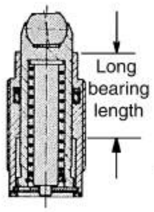
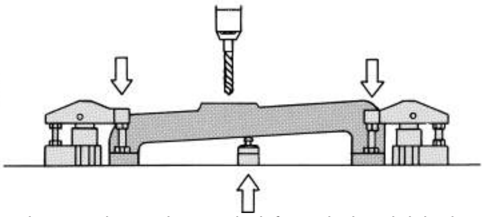
What makes Roemheld Power Workholding better than earlier hydraulic clamps?

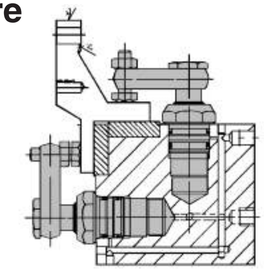
1 Designs specifically and purely for workholding





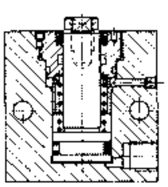
Earlier power clamping products descended from industrial jacks, pipe benders, and rams. Although these early devices (many still on the market) are fine for their original uses, they do not meet the special demands of modern workholding. For example, in a machining application, components are often subject to side loading due to cutting forces, not simply axial loads. This condition requires totally different engineering to provide sufficient bearing lengths for durability. As another example, workholding components are frequently exposed to coolant, chips, dirt, and grit, so clamps must include effective wipers and vent filters. Also, industrial cylinders converted to clamps are usually too bulky to fit easily on fixtures.

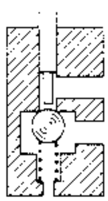
2 Compactness, with 7250-psi operating pressure

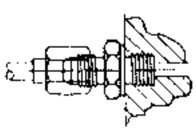


Earlier power clamps could operate at only 2000 to 3500 psi (pounds per square inch) fluid pressure. You needed large, bulky clamps with large internal cylinders to provide enough clamping force. Roemheld components are designed differently, inside and out, to fit easily on fixtures. They work comfortably even at 7250 psi, letting you use much smaller clamps to get the same clamping force. Compact Roemheld clamps open up new fixturing possibilities: you can now place clamps in tighter spots than before, and with the extra space, you can put more workpieces on a fixture (for example, six parts per cycle instead of only 4).

3 Zero-leakage sealing technology

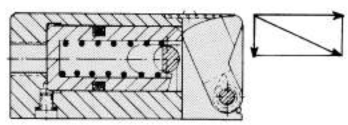


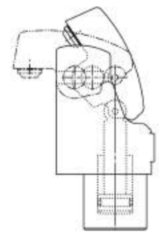




Another feature unique to Roemheld power workholding is leak-free hydraulic sealing. Zero leakage is always important for safe clamping, and is absolutely vital on portable palletized fixtures. Maintaining pressure in a closed, disconnected system requires that *all* components – clamps, valves, and fittings – be leak-free. This calls for drastic changes in sealing techniques: cylinder seals are different, poppet valves (not leaky spool valves) are used whenever possible, and all fittings use metal-to-metal sealing (straight BSPP pipe threads with knife-edge sealing, instead of leak-prone tapered pipe threads).

4 State-of-the-art product development



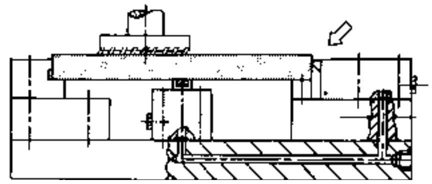


The Edge Clamps and Extending Clamps shown above are just two examples of advanced clamp designs in the Roemheld line. Both set new standards for good engineering and compact size. Our many new products and product improvements result from constant, extensive research and development. New products are field tested and proven, often for years, before they are ever offered for sale.

5 Extensive clamp sizes that follow a logical progression

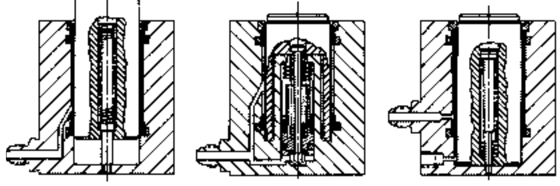
Roemheld offers a vast selection of clamp sizes and varieties, to match your requirements exactly. In fact, we offer *several times* as many catalog models as our closest competitor (with much better stock too)! Just as important, our clamp sizes follow a logical progression of clamping forces, so you can usually find a clamp that is just the right size.

6 Manifold mounting



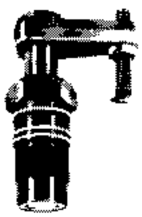
Our Roemheld line pioneered the ever-increasing use of manifold mounting: supplying fluid to clamps through passages drilled in the fixture, rather than through tubing or hoses. Manifold mounting, which requires specially designed clamps, allows designing totally "clean" fixtures without chip traps. Also, manifold mounting lets you put clamps closer together and in tighter spots, often letting you put more workpieces on a fixture.

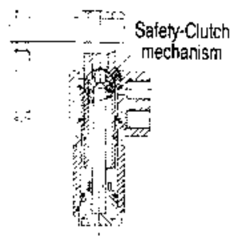
7 Work Supports



One of the most important improvements in power workholding is the work support. These components do not exert clamping force; instead, they lock off to restrain a workpiece during machining to prevent deflection and vibration. Roemheld work supports offer two major improvements: (1) drastically improved accuracy, with +/-.0002 inches repeatability, and (2) fluid-advanced and air-advanced supports. Fluid- and air-advanced versions offer significant advantages over conventional spring-loaded work supports. A spring-loaded support relies on a workpiece's weight to depress its support plunger to the proper height. While fluid pressure is off, the plunger remains in a raised position on the machine and can hamper loading and unloading. A fluid-advanced work support's plunger, on the other hand, is retracted when fluid pressure is off. Applying pressure first raises the plunger gently to the workpiece, then automatically locks it at the correct height. When pressure is released, the plunger retracts again for clear loading.

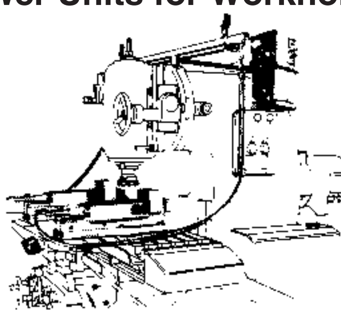
8 Swing Clamps





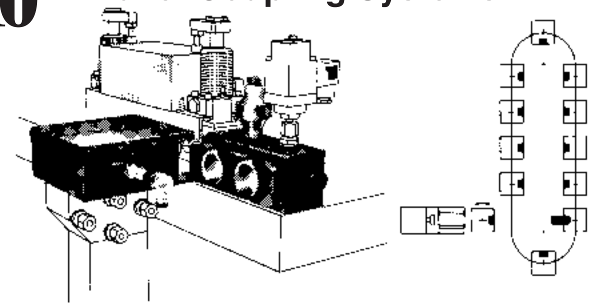
In all modesty, Roemheld Swing Clamps are by far the finest available anywhere, both in features and durability. Our proprietary safety-clutch mechanism prevents damage if the clamping arm strikes an unexpected object, such as an incorrectly loaded workpiece. The arm clutch disengages to avoid damaging the object or the clamp's helical-cam mechanism. In addition, our swing clamps incorporate a fast, totally dependable spring return, unlike our competitors'. We offer many varieties and sizes of swing clamps, including super-miniature and manifold-mounted versions.

9 Power Units for Workholding



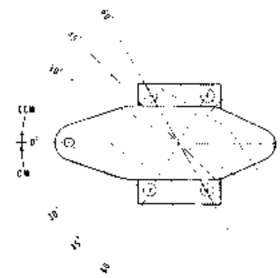
Early power-clamping systems relied either on limited-capacity air/oil intensifiers or on massive, noisy pumps for hydraulic power. Roemheld Electric and Air Power Units are totally different: they are compact, quiet power units designed especially for workholding. These turnkey units include an extremely durable pump, large fluid reservoir, clamping valves, switches, gauges, and numerous safety devices. Workholding power units are becoming a standard accessory on milling machines and machining centers.

10 Pallet Coupling Systems



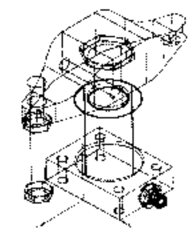
Power clamping on portable palletized fixtures is becoming quite common, yet presents some special challenges, such as maintaining full clamping pressure while the fixture is separated from its power source. We offer a wide choice of solutions, from rotary couplings, to manual pallet decouplers, to automatic coupling systems with programmable controllers.

11 Specials



Because many tough clamping problems require modified or totally special components, we offer full specials-engineering capabilities. Our research and development staff can quickly design products to meet your special requirements. And unlike our competitors, we are a full-capability manufacturer, from start to finish, so lead times are always reasonable.

12 Engineering and Service Support



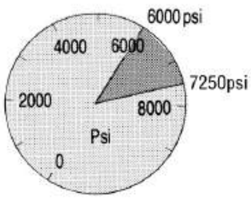
Drawing Files Available at www.carrlane.com

The combined resources of Carr Lane Roemheld Mfg. Co., Carr Lane Mfg. Co, and Roemheld GmbH bring you the world's finest technical support. Our capabilities include:
(1) Field engineers and regional managers helping our fine authorized distributors give you on-site assistance nationwide.
(2) Extensive CAD/CAM capabilities, both inhouse and for customer use, including a complete CAD library of catalog items available for users.
(3) A large stock of catalog items, plus quick-response manufacturing capabilities.
(4) Quality products that rarely need service, unlike those of our competitors, who regularly sell replacement parts and need repair stations throughout the country.

Design Information

1. Operating Pressure

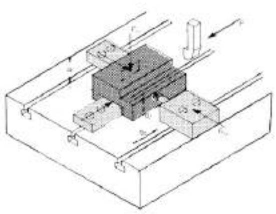
Although most Roemheld components operate comfortably and safely at up to 7250 psi, we recommend selecting a standard "design pressure" of 6000-psi for workholding fixtures. The table on each clamp's catalog page shows 6000-psi forces in bold for quick reference.



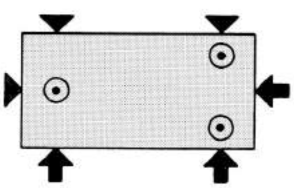
Designing at 6000 psi gives you most of the compactness benefits of high pressures, yet leaves a 25% reserve in case you find that you need additional holding force after building the fixture. Adjust up or down if necessary after checking the fixture. We recommend permanently labeling or stamping the fixture with the chosen operating pressure, for future reference. Operating at low pressures is somewhat a waste of our components' capabilities, but may occasionally be desirable with delicate workpieces. Whenever possible, stay with high pressures and use smaller clamps for better economy and minimum size. Minimum operating pressure is generally 1500 psi using an Electric Power Unit, or 2200 psi using an Air Power Unit. Work supports require at least 1500 psi. Please note, a few products in this catalog are limited to pressures lower than 7250 psi. To use these components in full-pressure systems, see Pressure Reducing Valves.

2. Machining Operations and Fixture Layout

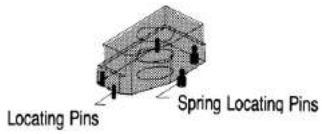
While developing your fixture concept, consider the following factors wherever possible:



Use positive stops to resist machining forces, rather than relying just on clamp forces. With well-placed locators, you can use smaller clamps.



Choose clamping points that are backed up by solid stops or rests to resist clamping forces. Clamping forces can distort a workpiece unless counteracted by firm supports.

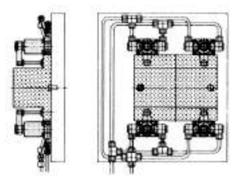


Evaluate workpiece-loading procedure and clamping sequence. Loading and clamping can be completely automatic, or involve some manual steps. To position the workpiece against locators, spring-loaded positioners (above) are often helpful. Sequence Valves are extremely useful to position hydraulically with push clamps before clamping. Total positioning force should be 30-50% of the workpiece's weight to overcome friction.

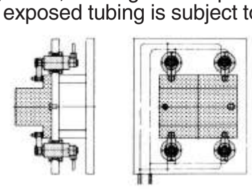
Decide how many parts you want to place on the fixture. For example, to place three workpieces on the above fixture, super-miniature Swing Clamps are necessary. With only one workpiece, just about any clamp would do.

3. Plumbing Options

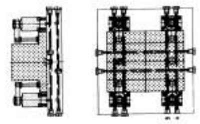
Supplying fluid to hydraulic fixtures is not merely an afterthought. Fluid supply is an integral part of fixture design. The following Swing Clamp fixtures illustrate four distinct plumbing concepts.



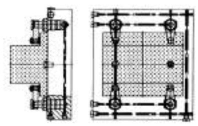
1. Tubing lines on top of fixture plate.
This is the oldest, most traditional method of supplying fluid to hydraulic clamps. Before manifold mounting, using tubing was about the only option available. Advantages; less baseplate machining is required; quick build time. Disadvantages: chips are easily trapped in tubing lines; a large base-plate area is required; exposed tubing is subject to damage.



2. Tubing lines underneath fixture plate.
Running tubing lines below the working area is an improvement on option 1. Advantages: no chip traps in working area; more freedom to position clamps with tubing out of the way. Disadvantages: a large base-plate area is still required; more complicated fixture construction.



3. Manifold mounting, with O-ring ports.
This option uses passages drilled in the fixture to feed fluid directly to O-ring ports underneath the clamps. Advantages: more compact fixture size; no chip traps in working area; most economical construction. Disadvantages; gundrilling is sometimes required; less freedom to mount clamps in odd positions.

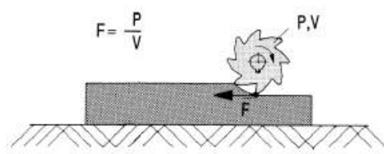


4. Cartridge-type manifold mounting.
Similar to option 3, except clamps are embedded in specially prepared, tapped mounting holes. Advantages: most compact fixture size; great freedom to position clamps in tight places; no chip traps in working area. Disadvantages: gundrilling is sometimes required; a thicker base plate is usually required (this is also an advantage because it makes the fixture more rigid).

4. Cutting Forces

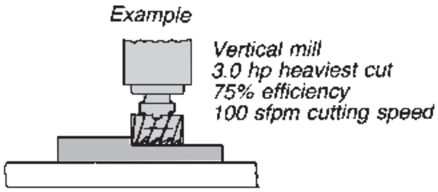
An important step in most fixture designs is looking at the planned machining operations to estimate cutting forces on the workpiece, both magnitude and direction. Your "estimate" can be a rough guess based on experience, or a calculation based on machining data. One simple formula for force magnitude is based on the physical relationship:

$$Force = \frac{Power}{Velocity}$$



$$\text{Cutting force (lbs)} = \frac{\text{Heaviest-cut horsepower} \times \text{Machine efficiency \%} \times 33{,}000}{\text{Cutting speed (sfpm)}}$$

Please note: heaviest-cut horsepower is not total machine horsepower, rather it is the maximum horsepower actually used during the machining cycle. Typical machine efficiency is roughly 75%. (.75). The number 33,000 is a units-conversion factor.
The above formula only calculates force magnitude, not direction. Cutting force can have X, Y, and/or Z components. Force direction (and magnitude) can vary drastically from the beginning, to the middle, to end of the cut.

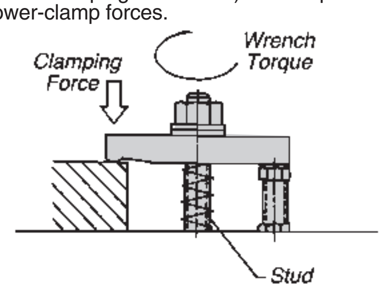


$$\text{Cutting force} = \frac{3.0\ \text{hp} \times .75 \times 33{,}000}{100\ \text{sfpm}} = 743\ \text{lbs}$$

Intuitively, force direction is virtually all horizontal. In this example (negligible z-axis component). Direction varies between the x and y axes as the cut progresses.

5. Clamp Forces / Sizes

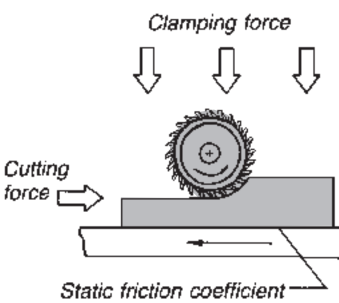
Clamping-force calculations can be quite complicated. Sometimes an approximate method is good enough. See table below for how much clamping force is available from manual clamp straps of various sizes (with a 2-to-1 clamping-force ratio) to compare with power-clamp forces.



Stud Size	Recommended Torque* (ft-lbs)	Clamping Force (lbs)
1/4-20	4	500
5/16-18	9	900
3/8-16	16	1300
1/2-13	38	2300
5/8-11	77	3700
3/4-10	138	5500

* Clean, dry clamping stud torqued to approximately 33% of its 100,000 psi yield strength (2:1 lever ratio).

You can also calculate required clamping forces based on calculated cutting force. A simplified example appears below, with cutting force entirely horizontal, and no workpiece stops

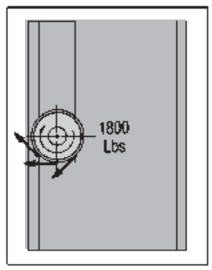


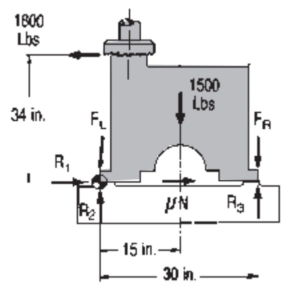
$$\text{Clamping force (lbs)} = \frac{\text{Cutting force (lbs)}}{\text{Static friction coefficient}} \times \text{Safety factor (usually 2)}$$

Contact surfaces	Friction coefficent (Dry)	Friction coefficent (Lubricated)
Steel on steel	.15	.12
Steel on cast iron	.19	.10
Cast iron on cast iron	.30	.19

(frictional force resists the entire cutting force). With workpiece stops and multi-direction forces, calculations become much more complicated. To simplify somewhat, determine the worst-case force situation intuitively, then treat the calculation as a two-dimensional static-mechanics problem (using a free-body diagram). In the example below, cutting force is already known to be 1800 lbs from previous calculations. The workpiece weighs 1500 lbs. Unknown forces are:

F_R = Total force from all clamps on right side
F_L = Total force from all clamps on left side
R_1 = Horizontal reaction force from fixed stop
R_2 = Vertical reaction force from fixed stop
R_3 = Vertical reaction force on right side
N = Normal force = $F_L + F_R + 1500$
μ = Coefficient of friction = .19





The equations below solve for unknown forces assuming that for a static condition:

1. The sum of forces in the x direction must equal zero
2. The sum of forces in the y direction must equal zero
3. The sum of moments about any point must equal zero

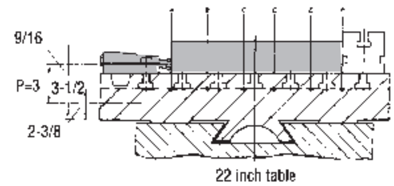
At first glance, the example above looks "statically indeterminate," i.e. there are 5 variables and only 3 equations. But for the minimum required clamping force, R_3 would be zero (workpiece barely touching) and F_L would be zero (there is no tendency to lift on the left side). Now with only 3 variables, we can solve:

$\Sigma F_x = 0$
$= -1800 + R_1 + (.19)(1500 + F_R)$
$\Sigma F_y = 0$
$= R_2 - 1500 - F_R$
$\Sigma M = 0$
$= (34)(1800) - (15)(1500) - (30)(F_R)$

Solving for the variables,

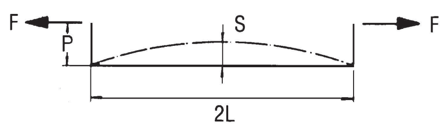
F_R = 1290 lbs
R_1 = 1270 lbs
R_2 = 2790 lbs

In other words, the combined force from all clamps on the right side must be greater than 1290 lbs. We recommend a 2-to-1 safety factor (2580 lbs). Even though F_L (the combined force from all clamps on the left side) equals zero, a small clamping force may be desirable to prevent vibration. Too much clamping force can be as bad as too little.



Excess force can cause fixture and machine-table distortion or even damage. Even a small hydraulic clamp can generate tremendous stresses (S). In the example above, three

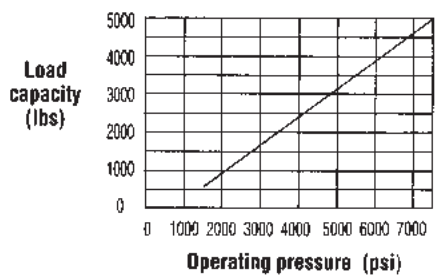
$$S = P \times \left(1 - \frac{1}{1 + \left(\frac{FL}{2EI}\right)^2}\right)$$



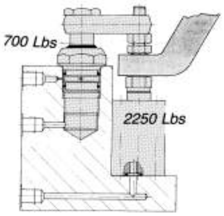
4560-lb Edge Clamps cause some machine-table bending. Using static beam-binding calculations, maximum distortion, at point D, is about .0006 inches (probably acceptable). However, if the clamping point were higher off the machine table (P dimension), distortion would be much greater. Higher clamps would require adding an intermediate fixture plate to increase table rigidity.

6. Work Supporting

Unlike clamps, work supports do not actually exert force on a workpiece. After adjusting to the part, work supports essentially become fixed supports or rests. A work support's load capacity increases proportionally as fluid pressure rises:



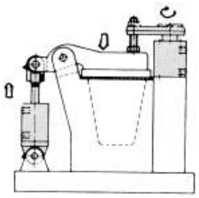
Choose enough load capacity to resist: (1) machining forces; (2) workpiece weight; (3) clamping forces not resisted by fixed stops.



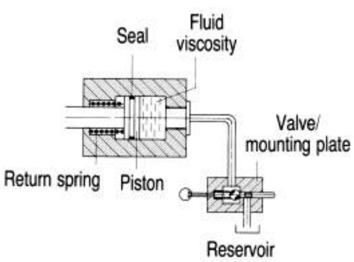
When supporting underneath a clamp, as in the example above, load capacity should be substantially greater than clamping force. Not only must the support resist static clamping force, it must resist dynamic load too (the "hammering" due to clamping-arm momentum). We recommend a load capacity of at least 2 times the clamping force. Another factor when clamping over a work support is that the clamp may build up force faster than the support builds up load capacity. To avoid this, use a sequence valve to delay clamping until load capacity builds up.

7. Single Acting vs. Double Acting

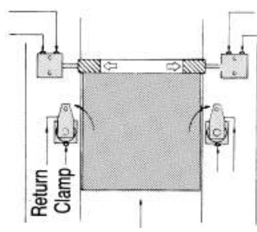
The return side of single acting elements, with a few exceptions (small work supports), require breather ports on the return side, and when used in systems with high flow or pressurized cutting fluids/coolants, great care must be taken to ensure that these fluids do not enter the return side of the clamps. It is highly recommended that double acting elements be used in such systems, thus eliminating the problem, and resultant machine down time. Double acting clamps should also be used in systems having an automatic load/unload, so that all functions can easily be coordinated.



1. Moving linkages or retracting heavy loads. For a quick, positive return when weight is too heavy for spring return.



2. Large fixtures with long tubing runs or flow restrictions. Return speed is adversely affected by: (1) pressure drop in tubing and hoses; (2) pressure drop in valves; (3) high fluid viscosity, especially at lower temperatures; (4) frictional force at piston seals, especially when clamped for an extended time, which displaces the fluid film on cylinder walls.

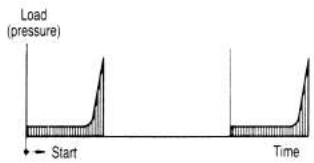


3. Machine-tool interlock. In automated systems where timing and synchronization are important, double-acting clamps are the best choice. By installing pressure switches in both clamping and return lines, a machine controller knows exact clamp status at all times.

8. Clamping Time

Hydraulic clamping is usually fast, but not instantaneous. To estimate clamping time, consider the two phases of clamping:

1. Extending time, under low-pressure free flow
2. Pressure-building time



Extending time is fairly easy to calculate, knowing fluid required by each clamp and the power units flow rate, using the formula below. One obvious way to reduce clamping time is to set clamps as close to the workpiece at possible, to use as little stroke as possible.

$$\text{Extend time (sec)} = \frac{\text{Maximum fluid req'd for all clamps (cu.in.)} \times \text{Portion of stroke used (usually 1/2)} \times 60}{\text{Power Unit flow rate (cu. in./.min.)}}$$

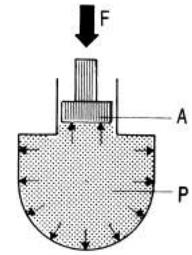
After extending, an additional volume of fluid must be pumped into the system to build pressure. This is due mainly to:

1. Compressibility of the hydraulic fluid (add about 4% of total system volume to build to 7250 psi)
2. Volume expansion of hydraulic hoses (.066 cu.in. per foot)
3. Charging an accumulator, if used

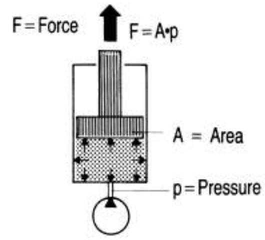
By calculating fluid required for each of the above factors, you can estimate pressure-building time. Using Sequence Valves lengthens clamping time, because each sequence step requires extending time and pressure-building time. To reduce clamping time, set Sequence-Valve trigger pressure as low as possible. With multiple Sequence Valves, set trigger-pressure differences at their minimum allowables value.

9. Other Hydraulic Considerations

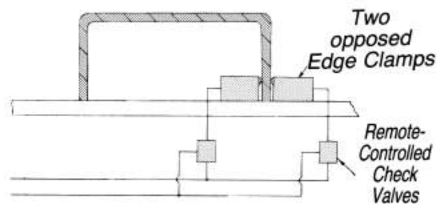
The basis of hydraulic clamping systems is "Pascal's Law", which says that if pressure is applied to a static fluid that is completely enclosed, that pressure is transmitted equally in all directions: This principle is used to transmit force to remote locations,



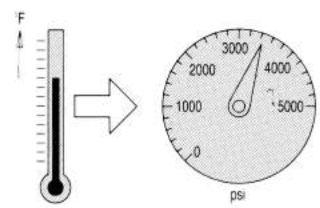
via hose, tubing, or drilled passages. When hydraulic pressure acts on a clamp's piston area, it generates external force according to the physical relationship F=P x A:



Clamping with hydraulics causes some strange effects not occurring with manual clamps. One such phenomenon is fluid shifting between equal-force opposing clamps.



In the example above, the two opposed clamps allow the workpiece to float between them. Pushing on one clamp encounters no resistance because fluid just shifts to the opposing clamp (if the check valves were not present). Do not let equal-force clamps oppose each other without Remote-Controlled Check Valves.



Another strange effect is pressure change due to temperature change of a closed system. In fact, pressure changes about 80 psi per 1° F! Be careful of excessive temperature changes, especially increases. Use a Pressure-Relief Valve for safety.

10. Hydraulic Symbols and Circuit Diagrams

Hydraulic symbols and diagrams area a useful "shorthand" method of describing how a clamping circuit works without detailed drawings. The following pages show two circuit examples, and a summary listing of hydraulic symbols.

Bleeding of the Spring Area ■ A0.110

Introduction
Due to increased use of coolants and cutting fluids in machining, there is an increased possibility that these fluids may penetrate into the spring areas of single acting cylinders and work supports. Many fluids can cause corrosion, which can lead to malfunction and possible failure.

Why bleeding is necessary
If not vented, excess pressure or vacuum in the spring area changes the spring forces which may lead to malfunctions.

Condensation from coolants can lead to corrosion on the piston, spring or housing.

Leakage of hydraulic seals must drain properly to avoid malfunctions.

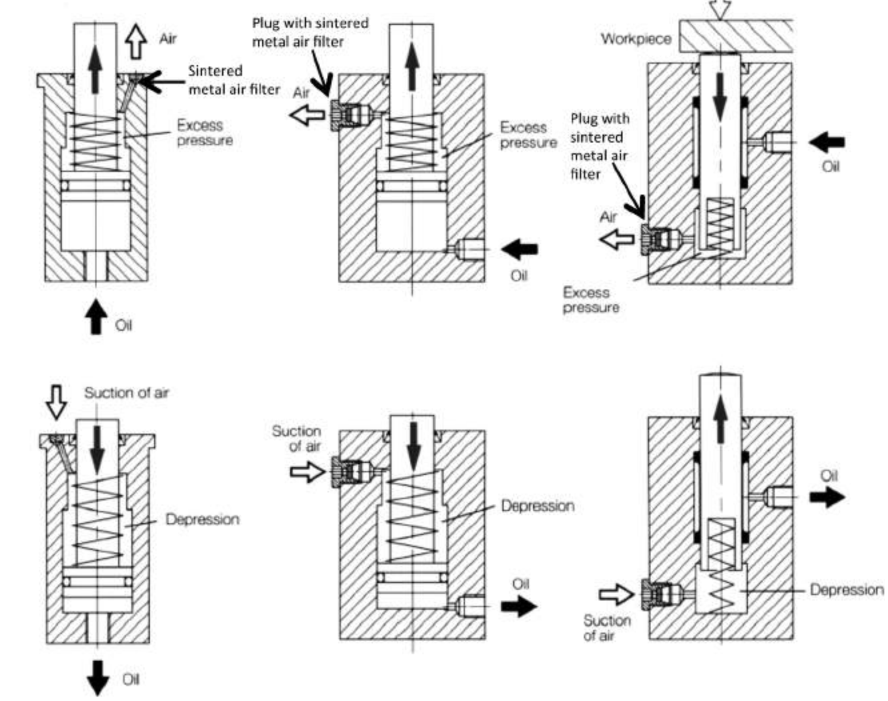
Using sintered metal filters minimizes dust and chips.

Liquids are the real problem because they can be drawn through the air filter. This can cause the spring area to be reduced. Malfunctions can occur due to this excess pressure or vacuum.

Catalog elements with bleeding of the spring area

Single-acting clamping elements
without bleeding port — with bleeding port

Work supports



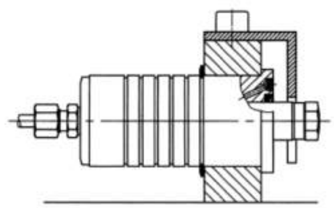
Venting of Spring Air ■ A0.110

Cover
Clamping elements without bleeding port can be covered, but due to today's normal quantities of coolants this does not seem to be successful. In such applications you should use other clamping elements, preferably double-acting elements.

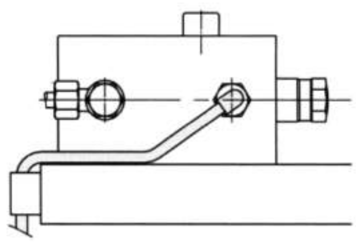
Bleeding hose
Connection of a bleeding hose is preferred and the opening is to be displaced to a point where no liquid can penetrate.

Closed bleeding system
Connecting the breather port to an external area can increase the spring area volume. By doing this, the amount of additional pressure or vacuum generated is minimal. This serves a dual purpose in allowing the spring area to be vented as well as protection from agressive coolants. A good solution is to use sealed electrical wiring boxes with connecting threads. **The volume of this additional area should be ten times the stroke volume of all connected elements.**

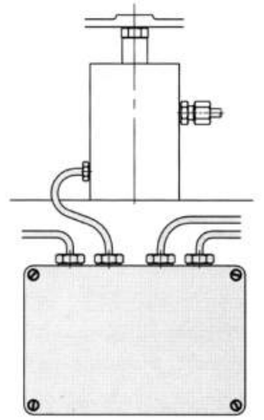
Cover



Bleeding hose

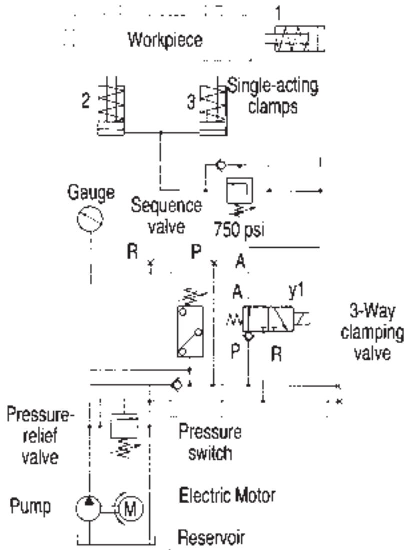


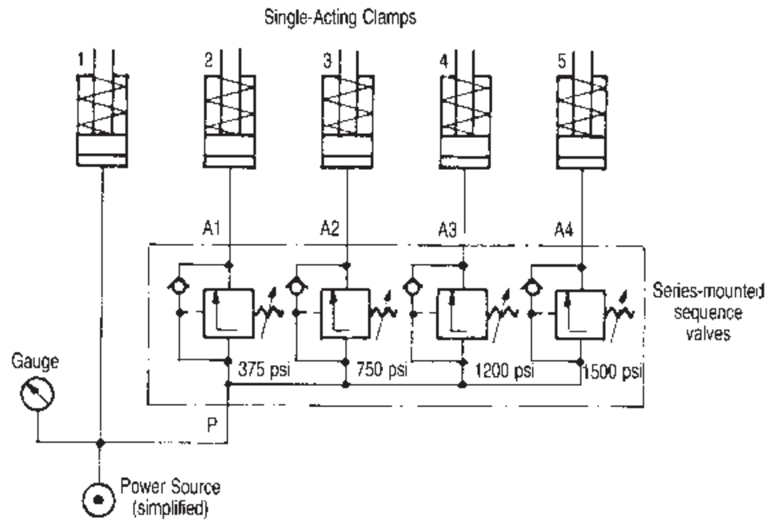
Closed bleeding system



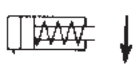
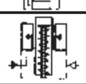
Subject to change. For further details, including detailed dimensions and mounting instructions, visit www.clrh.com.

Example Hydraulic Circuit Diagrams

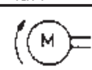




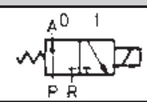
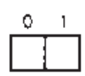
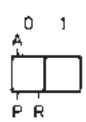
Clamp & Cylinder Symbols

	Push clamp or cylinder, single acting
	Push clamp or cylinder, double acting
	Pull clamp, single acting
	Swing clamp, single acting
	Swing clamp, double acting
	Extending clamp, single acting
	Extending clamp, double acting
	Work support, spring extended
	Work support, fluid advanced
	Work support, air advanced

Power Source Symbols

	Power source (simplified)
	Electric Power unit, consisting of a fluid reservoir, pump, electric motor, pressure-relief valve, pressure switch, clamping valve, and gauge.
	Electric motor, showing direction of rotation
	Constant displacement pump
	Variable displacement pump
	Fluid reservoir
	Fluid filter

Valve Symbols

 A 0 1, P R	3/2 directional-control valve (3-way, 2-position), complete symbol with solenoid operator and spring return (normally open)
 0 1	Boxes showing valve positions (two). For valves with spring return, the neutral position is shown at left (0).
 0 1, A, P R	Inlet and outlet connections are drawn at the neutral-position box, and are designed by capital letters: P = Inlet pressure from pump A,B,C… = Operating connections R,S,T = Outlet return (tank) L = Leakage line Z,Y,Z = Control Lines

Design Information

	Flow lines and directions are shown in each valve-position box. Lines show flow path, arrows show flow direction. Shutoffs are designated by capped-off lines inside the box.
	Valves can be normally open, as shown on top (clamped in neutral position), or normally closed, as shown on bottom (unclamped in neutral position)
	Valve operators are shown outside the boxes
	Solenoid operated
	Spring operated (or returned)
	Manually operated
	Detent position
	Lever operated
	Foot-pedal operated
	Push-button operated
	Cam-roller operated
	Plunger operated
	Air-pilot operated
	2/2 directional-control valve, normally closed on top, normally open below.
	4/2 directional-control valve, for double-acting clamps
	Sequence valve, with unrestricted return line
	Pressure-reducing valve, with unrestricted return line

	Check valve
	Remote-controlled check valve (pilot operated)
	Shutoff valve
	Pressure-relief valve
	Flow control valve, with unrestricted return line

Accessory Symbols

	Operating line, pressure or return
	Control line, for transmitting control/pilot signals
	Leakage line, for carrying away fluid leakage
	Flexible line, such as hydraulic hose
	Line connection
	Line crossing, without connection
	Pressure-connection point, such as a port
	Bleeding point
	Quick disconnect, coupled
	Quick disconnect, decoupled
	Rotary coupling (2 passage shown)
	Accumulator
	Gage
	Pressure switch
	Air filter/regulator/lubricator

Recommended Precautions For The Designer, Builder & Operator

IMPORTANT: READ THIS SHEET CAREFULLY BEFORE OPERATING.

Roemheld power workholding components are high quality products, engineered and manufactured to give you long, dependable and safe performance. For proper and safe operation, please follow all instructions on this sheet. Save these instructions for future reference.

SERVICE NOTE: Most Roemheld components are 100% individually tested for proper operation before leaving the factory. Please recheck these instructions if your new unit does not work properly. Should any component ever need service, please contact the factory. Do not disassemble the unit yourself — many are not user serviceable. Roemheld components incorporate advanced sealing technologies that eliminate the need for routine seal replacement.

TUBING: Use only *steel* tubing as specified in the Roemheld catalog: Seamless steel tubing, C1010, cold drawn, fully annealed, 5/16 OD, .065 wall thickness (Certified to 37,500 psi burst). Follow all tubing installation guidelines. We highly recommend the CLR-300-TL flaring tool to effectively flare this heavy-walled tubing.

HOSES: Use only hydraulic hoses as specified in the Roemheld catalog: 1/4 ID hydraulic hose, 25,520 psi min. burst pressure, (2) female swivel-nut ends, 5/16 JIC 37° flare.

FLUID CONNECTIONS: Connect fluid lines to the 5/16 JIC 37° flare male connection on each clamp (two for double-acting clamps). This fitting accepts either 5/16 OD 37° flared tubing, or a hydraulic hose with 5/16 JIC 37° swivel nuts (female) at each end. **Do not screw NPT pipe fittings into Roemheld components, or use NPT fittings anywhere in a workholding system.** Roemheld fittings are 5/16 JIC 37°. These fittings offer a positive metal-to-metal seal. **Do not use teflon tape or sealant.** Do not use fitting sizes other than 5/16. This size is ideal for workholding fixtures. Smaller tube sizes have poor flow rates. Larger tube sizes are not readily available with sufficient wall thickness for high pressure operation, and are difficult to flare. Never use brass fittings.

OPERATING PRESSURE: Do not operate components above their maximum allowable fluid pressure stated in the Roemheld catalog (7250 psi for most components). Always use a gauge to monitor fluid pressure. Locate pressure gauge where the machine operator can easily read it. Often, placing it directly on the machining fixture is best. All Roemheld Electric and Air Power units include a fluid-pressure gauge.

ADDITIONAL SAFETY PRECAUTIONS: If losing fluid pressure (due to a cut hose, etc.) would pose any danger to the operator, install a pressure switch, or other pressure-monitoring device, to monitor system pressure. This switch electrically signals the machine tool to shut down if fluid pressure is inadequate.

COMPONENT COMPATIBILITY: Do not mix non-Roemheld components into a Roemheld power-workholding circuit. Other brands are not leakfree, and their performance may be unpredictable.

HYDRAULIC FLUID: Always use absolutely clean, fresh hydraulic fluid. Fill the fluid under absolutely clean conditions. **Almost all service problems are caused by dirty, contaminated fluid. Fluid must be clean to 10 micron or better nominal filtration.** Use only the following DIN 51524, HLP, ISO Grade fluids to preserve your warranty:

Oil Temp. [°C]	Designation [as per DIN 51524]	Application
10-40	HLP 22	Power units with poppet valves or single acting circuits
15-50	HLP 32	Mechanical pumps or double acting circuits

See also CLR-000-V, high pressure in-line filter.

BLEEDING AIR: Usually components will bleed trapped air automatically when you clamp and unclamp them several times. If manual bleeding is still necessary, bleed at an elevated tube or hose connection, farthest from the power source. With the clamps actuated (system pressurized) slightly loosen the connection. After fluid seeps out for a few seconds, retighten. Repeat at other connections if necessary. After bleeding, unclamp (depressurize system) and refill the power sources fluid reservoir.

CAUTION: ALWAYS KEEP HANDS CLEAR OF POWER CLAMPS DURING OPERATION. THESE COMPONENTS EXERT VERY HIGH FORCES AND CAN CAUSE SERIOUS INJURY. DISCONNECT POWER SOURCE BEFORE CONNECTING, DISCONNECTING, ADJUSTING, OR OTHERWISE HANDLING COMPONENTS.

FLOW CONTROL: When using Swing Clamps, Extending Clamps, or Fluid-Advanced Work Supports with a high-flow-rate power source, make sure the fluid flow rate to each component is under the maximum stated in the catalog. Otherwise the components may not activate properly. See the Roemheld catalog for flow control valves.

FLOOD COOLANT: Work Supports and Swing Clamps have air vents protected by sintered-metal filters. These vents could draw in coolant if the components are submerged. To prevent this, attach an air vent tube via the tapped hole provided (see each component's catalog page for air-vent-fitting part numbers).

PRESS-TOOL CLAMPING: Clamping die sets on presses require different components and safety devices than found in our Roemheld Power Workholding catalog. Contact factory for press-tool clamping systems.

MOUNTING: Carefully follow mounting instructions as shown in the Roemheld catalog for each component.

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HILMA ▪ STARK

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