

L2058 Rev. C 03/12

Index:

| | |
|-----------------|-------|
| English..... | 1-9 |
| Deutsch..... | 14-20 |
| Français..... | 21-27 |
| Español..... | 28-34 |
| Italiano..... | 35-41 |
| Nederlands..... | 42-48 |

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.



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. The cylinders are designed for a max. pressure of 350 bar [5,000 psi]. Do not connect a jack or cylinder to a pump with a higher pressure rating.



DANGER: 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. Do not remove relief valve.



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.



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.

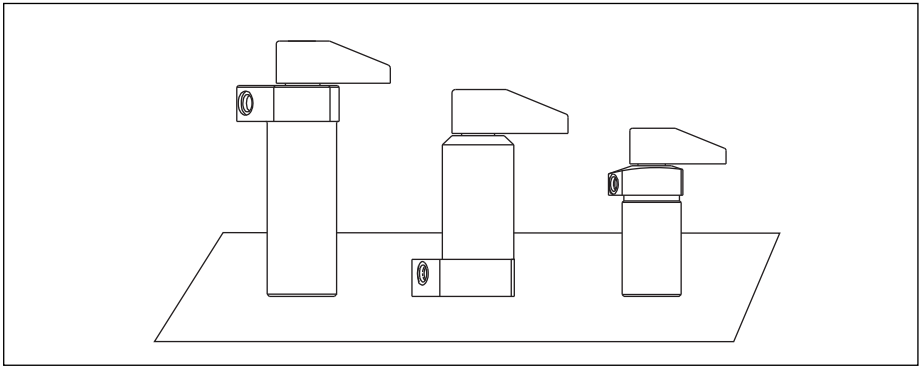


WARNING: Immediately replace worn or damaged parts by genuine ENERPAC parts. Standard grade parts will break causing personal injury and property damage. ENERPAC parts are designed to fit properly and withstand high loads.

3.0 DESCRIPTION

These swing cylinders are designed to swing 90° in a clockwise or counter-clockwise direction. They can also be used in straight clamping applications. Single-acting and double-acting swing cylinders are available.

Clamp arms are not supplied with cylinders. Clamp arms can be purchased separately or made according to the specifications on page 13.



| Model Number Code | | | | | | |
|--------------------|---|--|--|--------------------------|------------|-----------|
| 1 | 2 | 3 | 4 | 5 | 6 | Optional |
| S = swing cylinder | T = threaded body U = upper flange L = lower flange | R = right swing L = left swing S = straight (no swing) | S = single-acting D = double-acting | 2 = 2,2 kN 5 = 5,6 kN | 2 = metric | V = Viton |

4.0 PRELIMINARY INFORMATION

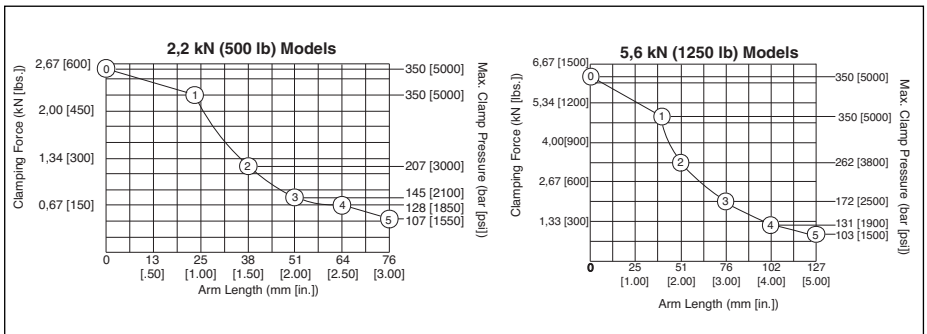
IMPORTANT: Failure to read and follow these instructions may lead to system malfunction or product failure, and could invalidate your warranty.

- (1) High flow rates can lead to excessive cylinder speed which can cause cylinder damage. Hydraulic pressure and cylinder speed must be adjusted to match the length of clamp arm. The clamping force also varies with the length of the clamp arm. Refer to page 2 for operating specifications.
- (2) Flow controls with return checks should be used to reduce swing cylinder speed to the recommended rate. The return checks help minimize back pressure that could lead to an unclamp malfunction on single-acting systems.
- (3) When using single-acting swing cylinders, limit the return flow back pressure to 3,5 bar (50 psi) maximum. Large diameter tubing (10 mm O.D. or larger) and flow controls with free flow return checks help minimize back pressure. Consult Enerpac for proper system design.
- (4) Excessive return flow back pressure can also damage double-acting swing cylinders. Limit the return flow back pressure to 42 bar (600 psi) maximum. Double-acting systems should be set up for a metered-in with reverse free flow in the clamp port.
- (5) Clamping of the part should occur at the midpoint of the vertical travel. No clamping of part shall occur while the swing clamp is turning. Clamp arm should freely travel during the 90° rotation (avoid contact with cutter heads, tools, etc.).
- (6) Attaching clamp arm to cylinder plunger must be done according to the instructions on page 6.

| Cylinder Specifications | | | |
|---|---------|---|-------------|
| Capacity [kN (lbs.)] | | 2,2 (500) | 5,6 (1250) |
| Body Style | | threaded body, lower flange, or upper flange mounting | |
| Cylinder Type | | single-acting and double-acting | |
| Hydraulic Stroke [mm (in)] | clamp | 8,1 (0.32) | 9,9 (0.39) |
| | total | 16,5 (0.65) | 22,6 (0.89) |
| Effective Area [cm ² (in ²)] | clamp | 1,22 (0.19) | 1,81 (0.28) |
| | unclamp | 1,55 (0.24) | 3,81 (0.59) |
| Oil Capacity [cm ³ (in ³)] | clamp | 4,59 (0.28) | 10,3 (0.63) |
| | unclamp | 9,67 (0.59) | 20,2 (1.23) |

| Operating Specifications — Maximum Flow Rate Chart | | | | | | |
|--|----------------------------|---------------------------|----------------------|----------------------|-----------------------|-----------------------|
| Also see graphs below. | | | | | | |
| 2,2 kN (500 lb) — Maximum Clamp Arm Length is 76 mm (3") | | | | | | |
| Arm Length [mm (in)] | 25 (0.97) straight pull | 38 (1.5) standard arm | 51 (2.0) extended | 64 (2.5) extended | 76 (3.0) extended | extended |
| Max. Flow [cc/min (in ³ /min)] | 197 (12) | 197 (12) | 98 (6) | 98 (6) | 98 (6) | 98 (6) |
| Max. Pressure [bar (psi)] | 350 (5000) | 350 (5000) | 207 (3000) | 145 (2100) | 128 (1850) | 107 (1550) |
| Clamping Force [kN (lbs)] | 2,6 (585) | 2,2 (500) | 1,2 (275) | 0,8 (175) | 0,7 (150) | 0,5 (110) |
| 5,6 kN (1250 lb) — Maximum Clamp Arm Length is 127 mm (5") | | | | | | |
| Arm Length [mm (inches)] | straight pull | 40 (1.58) standard arm | 51 (2.0) extended | 76 (3.0) extended | 102 (4.0) extended | 127 (5.0) extended |
| Max. Flow [cc/min (in ³ /min)] | 410(25) | 410 (25) | 197 (12) | 197 (12) | 197 (12) | 197 (12) |
| Max. Pressure [bar (psi)] | 350 (5000) | 350 (5000) | 262 (3800) | 172 (2500) | 131 (1900) | 103 (1500) |
| Clamping Force [kN (lbs)] | 6,2 (1390) | 5,0 (1100) | 3,3 (750) | 2,0 (450) | 1,2 (275) | 0,9 (200) |

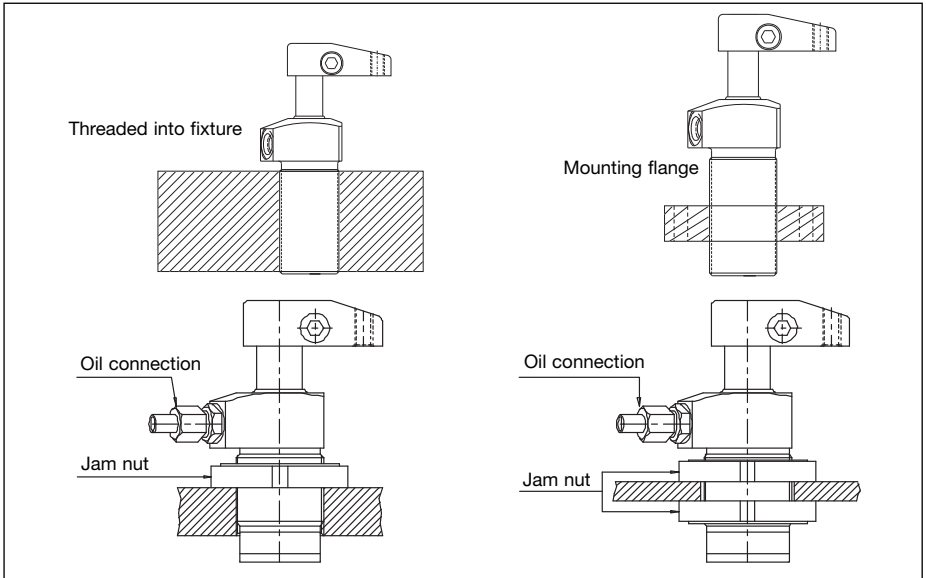
Clamping Force vs Arm Length Graphs



5.0 MOUNTING SPECIFICATIONS

5.1 Mounting Threaded Body Cylinders

Threaded body cylinders can be threaded into a tapped hole, secured to the fixture using a mounting flange, threaded into the fixture and secured with a jam nut, or mounted through a clearance hole and secured with jam nuts. See illustrations below.



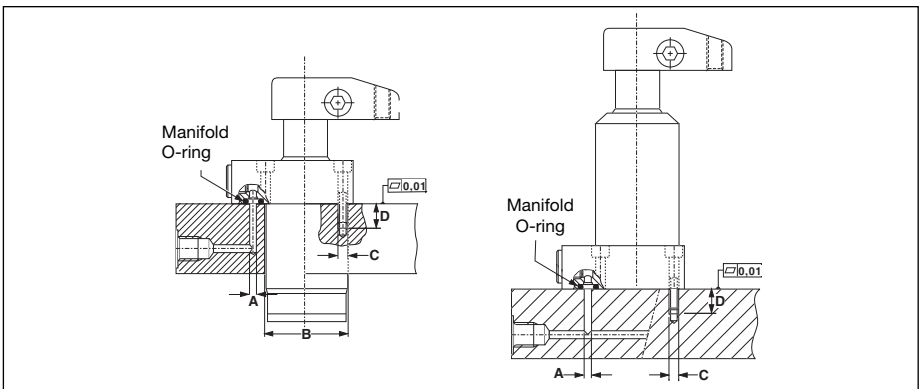
When a threaded body style swing cylinder is being installed in a fixture, the thread engagement should be no less than the thread engagement for the standard Enerpac mounting flange. If a cylinder is being mounted using just the lower portion of the threads, the engagement should be increased for additional support. See table below for minimum thread engagement.

| Cylinder Capacity | | Minimum Thread Engagement | |
|-------------------|---------|---------------------------|------|
| 2,2 kN | 500 lb | 13 mm | .50" |
| 5,6 kN | 1250 lb | 13 mm | .50" |

5.2 Mounting Upper and Lower Flange Cylinders



WARNING: The fixture must be capable of withstanding 350 bar (5000 psi) hydraulic working pressure when the cylinders are manifold mounted.



| Manifold Specifications | | | | | | |
|-------------------------|----------------------------------|------------------------------|-----------------------|---------------------------|---------------------------------|--|
| Cylinder Capacity | Max. Oil Channel Diameter Ø A | Fixture Hole Diameter Ø B | Mounting Threads C | Minimum Thread Depth D | Lubricated Mounting Bolt Torque | Manifold O-Ring Dimensions I.D. x w |
| 2,2 kN 500 lb | 4 mm 0.156" | 1.15 ± .03 | M5 | 12 mm 0.473" | 4,5-5,4 Nm 40-48 in-lbs | 6,07 x 1,78 mm 0.239 x 0.070" |
| 5,6 kN 1250 lb | 4 mm 0.156" | 1.42 ± .03 | M6 | 15 mm 0.591" | 12,2-14,9 Nm 9-11 ft-lbs | 7,65 x 1,78 mm 0.301 x 0.070" |

Before a swing cylinder can be manifold mounted, the port screw plugs and copper gaskets must be removed.

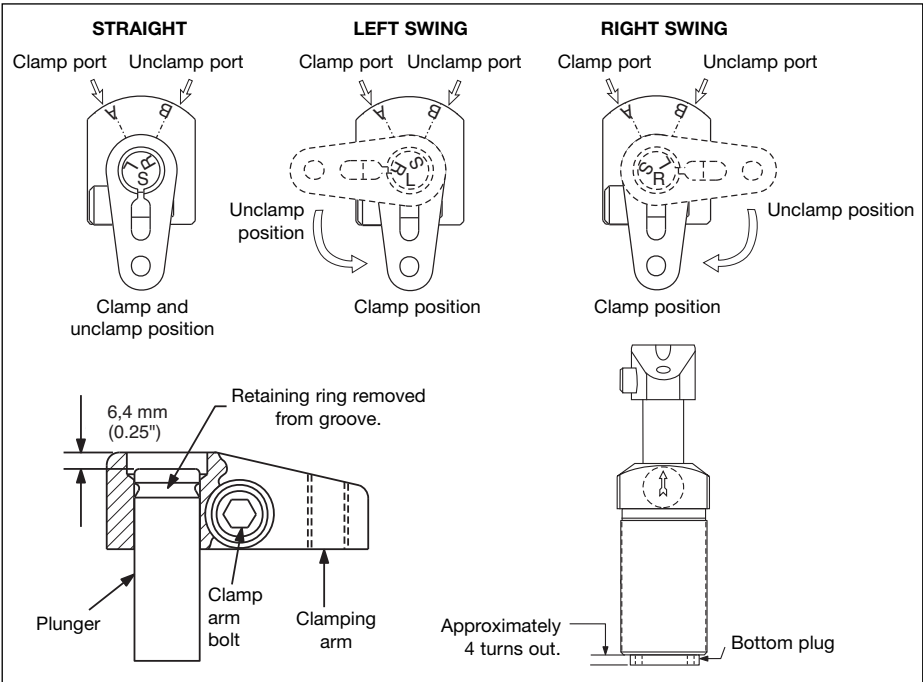
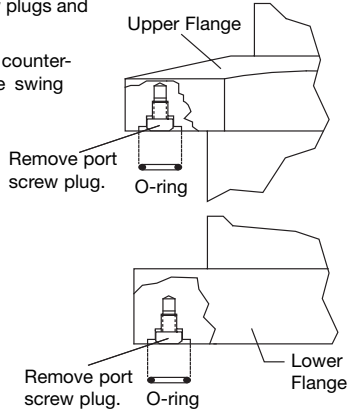
The o-rings provided should be lubricated and installed in the counter-bore around the port prior to mounting and bolting down the swing cylinder.

Be sure that the o-ring does not get pinched or damaged during mounting as leakage could result. To prevent leakage from the manifold mounting, provide a fixture mounting surface with flatness within 0,08 mm (0.003 in.) and a surface roughness not to exceed Ra 1,6.

6.0 INSTALLATION

These Swing Cylinders are designed so that you can set the position of the clamp arm after mounting the cylinder. If you need to change the rotation direction, do it before mounting the cylinder.

6.1 Changing Plunger Rotation (if needed)



Change plunger rotation by lining up the letter on top of the plunger with the arrow on the side of the cylinder opposite the ports. To change rotation, refer to illustrations and follow procedure below. You will need a spanner wrench.

1. Position the arm on the plunger to provide a handle to grasp for moving the plunger.
 - (a) Release the clamp arm bolt.
 - (b) Remove the retaining ring and slide the clamp arm down the plunger until the top of the arm is 6 mm (0.25") from the top surface of the plunger.
 - (c) Tighten the clamp arm bolt. DO NOT discard the retaining ring.
2. Place spanner wrench on bottom cylinder plug and turn the plug (facing you) counter-clockwise 4 turns.

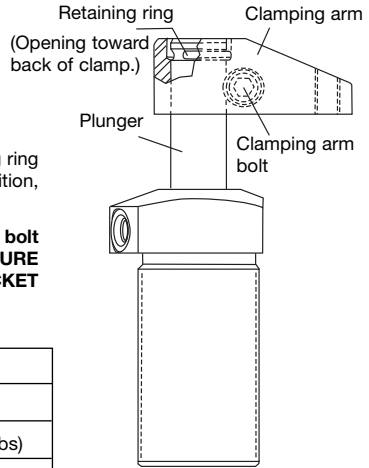
NOTE: Single-acting cylinders may need the bottom plug to be rotated more than 4 turns to help relieve return spring tension.
3. Push down on the plunger and rotate it to line up the desired letter (L, R, S) with the arrow on the side of the cylinder.
4. Once the letter and arrow are lined up, pull the plunger up, turn the bottom plug back in (clockwise) 4 turns, and tighten firmly.

6.2 Attaching Clamp Arm

1. Remove the retaining ring from the top of the plunger.
2. Slide the clamp arm down over the plunger and use a pliers to push the retaining ring back onto the plunger groove. Orient the retaining ring so the retaining ring gap will face the back of the clamp arm. See illustration.
3. Move the clamp arm up until it is firmly against the retaining ring and in the desired position. While maintaining this position, torque the clamp arm bolt to specification listed below.



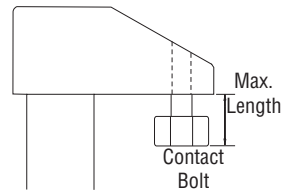
CAUTION: Inadequate torquing of the clamp arm bolt could cause the arm to slip during operation. BE SURE TO USE QUALITY GRADE 8 (12.9 DIN 912) SOCKET HEAD CAP SCREWS (supplied with standard clamp arms).



| Clamp Arm Bolt Torque | |
|-----------------------|-----------------------------------|
| Cylinder Capacity | Lubricated Torque |
| 2,2 kN (500 lbs) | 16,3 to 20,3 Nm (12 to 15 ft-lbs) |
| 5,6 kN (1250 lbs) | 32,5 to 39,3 Nm (24 to 29 ft-lbs) |

6.3 Arms for Upper Flange Body Style

To use the upper flange body style cylinders, you have to be sure that the contact bolt will clear the upper flange during operation. The clamp arm must be long enough for the contact bolt to clear the upper flange as the arm swings down. Clearance problems are most common when the final clamping position is at the side of the cylinder and the contact bolt must pass by the front or back of the upper flange as it swings down. You may need to use the longer, CAL Series clamp arm for these applications.



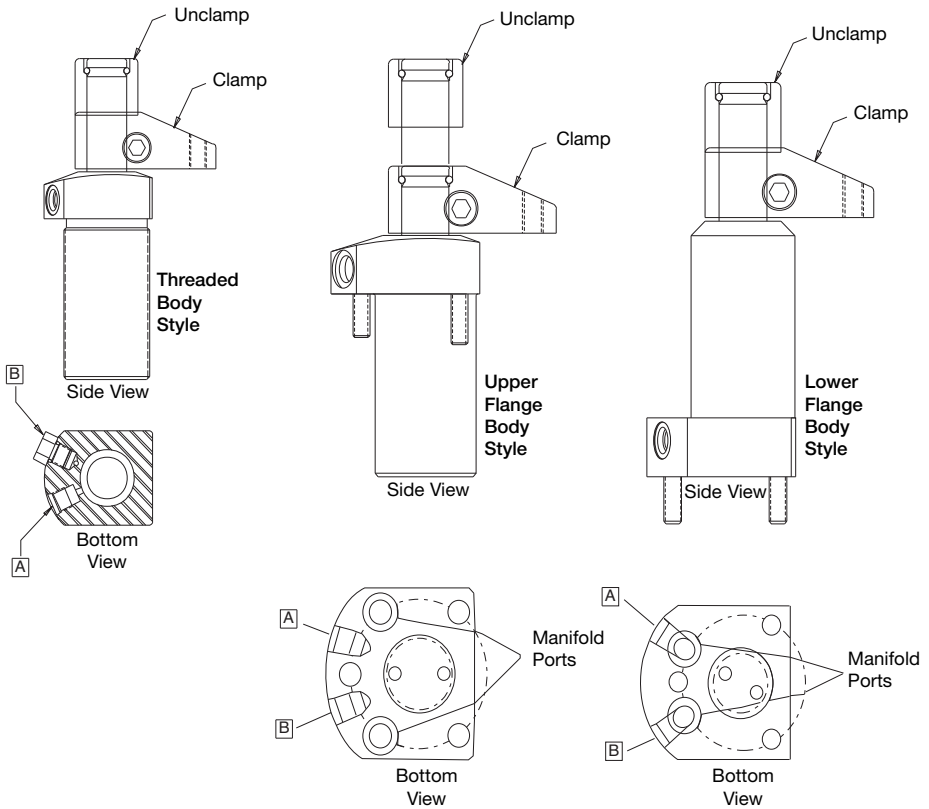
| Maximum Contact Bolt Length | |
|--|-----------------|
| Cylinder Capacity | Maximum Length |
| 2,2 kN (500 lbs) | 19,1 mm (0.75") |
| NOTE: Maximum length provided here is for 2,2 kN upper flange models only. | |

6.4 Hydraulic Connections

To make port connections, install fittings rated for 350 bar (5000 psi). **DO NOT** use thread sealant. Sealing is accomplished by using an o-ring on the fitting boss. Lubricate the o-ring prior to assembly. When designing your hydraulic circuit, consider the factors listed in *PRELIMINARY INFORMATION* on page 2. For more information about plumbing hydraulic circuits, see your Enerpac Catalog.

| Cylinder Ports | | | |
|-------------------|----------------------|-------------------|----------------------|
| Cylinder Capacity | 350 bar BSPP Fitting | Cylinder Capacity | 350 bar BSPP Fitting |
| 2,2 kN (500 lbs) | G 1/8 | 5,6 kN (1250 lbs) | G 1/8 |

6.5 Port Identification



KEY

- A Port:
Plunger rotates 90° and clamps
- B Port:
double-acting, plunger unclamps and rotates -90°
single-acting, vent port
- Do not remove vent plug except to attach tubing. (See vent plug section.)

7.0 OPERATION

Swing cylinders rotate 90° during the first portion of the stroke, continuing without rotation for the final clamping stroke. The straight downward stroke is the clamping stroke of the cylinder. Clamping force must be applied only during the vertical travel, not during the swing motion.



CAUTION:

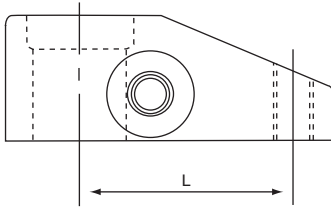
- If clamping force is applied during the rotation portion of the stroke, internal plunger damage will result.
- To ensure maximum cylinder performance and safety; be sure all hydraulic connections, hoses, and fittings are properly sealed and fully tightened.
- Be sure all items are rated to withstand system pressures. Under-rated components will not withstand higher pressure. Using under-rated components will lead to equipment damage and possible personal injury.

7.1 Vent Plug

Single-acting cylinders have a vented plug on the left side of the cylinder when you are facing the hydraulic ports. To prevent entry of chips and coolant, the vent plug must not be removed. If the vent plug is subjected to a continuous coolant flood condition, attach tubing to the port using a BSPP fitting, and run the tubing to a non-contaminated area of the fixture.

7.2 Pressure and Flow Rate

Clamp arm length (L) determines operating pressure setting and flow rate.



See *Operating Specifications — Maximum Flow Rate Chart* on page 2 for clamp arm length, pressure setting and flow rate. Set operating pressure and flow rate according to the limits established by the length of the clamp arm. Do not exceed the load-to-length pressure ratios. As the arm length increases, the clamping force and maximum operating pressure are reduced.



CAUTION: It is very important that you use the correct pressure and flow settings. Operating outside these limits will cause damage to the swing cylinder. Damage caused by exceeding rated pressure and maximum flow is NOT COVERED BY WARRANTY.

8.0 MAINTENANCE

Maintenance is required when wear or leakage is noticed. Occasionally inspect all components to detect any problem requiring service and maintenance. Enerpac offers ready-to-use Repair Parts Kits. Repair Parts Sheets are available with assembly drawing and parts list. Contact Enerpac.

IMPORTANT: Consult the Repair Parts Sheet for service information about correct assembly and disassembly. Incorrect maintenance and service such as wrong torque values may cause product malfunctions and/or personal injury.

9.0 TROUBLESHOOTING

The following information is intended to be used only as an aid in determining if a problem exists. For repair service, contact your Distributor or Authorized Enerpac Service Center.

| Problem | Possible Cause | Solution |
|---|---|---|
| 1. Cylinder will not clamp/unclamp. | A. Pump release valve open B. No oil in pump reservoir C. Air in system D. Couplers not fully tightened E. Blocked hydraulic line F. Spring broken in cylinder | A. Close pump release valve B. Fill pump reservoir C. Remove air from hydraulic system D. Retighten couplers E. Check valves, fittings, and tubing F. Replace spring |
| 2. Cylinder advances part way. | A. Oil level in pump too low B. Plunger binding normal. | A. Fill pump reservoir B. Replace damaged parts — refer to <i>Repair Parts Sheet</i> |
| 3. Cylinder clamps/unclamps slower than normal | A. Leaking connection B. Restricted hydraulic line C. Pump malfunction | A. Retighten fittings, couplers, and tubing B. Check valves, fittings, and tubing C. Refer to pump <i>Instruction Sheet</i> |
| 4. Cylinder clamps/unclamps but will not hold pressure. | A. Seals damaged B. Leaking connection C. Pump malfunction | A. Replace seals — refer to <i>Repair Parts Sheet</i> B. Retighten fittings, couplers, and tubing C. Refer to pump <i>Instruction Sheet</i> |
| 5. Cylinder leaks oil. | A. Seals damaged B. Plunger worn or damaged | A. Replace seals — refer to <i>Repair Parts Sheet</i> B. Replace damaged parts — refer to <i>Repair Parts Sheet</i> |
| 6. Clamp arm does not make swing movement. | A. Clamp arm loose B. Plunger damaged | A. Reposition and tighten clamp arm — see <i>Attaching Clamp Arm</i> B. Replace damaged parts — refer to <i>Repair Parts Sheet</i> |

Clamp Arm Machining Specifications (page 13)

See *Pressure and Flow Rate* on page 8 to correctly measure the arm length. To determine the maximum clamping force for the arm, refer to *Operating Specifications — Maximum Flow Rate Chart* on page 3.