ENERPAC
TOOLS. SERVICES. SOLUTIONS.

Instruction Sheet

Swing Cylinders - Imperial

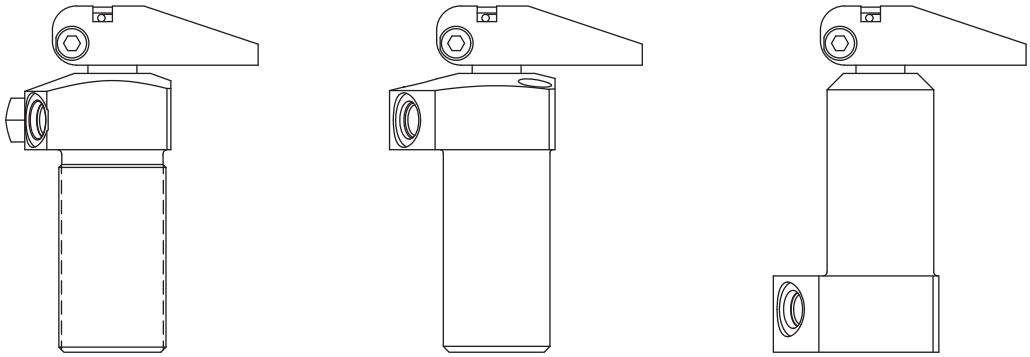
L1717 Rev. B 06/2019

IMPORTANT RECEIVING INSTRUCTIONS

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

DESCRIPTION

These swing cylinders are designed to swing 90° in a clockwise or counter-clockwise direction. 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 11.



Thread Body Style | Upper Flange Body Style | Lower Flange Body Style

Figure 1

Model Number Code							
1	2	3	4	optional	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 = singleacting D = doubleacting	L = long stroke 12 kN only	2 = 2,2 kN 5 = 5,6 kN 12 = 11,6 kN	1 = imperial	V = Viton

SPECIFICATIONS

Cylinder Specifications					
Capacity [lbs (kN)]		500 (2,2)	1250 (5,6)	2600 (11,6)	2600 (11,6) Long Stroke
Body Style		threaded body, lower flange , or upper flange mounting			upper flange mounting
Cylinder Type		single-acting and double-acting			double-acting
Hydraulic Stroke [in (mm)]	**clamp**	0.32 (8,1)	0.39 (9,9)	0.50 (12,7)	1.25 (31,8)
	total	0.65 (16,5)	0.89 (22,6)	1.12 (28,4)	1.87 (47,5)
Effective Area [in^2 (cm^2)]	**clamp**	0.19 (1,22)	0.28 (1,81)	0.63 (4,06)	0.63 (16,0)
	unclamp	0.24 (1,55)	0.59 (3,81)	1.23 (7,94)	1.23 (31,2)
Oil Capacity [in^3 (cm^3)]	**clamp**	0.28 (4,59)	0.63 (10,3)	0.71 (11,6)	1.18 (30,0)
	unclamp	0.59 (9,67)	1.23 (20,2)	1.38 (22,6)	2.30 (58,4)

Operating Specifications - Maximum Flow Rate Chart Also see graphs on page 3.						
500 lb (2,2 kN) — Maximum Clamp Arm Length is 3" (76 mm)						
Arm Length [inches (mm)]	straight pull	0.97 (25) standard arm	1.5 (38) extended	2.0 (51) extended	2.5 (64) extended	3.0 (76) extended
Max. Flow [in^3/min (cc/min)]	12 (197)	12 (197)	6 (98)	6 (98)	6 (98)	6 (98)
Max. Pressure [psi (bar)]	5000 (350)	5000 (350)	3000 (207)	2100 (145)	1850 (128)	1550 (107)
Clamping Force [lbs (kN)]	585 (2,6)	500 (2,2)	275 (1,2)	175 (0,8)	150 (0,7)	110 (0,5)

1250 lb (5,6 kN) — Maximum Clamp Arm Length is 5" (127 mm)						
Arm Length [inches (mm)]	straight pull	1.58 (40) standard arm	2.0 (51) extended	3.0 (76) extended	4.0 (102) extended	5.0 (127) extended
Max. Flow [in^3/min (cc/min)]	25 (410)	25 (410)	12 (197)	12 (197)	12 (197)	12 (197)
Max. Pressure [psi (bar)]	5000 (350)	5000 (350)	3800 (262)	2500 (172)	1900 (131)	1500 (103)
Clamping Force [lbs (kN)]	1390 (6,2)	1100 (5,0)	750 (3,3)	450 (2,0)	275 (1,2)	200 (0,9)

2600 (11,6 kN) — Maximum Clamp Arm Length is 6" (152 mm) (*includes long stroke version)*						
Arm Length [inches (mm)]	straight pull	2.00 (51) standard arm	3.00 (76) extended	4.00 (102) extended	5.00 (127) extended	6.00 (152) extended
Max. Flow [in^3/min (cc/min)]	100 (1639)	100 (1639)	50 (820)	50 (820)	50 (820)	50 (820)
Max. Pressure [psi (bar)]	5000 (350)	5000 (350)	3400 (235)	2600 (179)	2000 (138)	1700 (117)
Clamping Force [lbs (kN)]	3100 (13,8)	2600 (11,6)	1600 (7,1)	1100 (4,9)	750 (3,3)	600 (2,7)

Clamping Force -v- Arm Length Graphs

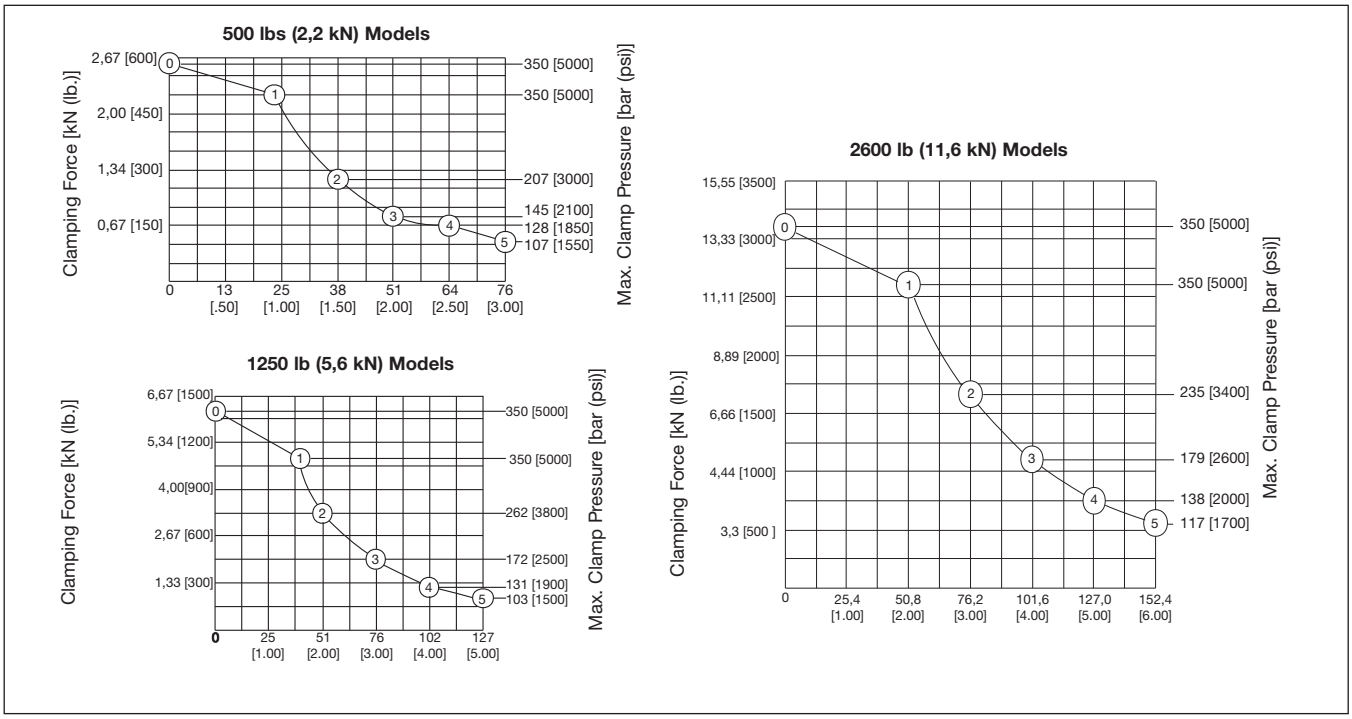


Figure 2

PRELIMINARY INFORMATION

IMPORTANT: Failure to read and follow these directions 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 the 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 cylinders, limit the return flow back pressure to 3,5 bar (50 psi) maximum. Large diameter tubing (10 mm [.39 in.] 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 the 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 7.

MOUNTING SPECIFICATIONS

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.

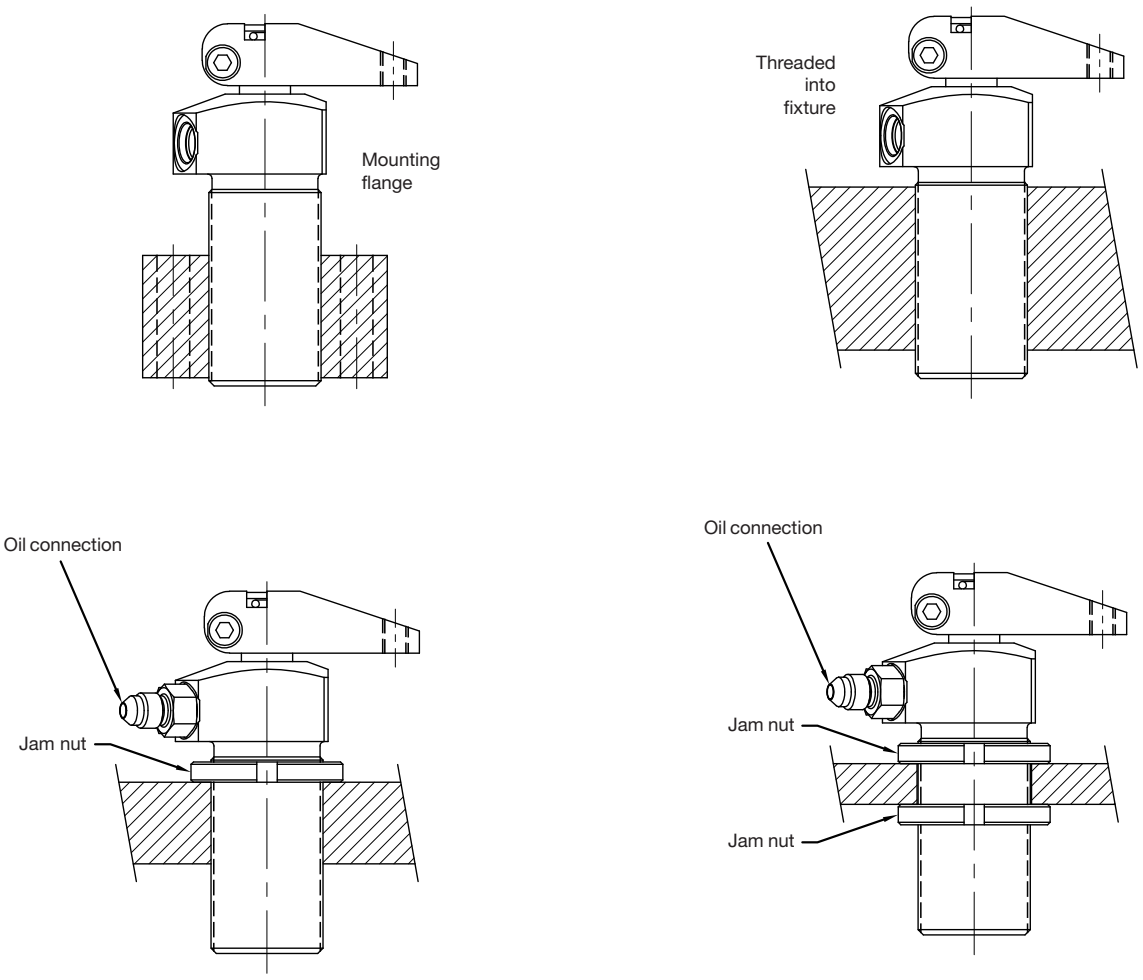


Figure 3

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	
500 lb	2,2 kN	.50"	13 mm
1250 lb	5,6 kN	.50"	13 mm
2600 lb	11,6 kN	.50"	13 mm

Mounting Upper and Lower Flange Cylinders

⚠ WARNING

The fixture must be capable of withstanding 5,000 psi (350 bar) hydraulic working pressure when the cylinders are manifold mounted.

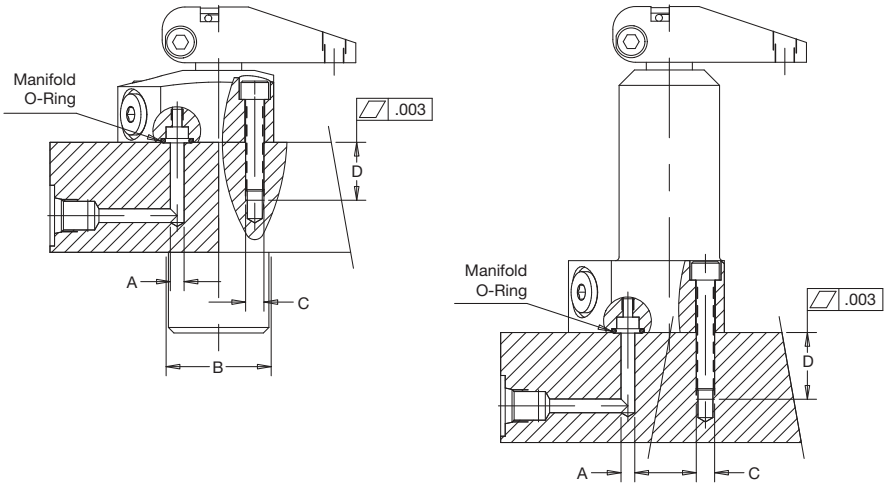


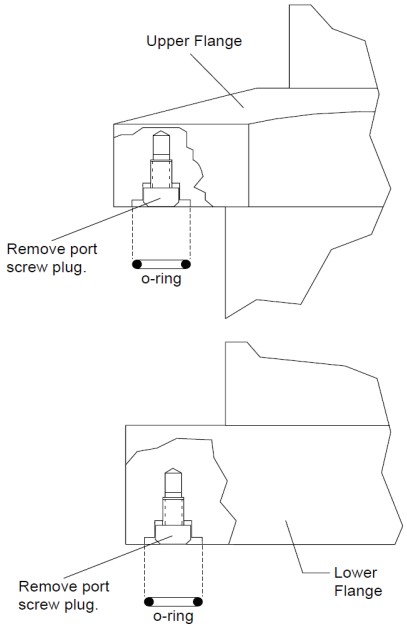
Figure 5

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**
500 lb 2,2 kN	0.156" 4 mm	1.15 ± .03	10-32 UNF	0.63" 16 mm	40-48 in-lbs 4,5-5,4 Nm	0.239 x 0.070" 6,07 x 1,78 mm
1250 lb 5,6 kN	0.156" 4 mm	1.42 ± .03	25-28 UNF	0.75" 19 mm	9-11 ft-lbs 12,2-14,9 Nm	0.301 x 0.070" 7,65 x 1,78 mm
2600 lb 11,6 kN *(incl. long stroke)*	0.156" 4 mm	1.93 ± .03	.3125-24 UNF	0.88" 22 mm	18-22 ft-lbs 24,4-29,8 Nm	.301 x .070 7,65 x 1,78 mm

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 0.003 in (0,08 mm) and a surface roughness not to exceed 32√ rms.



INSTALLATION

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

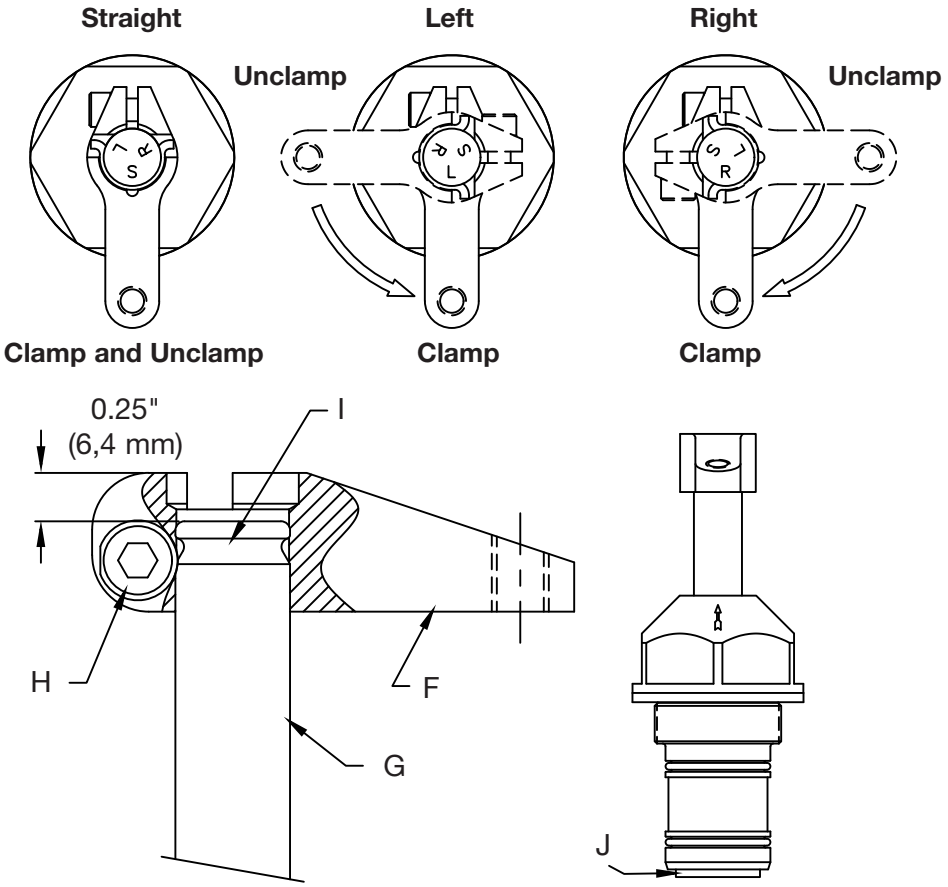


Figure 6

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 for the bottom plug.

1. Position the arm (F) on the plunger (G) to provide a handle to grasp for moving the plunger.
   (a) Release the clamp arm bolt (H).
   (b) Remove the retaining ring (I) and slide the clamp arm down the plunger until the top of the arm is 6 mm (0.25 in.) 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 (J) and turn the plug (facing you) counter-clockwise 4 turns.

NOTE: On single-acting models, you may need to turn bottom plug more than 4 turns to help relieve 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), and tighten firmly.

Clamp Arm Bolt Torque	
Cylinder Capacity	**Lubricated Torque**
500 lbs (2,2)	6 - 7 ft-lbs (8 - 9,5 Nm)
1250 lbs (5,6)	16 - 17 ft-lbs (22 - 23 Nm)
2600 lbs (11,6)	31 - 33 ft-lbs (42 - 45 Nm)

Attaching Clamp Arm

1. Remove the retaining ring (A) from the top of the plunger (B).
2. Slide the clamp arm (C) 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 or solid portion 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 (D) to specification listed below.

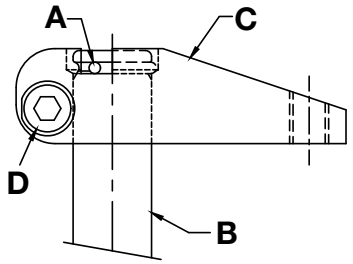


Figure 7

⚠ 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).

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.

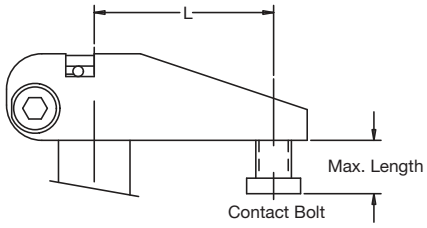


Figure 8

Maximum Contact Bolt Length	
Cylinder Capacity	**Maximum Length**
500 lbs (2,2 kN)	0.75" (19,1 mm)
NOTE: Maximum lengths provided here are for 300 and 500 lbs upper flange models only.	

Hydraulic Connections

To make port connections, install fittings rated for 5000 psi (350 bar).

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, remember to consider the factors listed in PRELIMINARY INFORMATION on page 3 of this Instruction Sheet. For more information about plumbing hydraulic circuits, see your Enerpac Production Automation Catalog.

Cylinder Ports	
Cylinder Capacity	**5000 psi SAE Fitting**
500 lbs (2,2 kN)	#2
1250 lbs (5,6 kN)	#4
2600 lbs (11,6 kN)	#4

Port Identification

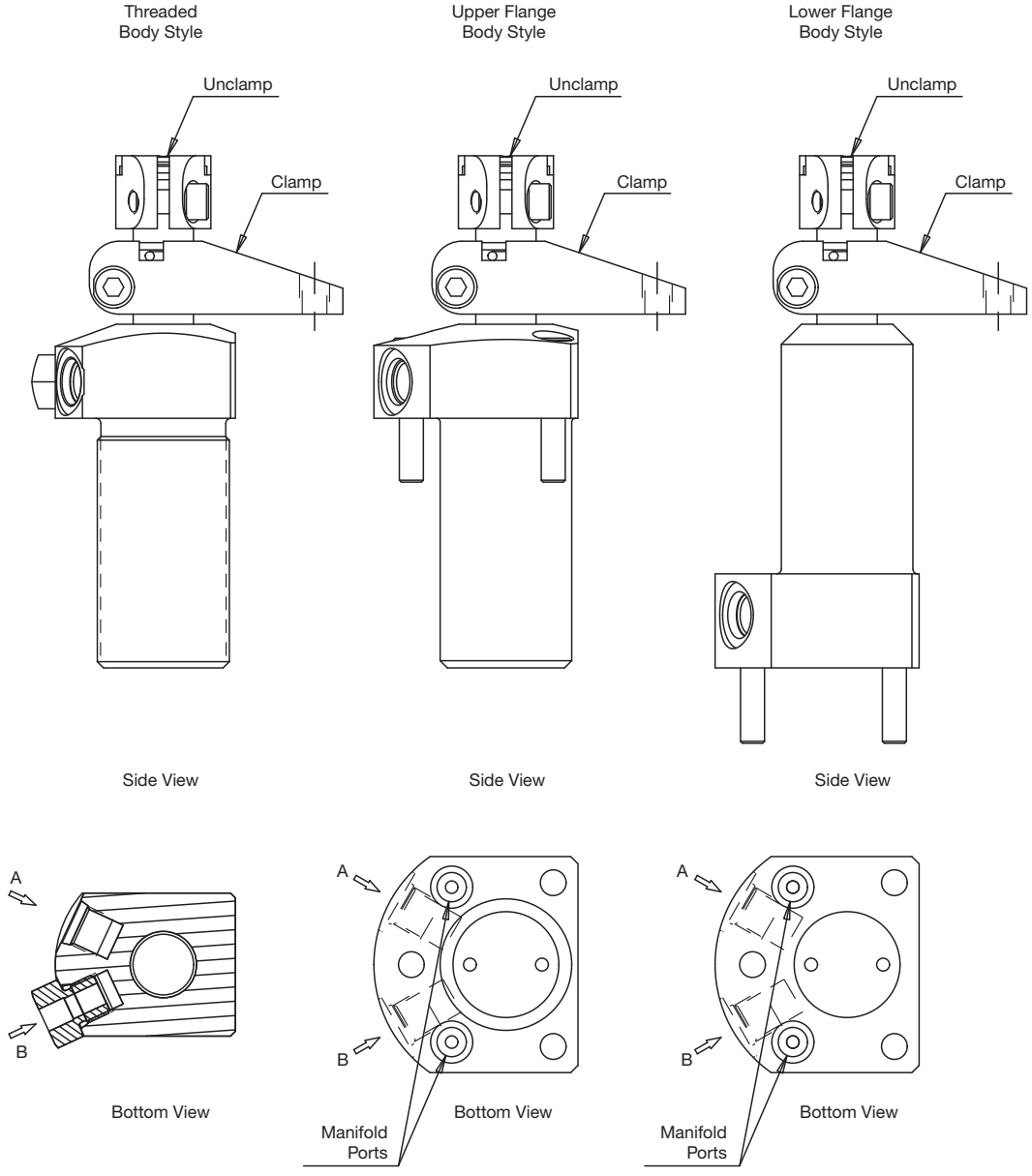


Figure 9

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 the 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.**

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 an SAE fitting, and run the tubing to a non-contaminated area of the fixture.

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.

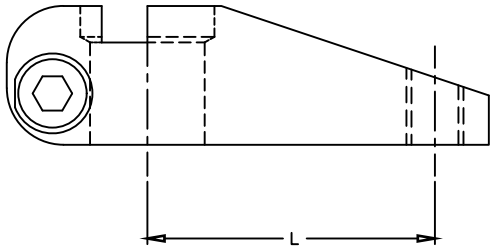


Figure 10

⚠ 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.

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 part 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 maintenace and service, such as wrong torque values, may cause product malfunctions and/or personal injury.

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.	A. Fill pump reservoir. B. Replace damaged parts —refer to Repair Parts Sheet.
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 Instruction Sheet.
4. Cylinder clamps/ unclamps but will not hold pressure.	A. Seals damaged. B. Leaking connection. C. Pump malfunction.	A. Replace seals. —refer to Repair Parts Sheet. B. Retighten fittings, couplers, and tubing. C. Refer to pump Instruction Sheet.
5. Cylinder leaks oil.	A. Seals damaged. B. Plunger worn or damaged.	A. Replace seals —refer to Repair Parts Sheet. B. Replace damaged parts —refer to Repair Parts Sheet.
6. Clamp arm does not make swing movement.	A. Clamp arm loose. B. Plunger damaged.	A. Reposition and tighten clamp arm—see Attaching Clamp Arm on page 6. B. Replace damaged parts —refer to Repair Parts Sheet.

CLAMP ARM MACHINING SPECIFICATIONS

See Pressure and Flow Rate on page 8 to correctly measure the arm length. To determine the maximum clamping force on the arm, refer to Operating Specifications — Maximum Flow Rate Chart on page 2.

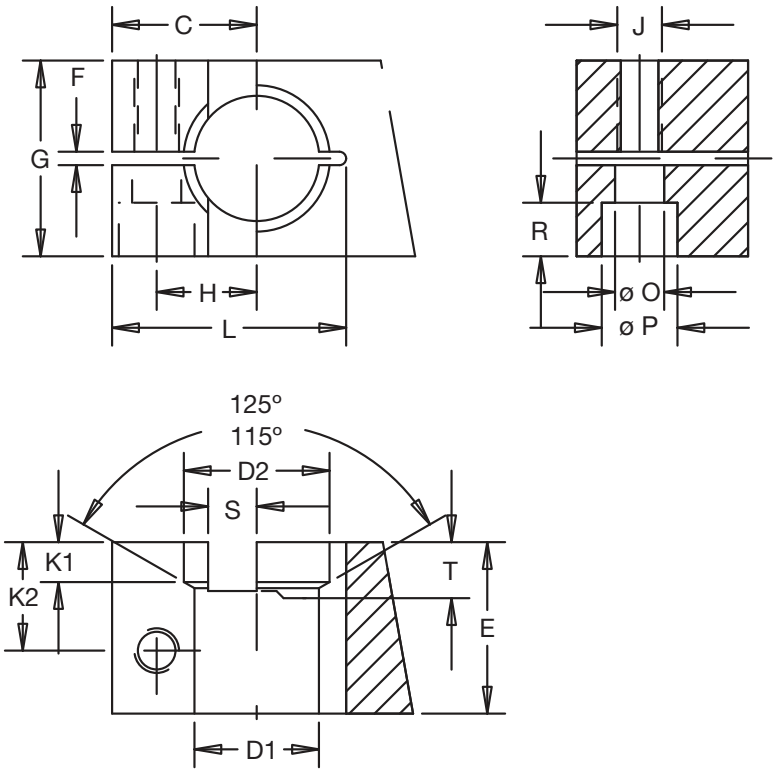


Figure 11

Clamp Force	500 lb (2,2 kN)	1250 lb (5,6 kN)	2600 lb (11,6kN)
C	.56 (14,2)	.77 (19,6)	1.01 (25,7)
D1 (Ø)	.393-.395 (10 H8)	.630-.631 (16 H8)	.876-.877 (22,24-22,27)
D2 (Ø)	.465-.475 (12,58-12,62)	.725-.745 (18,47-18,51)	1.014-1.034 (25,46-25,55)
E	.63 (16,0)	.75 (19,1)	1.18 (30,0)
F	.12 (3,0)	.12 (3,0)	.09 (2,3)
G	.63 (16,0)	1.00 (25,4)	1.38 (35,1)
H	.36 (9,1)	.52 (13,2)	.70 (17,8)
J	#10-32 UNF x .50	.250-28 UNF x .50	.312-24 UNF x .75
K1	.115-.135 (3,1-3,5)	.165-.185 (4,1-4,5)	.275-.295 (6,9-7,3)
K2	.39 (9,9)	.48 (12.2)	.80 (20,3)
L	.88 (22,4)	1.20 (30.5)	1.64 (41,7)
O (Ø)	.22 (5,6)	.28 (7,1)	.35 (8,9)
P (Ø)	.38 (9,7)	.44 (11,2)	.57 (14,5)
R	.13 (3,3)	.27 (6,9)	.37 (9,4)
S	.19 (4,8)	.25 (6,4)	.34 (8,6)
T	.16 (4,1)	.20 (5,1)	.28 (7,1)

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