ENERPAC
Hydraulic Technology Worldwide

Instruction Sheet

TR Series Hydraulic Cylinders (Models TRFM, TRFL and TRCM)

L2761 Rev. B 03/08

Index:

Repair Parts Sheets for this product are available from the Enerpac web site at www.enerpac.com, or from your nearest Authorized Enerpac Service Center or Enerpac Sales office.

1.0 IMPORTANT RECEIVING INSTRUCTIONS

Visually inspect all components for shipping damage. Shipping damage is not covered by warranty. If shipping damage is found, notify carrier at once. The carrier is responsible for all repair and replacement costs resulting from damage in shipment.

SAFETY FIRST

2.0 SAFETY ISSUES

Read all instructions, warnings and cautions carefully. Follow all safety precautions to avoid personal injury or property damage during system operation. Enerpac cannot be responsible for damage or injury resulting from unsafe product use, lack of maintenance or incorrect product and/or system operation. Contact Enerpac when in doubt as to the safety precautions and operations. If you have never been trained on high-pressure hydraulic safety, consult your distribution or service center for a free Enerpac Hydraulic safety course.

Failure to comply with the following cautions and warnings could cause equipment damage and personal injury.

A **CAUTION** is used to indicate correct operating or maintenance procedures and practices to prevent damage to, or destruction of equipment or other property.

A **WARNING** indicates a potential danger that requires correct procedures or practices to avoid personal injury.

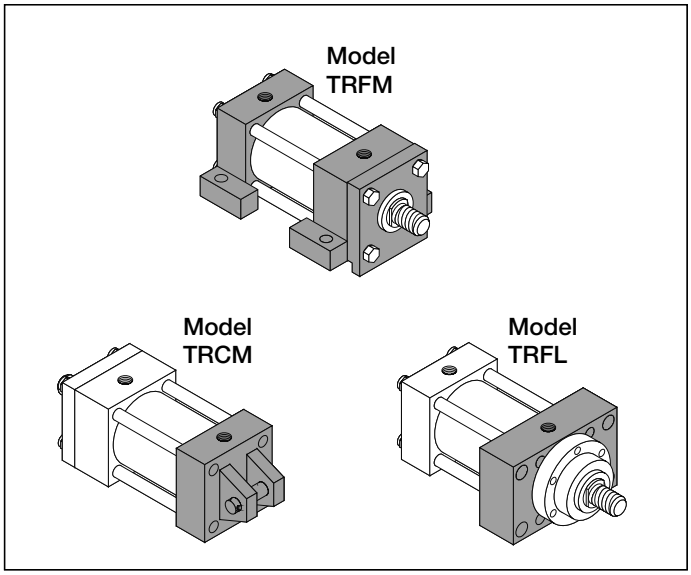
A **DANGER** is only used when your action or lack of action may cause serious injury or even death.

WARNING: Wear proper personal protective gear when operating hydraulic equipment.

WARNING: Stay clear of loads supported by hydraulics. A cylinder, when used as a load lifting device, should never be used as a load holding device. After the load has been raised or lowered, it must always be blocked mechanically.

WARNING: USE ONLY RIGID PIECES TO HOLD LOADS. Carefully select steel or wood blocks that are capable of supporting the load. Never use a hydraulic cylinder as a shim or spacer in any lifting or pressing application.

DANGER: To avoid personal injury keep hands and feet away from cylinder and workpiece during operation.



WARNING: Do not exceed equipment ratings. Never attempt to lift a load weighing more than the capacity of the cylinder. Overloading causes equipment failure and possible personal injury. Most TR Series cylinders are designed for a max. pressure of 5,000 psi [344 bar] (refer to pressure rating stamped on cylinder). Do not connect a TR Series cylinder to a pump with a higher pressure rating.

Never set the relief valve to a higher pressure than the maximum rated pressure of the pump. Higher settings may result in equipment damage and/or personal injury.

WARNING: The system operating pressure must not exceed the pressure rating of the lowest rated component in the system. Install pressure gauges in the system to monitor operating pressure. It is your window to what is happening in the system.

CAUTION: Avoid damaging hydraulic hose. Avoid sharp bends and kinks when routing hydraulic hoses. Using a bent or kinked hose will cause severe back-pressure. 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.

IMPORTANT: Do not lift hydraulic equipment by the hoses or swivel couplers. Use the carrying handle or other means of safe transport.

CAUTION: 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 equipment to temperatures of 65°C [150°F] or higher. Protect hoses and cylinders from weld spatter.

DANGER: 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.

WARNING: Only use hydraulic cylinders in a coupled system. Never use a cylinder with unconnected couplers. If the cylinder becomes extremely overloaded, components can fail catastrophically causing severe personal injury.

WARNING: BE SURE SETUP IS STABLE BEFORE LIFTING LOAD. Cylinders should be placed on a flat surface that can support the load. Where applicable, use a cylinder base for added stability. Do not weld or otherwise modify the cylinder to attach a base or other support.

Avoid situations where loads are not directly centered on the cylinder plunger. Off-center loads produce considerable strain on cylinders and plungers. In addition, the load may slip or fall, causing potentially dangerous results.

IMPORTANT: Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Authorized ENERPAC Service Center in your area. To protect your warranty, use only ENERPAC oil.

WARNING: Immediately replace worn or damaged parts by genuine ENERPAC parts. Standard grade parts will break causing personal injury and property damage. ENERPAC parts are designed to fit properly and withstand high loads.

3.0 PRODUCT DESCRIPTION

3.1 Cylinder Styles

Foot Mount (TRFM Models - NFPA style MS2)
The foot or “lug” mounted cylinder allows easy mounting with only four bolts. It provides a fairly rigid mount and can tolerate a slight amount of misalignment when the cylinder is at full stroke.

Flange Mount (TRFL Models - NFPA style ME5)

The end cap flange mount is one of the strongest, most rigid methods of mounting a cylinder. This type of mounting allows the majority of the cylinder length to be buried within a machine, if desired.

Clevis Mount (TRCM Models - NFPA style MP1)
These cylinders are designed to pivot during operation. In addition to the pivot pin on the base end, all clevis mount cylinders require a rod eye or clevis to allow pivoting on the opposite end.

3.2 Cylinder Ports

- Cylinders with 1-1/2" to 2-1/2" bore sizes have SAE-10 ports.
- Cylinders with 3-1/4" to 4" bore sizes have SAE-12 ports.

3.3 Maximum Rated Pressure

The maximum rated pressure for most Enerpac TRCM, TRFM and TRFL cylinder models is 5000 PSI [344 bar]. However, for the following models, the maximum rated pressure is lower:

- Model TRCM-1510 is rated at 4500 PSI [310 bar].
- Model TRCM-1512 is rated at 4000 PSI [275 bar].

Note: Maximum rated pressure for all cylinder models is subject to change due to custom engineering, special orders and other variables. For this reason, always refer to the “PSI rating” stamped on the cylinder.

4.0 INSTALLATION

4.1 General Guidelines

Cleanliness - Perhaps the most important consideration when installing the cylinder. When shipped from Enerpac, the ports are securely plugged with plastic plugs. These plugs should not be removed until installing hoses or piping.

Verify that all hoses, piping and fittings are thoroughly clean before making connections. Ensure that all threading and flaring burrs or chips are removed One chip can cause premature failure of the cylinder or other hydraulic system components.

Alignment - Ensure proper rod alignment between the cylinder and its mating component on your machine. As a precaution, check rod alignment with the cylinder in both the extended and retracted positions. Improper alignment will result in excessive cylinder wear.

Environment - Cylinders operating in areas where there is weld spatter, fast drying chemicals, paint, excessive heat or other hazardous conditions should have covers or shields installed to prevent damage to the rod and rod seals.

4.2 Mounting Recommendations

Foot Mounted Cylinders - The rod end retainer plate extends below the mounting surface of the cylinder. This extension must be fitted into a milled keyway in your mounting pad. The use of high strength alloy steel mounting bolts, 1/16" smaller than the hole size, is recommended.

Flange Mount Cylinders - The rod bushing extension can be used as a pilot to locate the flange mount. To prevent shifting, dowel pins should be used after the cylinder is mounted and aligned.

Clevis Mount Cylinders - This type of cylinder must be pivoted at both ends and the pivot pins must be in-line and parallel to each other. The pivot pins should be carried by bearings that are rigidly held and closely-fit along the entire length of the pin.

After mounting the cylinder, check to ensure that it is free to swing through its working arc without interference from other machined parts.

4.3 Sideload

Eliminate the presence of sideload forces when using high tonnage tie-rod cylinders. Sideload can occur through one or more of the following conditions:

1. An eccentric load on the piston rod.
2. A horizontal load on a structure.
3. A structure and/or cylinder misalignment.
4. Non-synchronized lifting actions.
5. Non-stable cylinder base support.

IMPORTANT: To reduce the chance of sideload, always use a flat, hard surface as a cylinder support plate surface.

5.0 OPERATION

IMPORTANT: It is mandatory that the operator has a full understanding of all instructions, safety regulations, cautions and warnings, before starting to operate the cylinder and its related hydraulic components. In case of doubt, contact Enerpac.

Note: Always refer to the operating instructions included with your pump and valve when operating the cylinder.

5.1 Advancing and Retracting the Cylinder

All TR Series cylinders are double-acting and are powered in both directions by the pump. Use a pump with a 4-way valve and two hoses. After making hydraulic connections:

To advance the cylinder, shift the valve on the pump to the advance position and run the pump.

To retract the cylinder, shift the valve to the retract position and allow the cylinder to retract.

5.2 Air Removal

To remove trapped air, place the cylinder on its side, with the hydraulic fittings facing UP.

Advance and retract the cylinder several times, avoiding pressure build-up. Air removal is complete when the cylinder motion is smooth in both directions.

Note: Bleeder ports are available as an optional accessory for applications where the cylinder is mounted at the high point of the circuit or where the cylinder does not complete a full stroke during its normal cycle.

6.0 MAINTENANCE AND SERVICE

Maintenance is required when wear or leakage is noticed. Periodically inspect all components to detect any problem requiring service and maintenance.

- Replace damaged parts immediately.
- Do not exceed oil temperature above 60˚C [140˚F].
- Keep all hydraulic components clean.
- Periodically check the hydraulic system for loose connections and leaks.
- Change hydraulic oil in your system regularly.

Refer to Enerpac Repair Parts Sheet L2762 for cylinder seal replacement and general maintenance instructions.

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

7.0 STORAGE

Cylinders are often delivered before the user is prepared to install them and must be stored for a period of time. When storage is required, the following items should be observed:

- Select an indoor area for storage, which has a dry and non-corrosive atmosphere. Take caution to protect the cylinder from both internal and external corrosion.
- Cylinders to be stored should be kept in a vertical position (piston rod up) whenever possible.
- Port protector plugs should be kept in the cylinder ports until the time of installation.

Troubleshooting Guide - Enerpac TR Series Cylinders

Problem	Cause(s) and Solution(s)
External Leakage	If leakage occurs between the end cap and barrel, check tie rod torque. If the torque is correct, then replace the barrel seal. When leakage occurs in the rod bushing area, the rod seals should be replaced. If leakage continues or re-occurs during a short period of operation, check the cylinder barrel, end caps and rod bushing for damage.
Cylinder Misalignment	Sideloading is a common problem which occurs when the cylinder application does not allow the piston rod to work in-line during the extend and retract motions of the cylinder. Evidence of this condition is frequent seal failure, bushing wear or galling of the piston rod. In some cases, bending of the piston rod or complete failure (breakage) of the rod will occur.
Contamination of the Piston Rod	Dirt and other material is often picked up when the piston rod is extended. When the rod is retracted in an excessively dirty application, the dirt is often carried back into the rod seal cavity of the cylinder, causing damage to the seals. With a slight modification of the cylinder rod end, a rod boot can be added to protect the rod bushing and seals for most applications.
Bad Mountings	Due to the wear of pivot pins or mounting bolts working loose, a cylinder may have sideload, even though the rod was in-line when the cylinder was first installed. All cylinder mountings should be checked periodically.
Damaged Piston Rod	An extended piston rod can be damaged by the impact of a hard object which could burr the rod. If this occurs, the rod should be checked immediately to prevent seal damage.
Internal Leakage	Inside the cylinder, leakage past the piston seals can cause sluggish movement or setting of the cylinder under load conditions. This occurs due to leakage of worn piston seals or rings.
Creeping Cylinder	When a cylinder creeps while stopped in mid-stroke, check for internal leakage. Creeping can also be caused by a worn control valve. The control valve should also be checked, even if the cylinder is found to have internal leakage.
Erratic or Sluggish Operation	Erratic or sluggish cylinder operation may be caused by a number of problems. The most common cause of sluggish operation is air in the system. Internal cylinder leakage may also be the problem. If the system starts out sluggishly but later speeds-up as the oil warms-up, the oil viscosity may be too high. The entire system should be checked for worn components if the cylinder still operates in a sluggish manner after making these checks.

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