section 10.2.2, item 1) into the top plate (Section 10.2, item 1). On direct drive units place oil on eccentric shaft to ease insertion through shaft seal.

4. Install one ring (Section 10.2.2 Item 4) onto eccentric.
 5. Install needle bearing (Section 10.2.2 Item 5) onto eccentric.
 6. Insert hex cam (Section 10.2.2, Item 6) into piston ring assembly so that it is centered and in contact with all piston heads. Make sure the piston heads rest on a flat section of the hex cam.
 7. Install piston ring assembly with the o-rings on the bottom onto the top plate assembly being careful to slide hex cam over eccentric bearing. The by-pass end cap needs to be oriented over the by-pass port in top plate (note the orientation of the bypass on Section 10.2).
 8. Place ring (Section 10.2.2, Item 4) onto eccentric assembly. The hex cam may need to be pushed down so the ring is flush with the top of the eccentric.
 9. Place the gear pump assembly onto the eccentric assembly. The gear pump may need to be rotated to fully engage the shaft. Use caution to make sure the O-rings do not fall off the gear pump during this operation. Once the gear pump is in contact with piston ring rotate the gear pump until the inlet filter is directly above the relief valve (Section 10.2.1, item 5).
- Note:** Do not force the gear assembly onto the eccentric assembly. If it requires a lot of force, check for misalignment or damage.
10. Install the 12 gear pump mounting capscrews and torque to 120-144 in-lbs. of torque using a crossing pattern.
 11. On 6 piston pumps turn pump over and install 6 capscrews (Section 10.2.1, item 6), tighten in an alternating sequence to a 120-144 in-lbs. of torque.

D TEST PROCEDURE

D.1 Back Pressure Test

1. Remove the existing valve from the pump and install a VM-2 valve in its place (NOTE: this is required due to the presence of an internal check valve in most other valve models).
2. Remove the pump assembly from the reservoir and place it on a test bench, lying on its side so the bottom of the pump can easily be observed.
3. Connect a 0-10,000 psi hand pump with a 0-15,000 psi pressure gauge to the VM-2 outlet. Fully close the VM-2 valve.
4. Operate the hand pump to pressurize the pump to 85% of its maximum rated pressure while observing for any system leakage. Verify the pressure remains steady.
5. If the pump safety relief opens before reaching 85% of maximum rated pressure, adjust the relief setpoint per 4.3 Safety Relief Valve Test.
6. If the pressure fails to hold steady at 85% of maximum rated pressure, locate, isolate and correct the source of any system leakage.
7. Release the system pressure and remove the hand pump, pressure gauge and VM-2 valve. Replace the original valve and restore the pump to its original condition.

D.2 Bypass Valve Test

1. Remove the pump assembly from the reservoir and place it on a test bench, lying on its side so the bottom of the pump can be easily observed.
2. Measure the bypass cap height shown in Section 10.2.3. This dimension should closely match the value shown in the Test Specification Table.
3. Replace the pump assembly into a test bench sump or the pump reservoir.
4. Attach a V-152 relief valve to advance port of the valve on the pump. Install a 0-15,000 psi pressure gauge onto the extra V-152 port and a low restriction return hose to the bottom (tank port) of the V-152. Route the return hose back to the sump or reservoir.
5. Plug pump into an electrical power supply.
6. Place the pump valve in the advance position and fully open the V-152 valve (turning its handle counter-clockwise).
7. Start the pump motor.
8. Monitor the pump pressure and amperage while slowly closing the V-152 valve by turning its handle clockwise. The bypass valve should be set so that the maximum current draw at bypass pressure is the same or slightly below the current draw at the maximum rated pressure of the pump.
9. If an ammeter is not available, check the Test Specification Table for the approximate pressure setting of the bypass valve.
10. If the maximum current draw at bypass pressure exceeds that of maximum pressure, or if the bypass pressure is more than 200 psi off, adjust the bypass setting. Unplug the pump from its power supply, lift the pump assembly from the sump or reservoir and turn the bypass cap (Section 10.2.3, Item 12) (clockwise to increase the setpoint, counterclockwise to decrease). Repeat steps 5 through 10 until the proper bypass setting is reached.
11. Stop the pump motor and unplug the pump from its power supply. Remove the V-152 valve and pressure gauge and restore the pump to its original condition.

D.3 Safety Relief Valve Test

1. Remove the existing valve from the pump and install a VM-2 valve in its place (NOTE: this is required due to the presence of an internal check valve in most other valve models).
2. Remove the pump assembly from the reservoir and place it on a test bench, lying on its side so the bottom of the pump can easily be observed.
3. Connect a 0-10,000 psi hand pump with a 0-15,000 psi pressure gauge to the VM-2 outlet. Fully close the VM-2 valve.
4. Operate the hand pump and monitor the pressure gauge. Note the pressure at which the pump safety valve begins to relieve at.

TEST SPECIFICATION TABLE

Pump Element Number	By-pass Pressure at Max. Amp PSI [Bar]	Internal Safety Relief Valve PSI [Bar]	1st Stage Flow in ³ /rev [mL/rev]	2nd Stage Flow in ³ /rev [mL/rev]	By-pass Cap Height in [mm]
DC9715900	2425 [167.2]	10,300 [710] - 10,800 [745]	0.252 [4.13]	0.07 [1.15]	.85 [21.6]

5. If this value is outside the limits listed for the appropriate model in the Test Specification Table, adjust the setpoint by inserting a 5mm Allen wrench into the end of the relief valve and turning the adjustment screw (clockwise to increase the setpoint, counterclockwise to decrease). Repeat steps 4 and 5 until the proper setting is reached.
6. Release the system pressure and remove the hand pump and pressure gauge.
7. Replace the pump assembly into a test bench sump or the pump reservoir.
8. Attach a V-152 relief valve to advance port of the valve on the pump. Install the pressure gauge onto the extra V-152 port and a low restriction return hose to the bottom (tank port) of the V-152. Route the return hose back to the sump or reservoir.
9. Fully close the VM-2 valve and fully open the V-152 valve (turning its handle counter-clockwise).
10. Plug pump into an electrical power supply.
11. Start the pump motor.
12. Verify the safety valve relief setting by slowly closing the V-152 valve (turning its handle clockwise) and monitoring the system pressure.
13. If this value is outside the limits listed for the appropriate model in the Test Specification Table, repeat steps 2 through 12 until the proper setting is reached.
14. Stop the pump motor and unplug the pump from its power supply. Remove the V-152 valve, pressure gauge and VM-2 valve and restore the pump to its original condition.

F FLOW TEST PROCEDURE

FLOW METER METHOD (requires test bench)

F.1 Low Pressure Flow Measurement

1. Connect an unrestricted hose from the advance port of the pump valve to the test bench flow meter supply. Route the flow meter return hose back to the return port of the pump valve (for 4 way valves) or the reservoir (for 3 way valves).
2. Plug the pump into an electrical power supply.
3. Start the motor and operate the pump in the advance mode for 30 seconds.
4. Check Test Specification Table. If pump does not meet 1st stage flow rating see Section 1.0 Troubleshooting.
5. Stop the pump motor and unplug the pump from its electrical power supply.
6. Disconnect the flow meter hoses from the pump and return the pump to its original condition.

F.2 High Pressure Flow Measurement

1. Attach a V-152 relief valve to advance port of the valve on the pump. Install a 0-15,000 psi pressure gauge onto the extra V-152 port and a low restriction return hose to the bottom (tank port) of the V-152.
2. Connect the hose from the V-152 valve to the test bench flow meter supply. Route the flow meter return hose back to the return port of the pump valve (for 4 way valves) or the reservoir (for 3 way valves).
3. Fully open the V-152 valve (turning its handle counter-clockwise).
4. Plug the pump into an electrical power supply.
5. Start the motor and operate the pump in the advance mode.
6. Monitor the system pressure and slowly close the V-152 valve by turning its handle clockwise until 85% of

maximum pressure is reached.

7. Check Test Specification Table. If pump did not meet 2nd stage flow ratings see Section 1.0 Troubleshooting.
8. Stop the pump motor and unplug the pump from its electrical power supply.
9. Disconnect the flow meter hoses from the pump.
10. Remove the V-152 valve and pressure gauge and restore the pump to its original condition.

BEAKER METHOD

F.3 Low Pressure Flow Measurement

1. Verify sufficient oil exists inside the pump reservoir to complete this test.
2. Connect an unrestricted hose from the advance port of the pump valve to a graduated cylinder or beaker (ensure the container contains sufficient volume to complete the test – also take care that the initial flow oil flow surge will not tip it over or cause the hose to jump outside).
3. Plug the pump into an electrical power supply.
4. Start the motor and operate the pump in the advance position for 30 seconds.
5. Stop the pump motor and unplug the pump from its electrical power supply.
6. Calculate the flow rate by dividing the amount of oil collected in the cylinder or beaker and dividing by 30 seconds (0.5 minutes).
7. Check Test Specification Table. If pump does not meet 1st stage flow rating see Section 1.0 Troubleshooting.
8. Disconnect the hose from the pump and return the pump to its original condition.

F.4 High Pressure Flow Measurement

1. Verify sufficient oil exists inside the pump reservoir to complete this test.
2. Attach a V-152 relief valve to advance port of the valve on the pump. Install a 0-15,000 psi pressure gauge onto the extra V-152 port and a low restriction return hose to the bottom (tank port) of the V-152.
3. Route the hose from the V-152 valve to an oil sump and prepare a graduated cylinder or beaker (ensure the container contains sufficient volume to complete the test).
4. Fully open the V-152 valve (turning its handle counter-clockwise).
5. Plug the pump into an electrical power supply.
6. Start the motor and operate the pump in the advance position.
7. Monitor the system pressure and slowly close the V-152 valve by turning its handle clockwise until 85% of maximum pressure is reached.
8. Shift the return oil hose from the sump to the graduated cylinder or beaker and continue running the pump in the advance position for 30 seconds.
9. Stop the pump motor and unplug the pump from its electrical power supply.
10. Calculate the flow rate the dividing the amount of oil collected in the cylinder or beaker and dividing by 30 seconds (0.5 minutes).
11. Check Test Specification Table. If pump does not meet 2nd stage flow rating see Section 1.0 Troubleshooting.
12. Remove the V-152 valve, pressure gauge and hose and restore the pump to its original condition.

12.3 VM43 Manual Valve

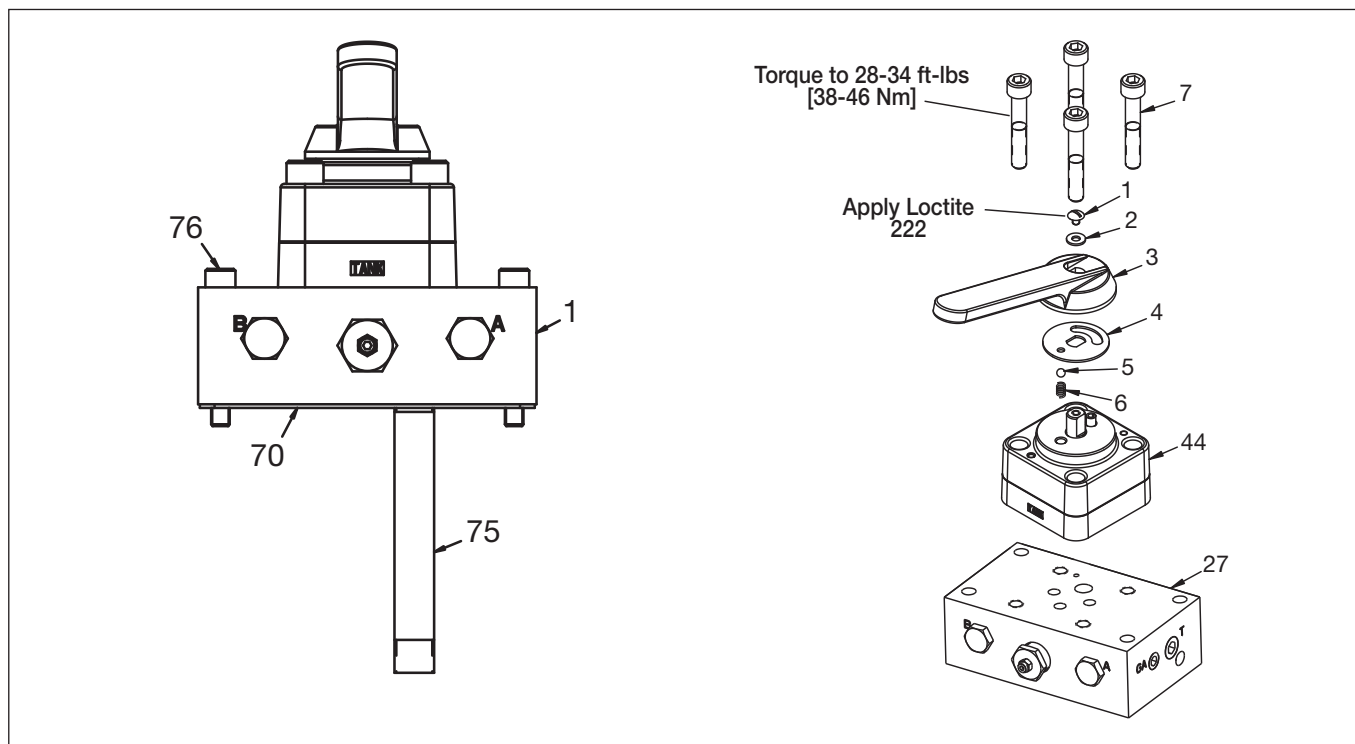


Figure 21: VM43 Top Level

Repair Parts List for VM43 Series Valves			
Item	Part Number	Qty.	Description
1	VM43	1	4-way Mnuual Valve
70	DC9356037	1	Gasket
75	DC2749768	1	Return Pipe
76	CBE837028-1A	4	SHCS

12.3.1 Upper Valve Assembly

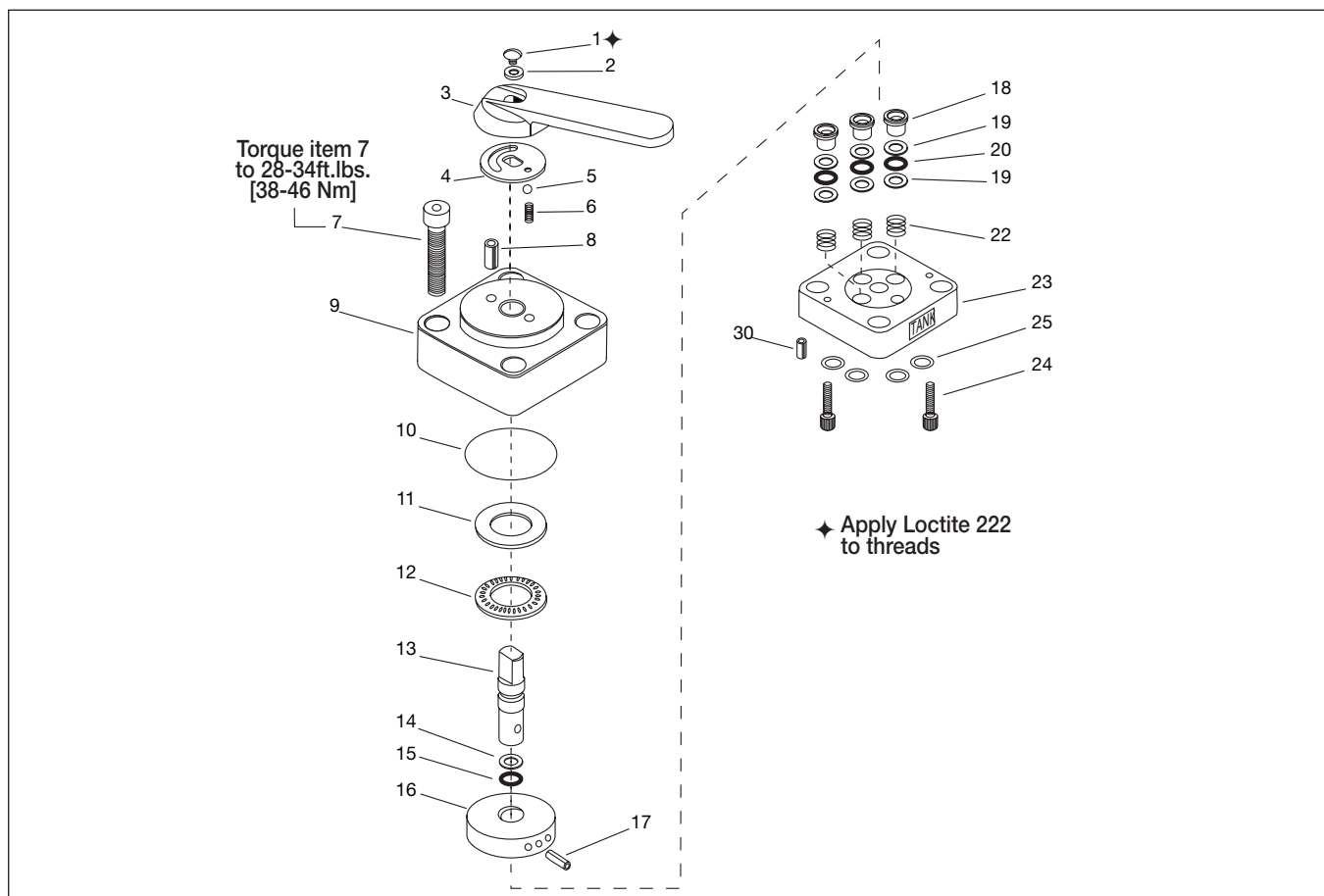


Figure 22: Upper Valve Assembly

Repair Parts List for V42 Valve							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	★ A8076048	1	Screw	16	CH542950SR	1	Disk Assembly
2	★ B1086108	1	Washer	17	★ B1109057	1	Roll Pin
3	Y325070	1	Handle	18	◆ DA9560041	3	Shear Seal
4	A8005071	1	Disk	19	★◆ B1011564	6	Backup Ring
5	▲★ B1006016	1	7/32" Ball	20	★◆ B1006503	3	O-Ring
6	▲★ A8039110	1	Spring	22	★◆● CB28110	3	Spring
7	CBE1037028-1A	4	SHCS	23	CH539190	1	Body
8	★ B1126057	1	Roll Pin	24	B1326028	2	Bolt
9	CB324001	1	Valve Cap	25	★ B1111803	4	O-Ring
10	★◆● B1269503	1	O-Ring	27	DC5947950SR	1	Port Manifold
11	CB327101	1	Bearing Plate	30	B1051057	1	Pin, Locating
12	CB328281	1	Bearing	44	■ CB317900SR	1	Manual Valve, 4-way
13	CH536104	1	Shaft	84	● DC7250041	3	Shear Seal
14	★ B1012564	1	Backup Ring	85	● B1011564	3	Backup Washer
15	★ B1007503	1	O-Ring	86	● B1011203	3	O-Ring

★ Items included in Repair Kit VM4K3. Items not sold separately.

◆ Items included in Repair Kit DA9560041SR. Items not sold separately.

● Items included in Repair Kit DC7250041SR. Items not sold separately.

■ Includes items 9-20 & 22-25.

▲ Items included in Repair Kit VMMK. Items not sold separately.

12.3.2 Manifold Assembly

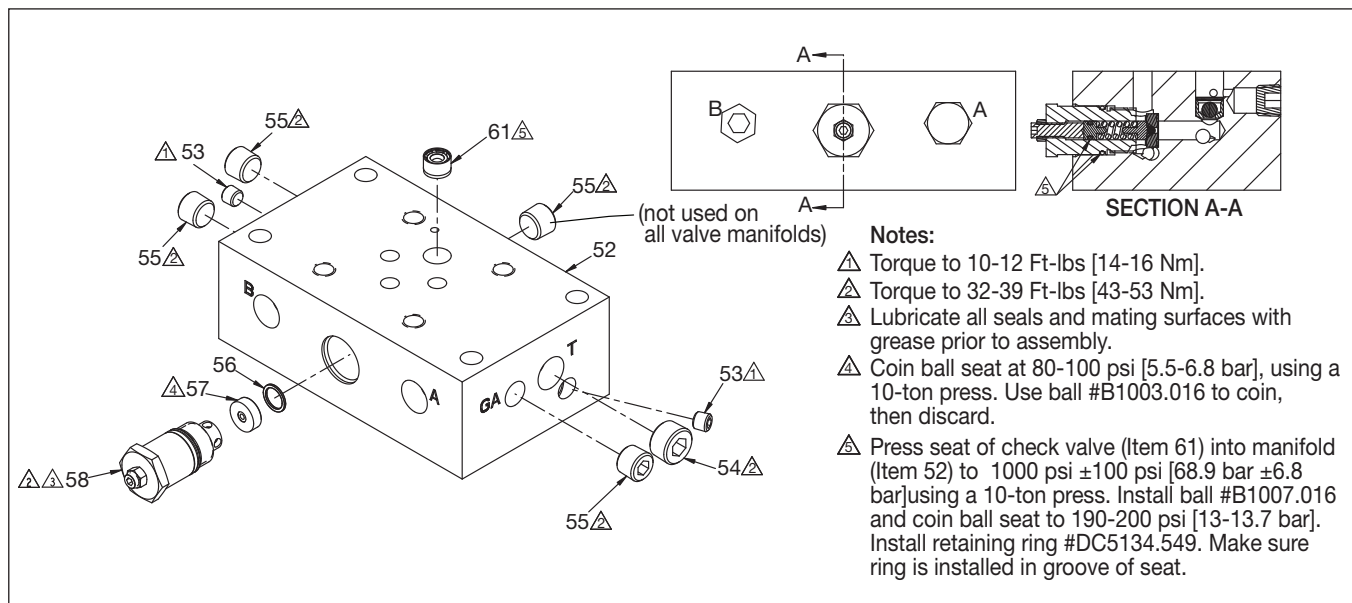


Figure 24: Manifold Assembly

Repair Parts List for DC5947950SR, Manifold Assembly, VM43							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
52	★ DC6308038	1	Manifold	57	★ DC5124290	1	Relief Valve System
53	★ DC6792245	2	1/16 Plug	58	★ DC5139900SR	1	Relief Valve Assy. (See Section 10.3.3)
54	★ DC6795245	1	3/8 Plug	61	★ DC5140900	1	Check Valve (See Section 10.3.4)
55	★ DC6794245	3 or 4	1/4 Plug	★ Items included in Repair Kit DC5947950SR.			
56	★ P20037	1	Gasket				

12.3.3 User-Adjustable Relief Valve Assembly

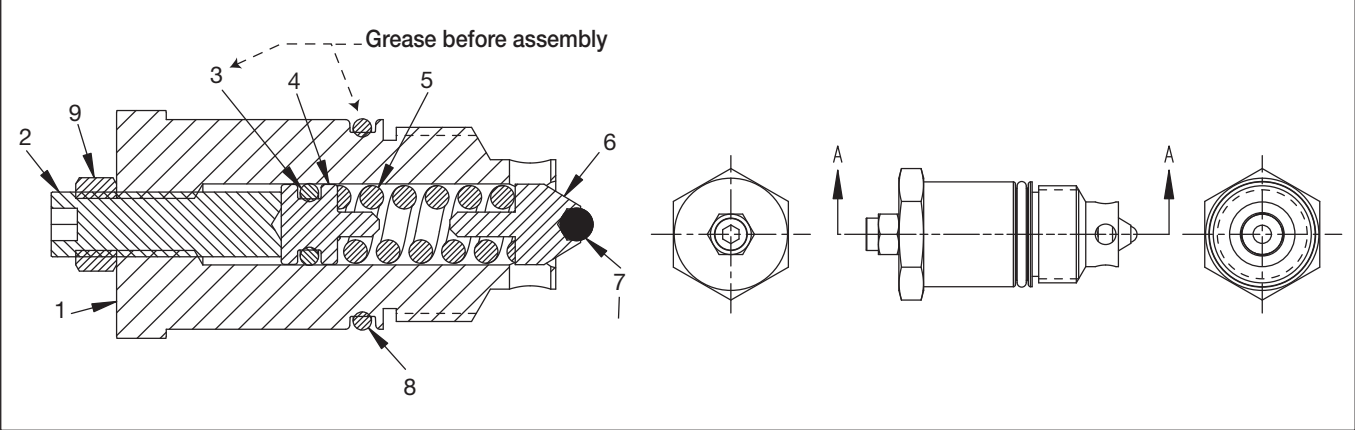


Figure 26: User-Adjustable Relief Valve Assembly

Repair Parts List for DC5139900SR, User Adjustable Relief Valve Assembly							
Item	Part Number	Qty.	Description	Item	Part Number	Qty.	Description
1	★ DC5138190	1	Body	7	★ B1003016	1	1/8 Dia Ball
2	★ BC2512027FX	1	Set Screw	8	★ B1223503	1	O-Ring
3	★ B1003503	1	O-Ring	9	★ B1001122	1	Lock Nut
4	★ DC5127007	1	Plug		★▲ DC5124290	1	Seat (not shown)
5	★ A8126110	1	Spring		★▲ P20037	1	Gasket (not shown)
6	★ DC5125013	1	Guide				
★ Items included in Repair Kit DC5139900SR.				▲ See Section 10.3.2, items 56 and 57.			

12.3.4 In-line Check Valve

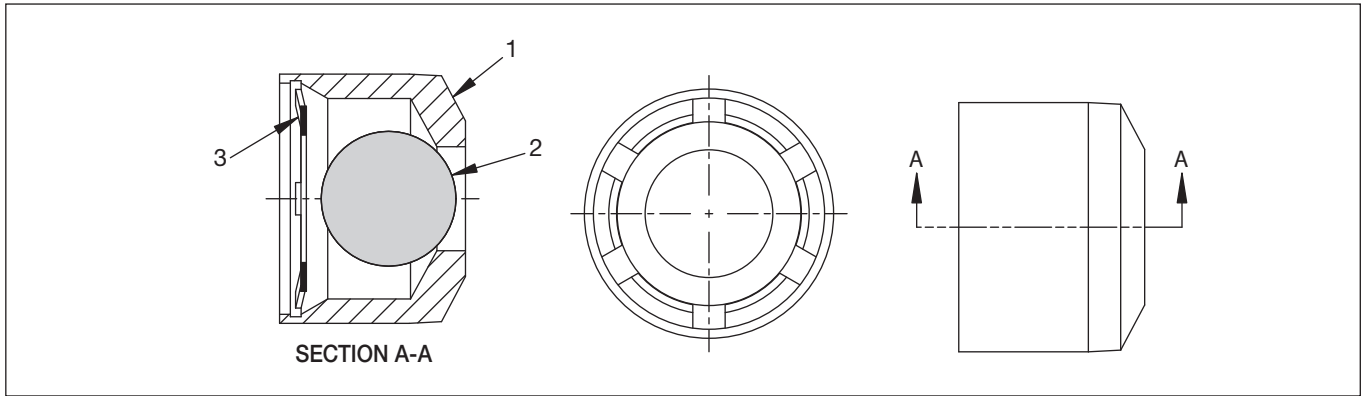


Figure 27: In-line Check Valve

Repair Parts List for In-line Check Valve			
Item	Part Number	Qty.	Description
1	---	1	Seat (available only in the manifold)
2	★ B1007016	1	1/4 Ball
3	★ DC5134549	1	Retaining Ring
★ Items included in and available only as part of Repair Kit DC5140900SR.			

12.3.5 VM43 Service Instructions

In diagnosing malfunctioning valves, certain symptoms may be common not only to valves, but often to hydraulic equipment in general. Before repairing the valve, mount a different VM valve onto the pump and verify that the problem is not with the pump.

TROUBLESHOOTING:



CAUTION: Standard safety procedures are to be followed during assembly to minimize any possibility of injury.

1. Inability to obtain any pressure may be the result of damaged connector seals on the pump, or failed relief valve components (items 6, 7, Section 10.3.3) a damaged ball and seat in the body (items 1, 2, Section 10.3.4), or damaged or worn shear seals and disc (items 16, 18, 84, Section 10.3.1 1D). These problems are usually a symptom of contaminated hydraulic oil. The system should be drained and refilled with fresh ENERPAC hydraulic oil.
2. Pressure leaks that are consistent and increase proportionately with increasing pressure ranges are usually the result of leaking gaskets or threaded surfaces such as NTPF fittings or plugs.
3. Ball seat leakage is often erratic and intermittent and is caused by contaminants trapped on the sealing edge. Over time, as wear occurs, these seats will need to be replaced.
4. Leakage observed on the external surfaces around the shaft (item 13, Section 10.3.1 1D) is an indication that the o-ring (item 15) and backup ring (item 14) need to be replaced.
5. Leakage observed on the external surfaces around the relief valve body (item 1, Section 10.3.3) is an indication that the o-ring (item 8) needs to be replaced.

DISASSEMBLY:

1. Remove the 4 socket head cap screws (item 76, Section 10.3) and remove the valve from the pump.
2. Remove the return tube (item 75) and gasket (item 70).
3. Remove the screw (item 1, Section 10.3.1) and washer (item 2) from the shaft (item 13).
4. All models except VM33M & 43M: Remove the handle (item 3), disk (item 4) ball (item 5) and spring (item 6).
5. Models VM33M & VM43M only: Remove handle cap (item 66) lever (item 67) and knob (item 68) as an assembly. Remove ball (item 5) and spring (item 6).
6. Remove the 4 socket head cap screws (item 7) and remove the upper valve assy. (item 44, Section 10.3) from the manifold (item 27) or locking valve block (item 45 or 46).
7. Remove the 2 socket head cap screws (item 24, Section 10.3.1) and separate the body (item 23) from the valve cap (item 9).
8. Remove the shaft assembly and inspect the o-ring (item 15) and backup ring (item 14) for damage. Replace if needed.
9. Remove the o-ring (item 10) and inspect for damage such as nicks or cuts. Replace if needed.
10. Remove the bearing (item 12) and bearing plate (item 11) and inspect for damage. Replace if needed.

11. Remove the shear seal assemblies (items 18-20 or 84-86) from the bores in the body.
12. Remove o-rings (item 20 or 86) and backup washers (item 19 or 85) and inspect for damage. Replace if needed.
13. Remove springs (item 22) and inspect for damage such as breakage or permanent set. Replace if needed.
14. Disassembly of the manifold is as follows:
15. Loosen lock nut (item 9, Section 10.3.3) and unscrew the set screw. (item 2).
16. Using a 7/8" socket, loosen and remove the relief valve assembly (item 58, Section 10.3.2) from the body.
17. Remove the seat (item 57) from the body.
18. Inspect the seat for damage such as nicks or dents on the sharp edge of the internal diameter. Replace if necessary.
19. Inspect the o-ring (item 8, Section 10.3.3) for damage and replace if necessary.
20. Inspect the ball (item 7) and guide (item 6). Replace if necessary.
21. Remove the pipe plugs (item 53, 54, 55, Section 10.3.2) and clean the body. Inspect body for damages.

REASSEMBLY:

Procedure for Manifold Assembly

1. Apply Teflon tape to threads. Install new pipe plug (item 53, Section 10.3.2) and torque to 10-12 ft-lbs [14-16 Nm]. Install pipe plug (item 54, 55) and torque to 32-39 ft-lbs [43-52 Nm].
2. Install copper gasket (item 56) onto seat (item 57), with round edges facing away from the seat.
3. Place seat onto the bottom counter bore in the valve body, with the gasket side down. Note: make sure that the seat is firmly seated and not crooked.
4. Grease o-ring on relief valve assembly and insert into cavity in the valve body.
5. Torque relief valve assembly (Item 58) to 32-39 Ft-lbs [43-53 Nm].

Procedure for Upper Manual Valve Assembly

1. Position plate (item 11, Section 10.3) and bearing (item 12) into cap.
2. Place o-ring (item 10) into cap groove.
3. Place o-ring (item 15) and backup ring (item 14) onto shaft (item 13). The o-ring is placed closest to the threaded end of the shaft.
4. Place roll pin (item 17) into thru hole in disc (item 16). Insert shaft (item 13) into disc from the solid side of the disc. Align the thru hole in the shaft with the thru hole in the disc and press or hammer roll pin until flush with disc outside diameter.
5. Lubricate the o-ring and backup ring on the shaft with grease. Insert the shaft and disc assembly into the valve cap (item 9).
6. Place springs (item 22) in each of 3 holes except for hole on tank side of the body (item 23).
7. All models except VM33M & VM43M: Assemble each shear seal (item 18) with 2 backup washers (item 19) and 1 o-ring (item 20). The o-ring is placed between the backup washers.
8. Models VM33M & VM43M Only: Assemble each shear

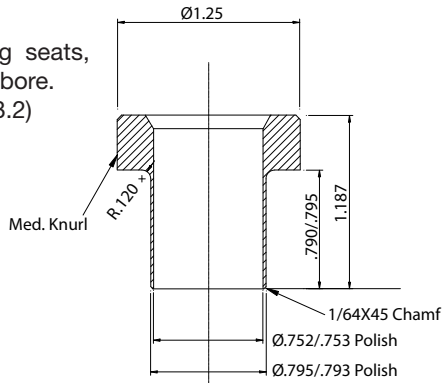
seal (item 84) with 1 backup washer (item 85) and 1 o-ring (item 86). The o-ring is placed under the backup washer.

9. Lubricate the o-rings and backup washers. Insert the shear seal assemblies into body (item 23) by hand.
10. Tighten body onto cap with 2 screws (item 24) with a 5/32" hex wrench, hand tight.
11. Place 4 o-rings (item 25) onto body.
12. Mount upper valve assy onto manifold or locking valve block using 4 socket head cap screws (item 7, Section 10.3). Torque to 28-34 ft-lbs [38-46 Nm].
13. Insert spring (item 6, Section 10.3.1) into hole in valve cap (item 9). Install ball (item 5) onto the spring.
14. All models except VM33M & VM43M: Place disk (item 4) with sharp edged side facing upwards onto the shaft and resting on ball. Place handle (item 3) onto shaft.
15. Models VM33M & VM43M Only: Place handle cap (item 66), lever (item 67) and knob (item 68) onto shaft as an assembly.
16. Insert washer (item 2) onto shaft. Apply Loctite 222 to threads on screw (item 1) and hand tighten.

SPECIAL TOOLS

AT100479

Use for installing seats, item 39, into the bore. (see Section 10.3.2)



AT100479-1

Use for installing piston assembly, items 40-42, into the bore. (see Section 10.3.2)

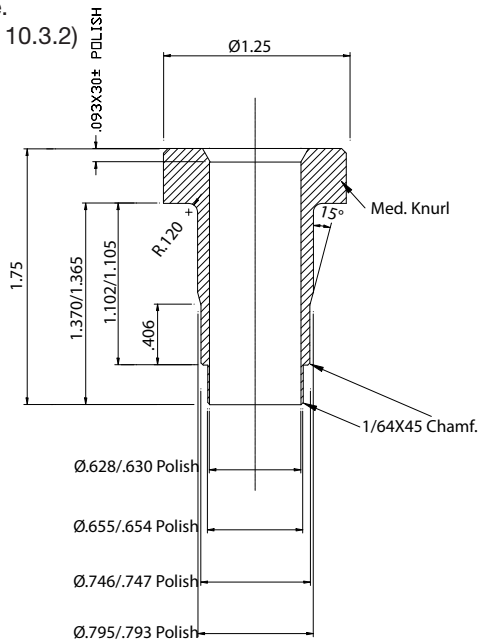


Figure 29: Special Tools

Relief Valve Adjustment

The valve assembly is equipped with a user-adjustable relief valve. Adjust pressure as follows:

1. Install a 0-15,000 psi [0-1,035 bar] gauge in the "A" port (see Figure 30).
2. VM43 and VM43M Only: Place a 3/8" pipe plug in the "B" port and torque to 25 ft-lbs [33 Nm].
3. Loosen the relief valve locknut to permit adjustment of set screw.
4. Rotate the control valve handle to the neutral ("3") position. See Figure 31 for VM33 and VM43 valve positions.
5. Start the pump and allow the oil to warm.
6. Rotate the control valve handle to the advance ("1") position. Allow pressure to build.
7. To increase pressure: SLOWLY turn the relief valve set screw clockwise until pressure increases to the desired setting.

NOTE: An internal check valve in the manifold will prevent the pressure from dropping when the set screw is turned counter-clockwise. To lower the pressure setting, follow the procedure in steps 8a through 8e.

8. To decrease pressure:
 - a. Be sure the pump is running.
 - b. Rotate the control valve handle to the neutral ("3") position to relieve pressure on the "A" port.
 - c. Turn the relief valve set screw counter-clockwise one turn.
 - d. Rotate the control valve handle to the advance ("1") position.
 - e. SLOWLY turn the relief valve set screw clockwise until pressure increases to the desired setting.
9. When the desired pressure setting is reached, lock the set screw with the locknut. DO NOT overtighten.
10. Before turning off pump, rotate the control valve handle momentarily to the retract ("2") position to relieve pressure at the "A" port. Then, rotate the handle to the neutral ("3") position. Check that gauge indicates zero (0) psi.

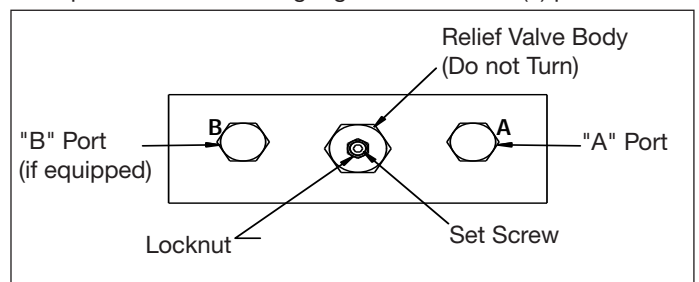


Figure 30: Adjustment Details

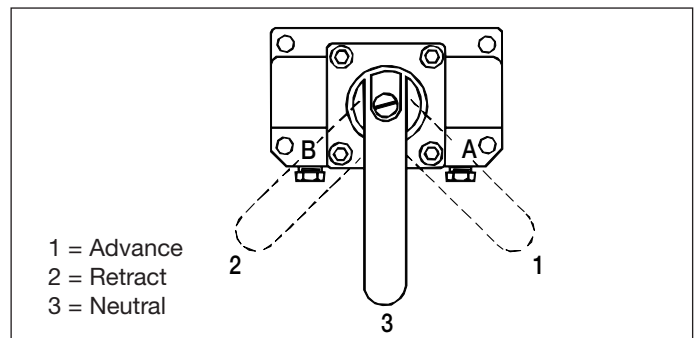


Figure 31: Valve Handle Positions

12.4 HCR50 Cylinders and Fittings

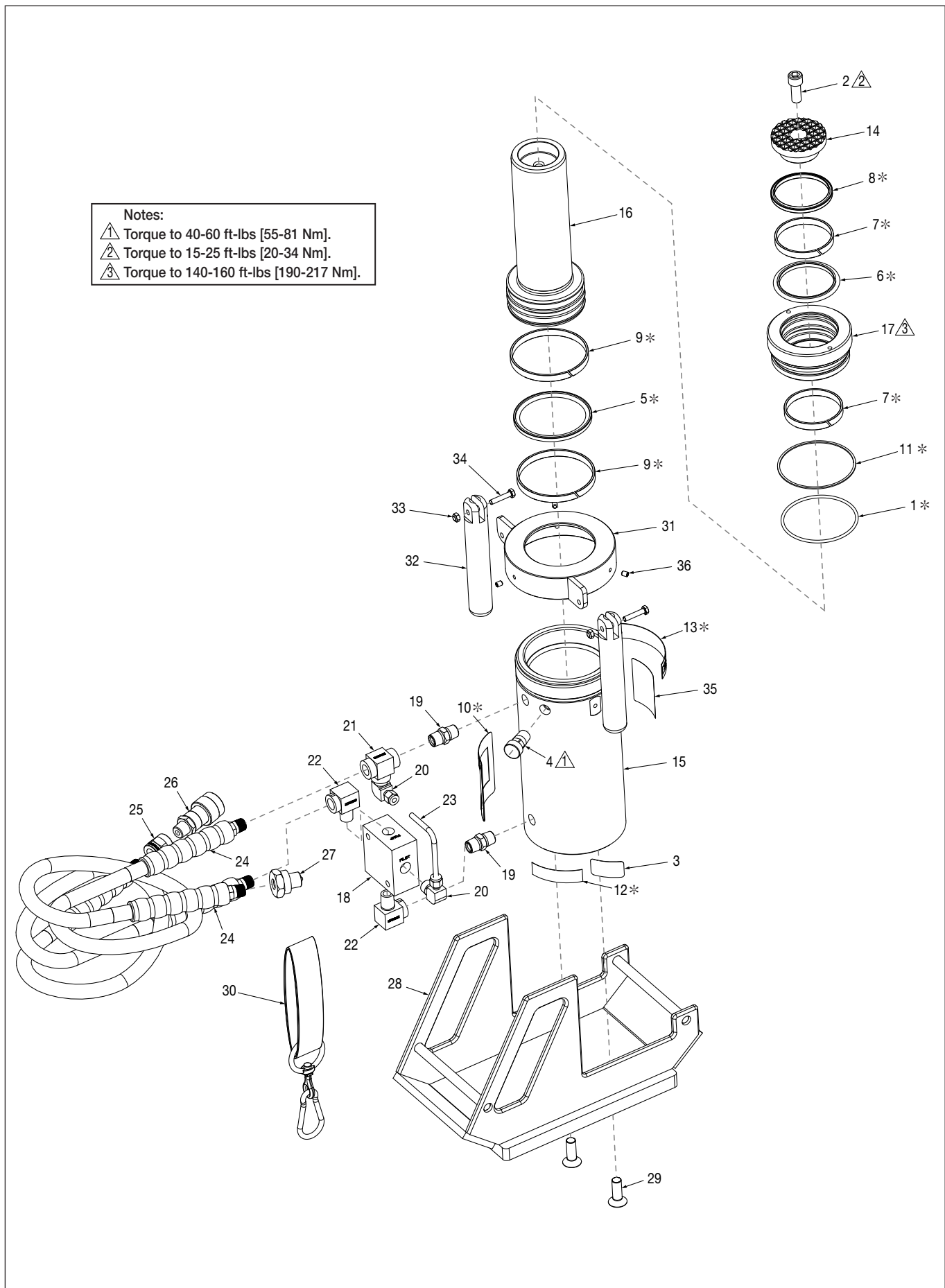


Figure 32: HCR506_TL248

Repair Parts List for HCR506_TL248			
Item	Part Number	Qty.	Description
1	* B1105503	1	O-Ring 91,67 x 3,53 Dash 239
2	CBE1225028-1A	1	Screw-SHCS, Hex, M12 x 30
3	◆ DB9472026	1	Enerpac UIN Warning Decal
4	DB8049900	1	Relief Valve Assembly
5	* DB8051076	1	Piston Seal 100 x 84.5 x 6.3
6	* DB8052076	1	Rod Seal 70 x 85.1 x 6.3
7	* DB8054155	2	Bearing, Rod 70 x 9.7
8	* DB8055776	1	Wiper 70 mm
9	* DB8056155	2	Bearing, Piston 100 x 9.7
10	◆* DB8100026	1	Decal, Product Specification
11	* DB8119565	1	Back Up Ring 100 x 94.6 x 1.4
12	◆* DC6154026	1	Decal, Safety Warning
13	◆* DD2459026	1	Decal, Enerpac
14	DD8513045	1	Saddle
15	N/A	1	Base HCG/HCR 50 Ton 150 mm
16	HCR506040	1	Plunger HCG/HCR 50 Ton 150 mm
17	HCR502044	1	Stop Ring HCG/HCR 50 Ton Short
18	V42	1	V42 Valve
19	CJ651096	2	Hex Nipple .375 NPTF
20	DD9901093	2	Fitting, Flareless 90 Elbow 1/4" Tube To Male 3/8" NPT
21	CJ652096	1	FTG-FEM Tee, 0.375x0.375
22	CJ641291	2	Street Elbow
23	DD9899268	1	Tube, Pilot HCR506
24	H7206	2	Hose 6 FT 3/8 NPT + 3/8 NPT
25	CJ649096	1	Connection Fitting
26	CR400	1	Female Coupler, inc. Dust Cap
27	CH604	1	Male Half Coupler, inc. Dust Cap
28	DF1046500	1	Weldment, Base HCR506
29	CBA1227028-1B	2	Screw-FHS, Hex, M12 X 35
30	DD9971217	1	Strap with Carabiner 24" Long
31	DF1047489	1	Collar, Handle HCR50 Network Rail
32	DF1048070	2	Handle, Network Rail
33	CBE1060120-2A	2	Nut-Lock, HEX, M6 x 10
34	CBE625046-1B	2	Screw-HHCS, HEX, M6 x 30
35	◆ DF1132026	1	Decal, Two Person Lift
36	CCA613028-5A	3	Screw-Set, Flat, M6 x 8
* Included in HCR50K1 Seal Kit. ◆ Items included in Decal Kit TL248014. N/A - Not Available.			

12.5 V42 Valve

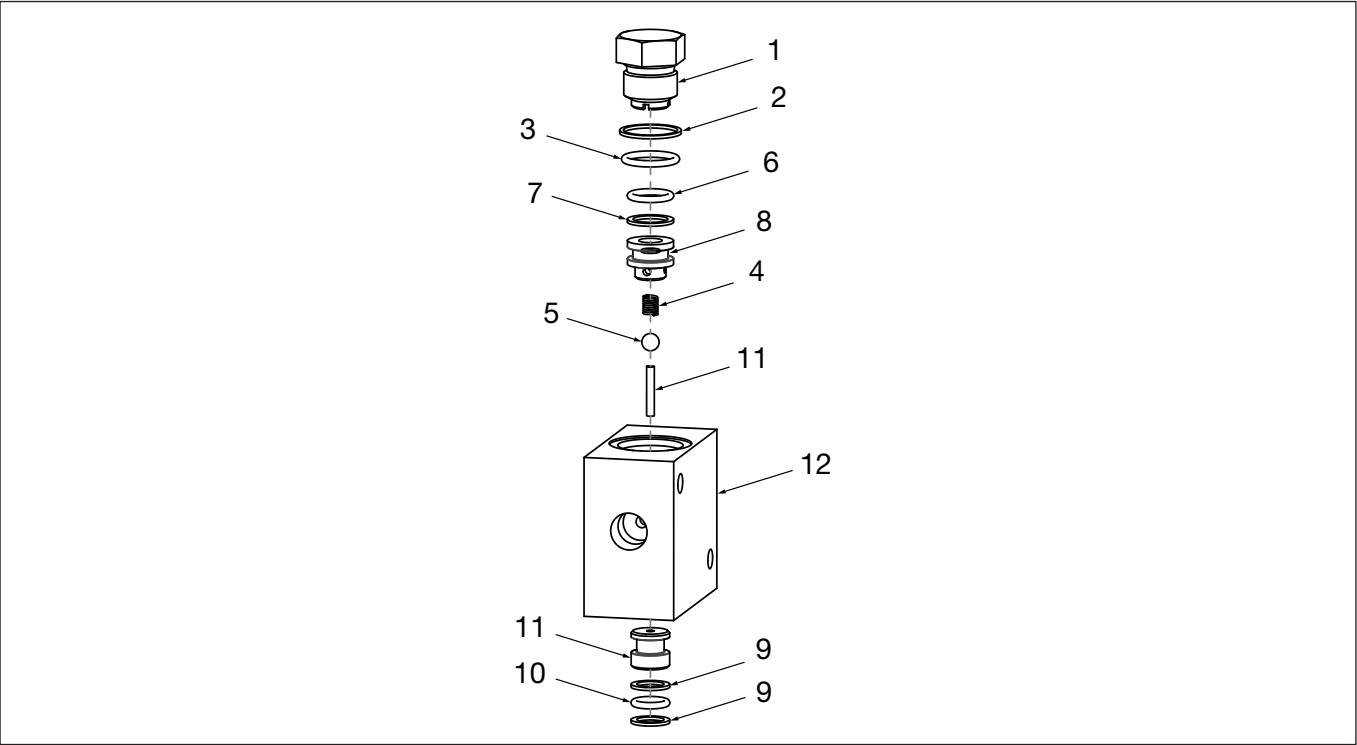


Figure 33: V42 Valve

Repair Parts List for V42 Valve								
Item	Part Number	Qty.	Description		Item	Part Number	Qty.	Description
1	CR356013	1	Spring Guide		9	★ B1111564	2	Back-Up Ring
2	CR355167	1	Gasket		10	★ B1009503	1	O-Ring
3	★ B1116803	1	O-Ring		11	Y362900	1	Piston Assembly
4	★ CJ656110	1	Spring		12	CB769190	1	Valve Body
6	★ B1011503	1	9/32" Ball		13	CB559026	1	Decal (not shown)
7	★ B1113564	1	O-Ring		14	CH272026	1	Caution Decal (not shown)
8	Y126290	1	Back-Up Ring					
★ Items included in and available only as part of Repair Kit V42K.								

12.6 Frame Accessories

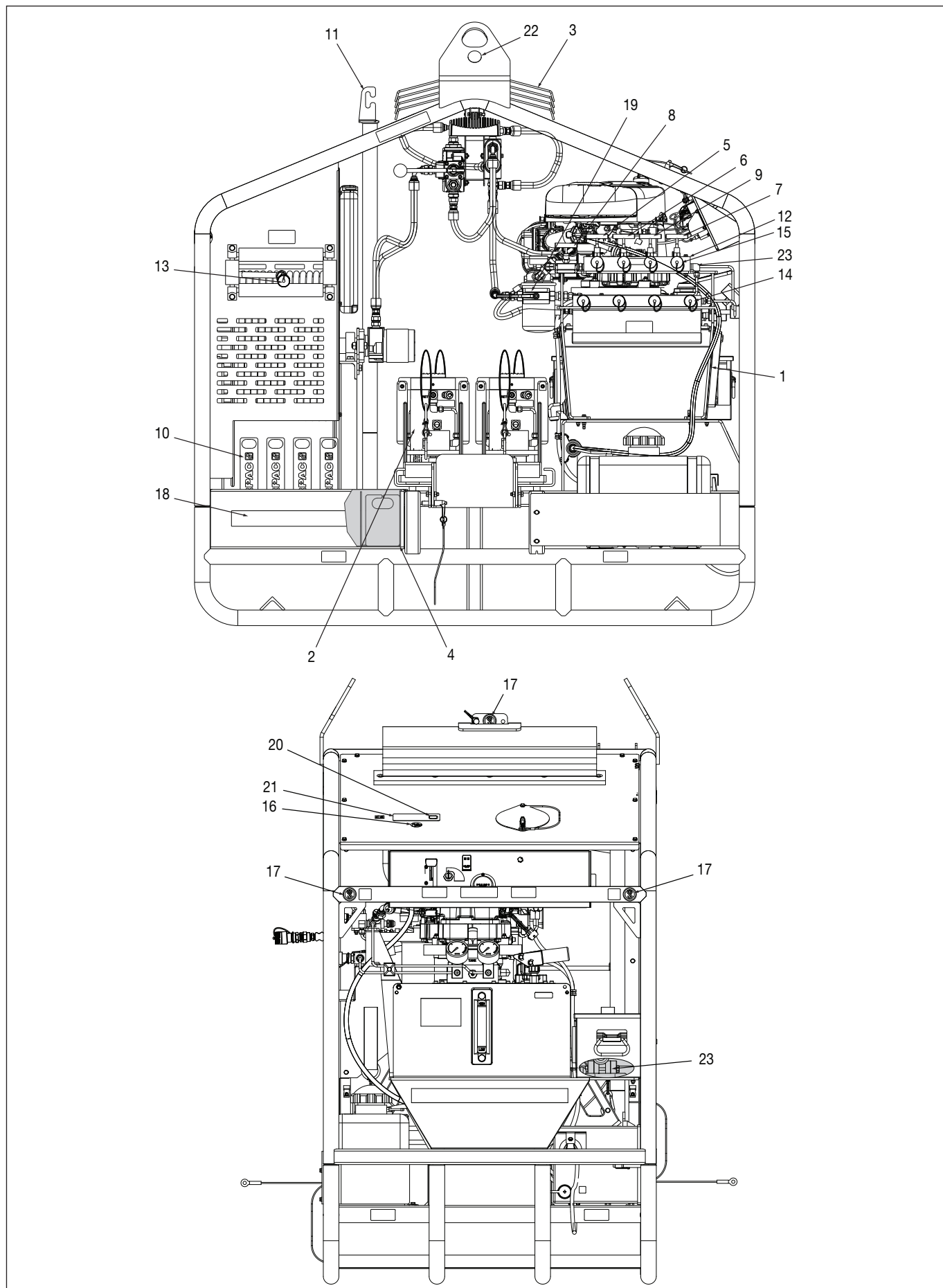


Figure 34: Frame Accessories

Repair Parts List for Frame Accessories			
Item	Part Number	Qty.	Description
1	TL248001	1	Pump ZG6 VM43 40L TL248
2	TL248002	4	Cylinder 50T 150mm TL248
3	TL248003	4	Shield Ballast TL248
4	TL248004	1	Spacer Set TL248 (10 Spacers)
5	TL248005B	1	Handle, Valve Blue
6	TL248005G	1	Handle, Valve Green
7	TL248005O	1	Handle, Valve Orange
8	TL248005R	1	Handle, Valve Red
9	TL248005Y	1	Handle, Valve Yellow
10	TL248006	1	Flag Set, Location TL248 (4 Flags)
11	TL248007	1	Jack Placement TL248
12	TL248008	1	Manifold, 4 Port Advance
13	TL248009	9	50' Polarized Hose 3/8" ID
14	CD411M	4	Dust Cap Metal CH604 (Female)
15	CD415M	4	Dust Cap Metal CH604 (Male)
16	✦ DC9920026	1	Decal Read Instruction
17	✦ DC9950026	6	Decal No Lift
18	✦ DF1086026	3	Decal Enerpac
19	DD5209661	1	Valve, Shutoff, Female NPTF
20	✦ DD8995026	1	UIN UL Polyester Bug Decal
21	✦ DD9810026	1	Decal, Product Specification, TL248
22	✦ DD9883026	2	Decal, Lift Point 1.5" Diameter
23	DD9901093	4	Fitting, Flareless 90 Elbow 1/4" Tube to Male 3/8" NPT
❖	CT604	1	Coupler Bleed Tool
●	✦ DF1080026	1	Decal, Enerpac
❖	TL248012	1	Handpump Handle Assembly
❖	TL248013	1	Crank Hose Reel
●	TL248010	1	Storage Cover, TL248
●	TL248011	1	Hose Kit Non-Conductive TL248
❖ Not shown. Located in toolbox.			
● Not Shown.			
✦ Items included in Decal Kit TL248014.			

NOTES

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