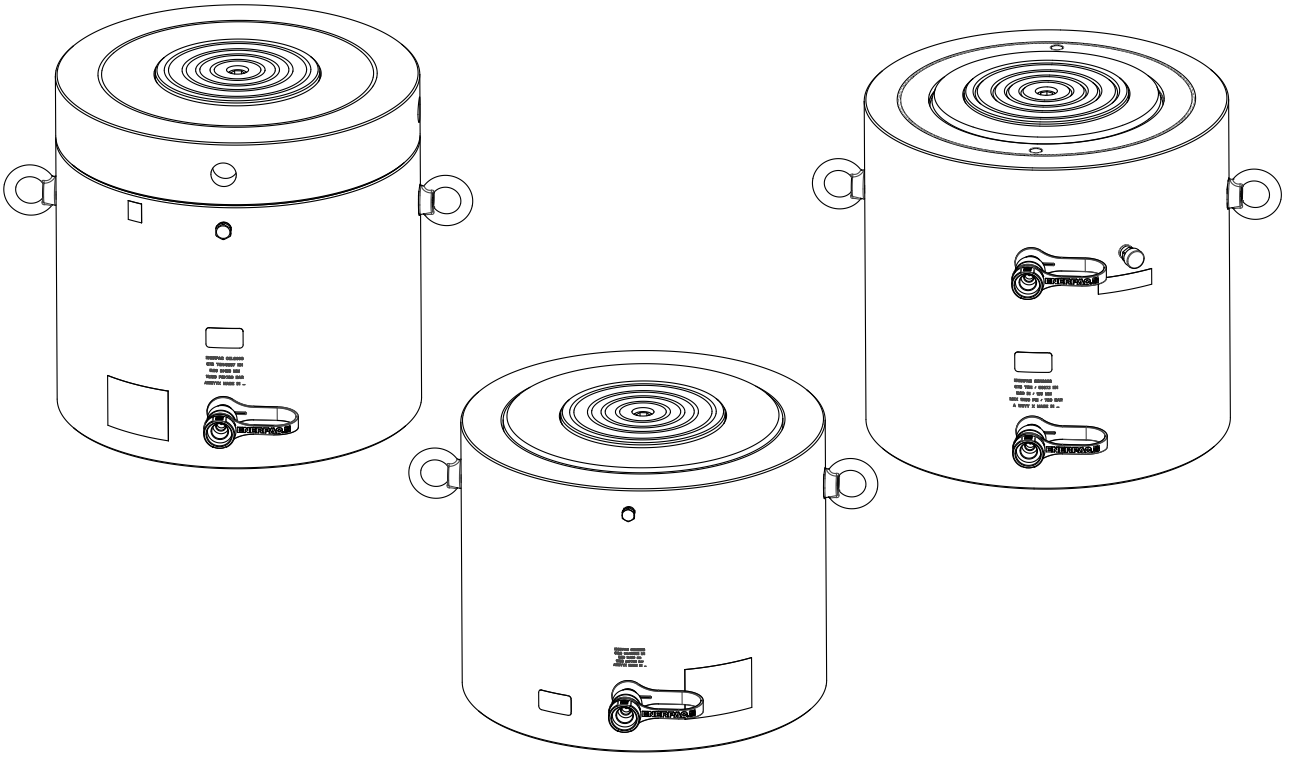
ENERPAC

Operation and Maintenance Manual

Enerpac
Core Cylinders

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CE UK CA



⚠ To reduce the risk of injury, users 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.

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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

Cylinder model number, maximum load, maximum stroke, maximum pressure, and location of manufacture are stamped directed onto the cylinder base.



AVAILABLE LANGUAGES

L4787 is available in the following languages, visit www.enerpac.com for a copy.

- Další jazyky lze nalézt na www.enerpac.com.
- Weitere Sprachen finden Sie unter www.enerpac.com.
- Para otros idiomas visite www.enerpac.com.
- Muunkieliset versiot ovat osoitteessa www.enerpac.com.
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- Per altre lingue visitate il sito www.enerpac.com.
- Ga voor de overige talen naar www.enerpac.com.
- For alle andre språk henviser vi til www.enerpac.com.
- Inne wersje językowe można znaleźć na stronie www.enerpac.com.
- Para outros idiomas consulte www.enerpac.com.
- Alte limbi pot fi găsite la www.enerpac.com.
- Информацию на других языках вы найдете на сайте www.enerpac.com.
- För andra språk, besök 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.

- Read and completely understand the safety precautions and instructions in this manual before operating the cylinder or preparing it for use. Always follow all safety precautions and instructions, including those that are contained within the procedures of this manual.
- Operating procedures will vary, depending on the system arrangement. Always read, follow and completely understand all manufacturer's instructions when operating pumps, valves and all other devices used with the cylinders. Follow all safety precautions contained in the manufacturer's manuals.
- Always wear appropriate personal protective equipment (P.P.E.) when operating hydraulic equipment. Be sure to wear eye protection, work gloves and protective clothing. Use of additional P.P.E. safety items such as dust mask, non-skid safety shoes, hard hat, and hearing protection (used as appropriate for the conditions) will reduce the chance of personal injuries. The use of these items may also be required by local regulations or laws.
- Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin. If oil is injected under the skin, see a doctor immediately.
- Do not pressurize disconnected couplers.
- Use hydraulic cylinders only in a coupled system. It is acceptable to use a cylinder with a disconnected coupler only if the load is mechanically supported by the cylinder lock nut, and all hydraulic pressure is completely relieved.
- When holding loads, be certain that the lock nut is turned down firmly against the cylinder base so that the load is mechanically supported. Also be sure that all hydraulic pressure is completely relieved.
- Do not remove or disable the pump relief valve.

- Do not remove or disable the cylinder relief valve (if equipped).
- The system operating pressure must not exceed the pressure rating of the lowest rated component in the system.
- Install pressure gauge(s) in the system to monitor operating pressure. It is your window to see what is happening in the system.
- Never set a relief valve to a higher pressure than the maximum rated pressure of the pump and cylinder. If ratings are different, relief valve setting should not exceed the setting of the lowest rated component (pump or cylinder).
- Enerpac Core Cylinders (CC) are designed for a maximum working pressure of 10150 psi [700 bar]. Do not connect a pump with a higher pressure rating to these cylinders.
- Basic and lock nut cylinders DO NOT contain a stop ring. Advance the plunger slowly to avoid hydraulically ejecting the plunger from the cylinder base. Stop advancing the plunger immediately if the maximum stroke indicator line appears. Refer to sections 5.1 of this manual for additional information and precautions.
- Do not exceed equipment ratings. Never attempt to lift a load weighing more than the rated capacity of the cylinder. Overloading may cause equipment failure and possible personal injury.
- Be sure setup is stable before lifting load. Cylinders should be located on a firm and level surface capable of supporting the full load.
- Do not weld, drill or otherwise modify a cylinder to attach a base plate or other support unless approved in writing by the Enerpac Engineering Department. Use only the provided bolt holes.
- Always perform a visual inspection of the cylinder before placing it into operation. If any problems are found, do not use the cylinder. Have the cylinder repaired and tested by an Enerpac Authorized Service Center before it is returned to service.
- Never use a cylinder that is leaking oil. Do not use a cylinder that is damaged, altered or in need of repair.
- Always lift the cylinder using a hoist, crane or other suitable lifting device of sufficient rated capacity. Use only the supplied cylinder lifting eyes to attach the cylinder to the lifting device. Replace any missing or damaged lifting eyes.
- Allow only trained and experienced personnel to supervise and perform lifting and lowering procedures.
- Be certain that no persons are working on or near any cylinders before lifting or lowering of the load begins. Alert all personnel in advance that lifting or lowering is about to occur.
- Use suitable cribbing of rigid construction to hold loads.
- Never use a hydraulic cylinder as a shim or spacer in any lifting or pressing application.
- A cylinder should never be used as a load holding device. After the load has been raised or lowered, it always must be blocked mechanically.
- Be certain that the load is centered and covers the entire plunger saddle surface. Avoid situations where loads are not directly centered on the plunger saddle. The load may slip or fall, causing potential danger.
- Lift only dead weight loads. Avoid lifting live weight loads.
- Be especially careful when lifting loads such as partially filled storage tanks, in which the center of gravity could move or shift during lifting. Be aware that the distribution of some loads can change quickly and without warning.
- Do not use the cylinder to lift people. Do not allow people to be on top of the load during lifting or lowering.
- Keep all personnel clear of the work area while lifting or lowering is in progress. To avoid personal injury, keep hands and feet away from cylinder and load during operation.
- Maintain communication with the operator at all times during lifting or lowering 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 pump and valve as required to ensure that the load is lifted and lowered evenly and at a controlled rate.
- Closely watch the load at all times during lifting and lowering. Stop lifting or lowering immediately if the load becomes unstable or appears to be lifting or lowering unevenly.
- Never allow persons to work under or near the load while the load is being supported hydraulically. After the load has been raised or lowered, it always must be blocked mechanically by the cylinder lock nut or via suitable cribbing.
- Always be certain that hydraulic pressure is fully relieved and that the load is fully removed from the cylinder(s) before disconnecting hydraulic hoses, loosening hydraulic fittings, or performing any cylinder disassembly or repair procedures..

⚠ CAUTION

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

- Be careful to avoid damaging hydraulic hoses. Avoid sharp bends and kinks when routing hydraulic hoses. Do not exceed the minimum bend radius specified by the hose manufacturer. 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 hoses. 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 hoses or couplers. Use the cylinder lifting eyes and appropriately rated lifting equipment.
- 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 150˚F [65˚C] or higher. Protect all hydraulic equipment from weld spatter.
- Immediately replace worn or damaged parts with genuine Enerpac parts. Enerpac parts are designed to fit properly and to withstand high loads. Non-Enerpac parts may break or cause the product to malfunction.

NOTICE

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

- 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.

1.2 Crush and Pinch Point Hazard (Lock Nut Cylinders)

⚠ WARNING Never reach in between the cylinder lock nut and the top of the cylinder base. Serious personal injury can occur if cylinder is retracted and hands, fingers or other body parts are present in this area. See Figure 1.

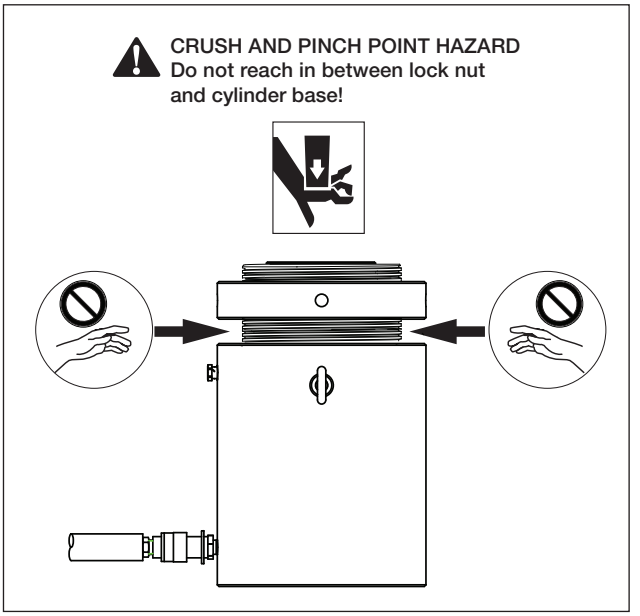


Figure 1: Crush and Pinch Point Hazard

1.3 Additional Safety References

Consult the applicable industry and/or government standards in your country or region for additional safety precautions and work rules applicable to hydraulic cylinders, jacks and other similar lifting equipment.

In the USA, refer to the following publications:

- Code of Federal Regulations - Title 29 Occupational Safety and Health Standards (U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001. www.gpo.gov).
- ASME B30.1 Standards - Jacks (American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990. www.asme.org).

In the European Union, refer to the standards and directives listed in the product's EU Declaration of Incorporation. A copy of this document is packed separately with the cylinder.

2. Compliance Statement(s)

2.1 Conformance to National and International Standards

CE UKCA These tools conform with the requirements for CE and UKCA.

Enerpac declares that the product(s) have been tested and conforms to applicable standards and the product(s) are compatible to all EU and UK Requirements.

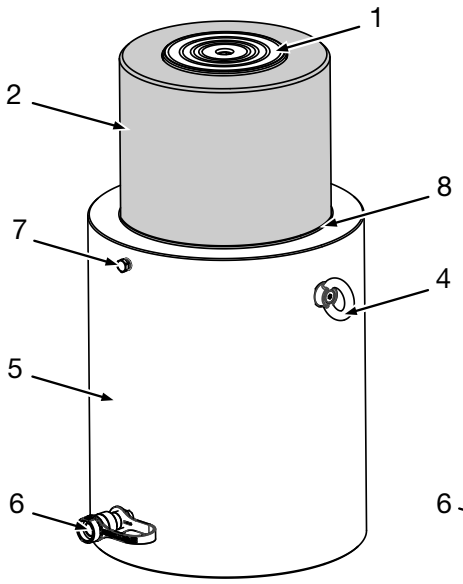
Copies of the EU Declaration as well as the UK Self-Declaration are enclosed with each shipment.

3. Features & Components

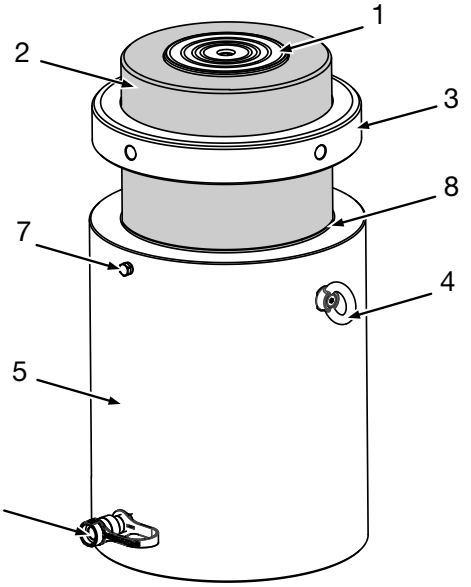
3.1 Cylinder Features

BASIC / LOCK NUT CYLINDERS

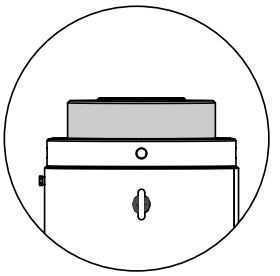
1. Saddle
2. Plunger
3. Lock Nut
4. Lifting Eye (2)
5. Cylinder Base
6. Hydraulic Coupler 3/8”-18 NPTF
7. Overflow Port
8. Max. Stroke Indicator Line
9. Tilt Saddle (optional accessory)



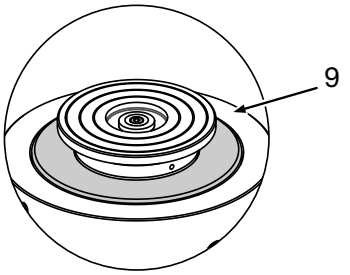
Basic Cylinder



Lock nut Cylinder

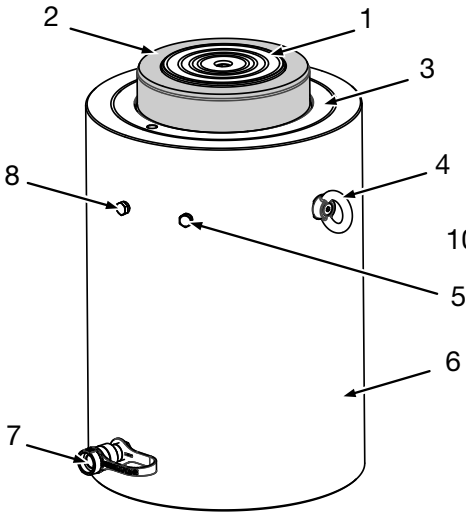


LOCK NUT TIGHTENED (Mechanical Load Holding)

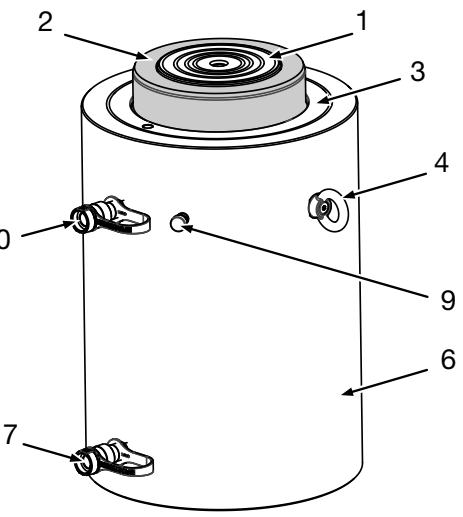


STOP RING CYLINDERS

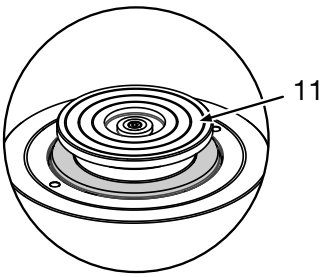
1. Saddle
2. Plunger
3. Stop Ring
4. Lifting Eye
5. Vent Port
6. Cylinder Base
7. Hydraulic Coupler, Advance 3/8”-18 NPTF
8. Plug
9. Safety Relief Valve
10. Hydraulic Coupler, Retract 3/8”-18 NPTF
11. Tilt Saddle (optional accessory)



Single-acting stop ring Cylinder



Double-acting stop ring Cylinder



3.2 Cylinder Description

Enerpac CC cylinders are an ideal solution for a wide variety of commercial and industrial lifting applications.

Type	Series	Operation	Stop Ring	Lock Nut
Basic	CCX	Single-acting, load return	No	No
Lock Nut	CCL, CPL	Single-acting, load return	No	Yes
Stop Ring	CCG	Single-acting, load return	Yes	No
	CCR	Double-acting	Yes	No

All CC cylinders are designed for 10150 psi [700 bar] maximum working pressure.

A hardened grooved saddle is standard equipment on all models. A user-installable tilt saddle is available as an optional accessory.

3.3 Basic CC Cylinders Description (CCX)

Basic CC cylinders are single-acting, with hydraulic advance and load return. To continuously hold a load, a basic cylinder must be kept pressurized to keep the piston in the advanced position.

Refer to the product data markings on the cylinder base for the capacity rating of your cylinder model. Good practice encourages using only 80% of these ratings.

Basic cylinders contain a maximum stroke indicator line and an overflow plug to avoid exceeding the maximum allowable stroke.

3.4 Lock Nut CC Cylinders Description (CCL, CPL)

Lock Nut CC cylinders are single-acting, with hydraulic advance and load return. An integral lock nut allows the load to be mechanically supported when hydraulic pressure is relieved.

Refer to the product data markings on the cylinder base for the capacity rating of your cylinder model. Good practice encourages using only 80% of these ratings.

Lock nut cylinders contain a maximum stroke indicator line and an overflow plug to avoid exceeding the maximum allowable stroke.

3.5 Stop Ring Cylinders Description (CCG, CCR)

Single-acting stop ring CC cylinders (CCG) operate with a hydraulic advance and load return. To continuously hold a load, a basic cylinder must be kept pressurized to keep the piston in the advanced position.

Single-acting stop ring cylinders include a vent port designed to vent air from the small chamber of the cylinder.

Double-acting stop ring CC cylinders (CCR) operate with a hydraulic advance and return. The hydraulic return feature allows greater control during lowering and provides positive retraction of the plunger. Double-acting stop ring cylinders are not designed for pulling applications.

Double-acting stop ring cylinders include a retract side relief valve designed to relieve retract chamber pressure in the event that hydraulic flow is directed to the advance side of the cylinder while the retract side hose is disconnected.

The cylinder stop ring is designed to withstand the full load. However, to reduce cylinder wear, use less than full stroke and pressure when possible.

Refer to the product data markings on the cylinder base for the capacity rating of your cylinder model. Good practice encourages using only 80% of these ratings.

4. Setup

4.1 Lifting The Cylinder

CC-Series cylinders are typically equipped with two pre-installed lifting eyes. Always use both lifting eyes when hoisting the cylinder.

Lifting straps or chains must be positioned at an angle where they will not interfere with the cylinder base. Use of a spreader bar is recommended. See Figure 2.

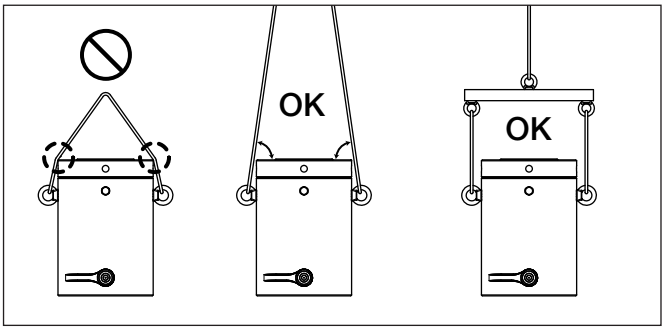


Figure 2: Lifting Arrangements (typical)

4.2 Hydraulic Pump Requirements

Hydraulic pumps are sold separately and are not included with the cylinders.

A hand-operated hydraulic pump can be used to operate a smaller cylinder. However, a larger size cylinder (or a series of coupled cylinders) will typically require the use of an electric, air or gas powered hydraulic pump.

Whichever type of pump is used, be certain that the pump reservoir is capable of holding a sufficient amount of hydraulic oil to operate the cylinder (or set of cylinders) to full extension.

If used with single-acting cylinders the pump must be equipped with a pressure release valve. If greater control is required, a three way directional control valve may be used instead. Both valve types can be either manual or remote operated.

If used with double-acting cylinders, the pump must be equipped with a four-way directional control valve. These valves may be either manual or remote operated.

The pump must also be equipped with a separate safety pressure relief valve that opens if the system working pressure exceeds 10150 psi [700 bar]. Verify that the pump safety relief valve is adjusted to the proper setting before using the pump with the cylinder(s).

4.3 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.

NOTICE

- Failure to use the correct oil type (high-quality ISO 32 hydraulic oil) may result in damage to cylinder hydraulic components and will void the product warranty.
- Be sure that the oil is clean. The oil cleanliness should be maintained to a maximum level of 18/16/13 per the ISO 4406 standard. If the 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.
- When using a hand-operated pump to power the cylinder(s), it is permissible to use a high-quality brand of ISO 15 hydraulic oil. The lower oil viscosity will result in reduced pumping effort, especially in cold weather conditions.

4.4 Tilt Saddle (optional accessory)

The Enerpac CATS Series tilt saddle is available as an optional accessory. If ordered with a stop ring cylinder, the tilt saddle is shipped separately and must be installed on the cylinder before use, as described in the following procedure.

Install the tilt saddle as described in the following steps. Refer to Figure 3 for installation details.

1. Remove the existing center bolt and standard saddle from the plunger bore.
2. Inspect the mating surfaces of the plunger bore and the tilt saddle lower half. Mating surfaces must be free of dust, dirt, moisture or corrosion.
3. Apply service-removable thread locking compound (Loctite® 243 or equivalent) to the threaded stud at the bottom of the tilt saddle.
4. By hand, gently engage the threads of the threaded stud with the threads of the tapped hole at the center of the plunger. Check for free movement. Be sure the stud is not cross-threaded.
5. Rotate the tilt saddle clockwise several turns, until it is fully seated in the plunger bore.

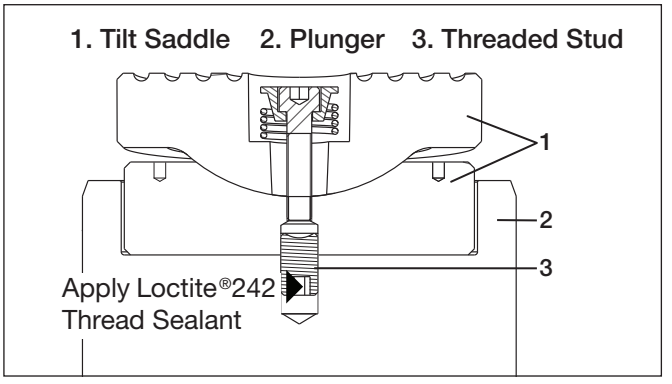


Figure 3: CATS Series Tilt Saddle Accessory (typical)

4.5 Hydraulic Connections

All single-acting cylinders are equipped with one 3/8”-18 NPTF female hydraulic coupler. For lock nut cylinders refer to Section 3.1, item 6 for location. For single-acting stop ring cylinders refer to Section 3.1, item 6 for location on the single-acting stop ring cylinders.

The double-acting cylinders are equipped with two 3/8”-18 NPTF female couplers, one for advance side hydraulic flow and one for retract side hydraulic flow. For double-acting stop ring cylinders Refer to Section 3.1, items 7 and 11 for locations.

This coupler provides hydraulic flow for both advance and retract functions. It is compatible with all Enerpac HC Series hydraulic hoses.

Be certain that all hose couplers are fully connected, so that hydraulic flow is not blocked or restricted.

All hoses, fittings and other hydraulic components in the circuit must be rated for at least 10150 psi [700 bar] operation.

NOTICE For double-acting cylinders, in both operational modes, return oil flow (from the non-pressurized side of the cylinder) must be directed back to the hydraulic reservoir. Check for proper flow before placing the equipment into operation.

4.6 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 hydraulic 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.

   [For lock nut cylinders] Verify that the lock nut is positioned at the top of the plunger to allow the plunger to be fully retracted during the air removal process.

⚠ WARNING The basic or lock nut cylinder does NOT include a stop ring. SLOWLY advance the cylinder plunger during the next step. The plunger may be hydraulically ejected from the cylinder base if it is advanced too far. Serious personal injury, high pressure oil leakage and property damage could result.

3. 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.

   [For single-acting cylinders] Manually push the plunger to retract it into the cylinder base. Use of a hydraulic pump equipped with a vacuum valve will help retracting the plunger.
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.

4.7 Cylinder Base Support

Be certain to provide adequate support for the cylinder base. All cylinders require a flat and stable lifting surface that is capable of supporting the load without settling. A steel plate or steel bars of appropriate size should be placed between the cylinder base and the ground or other lifting surface. See Figure 4.

⚠ CAUTION Use of cylinders on surfaces such as sand, mud or dirt may result in loss of load and/or damage to cylinder.

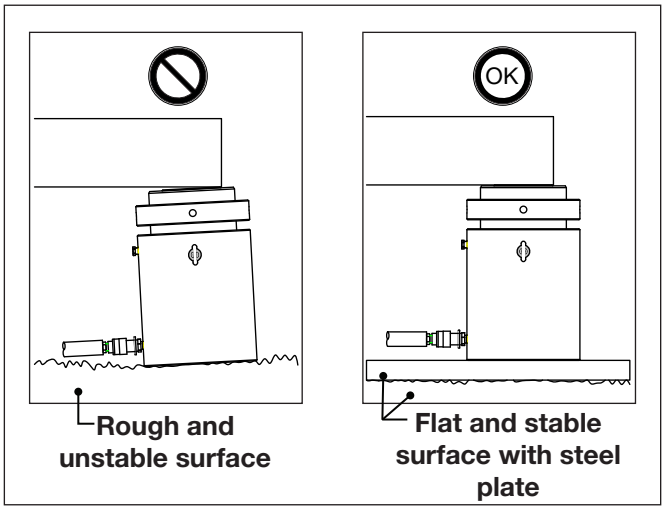


Figure 4: Cylinder Base Support

4.8 Avoiding Side Load

Plan ahead to eliminate the presence of side load forces (offset loading) when using hydraulic cylinders. Side load can occur as a result of one or more of the following conditions:

• An eccentric load on the plunger. • A horizontal load on a structure. • A shifting center of gravity. • Structure and/or cylinder misalignment. • Non-synchronized lifting actions. • Non-stable cylinder base support.

It is understood that some side load will occur in many lifting situations. However, the user should do everything possible to minimize or eliminate this condition.

The possibility of side load can be reduced by ensuring that the cylinder base is located on a flat and hard surface, capable of supporting the cylinder and the load without settling.

To help reduce the effects of side load that cannot be eliminated, use of the CATS Series tilt saddle is strongly recommended.

The CATS series tilt saddle helps compensate for initial misalignment of the load and the saddle surface. It reduces saddle edge loading, which can result in an undesirable off-center load being applied to the plunger. This item is available as an optional accessory for all cylinders. Refer to Section 4.4 for additional information.

5. Operation

Operation procedures will vary, depending on hydraulic pump type, valve configuration and other factors. For detailed operating instructions and related information, refer to the instruction sheet included with your pump. Also follow the additional instructions and precautions contained in sections 5.1 and 5.2 of this manual.

If using multiple double-acting stop ring cylinders: without load, verify that all plungers advance and retract in the same direction when the control valve is shifted. If necessary, relieve pressure and properly reconnect any reversed hydraulic hoses.

NOTICE It is mandatory that the operator has a full understanding of all instructions, safety precautions and applicable safety regulations before operating any high force hydraulic equipment. If questions or concerns, contact your local Enerpac Distributor or Authorized Service Center.

5.1 Basic (CCX) and Lock Nut (CCL, CPL) Cylinders

5.1.1 Operating Precautions

⚠ WARNING

Failure to observe the following instructions and precautions could result in serious personal injury, oil leakage and/or property damage.

- Basic and Lock nut cylinders are NOT equipped with a stop ring. Use these cylinders only in the vertical position with the plunger pointing upwards.
- Advance the plunger slowly. Immediately stop advancing the plunger if the maximum stroke indicator appears or if any oil begins flowing from the plunger stroke limiter port.
- Use extreme caution when using high oil flow pumps with basic or lock nut cylinders. The plunger may advance more quickly than expected.
- Stay clear of pinch point area between lock nut and cylinder base at all times (refer to Section 1.2 for additional details).

NOTICE It is mandatory that the operator has a full understanding of all instructions, safety precautions and applicable safety regulations before operating any high force hydraulic equipment. If questions or concerns, contact your local Enerpac Distributor or Authorized Service Center.

5.1.2 Maximum Stroke Indicator Line and Plunger Stroke Limiter Port

The cylinder plunger contains a maximum stroke indicator line. When this line becomes visible, the plunger has reached its maximum allowable stroke. See Figure 5, item A.

The plunger stroke limiter port (or “overflow port”) is located near the top of the cylinder base. This port is a safety feature, designed to vent hydraulic oil from the cylinder if the plunger exceeds the cylinder’s maximum allowable stroke. See Figure 5, Item B.

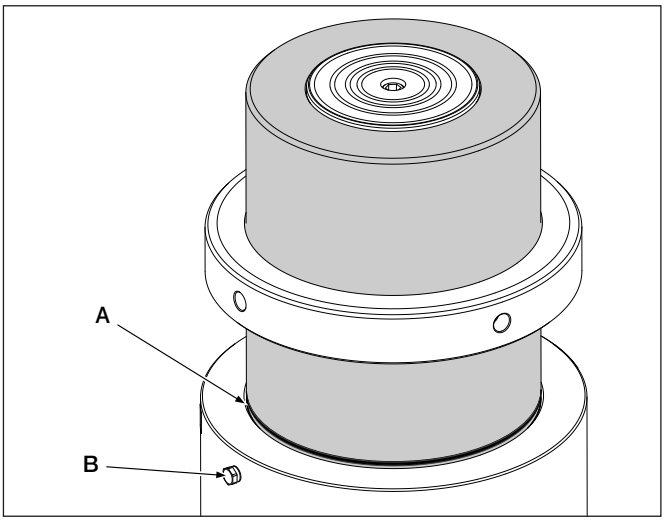


Figure 5: Maximum Stroke Indicator Line (A) and Plunger Stroke Limiter Port (B)

⚠ WARNING

Failure to observe the following instructions and precautions could result in catastrophic failure, erratic operation, high pressure oil leakage and/or damage to cylinder. Death or serious personal injury could result.

STOP advancing the plunger immediately. . .

- If the maximum stroke indicator line becomes visible.
- If oil flow occurs at the plunger stroke limiter port.

Advancing the cylinder an additional amount could result in the plunger being hydraulically ejected from the cylinder base, especially if the plunger is advanced quickly.

The plunger stroke limiter port contains a specially designed orifice fitting. Never cover or obstruct the orifice fitting passage. Never operate the cylinder with the orifice fitting removed. Never install a pipe plug or any other hydraulic fitting in place of the orifice fitting.

5.1.3 Basic Cylinders (CCX) Instructions

To advance: Operate pump and valve so that pressurized oil flow is directed in a controlled rate from the pump reservoir to the cylinder coupler.

To hold the load: Stop the pump and hold the pressure constant.

To retract: The plunger will return to its initial position by load-return. Note that additional hydraulic components may be required to control the rate at which the plunger retracts under load.

NOTICE Basic cylinders DO NOT contain a plunger return spring. External force will be required to fully retract the plunger if it is not under load. Use of a hydraulic pump equipped with a vacuum valve will help retracting the plunger.

5.1.4 Lock Nut Cylinders (CCL, CPL) Instructions

⚠ WARNING To prevent serious personal injury, keep hands, fingers and other body parts clear of pinch point area between lock nut and cylinder base during cylinder operation (refer to Section 1.2 for additional details). Be certain that plunger is not moving when tightening or loosening lock nut.

To advance: Operate pump and valve so that pressurized oil flow is directed in a controlled rate from the pump reservoir to the cylinder coupler.

To hold the load: Tighten the lock nut until it is snug against the top edge of the cylinder base. This will mechanically prevent the plunger from retracting when hydraulic pressure is relieved.

To loosen lock nut: Advance the plunger about 1/4 inch [6 mm] to remove any weight from the lock nut. Then, loosen the lock nut using a tommy bar of appropriate diameter.

To retract: Be sure that the locknut has been loosened a sufficient amount of turns, so that the plunger can be retracted the desired amount. The plunger will return to its initial position by load-return. Note that additional hydraulic components may be required to control the rate at which the plunger retracts under load.

NOTICE Lock nut cylinders DO NOT contain plunger return spring. External force will be required to fully retract the plunger if it is not under load. Use of a hydraulic pump equipped with a vacuum valve will help retracting the plunger.

5.2 Stop Ring Cylinders (CCG, CCR)

5.2.1 Single-Acting Stop Ring Cylinders (CCG) Instructions

To advance: Operate pump and valve so that pressurized oil flow is directed in a controlled rate from the pump reservoir to the advance coupler of the cylinder.

To retract: The plunger will return to its initial position by load-return. Note that additional hydraulic components may be required to control the rate at which the plunger retracts under load.

NOTICE Single-acting stop ring cylinders DO NOT contain plunger return spring. External force will be required to fully retract an single-acting stop ring cylinder if it is not under load. Use of a hydraulic pump equipped with a vacuum valve will help with plunger retraction.

5.2.2 Double-Acting Stop Ring Cylinders (CCR) Instructions

To advance: Operate pump and valve so that pressurized oil flow is directed from the pump reservoir to the advance coupler of the cylinder.

To retract: Operate pump and valve so that pressurized oil flow is directed from the pump reservoir to the retract coupler of the cylinder. Note that additional hydraulic components may be required to control the rate at which the plunger retracts under load.

5.2.3 Vent Port (Single-Acting Stop Ring Cylinders)

On single-acting stop ring models, a built-in vent port provides vacuum relief and pressure equalization for the cylinder plunger cavity. The vent port is located near the top of the cylinder base. See Section 3.1, item 5.

The plug is designed to vent air from the small chamber of the cylinder. It includes a filter to avoid dirt getting inside the cylinder.

5.2.4 Retract Side Safety Relief Valve (Double-Acting Stop Ring Cylinders)

Double-acting stop ring models include a retract side safety relief valve. It is located near the top of the cylinder base. See Section 3.1, item 9.

The valve is designed to relieve retract chamber pressure in the event that hydraulic flow is directed to the advance side of the cylinder while the retract side hose is disconnected. It is factory set at approximately 862-896 bar [12500-13000 psi].

⚠ WARNING Do not remove, alter or disable the retract side safety relief valve. Do not readjust the valve setting. Failure to observe this instruction may result in possible catastrophic failure of the cylinder. Serious personal injury could result.

5.2.5 Relieving Trapped Pressure

Hydraulic pressure can sometimes become trapped within a hydraulic cylinder. 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 (available from your Enerpac distributor) 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.

6. Inspection, Maintenance & Storage

Enerpac recommends the following steps are taken for the correct maintenance and storage of the CC Cylinders.

- Periodically check the hydraulic system for loose connections leaks and obvious problems. Replace any damaged components immediately.
- Monitor the hydraulic oil temperature during operation. Do not exceed oil temperatures above 150°F [65°C].
- Install dust caps and plugs on all hydraulic couplings after the hydraulic hose is disconnected from the cylinder.
- Keep all hydraulic components clean.
- Periodically check that the orifice at the plunger stroke limiter port is free of dirt or other obstructions.
- Periodically check the tilt saddle (if equipped) for free movement. If required, disassemble, clean and lubricate the tilt saddle. Use white lithium grease.
- Change the hydraulic oil at the recommended interval shown in the pump instruction sheet. Change the oil immediately if contamination is suspected.
- Store cylinders in the vertical 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 your 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.

7. 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.

Troubleshooting Guide		
Symptom	**Possible Cause**	**Solution**
1. Plunger will 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 4.3.
	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.
2. Plunger advances only part way.	a. Oil level in pump is low.	Add oil to pump reservoir as required. See Section 4.3.
	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 4.6.
	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. Loose connection.	Tighten or repair connection.
	b. Oil flowing from plunger stroke limiter port. (plunger has exceeded maximum stroke)	Stop advancing plunger immediately when maximum stroke indicator line appears.
	c. Worn or damaged cylinder seals.	Repair or replace cylinder.
	d. Internal cylinder damage.	Repair or replace cylinder.
7. Plunger will 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. Lock nut not loosened.	Loosen lock nut a sufficient amount of turns.
	d. Pump reservoir is overfilled.	Drain oil from pump reservoir as required.
	e. Improper hose connections.	Check hose connections.
	f. Narrow hose restricting oil flow.	Replace with larger diameter hose.
	g. Cylinder plunger binding and/or internal damage.	Repair or replace cylinder.
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.

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