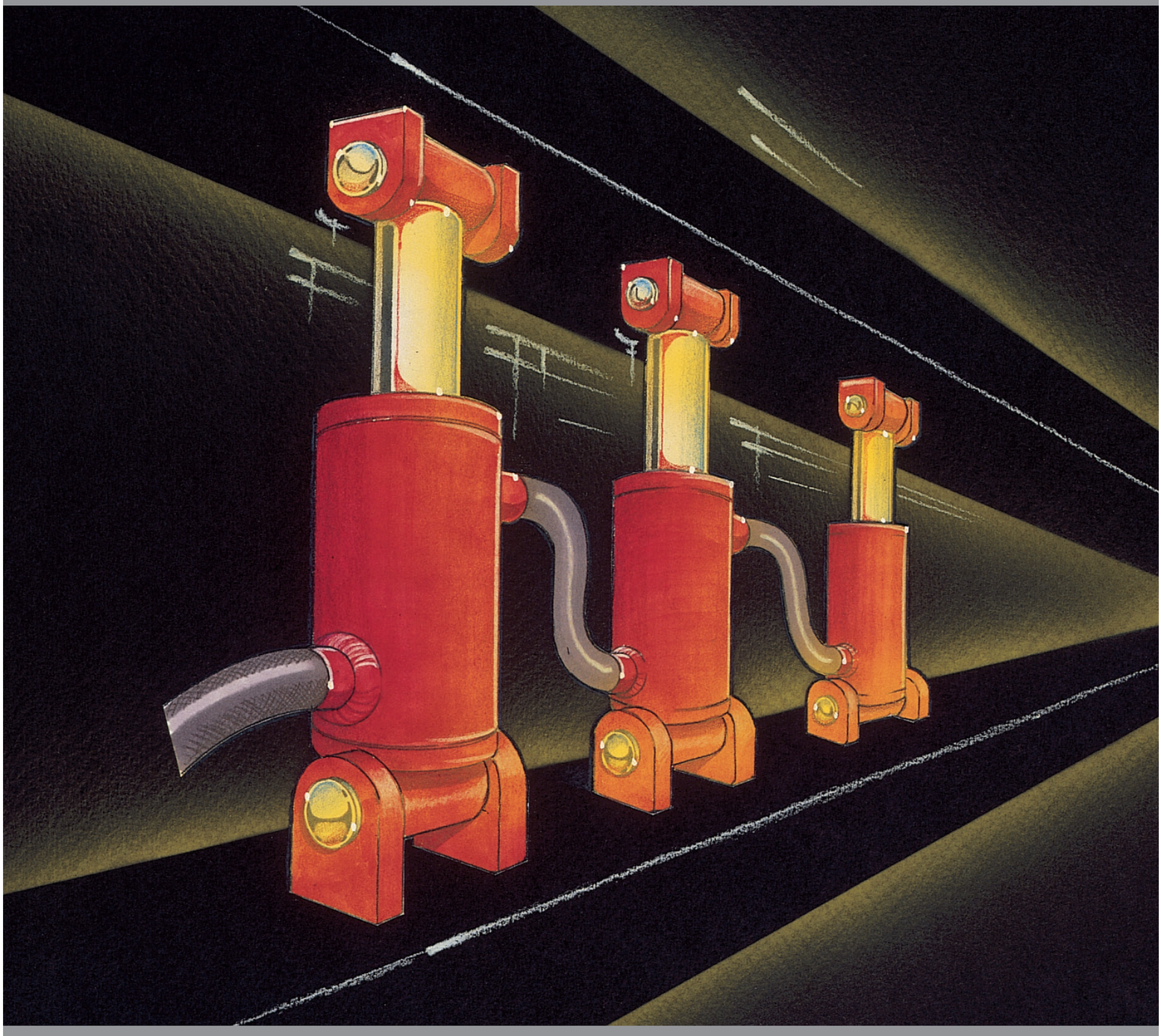
ENERGY®

Manufacturing Company, Inc.

REPHASING TYPE CUSTOM WELDED HYDRAULIC CYLINDERS



For Working Pressures to 5000 PSIG (345 Bar)

2

What are Rephasing Cylinders?

Rephasing cylinders are two or more cylinders plumbed in series or parallel, with the bores and rods sized such that all rods extend and/or retract equally when flow is directed to the first, or last, cylinder within the system.

In “parallel” applications, the bore and rod sizes are always the same, and the cylinders are always used in pairs. The schematic shown as “Figure A” is for a “parallel” re-phasing cylinder application. Such circuits are typically used for the steering function on machines.

In “series” applications, the bore and rod sizes are typically different, and two or more cylinders may be used. In these applications, the bores and rods are sized such that all rods extend or retract equally when flow is applied to the first or last cylinder within the system. The schematic shown as “Figure B” on this page represents a “series” rephasing application.

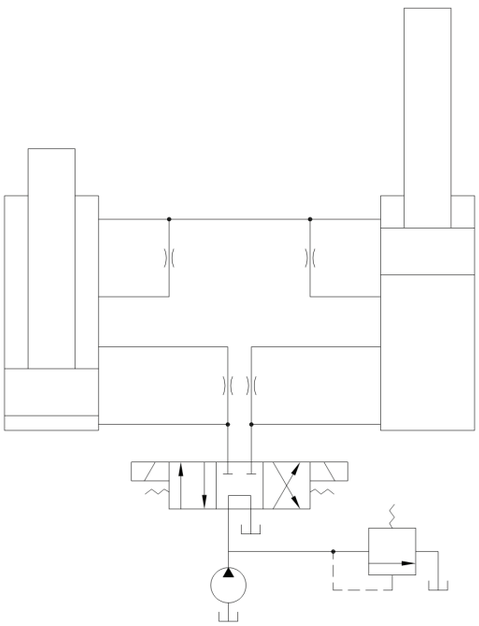


Figure A –
Schematic Representation of a “Parallel” Rephasing Cylinder Application

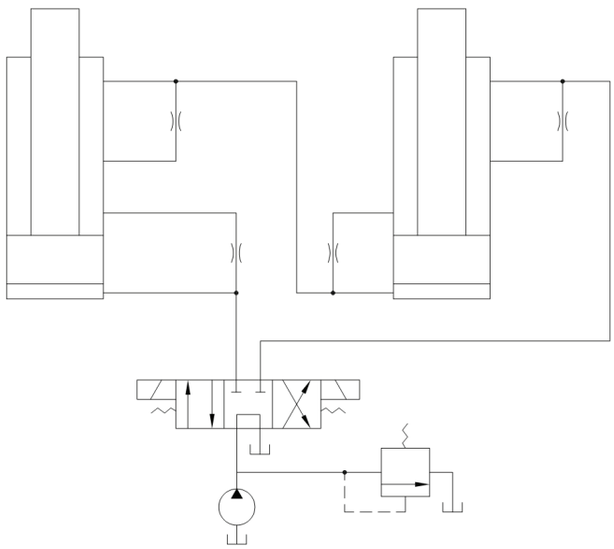


Figure B –
Schematic Representation of a “Series” Rephasing Cylinder Application

This hydraulic synchronization of rod positions eliminates the need for a flow divider in the hydraulic system, or any type of mechanical connection between the cylinder rods to achieve synchronization. All Energy® welded cylinders can be modified to take advantage of these rephasing design benefits.

HOW IS REPHASING ACHIEVED?

Rephasing is a means to allow hydraulic fluid to bypass the cylinder piston seal (i.e., to “rephase”) at the fully extended and/or retracted position. This allows the cylinders to resynchronize in the event of a slight difference in the rod positions. It also allows air to be purged from the hydraulic system upon commissioning.

The schematic at right represents the rephasing concept within a hydraulic cylinder.

Energy’s Rephasing is achieved by one of two designs. The first one (Figure D) is a groove that is milled into the inside of the cylinder wall (body) at the fully extended and/or retracted position. These grooves create a hydraulic bypass around the piston, allowing makeup oil and/or air to bypass the piston at the fully extended and/or retracted position.

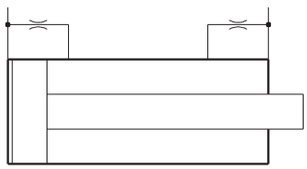


Figure C –
Schematic Representation of a Rephasing Hydraulic Cylinder

ENERGY® MANUFACTURING COMPANY, INC.
Telephone: 319-465-3537 • Fax 319-465-5279 Email: info@energymfg.com
Website: www.energymfg.com

ENERGY® Rephasing Cylinders

Energy uses a special milling tool to machine the rephasing groove. In addition, a special deburring operation is added after the grooves are machined. This achieves a very smooth surface for the piston seals to pass over, minimizing the possibility of a cut or damaged seal.

This approach achieves the rephasing function at the lowest cost.

The second technology utilized is a rephasing valve within the cylinder's piston. The two figures below (Figures E & F) illustrate this approach.

The rephasing valve is a bi-directional mechanically-actuated check valve. At all positions other than fully extended or fully retracted, it does not allow flow through the piston. However, at the fully extended and/or retracted position, the valve makes mechanical contact with the cylinder guide or endcap. This contact actuates the valve, allowing makeup oil and/or air to bypass the piston.

The advantage of this concept is that it is extremely robust. Also, there is no pressure limitation. At high pressures, fluid velocities through rephasing grooves can become excessive, potentially causing seal damage. The rephasing valve eliminates this possibility by routing the fluid through, rather than around, the piston.

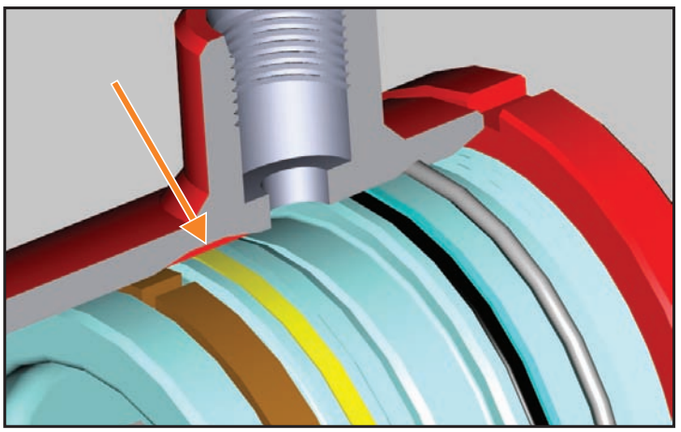


Figure D –
Rephasing Slot Milled Into Inside Of Cylinder Wall

WHAT ARE THE BENEFITS OF THE REPHASING DESIGN APPROACH?

- Lower Overall Installed Cost – Eliminates The Need For Additional Flow Dividing Component(s) Within The Hydraulic System
- Synchronization Of Rod Positions Can Be Achieved Without A Mechanical Connection Between The Rods
- Facilitates The Purging Of Air From The Hydraulic System

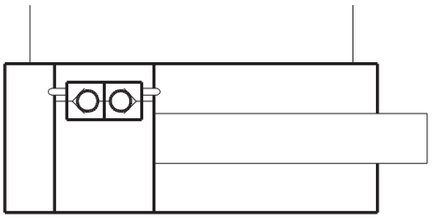


Figure E –
Schematic Representation of a Cylinder Containing a Rephasing Valve within the Piston

AVAILABLE FEATURES FOR ENERGY'S REPHASING CYLINDERS INCLUDE:

- Standard bores from 1 inch (2.54 cm) to 10 inch (25.4 cm); other sizes available
- Standard rod diameters from .625 inch (1.59 cm) to 6 inch (15.24cm); other sizes available
- Standard strokes to 15 feet (4.57 m); longer strokes available
- Working pressures to 5,000 psig (345 bar); special designs available for working pressures up to 10,000 psig (690 bar)
- A wide variety of mounting configurations and end mechanisms
- A variety of integral valves
- SAE ORB, NPTF, and other porting configurations available
- Special housing and rod materials for corrosive or hostile environments
- Stop tubes, cushions, and external fluid lines
- Various packing, seal, and wiper materials for optimum life and performance in the customer's application
- Various surface finishes and treatments for optimum life and performance in the customer's application
- Electronic position-sensing systems

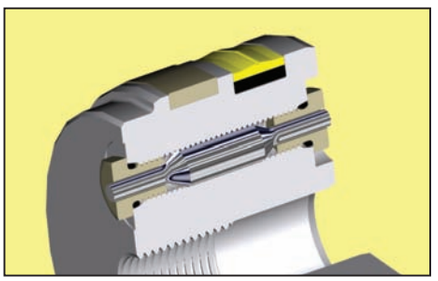


Figure F –
Cut-Away View of a Typical Rephasing Valve Within a Cylinder Piston

ENERGY® MANUFACTURING COMPANY, INC.
Telephone: 319-465-3537 • Fax 319-465-5279 Email: info@energymfg.com
Website: www.energymfg.com

CUSTOM QUOTATION REQUEST

All Energy® welded cylinders are custom-made.
Please complete and return the following sheet so that we can provide you with the best cylinder for your application.

ENERGY® Custom Quotation Request Form

This form must be filled out in its entirety before a welded cylinder quotation can be prepared. Unless noted otherwise by the customer, Energy® Manufacturing will use the following parameters with respect to the processing of this request:

1. The oil temperature in the cylinder will be 170° Fahrenheit (77° Celsius) or less.
2. The rod speed will be 50 feet per minute (15.2 meters per minute) or less.
3. System filtration will be 20 micron or better.
4. The fluid used is SAE 20 (ISO VG68) or less-viscous petroleum-based fluid and is non-foaming type for hydraulic use.
5. Mount center-to-center and stroke dimensions are +/- 1/8" (+/-3.2 mm).
6. The cylinder is not used in a corrosive environment.

PURPOSE OF QUOTE: _____ **QUOTE DEADLINE DATE:** _____

CUSTOMER DATA

Customer name: _____
Address: _____
City, State or Province, Zip or Postal Code: _____
Telephone number: _____
Fax number: _____
E-mail: _____
Purchasing contact: _____
Engineering contact: _____

CYLINDER DATA

All welded cylinder quotation requests should be accompanied by a blueprint or sketch and the following data should be completed.
Cushioned cylinder requests must include pump flow to cylinder, weight of load, and details of the linkage between cylinder and load.

Bore size: _____
Stroke length: _____
Rod diameter: _____
Retracted pin center length: _____
Port type: _____
Port size: _____
Mounting pin diameter: _____
Test requirements: ( ) Standard 100% air test ( ) 100% hydraulic test
Is cylinder cushioned? ( ) Yes ( ) No

QUOTATION DATA

Annual Usage: _____
Target Price: _____

APPLICATION DATA

Type if machine (crane, combine, etc.): _____
_____
Will cylinder be used to lift people? _____
Type of function (hoist, swing, steering, etc.): _____
_____
Estimated cycles per year: _____
Does cylinder always reach full extend or retract position? _____
Is cylinder subjected to high overrunning loads: _____
Is cylinder subjected to side loading? _____
Is cylinder barrel braced to restrict buckling? _____
Is cylinder exposed to corrosive environments? _____

Mountings:
Base: _____
Rod: _____
Finish:
Acrylic Water-Based
Primer Paint (please specify color): _____
Other Paint (please specify): _____
Clear Rust-Preventative Coating: _____
None: _____
Does cylinder rephase? ( ) Yes ( ) No
Release Quantity: _____
Customer Part Number: _____

Primary cylinder effort will be to ( ) push load
( ) pull load ( ) both push and pull load
Cylinder is ( ) double acting ( ) single acting
Cylinder is mounted ( ) vertically ( ) horizontally
( ) swings through arc with mechanism

Pressure values:
Operating: _____
Peak: _____
Main system relief: _____
Operating flow range: _____

ENERGY® Manufacturing Company, Inc.
ENERGY® MANUFACTURING COMPANY, INC.
204 Plastic Lane • Monticello, IA 52310-9472 USA
Phone: 319-465-3537 • Fax 319-465-5279
Website: www.energymfg.com • Email: info@energymfg.com

00.336.1 ISO 9001: 2008
Energy® Mfg. Co., Inc.

 Form: Rephasing (Rev. 11/2011)