Υδραυλικά Συστήματα

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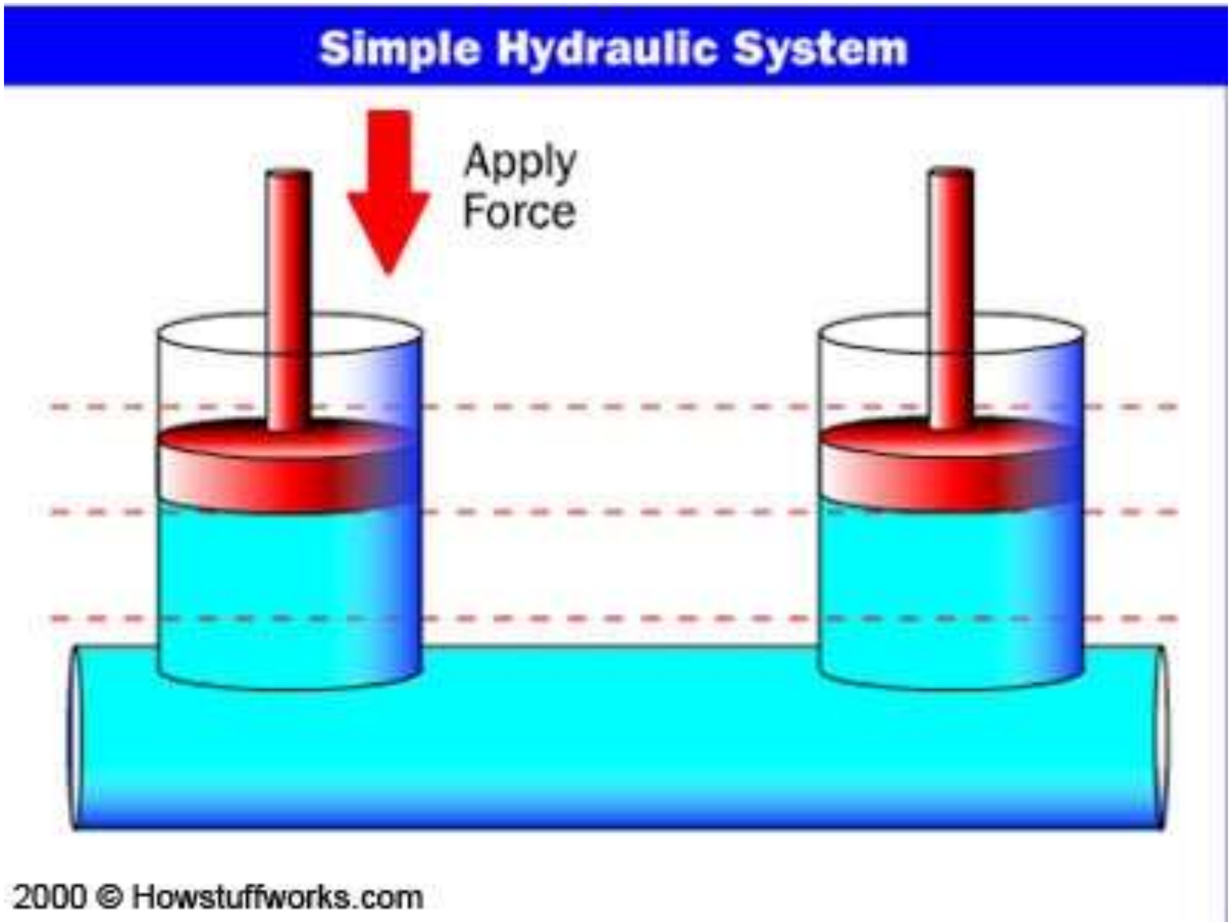
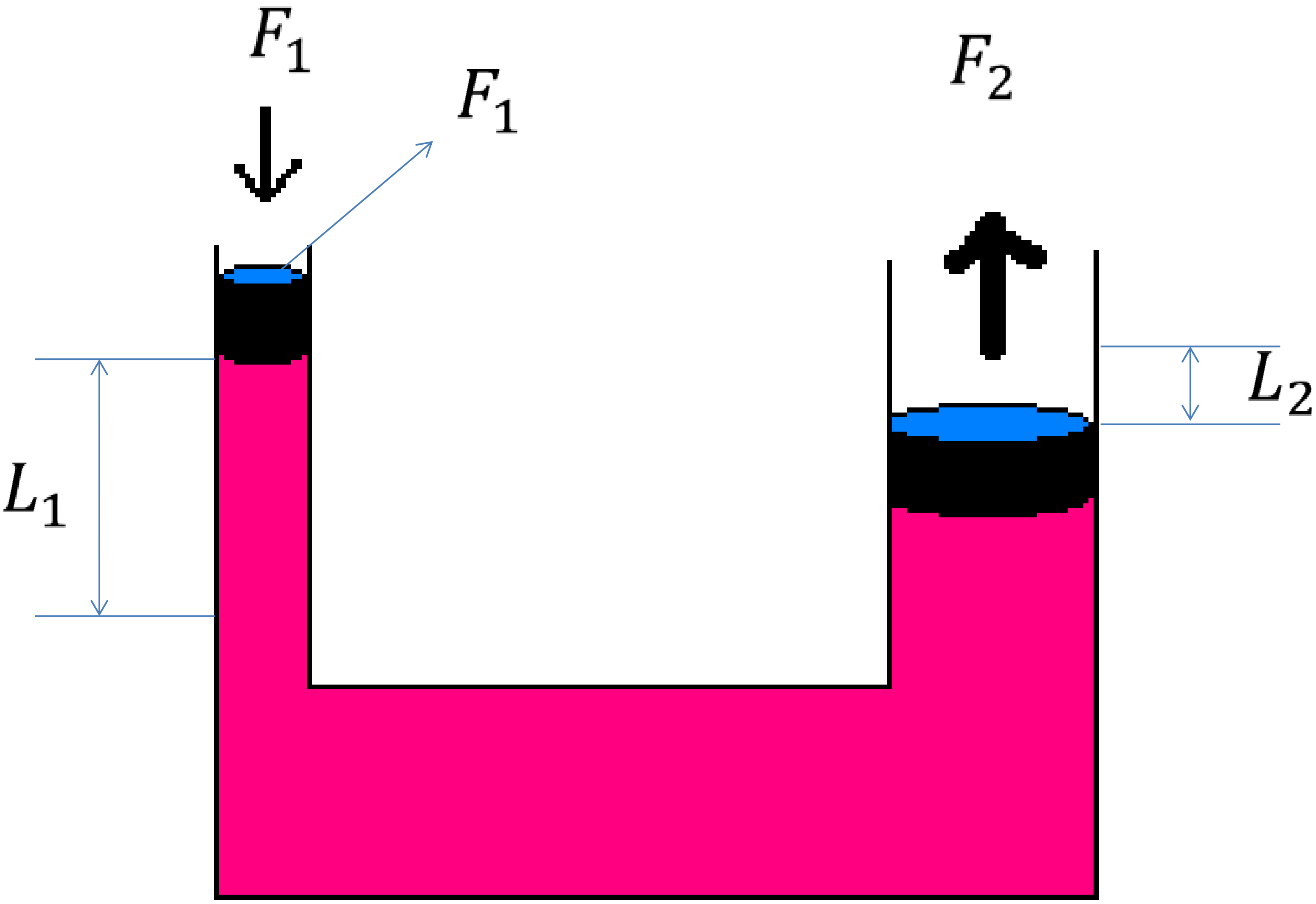
Δρ. Μηχανολόγος Μηχανικός Ε.Μ.Π

Η λειτουργία τους βασίζεται σε ρευστό «εγκλωβισμένο» σε **κλειστό δοχείο**



Βασικά πλεονεκτήματα

- Συμπαγή – πολύ αποδοτικά συστήματα.
- Μετάδοση μεγάλων δυνάμεων
- Εύκολος έλεγχος
- Εύκολη αντιστροφή κατεύθυνσης
- Μακρά αξιόπιστη λειτουργία

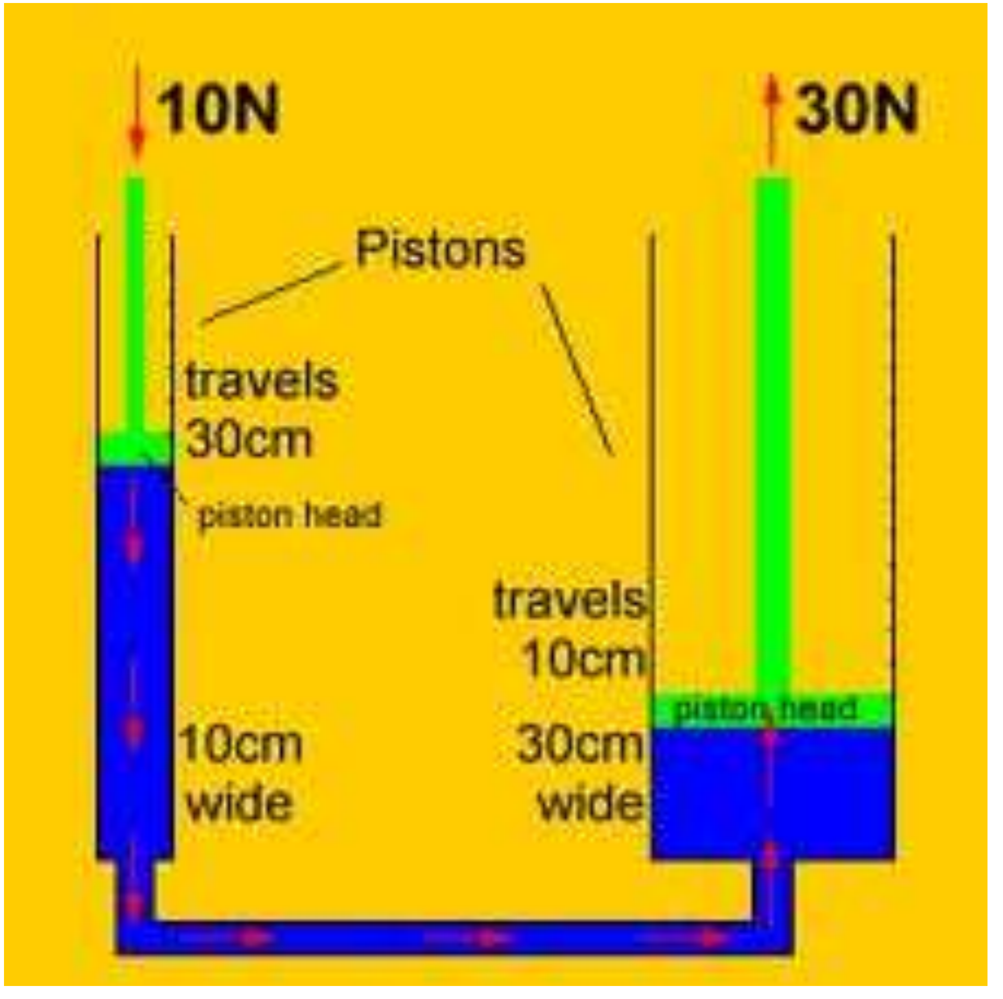

F_1
F_1
F_2
L_1
L_2

$$\frac{F_1}{F_2} = \frac{A_2}{A_1}$$

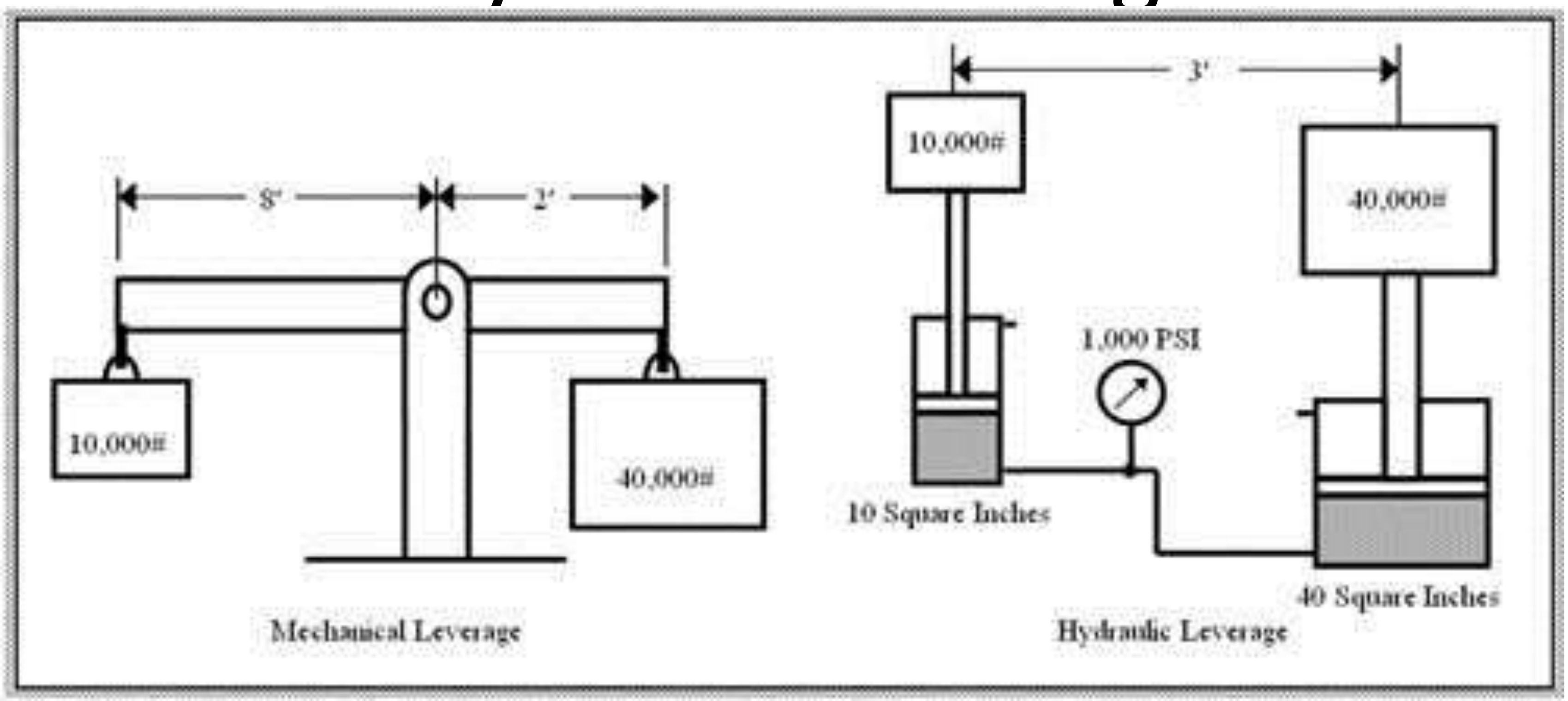
Σχέση Δυνάμεων

$$\frac{L_2}{L_1} = \frac{A_2}{A_1}$$

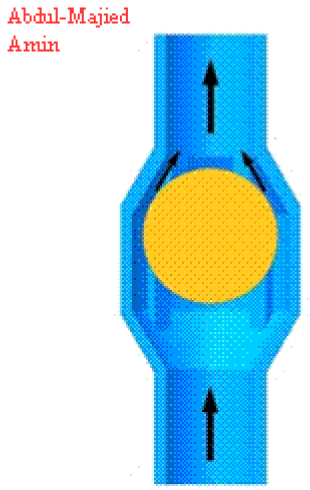
Σχέση μετακίνησης εμβόλων

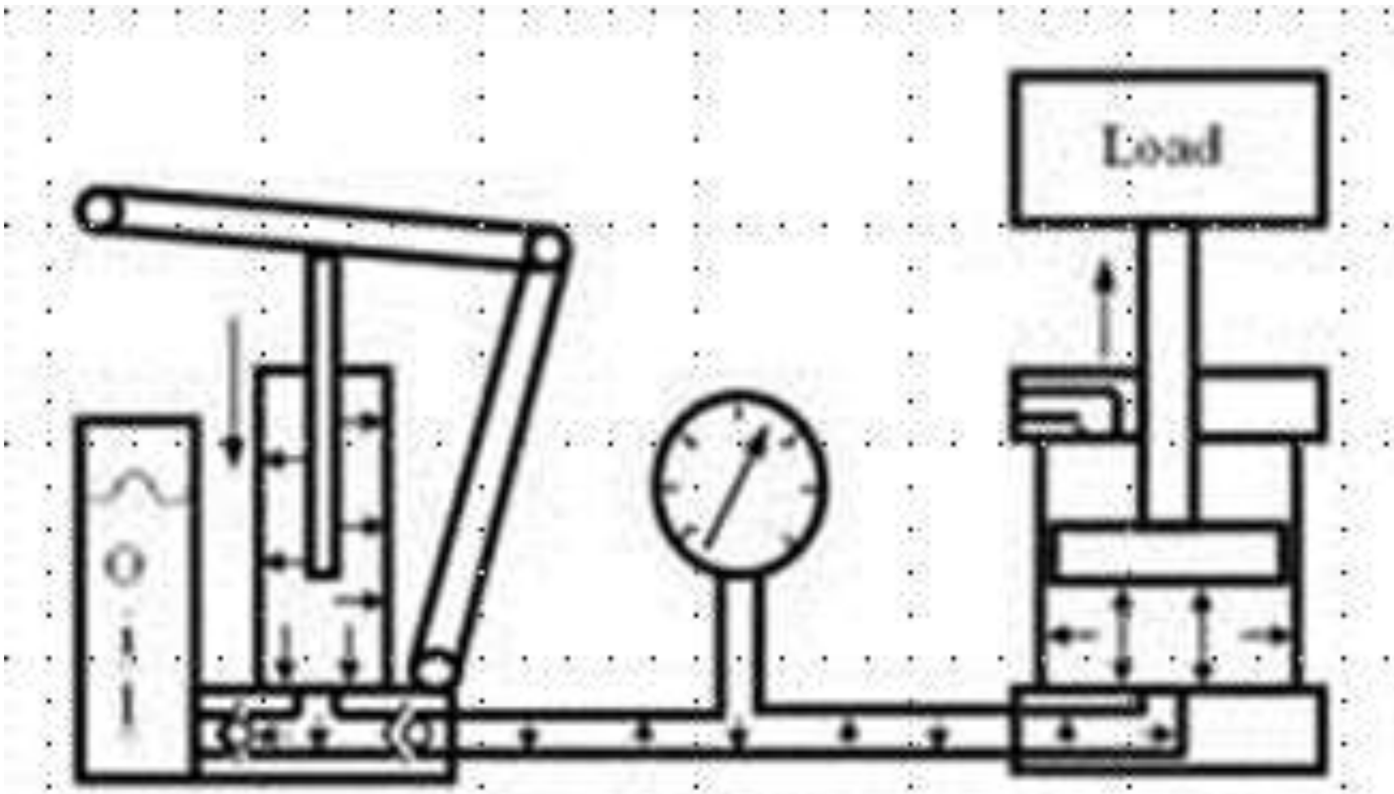

10N
30N
Pistons
travels
30cm
piston head
travels
10cm
piston head
10cm
wide
30cm
wide

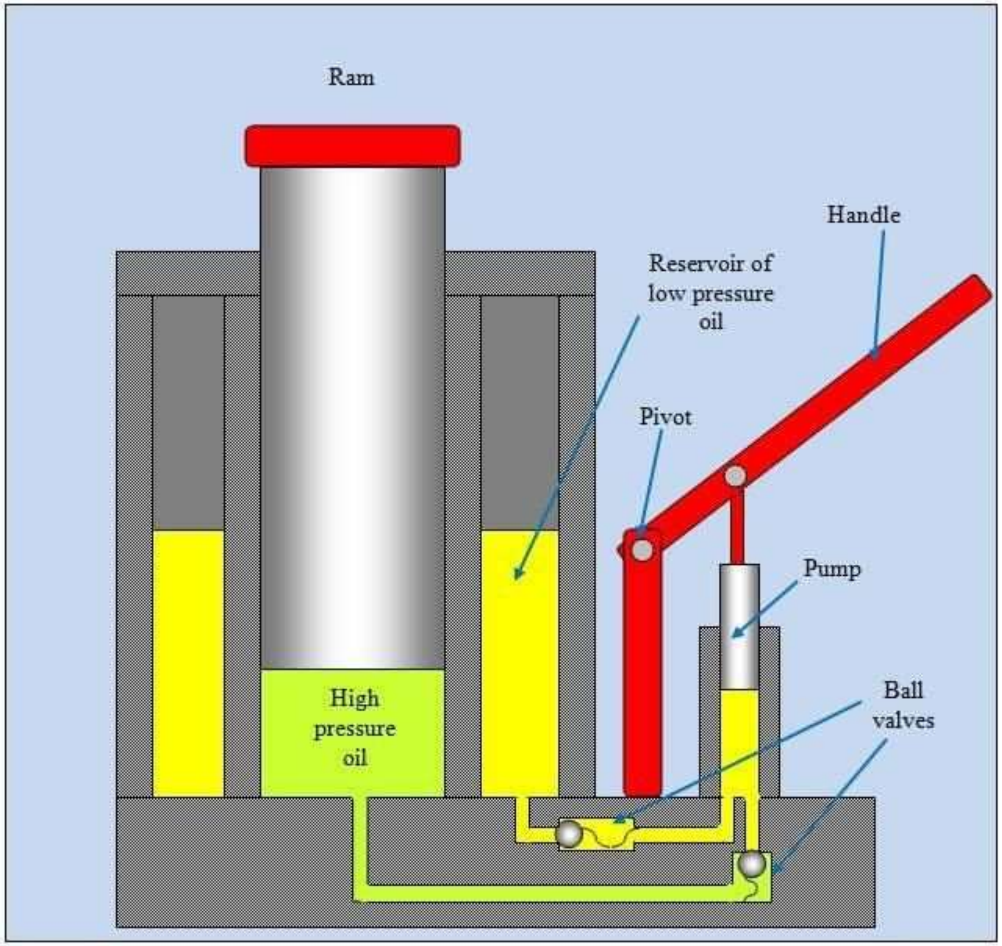
Comparison of mechanical and hydraulic leverage

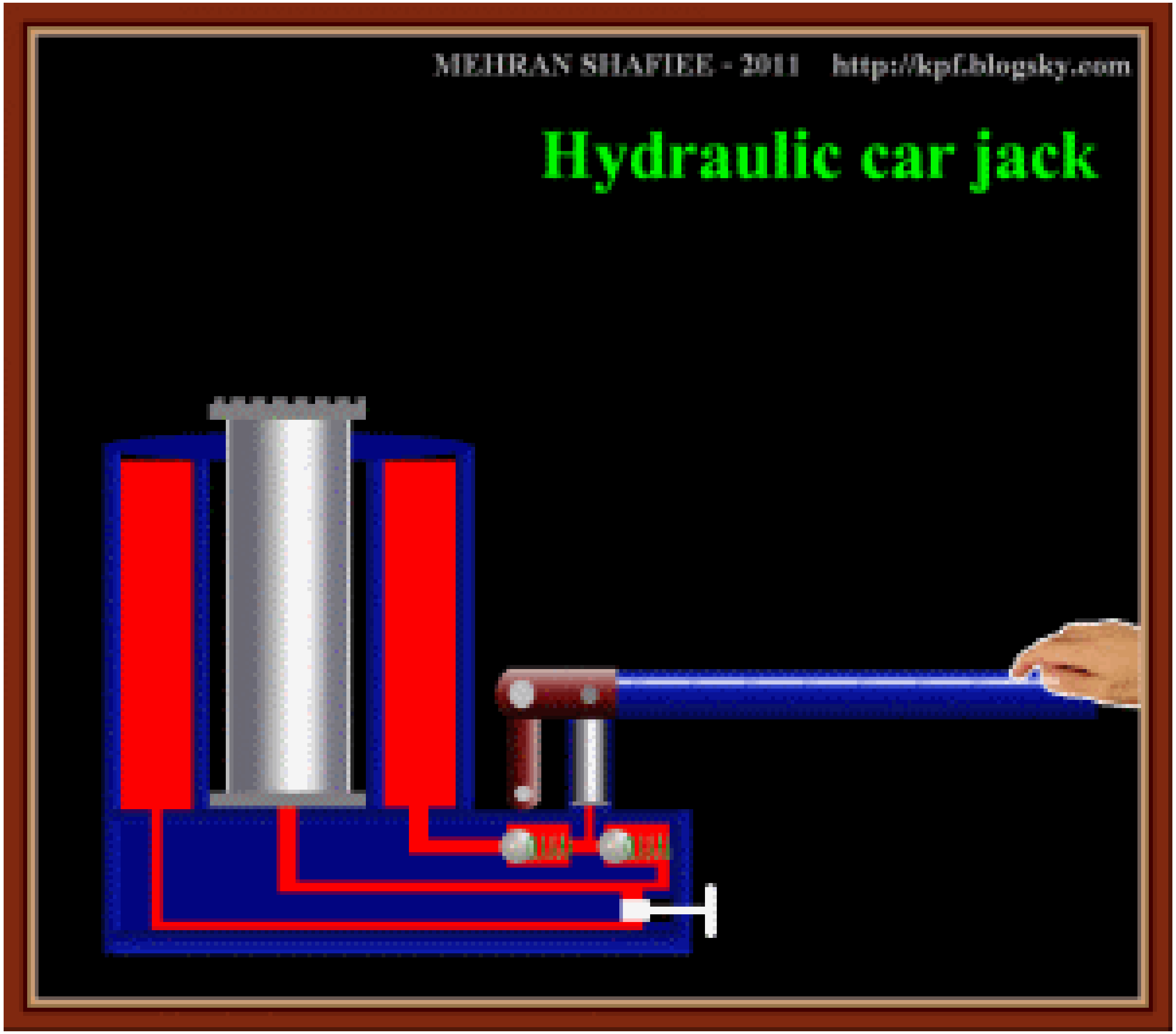


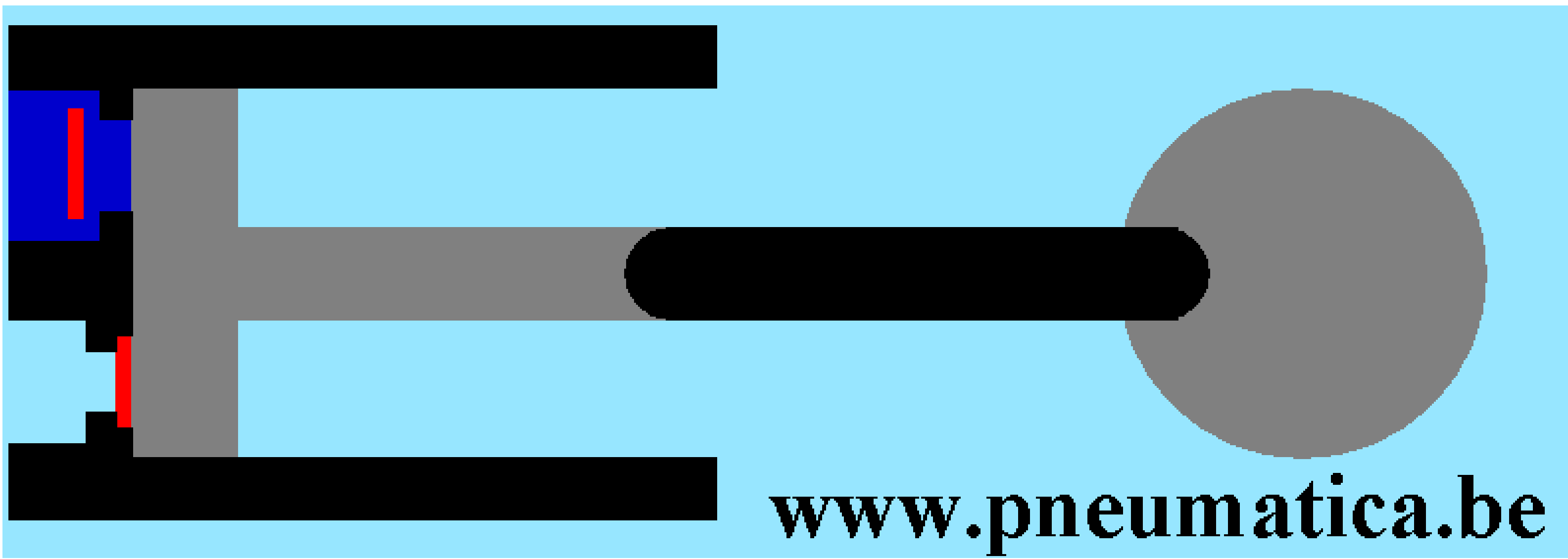
Αντεπίστροφη Βαλβίδα

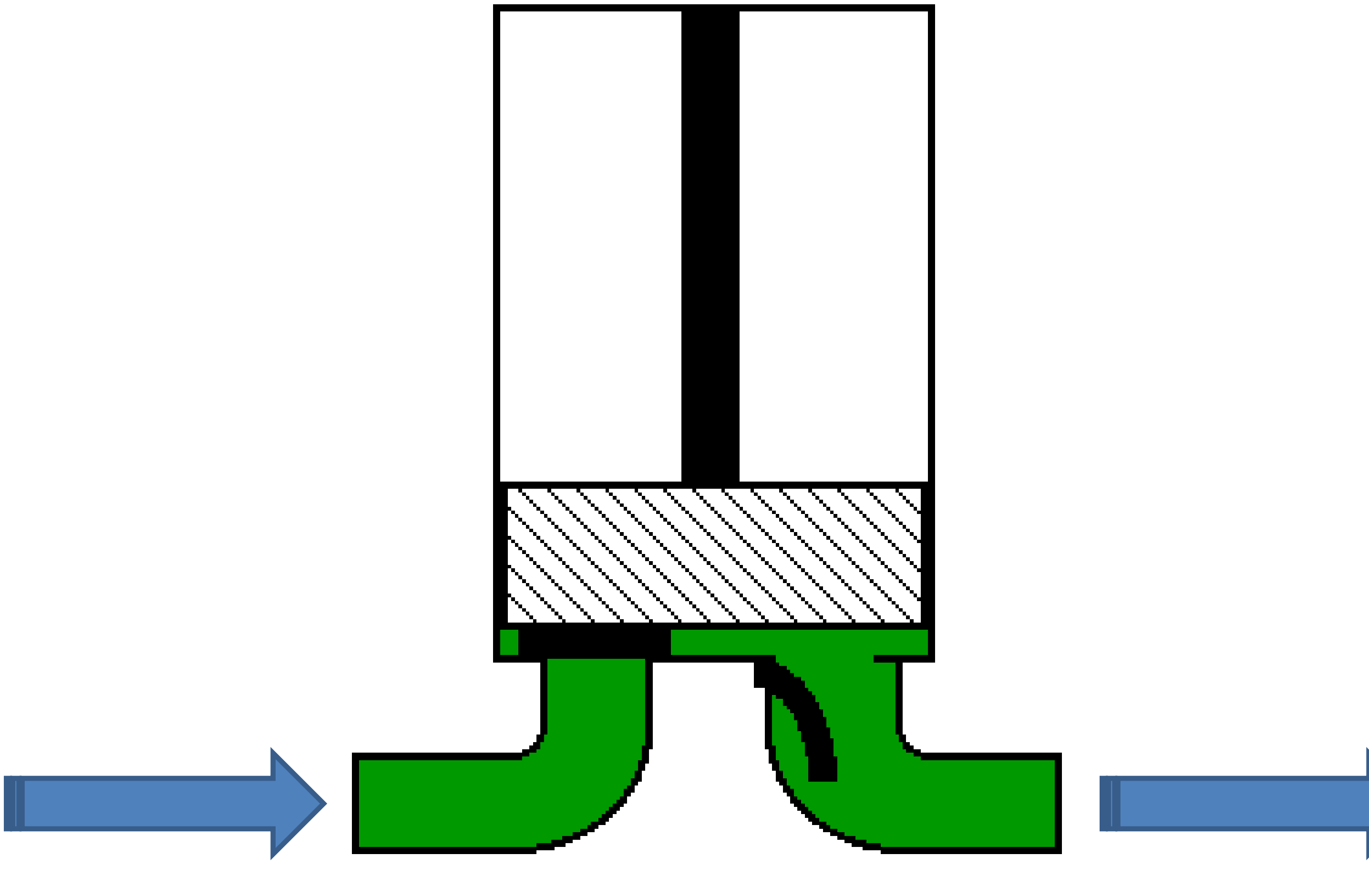


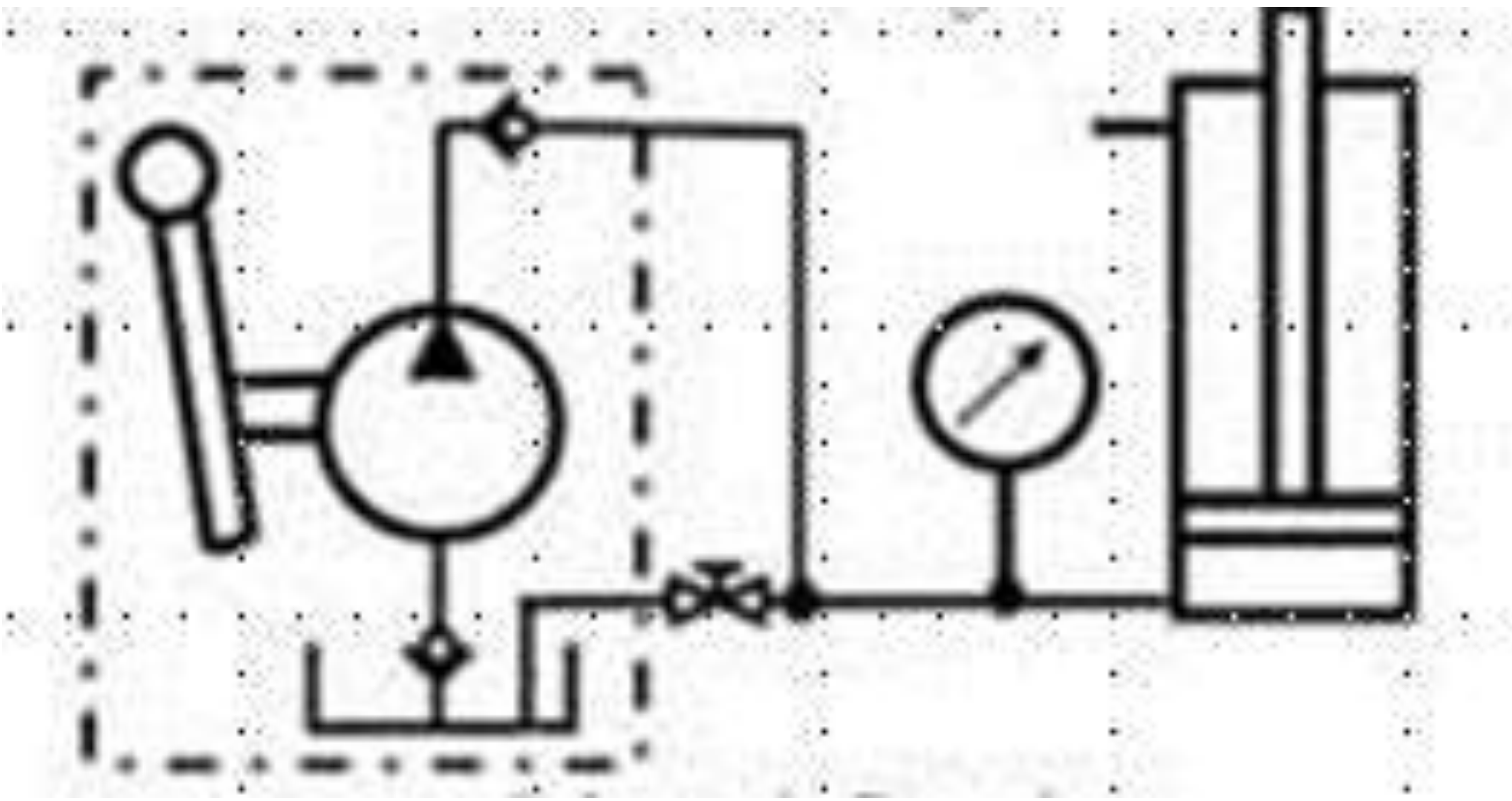

Load
O


Ram
Handle
Reservoir of low pressure oil
Pivot
Pump
High pressure oil
Ball valves

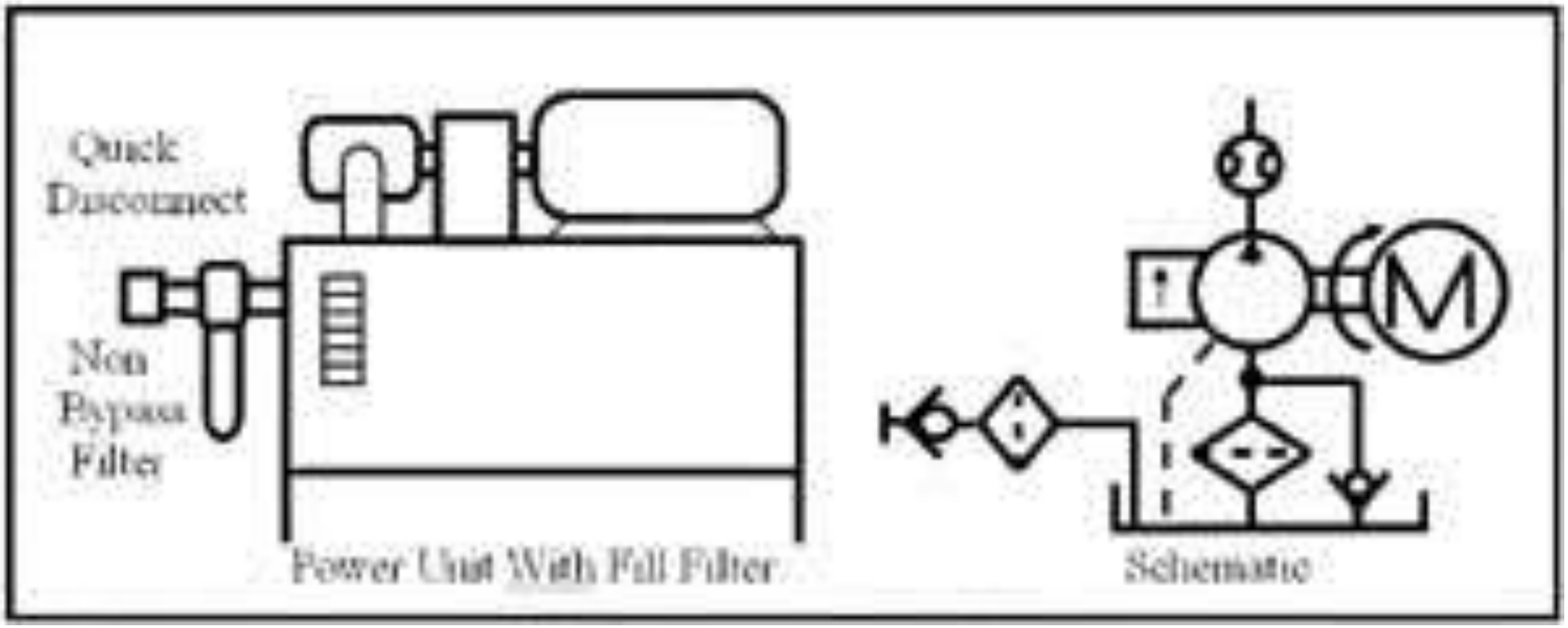

MEHRAN SHAFIEE - 2011 http://kpf.blogsky.com
Hydraulic car jack


www.pneumatica.be

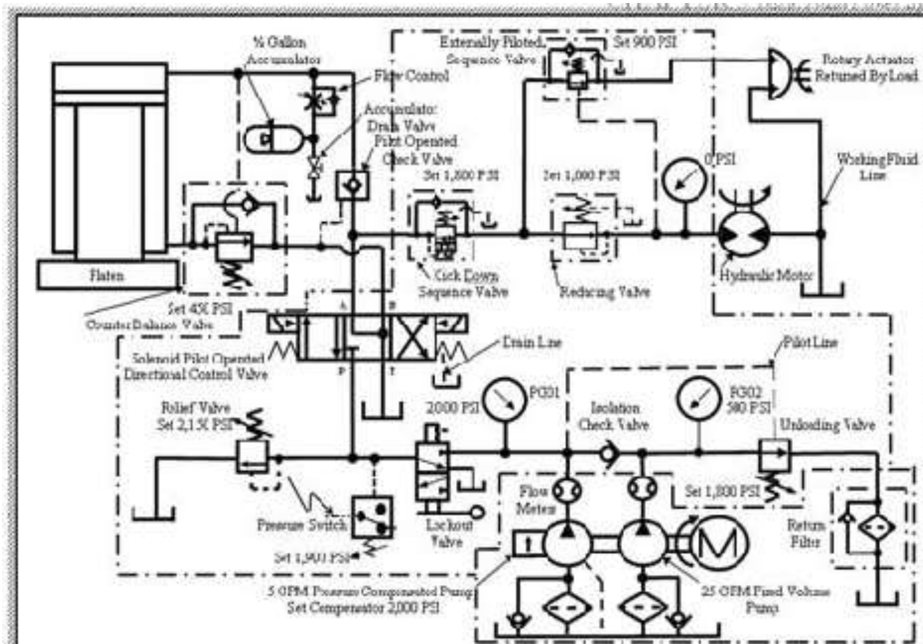




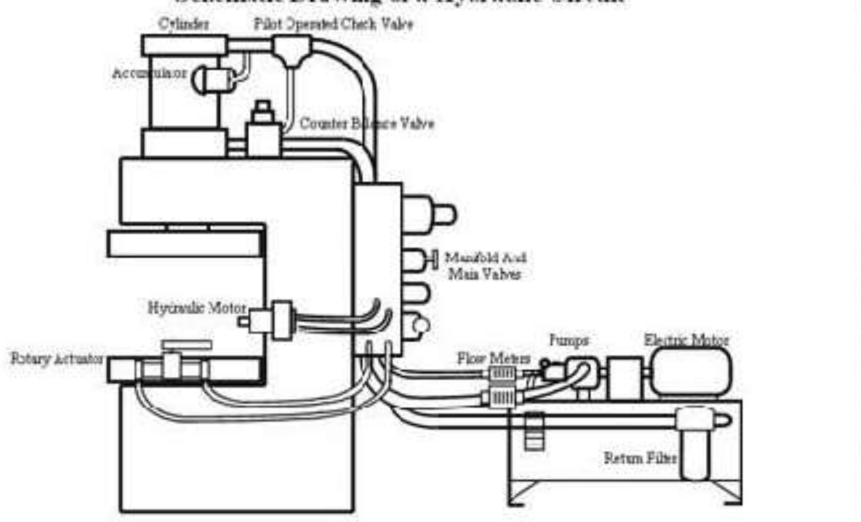
Hydraulic power unit and circuit diagram of its filter arrangement



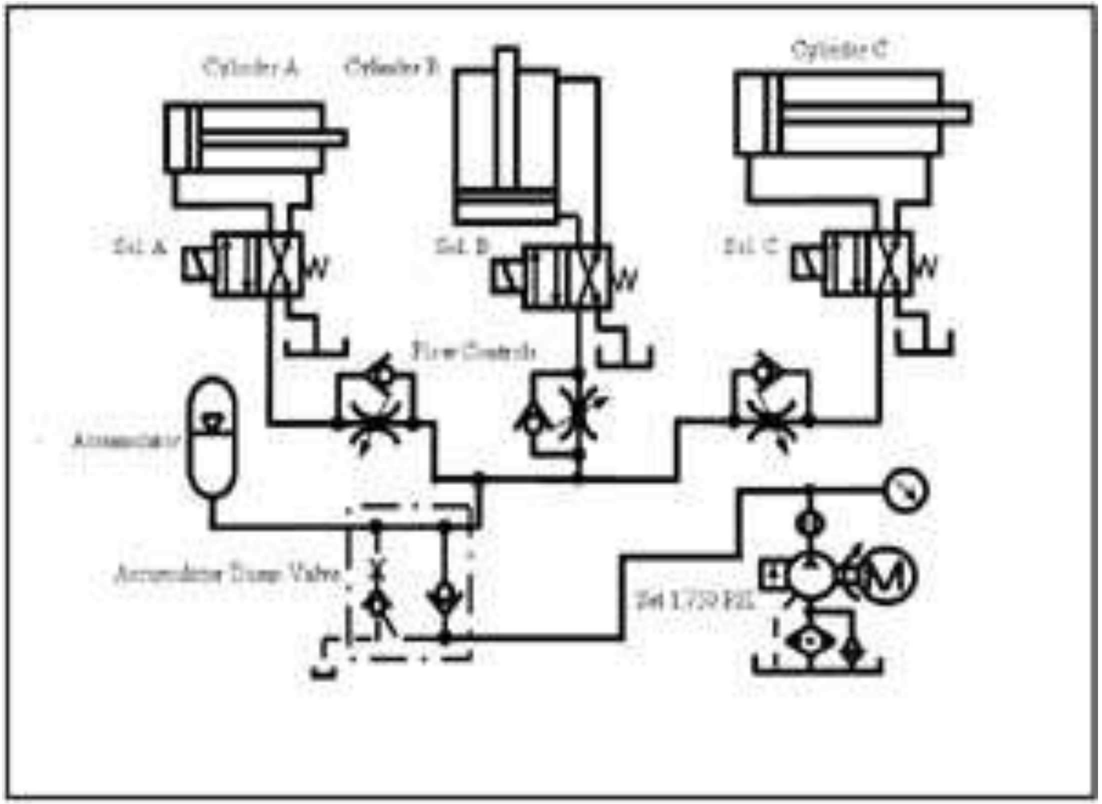
Σχηματική και φυσική απεικόνιση ενός τυπικού υδραυλικού συστήματος



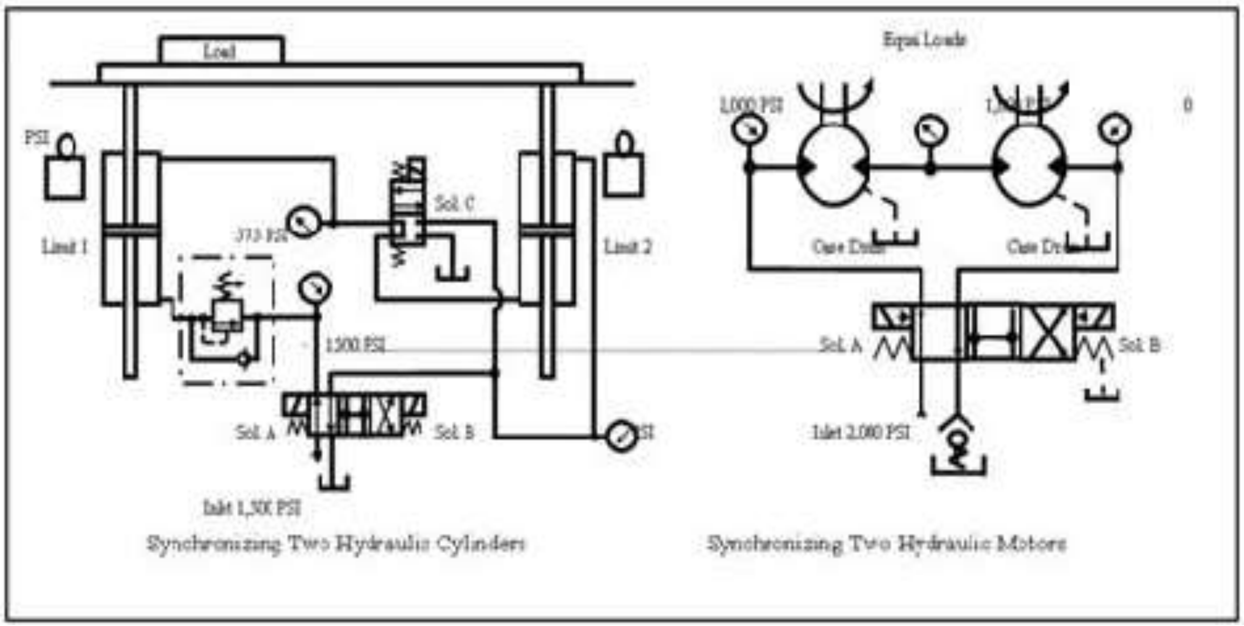
Schematic Drawing of a Hydraulic Circuit



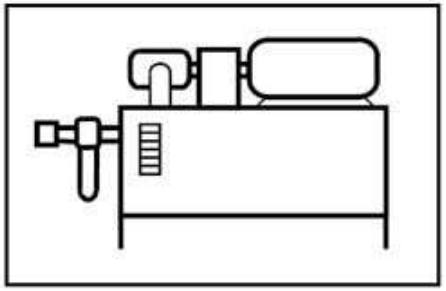
Physical Drawing of a Hydraulic Circuit

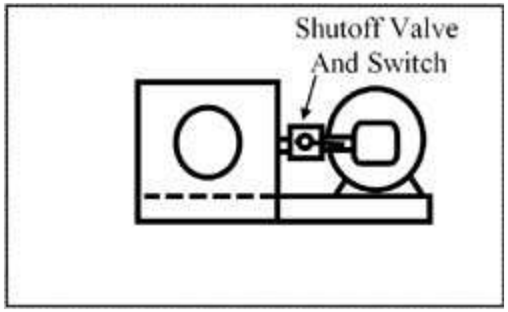

Cylinder A
Cylinder B
Cylinder C
Sol. A
Sol. B
Sol. C
Flow Controls
Accumulator
Accumulator Dump Valve

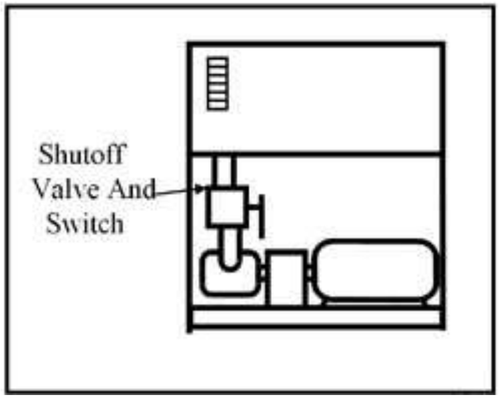
Σχηματική απεικόνιση δύο υδραυλικών κυκλωμάτων συγχρονισμένης λειτουργίας.



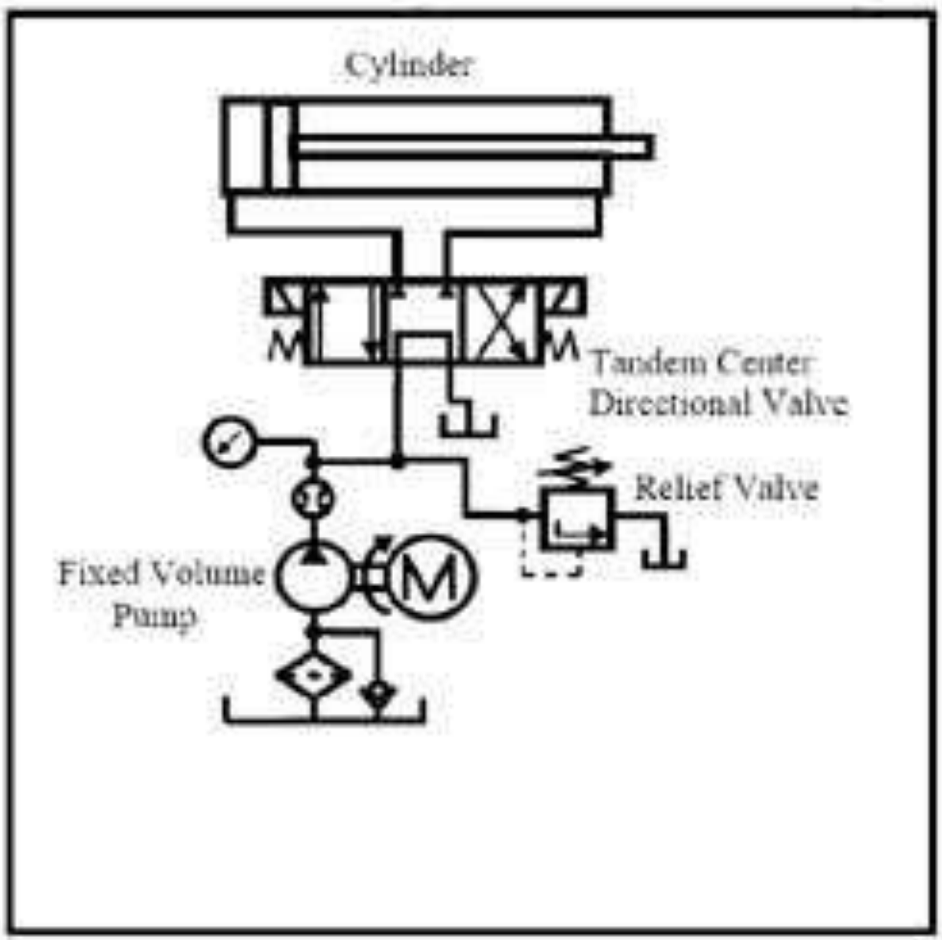
Υδραυλική Μονάδα Ισχύος

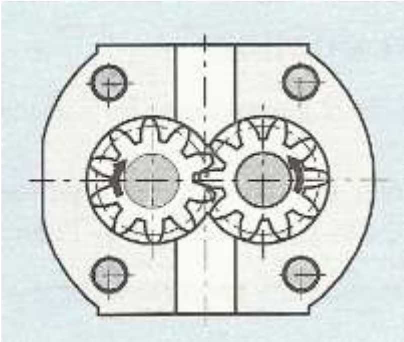






Τυπικό κύκλωμα με αντλία σταθερής μετατόπισης





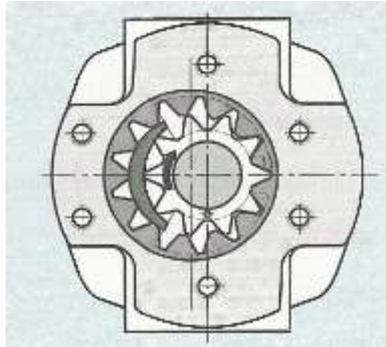
$$V = m \cdot z \cdot b \cdot h \cdot \pi$$

m = modulus

z = number of gears

b = width of gears

h = height of gears



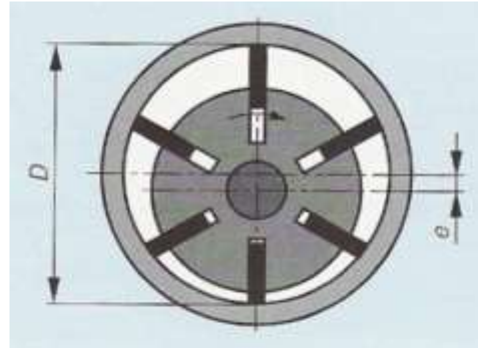
$$V = m \cdot z \cdot b \cdot h \cdot \pi$$

m = modulus

z = number of internal gears

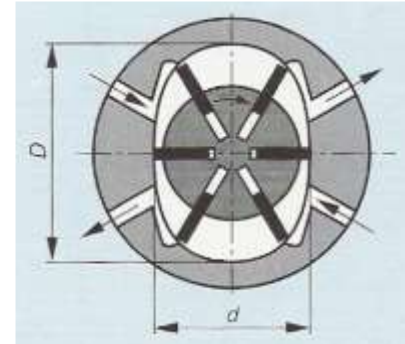
b = width of gears

h = height of gears



$$V = 2 \cdot \pi \cdot b \cdot e \cdot D$$

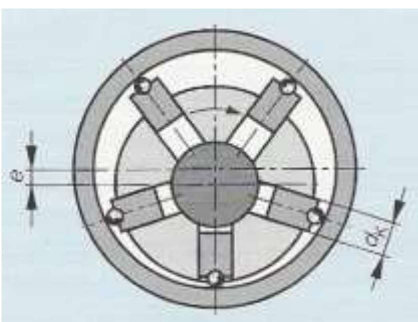
b = vane width



$$V = \left(\frac{\pi \cdot (D^2 - d^2)}{4}\right) \cdot k \cdot b$$

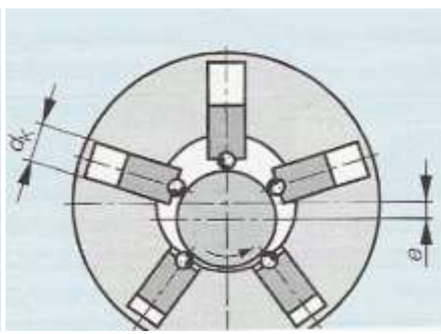
b = vane width

k = vane stroke per revolution



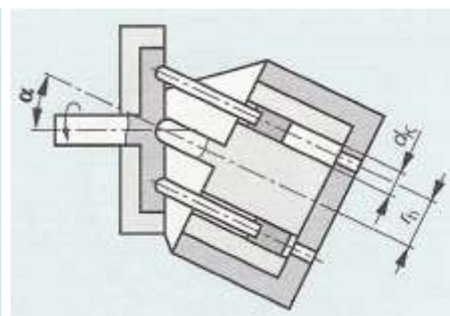
$$V = \frac{d_K{}^2 \cdot \pi}{4} \cdot 2\,e \cdot z$$

z = number of pistons

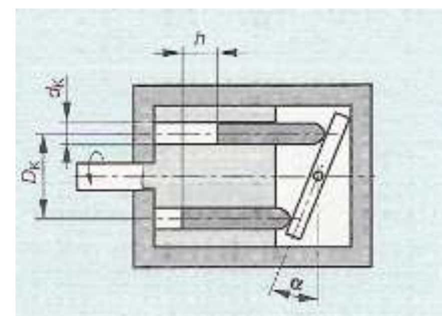


$$V = \frac{d_K{}^2 \cdot \pi}{4} \cdot 2\,e \cdot z$$

z = number of pistons



$$V = \frac{d_K{}^2 \cdot \pi}{4} \cdot 2\,r_h \cdot z \cdot \sin\alpha$$



$$V = \frac{d_K{}^2 \cdot \pi}{4} \cdot D_K \cdot \tan\alpha$$

Υδραυλικό Υγρό

- Μεταδίδει ενέργεια
- Λιπαίνει
- Στεγανοποιεί

Υδραυλικό Υγρό

- Ορυκτέλαιο (με πρόσθετα)
- Συνθετικό έλαιο
- Νερό
- Μίγμα Νερού – γλυκόλης
- Μίγμα Νερού – ελαίου
- Έλαιο φυτικής προέλευσης

Υδραυλικό Υγρό

Πρόσθετα Βελτίωσης

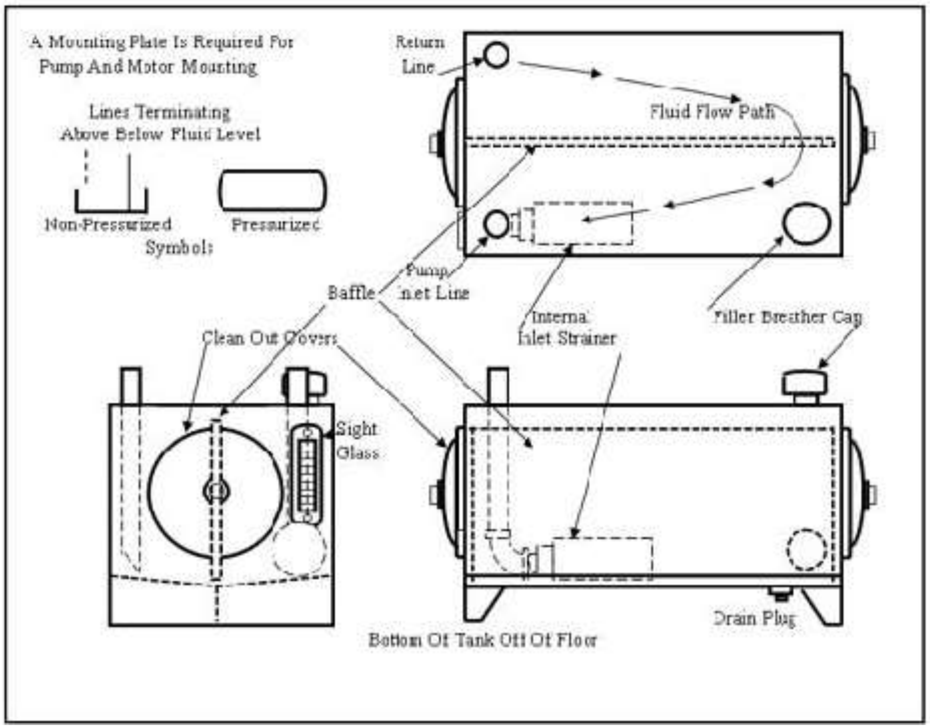
- της λιπαντικής ικανότητας
- Του ιξώδους
- Της αντιοξειδωτικής προστασίας
- Της προστασίας έναντι δημιουργίας αφρού

- κλπ

Υδραυλικό Υγρό

- Υπερθέρμανση
- Μόλυνση

Δεξαμενή Λαδιού



Απορρόφηση – εκπομπή θερμότητας από τη δεξαμενή.

$$\mathbf{HP=0.001 \times (T_{Fmax}-T_{Amax}) \times A}$$

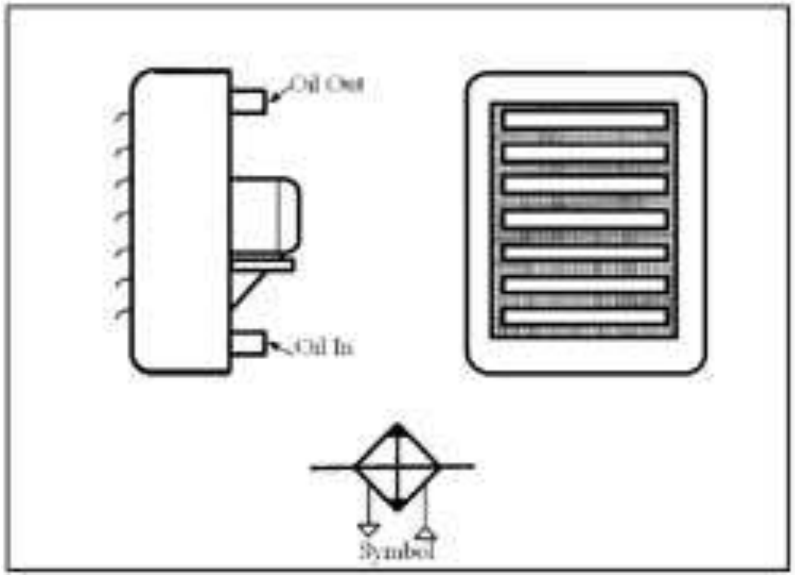
HP: Θερμική Ισχύς που μπορεί να διαχυθεί από τη δεξαμενή. - hp

T_{Fmax}: Μέγιστη επιτρεπόμενη θερμοκρασία υδραυλικού υγρού. - ^{o}F

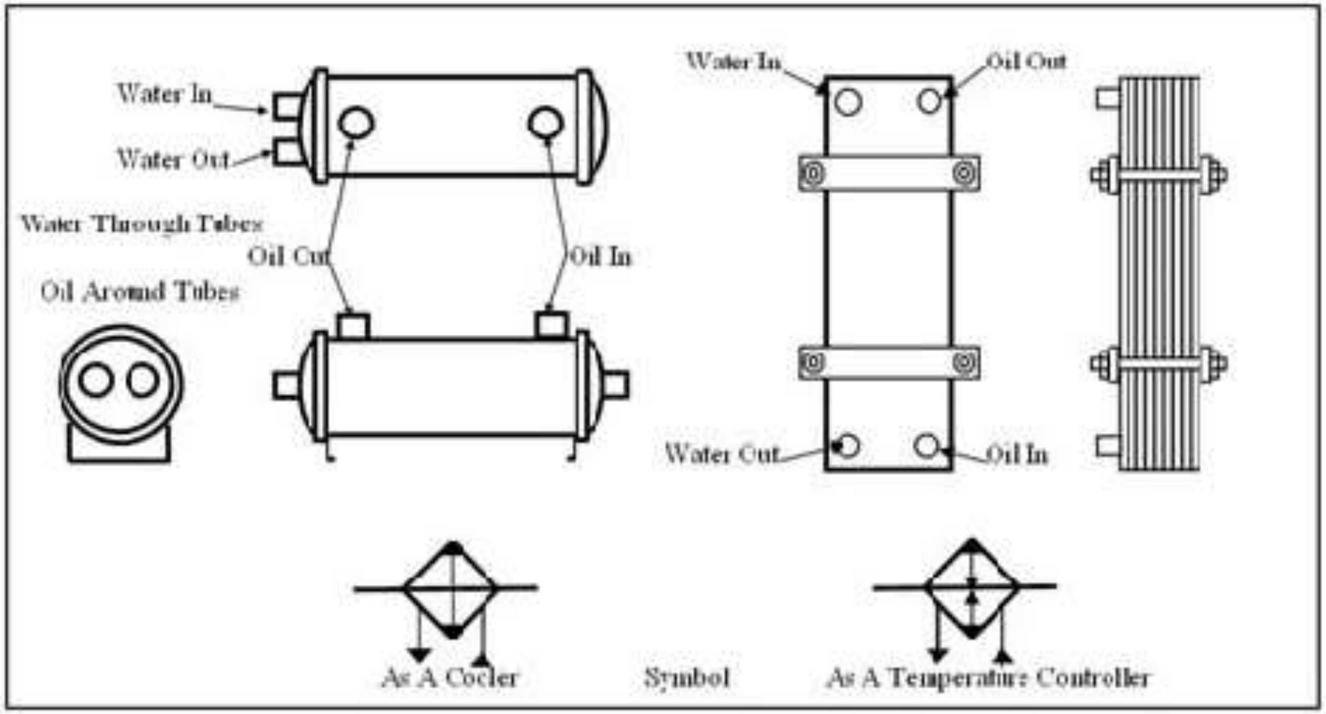
T_{Amax}: Μέγιστη θερμοκρασία αέρα – ^{o}F

A: Επιφάνεια επαφής δεξαμενής με το υδραυλικό υγρό – ft^2

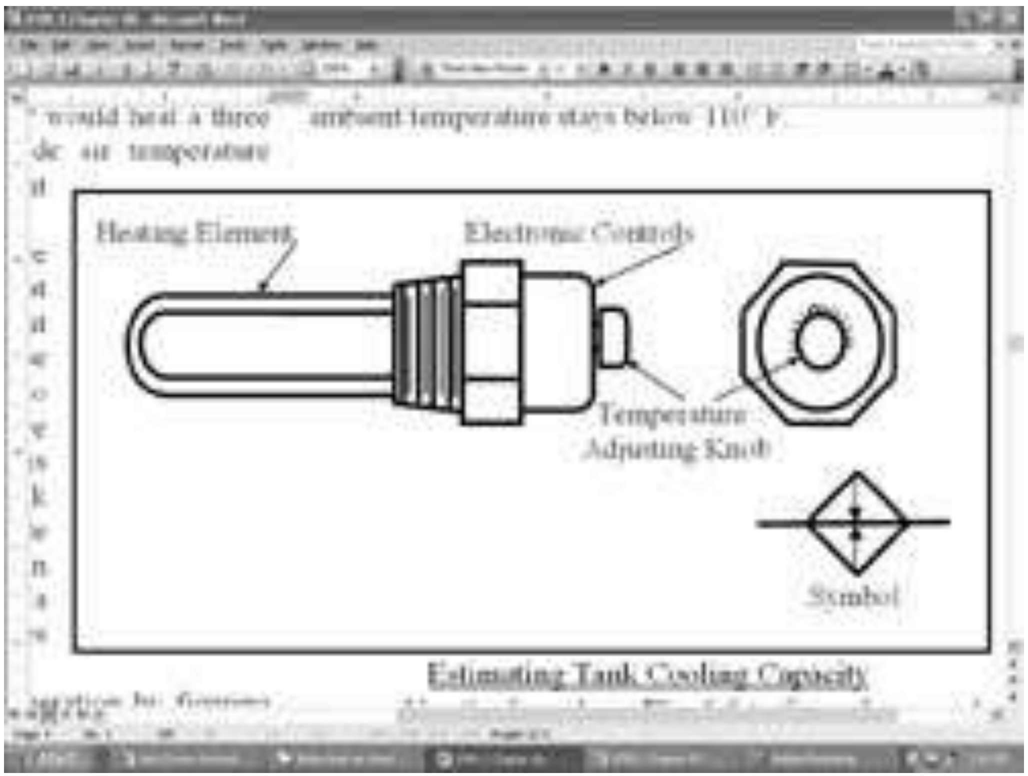
Ψύκτης



Ψύκτες


Water In
Water Out
Water Through Tubes
Oil Out
Oil In
Oil Around Tubes
Water In
Oil Out
Water Out
Oil In
As A Cooler
Symbol
As A Temperature Controller

Θερμαντήρας Δεξαμενής



Θερμαντής

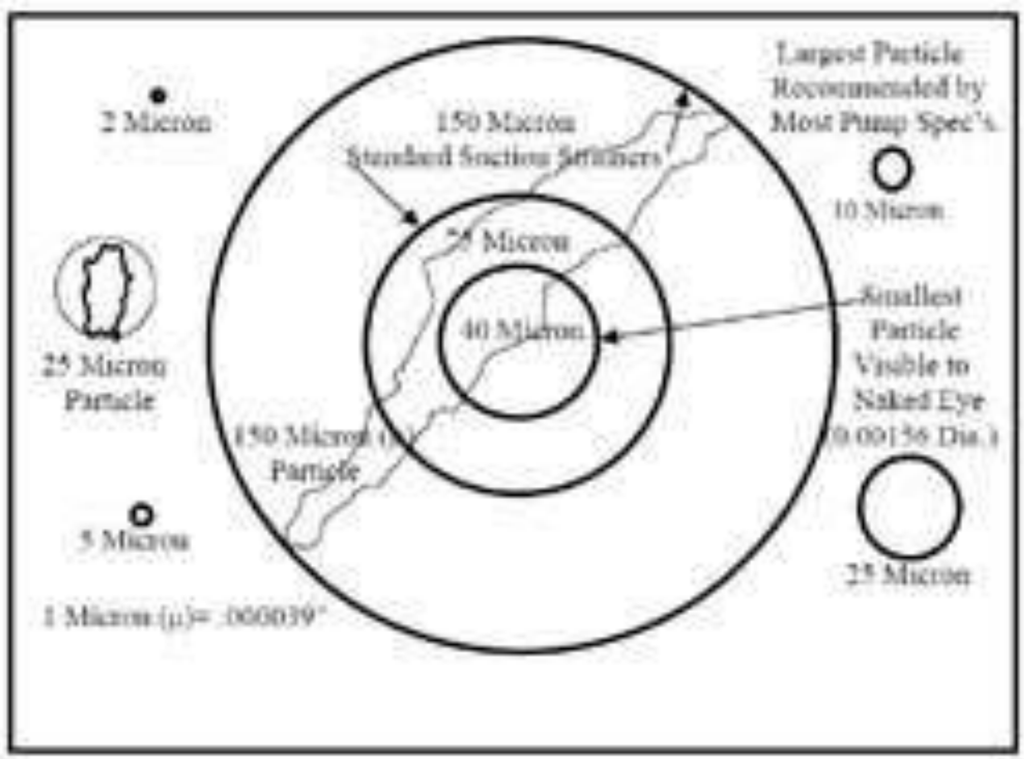
$$kW = \frac{C_T \times (T_{Fd} - T_{Amin})}{800 \times t}$$

kW = power required to heat fluid — kW
C_T = capacity of tank — gal
T_{Fd} = desired fluid temperature — °F
T_{Amin} = minimum ambient air temperature — °F
A = tank area in contact with fluid — ft^2
t = allowable time — hr

Note: To minimize the size of heating elements, allow 1 to 3 hr for heating in this worst-case scenario.

To only maintain a desired temperature, reduce power (kW) by ⅓ to ⅔ based on time (t).

Σωματίδια στο λάδι

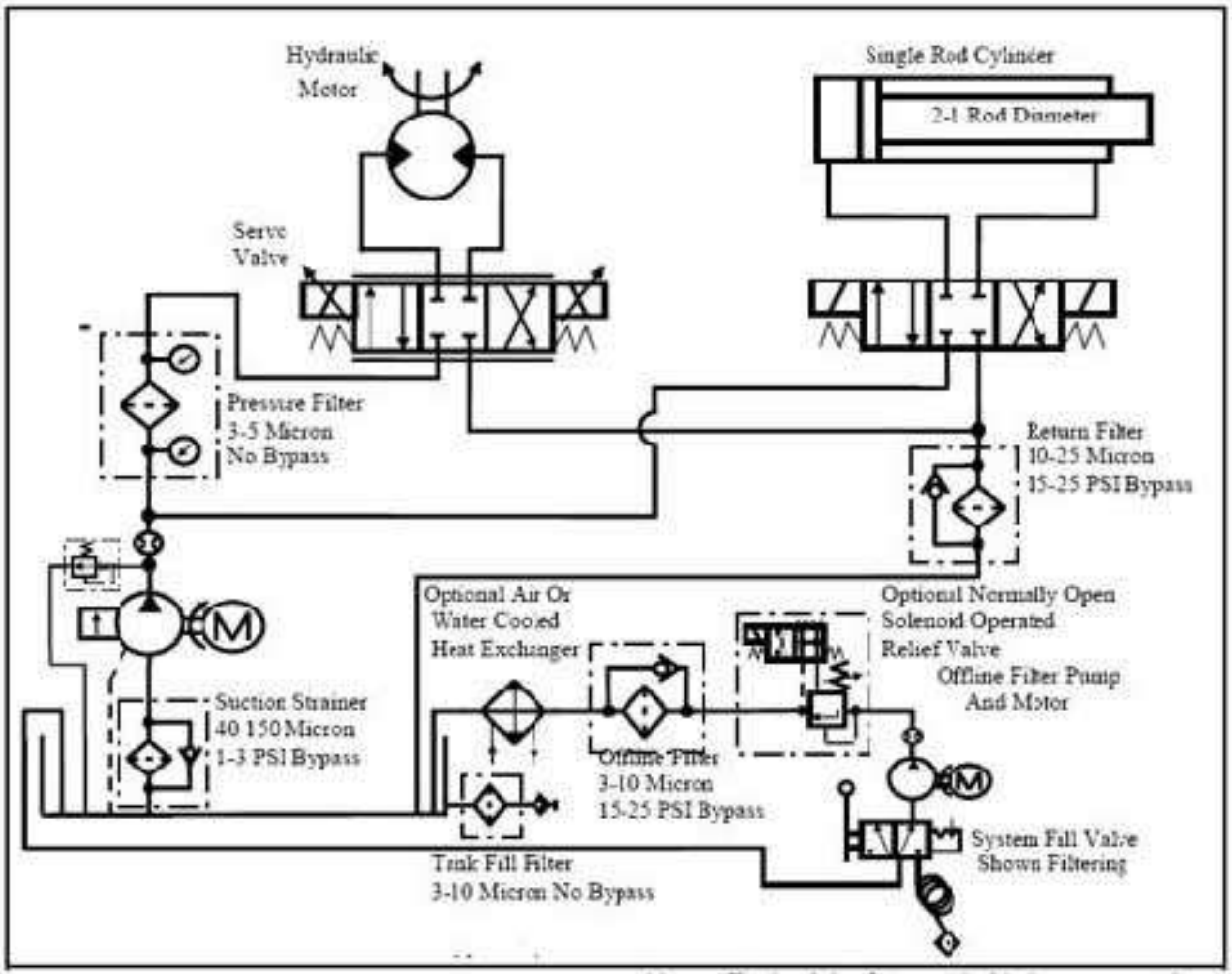


Υδραυλικό Υγρό

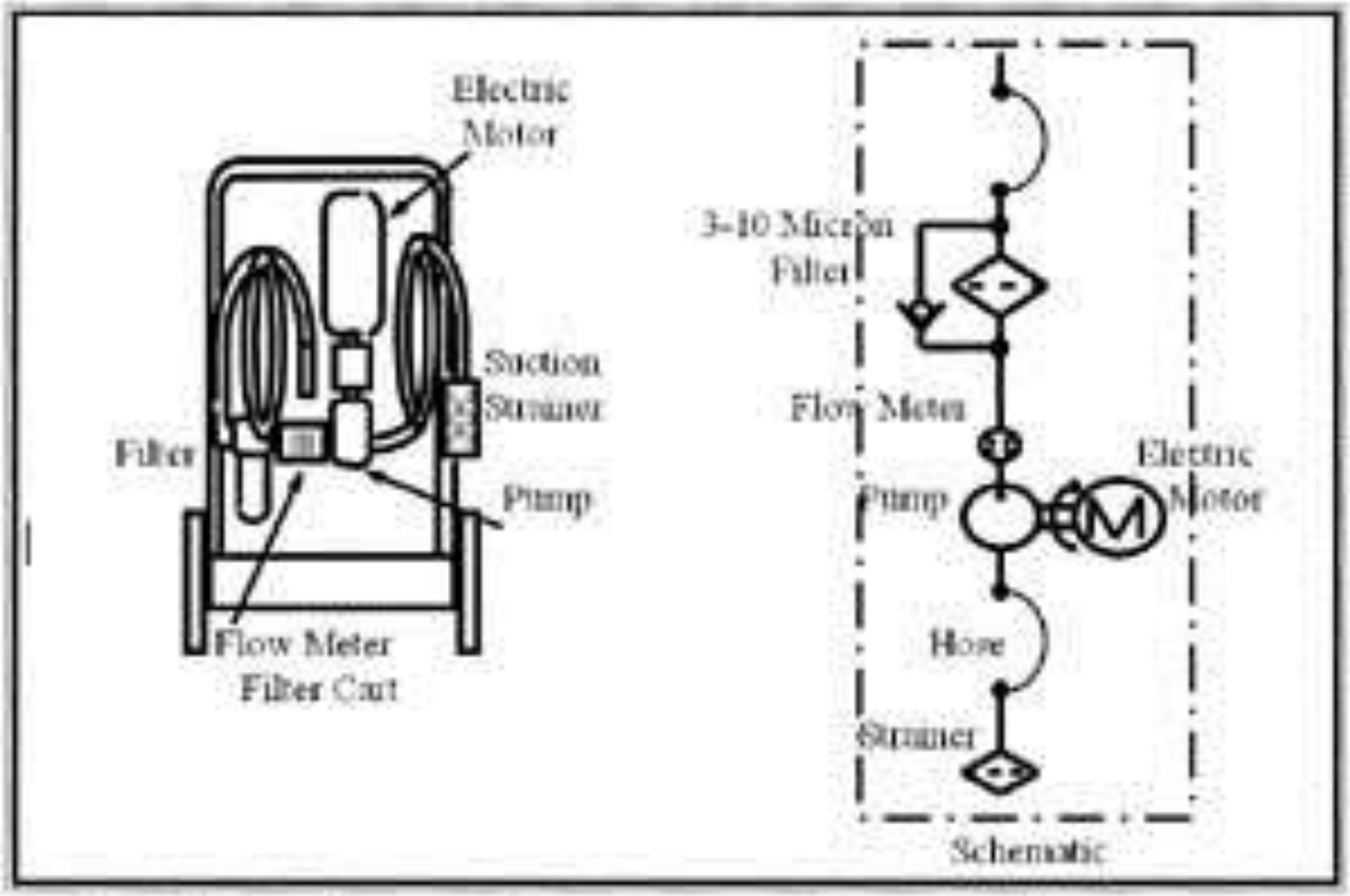
ISO 4406 Chart		
Range Number	Number of Particles per ml	
	More Than	Up to and Incl.
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	.64	1.3
6	.32	.64

COMPONENT	ISO Code
Servo Control Valves	16/14/11
Proportional Valves	17/15/12
Vane and Piston Pumps	
And Motors Directional and	18/16/13
Pressure Control Valves	18/16/13
Gear Pumps and Motors	18/17/14
Flow Control Valves and Cylinders	20/18/15
New Unused Oil	20/18/15

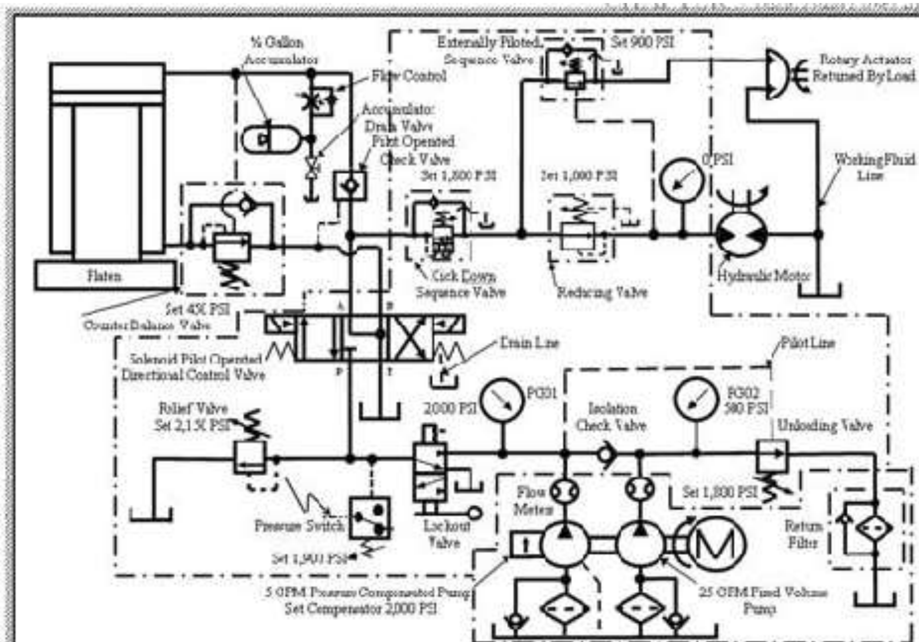
Φίλτρα


Hydraulic Motor
Single Rod Cylinder
2-1 Rod Diameter
Servo Valve
Pressure Filter
3-5 Micron
No Bypass
Return Filter
10-25 Micron
15-25 PSI Bypass
Optional Air Or Water Cooled Heat Exchanger
Optional Normally Open Solenoid Operated Relief Valve
Offline Filter Pump And Motor
Suction Strainer
40 150 Micron
1-3 PSI Bypass
Offline Filter
3-10 Micron
15-25 PSI Bypass
System Fill Valve Shown Filtering
Tank Fill Filter
3-10 Micron No Bypass

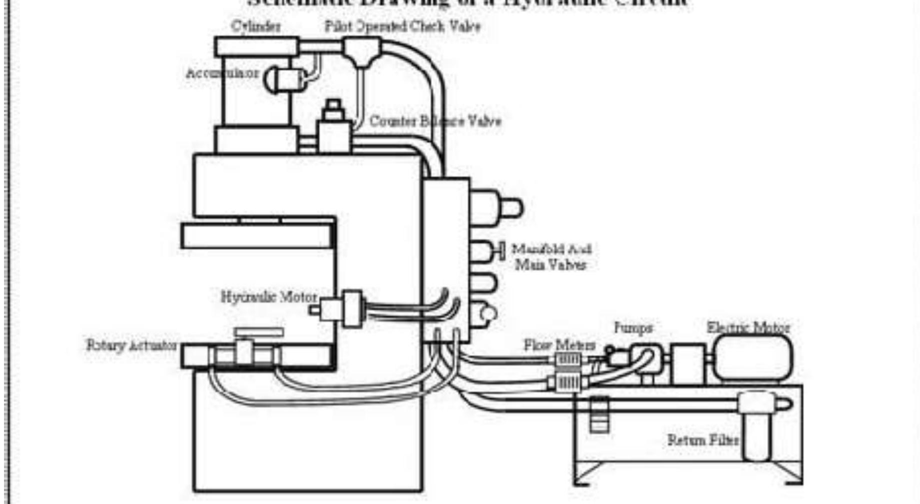
Filter cart (used to transfer hydraulic fluids) and its circuit schematic diagram



Σχηματική και φυσική απεικόνιση ενός τυπικού υδραυλικού συστήματος

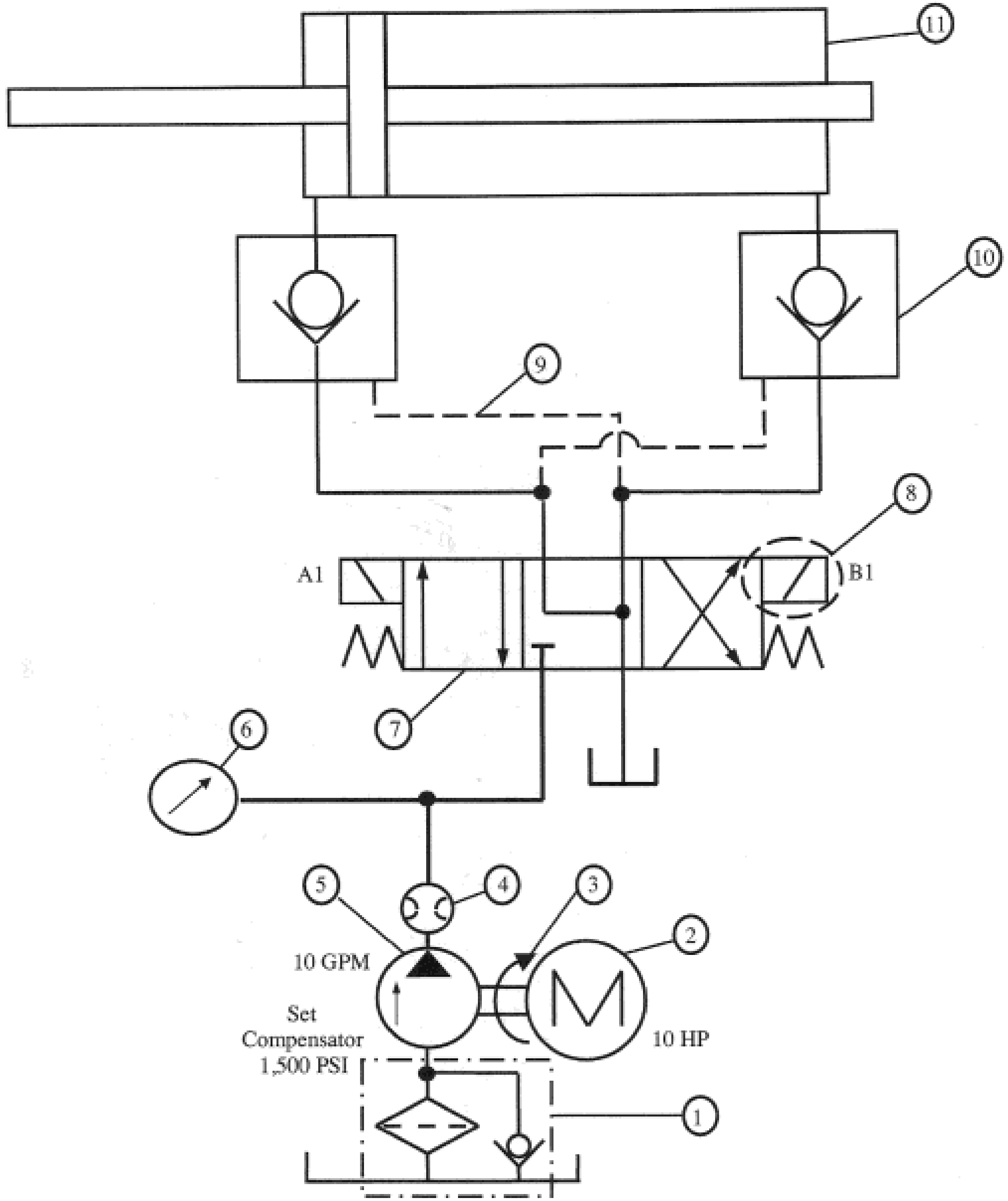


Schematic Drawing of a Hydraulic Circuit

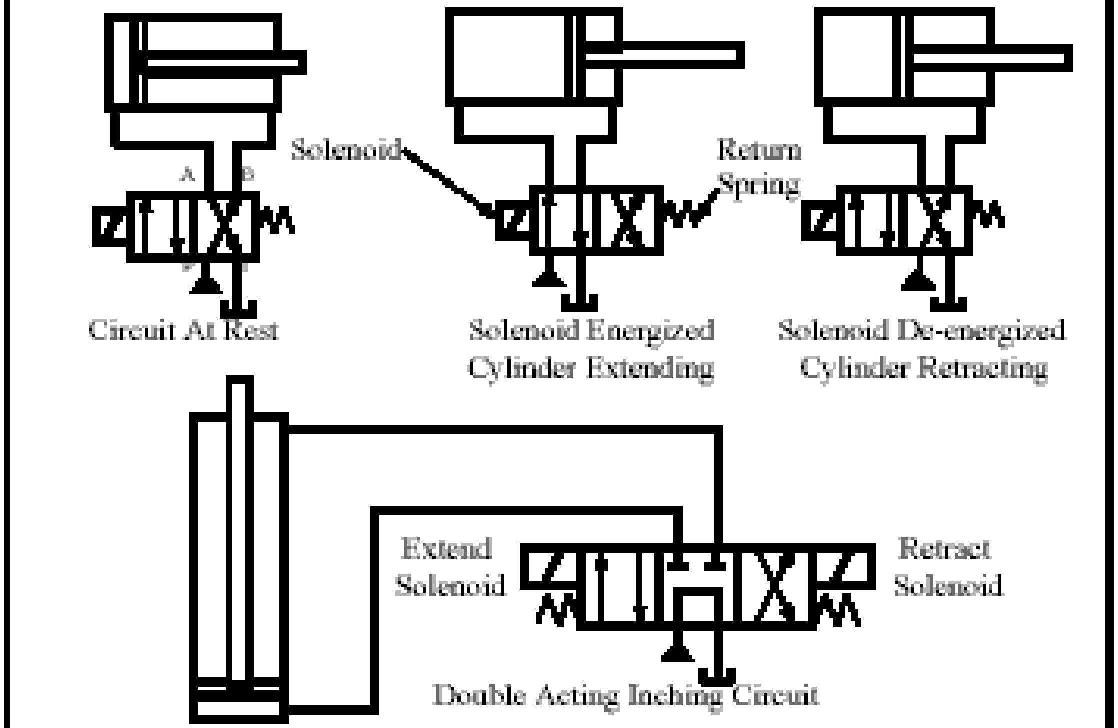


Physical Drawing of a Hydraulic Circuit

Dual Pilot Operated Check Valve Locking Circuit

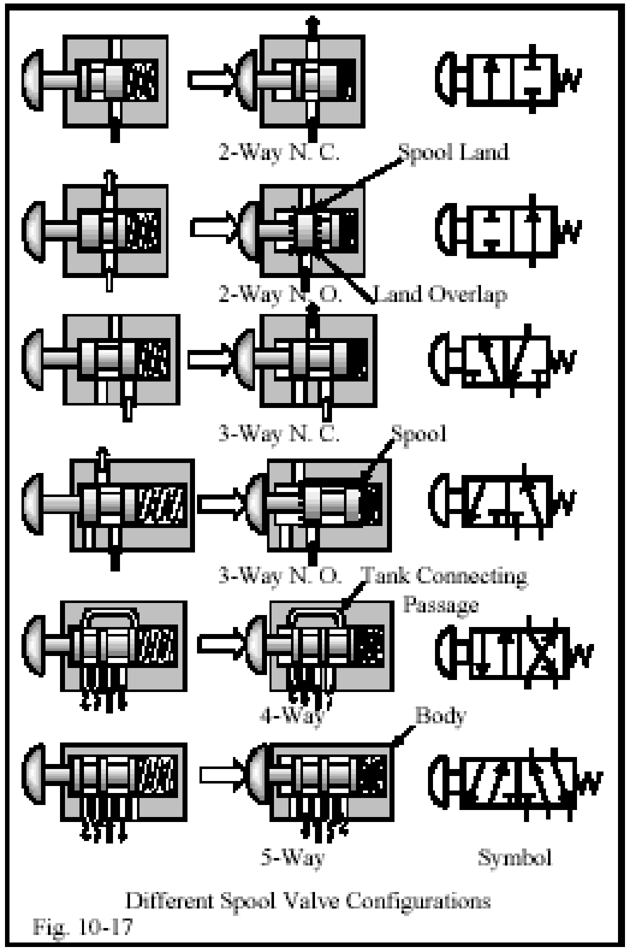


Circuits in which 2- and 3-position, 4-way valves operate cylinders

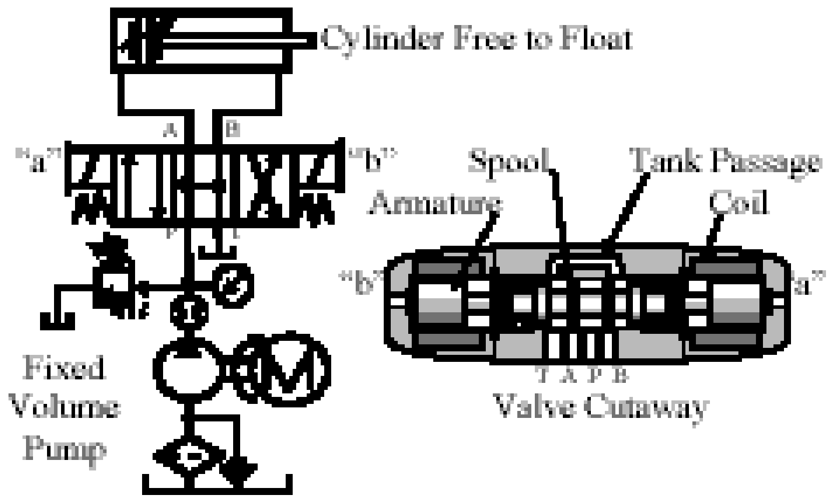


4-Way, 2 &3-Position Directional Control Valves Operating a Cylinder
Fig. 10-12

Views of a variety of valve spool configurations, with their symbols. (All have palm-button operators.)



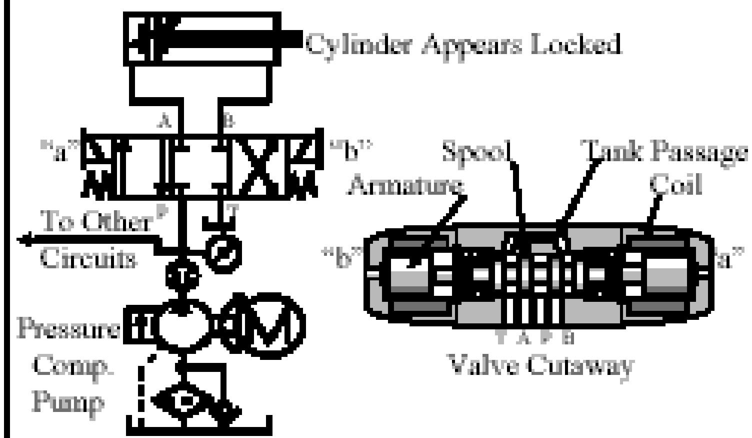
All ports open



Typical Circuit For A 4-Way Directional Control Valve
"All Ports Open" Center Condition

Fig. 10-18

All ports closed



Typical Circuit For A 4-Way Directional Control Valve
"All Ports Closed" Center Condition
Fig. 10-19A

With all-ports-closed valve center condition, bypass flow will extend cylinder

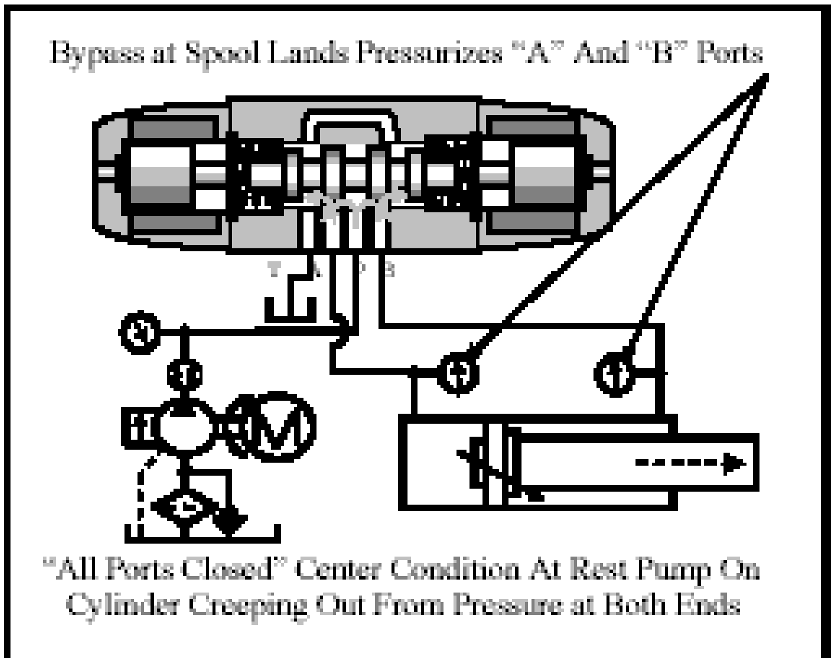
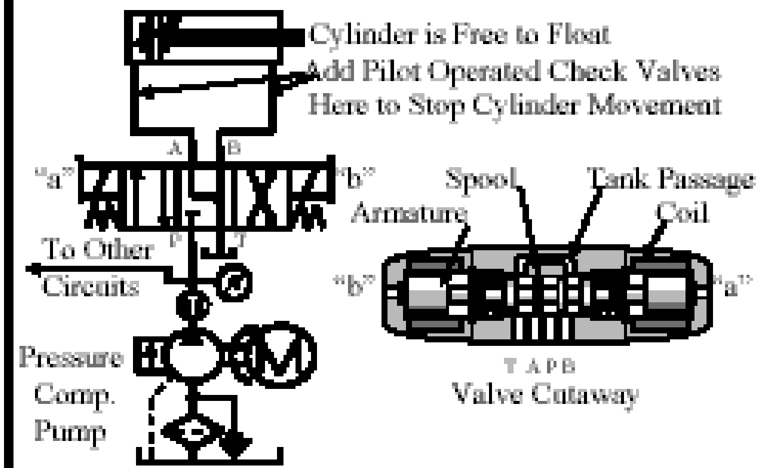


Fig. 10-19B

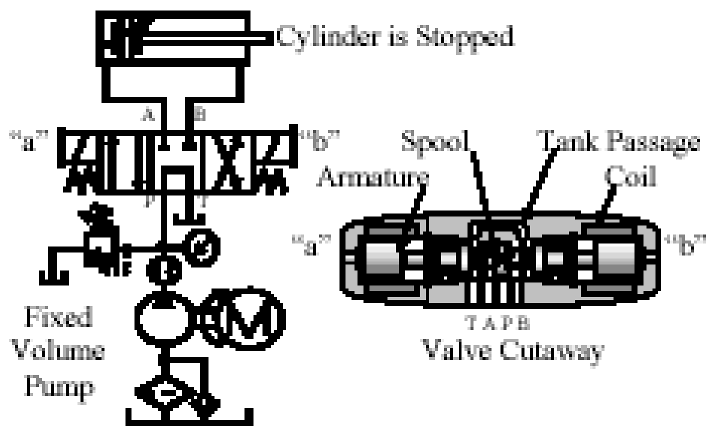
Float center



Typical Circuit For A 4-Way Directional Control Valve
"P" Blocked "A" and "B" to Tank " Center Condition
"Float Center"

Fig. 10-20

Tandem center



Typical Circuit For A 4-Way Directional Control Valve
"A" and "B" Blocked "P" to "T" Center Condition
"Tandem Center"

Fig. 10-21

Valve operators

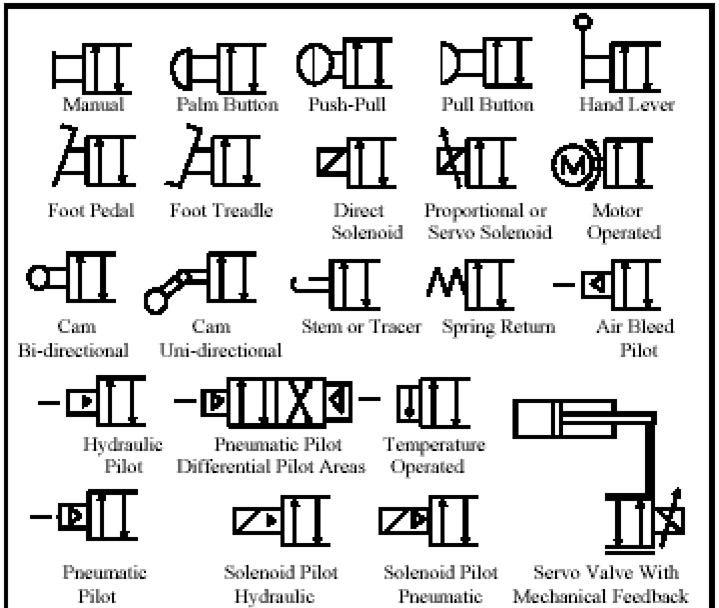
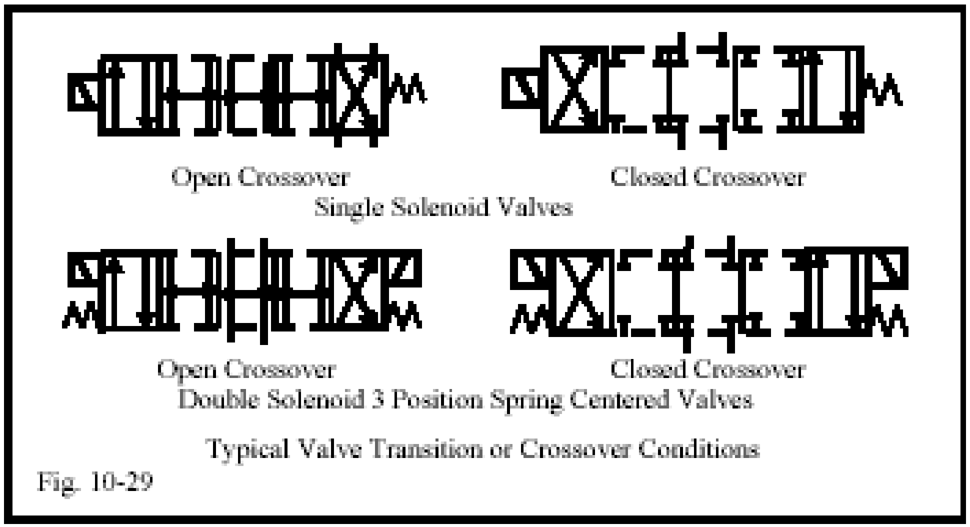


Fig. 10-28 Valve Operators

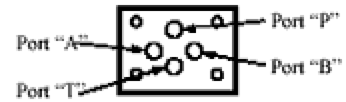
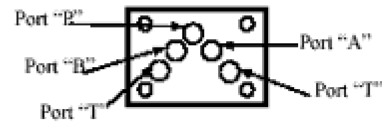
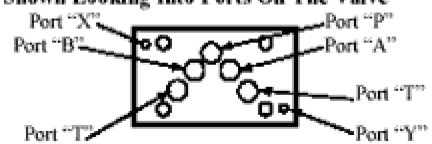
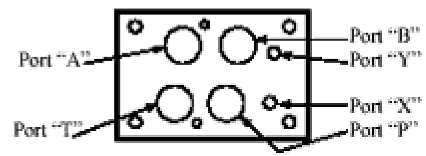
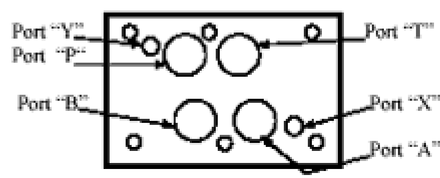
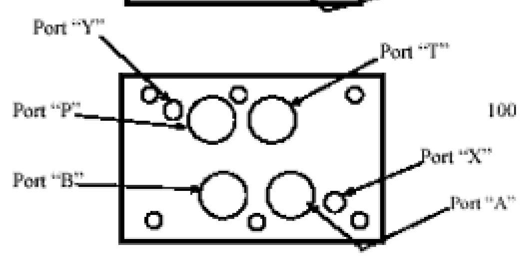
Symbols for typical valve transition or crossover conditions



Typical Valve Transition or Crossover Conditions

Fig. 10-29

NFPA AND ISO STANDARD INTERFACE LAYOUTS FOR HYDRAULIC DIRECTIONAL CONTROL VALVES

NFPA.	ISO	*CETOP*	NG	PORT DIA	PORT CONFIGURATION	NOMINAL FLOW
D02	02	*2*	4	.177		5 GPM
D03	*03*	3	6	.295		10 GPM
D05	05	*5*	10	.440		20 GPM
D05H	05			.440		25 GPM
D07	07	*7*	16	.690		30 GPM
D08	08	8	25	.984		60 GPM
D10	10	*10*	32	1.250		100 GPM

All Views Shown Looking Into Ports On The Valve



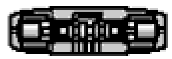
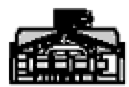
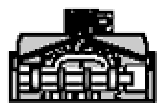
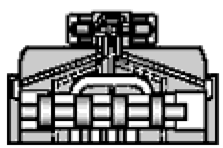
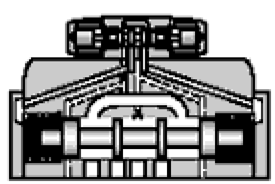
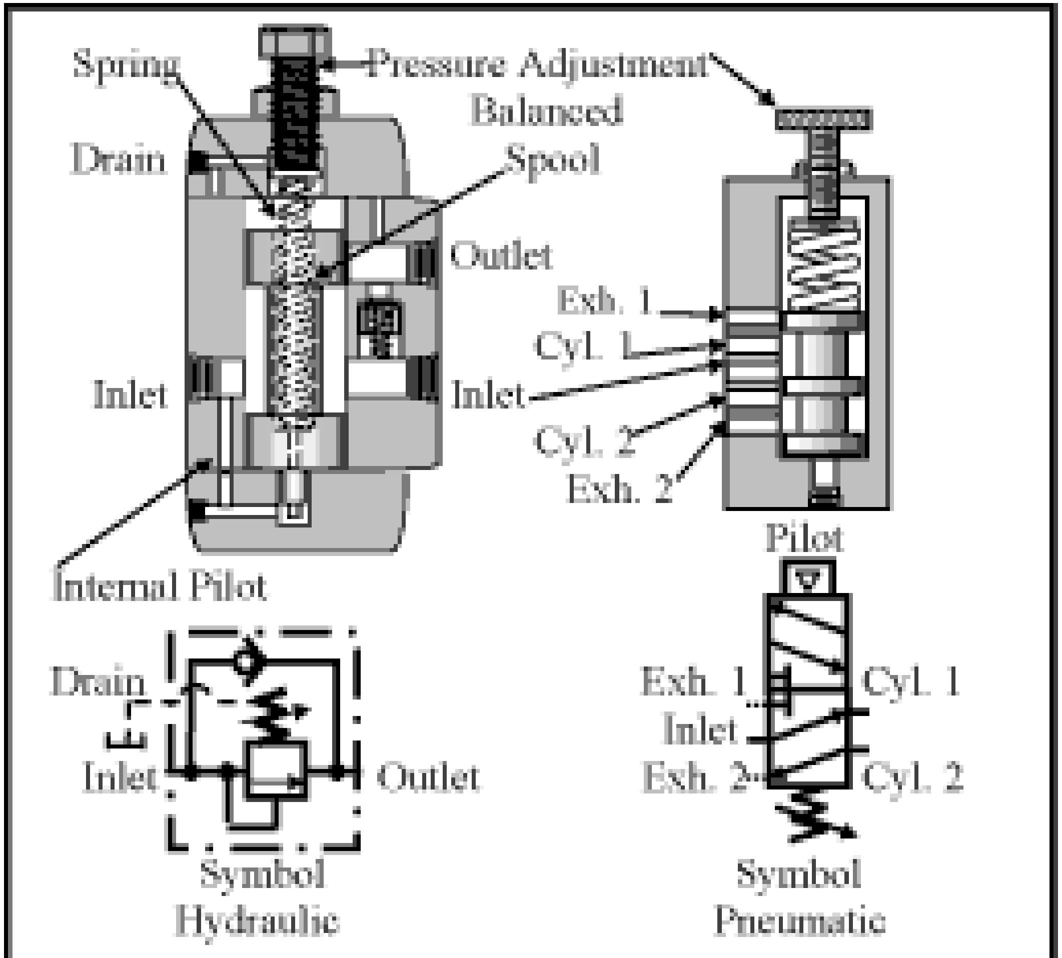






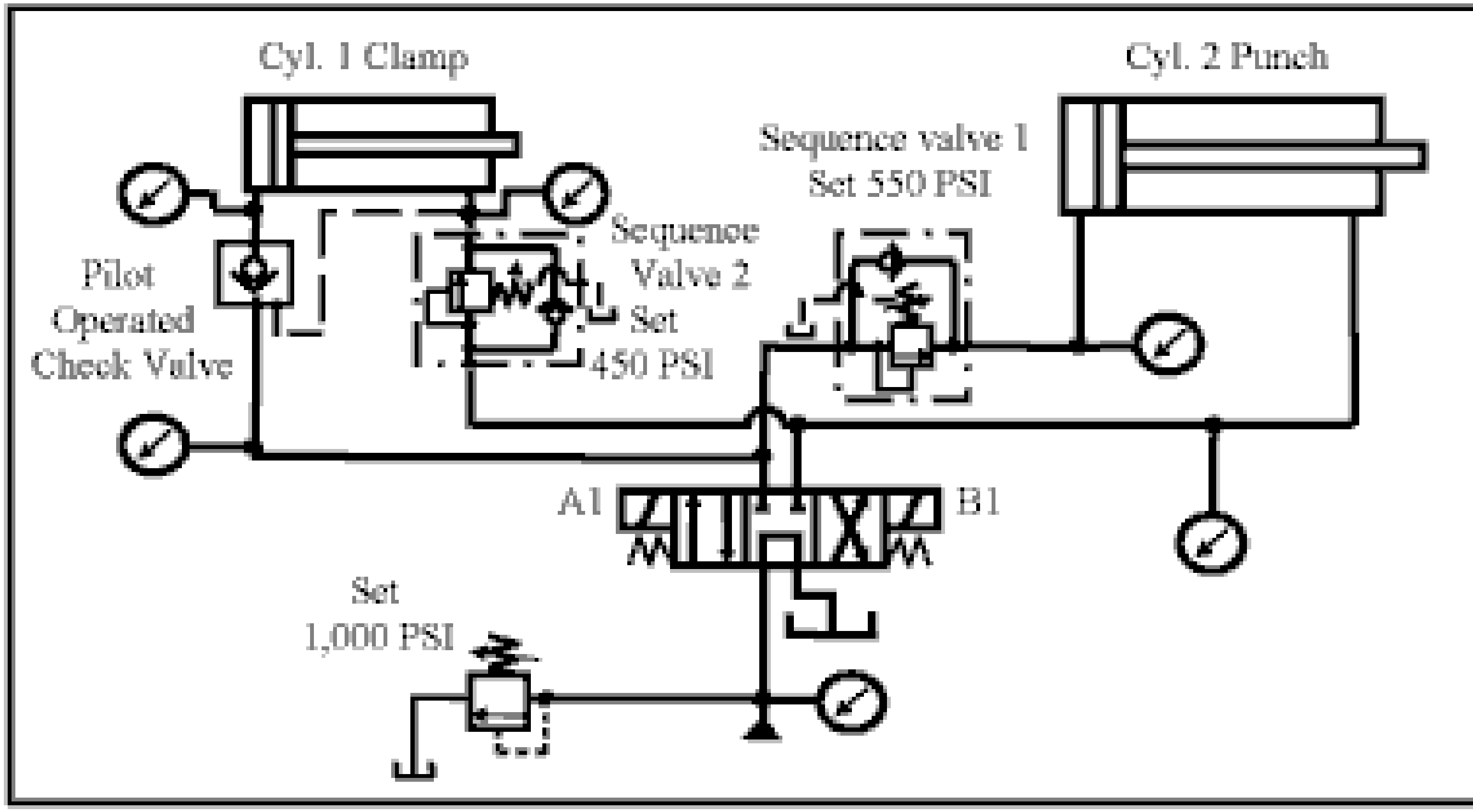
Fig. 10-32

- **Sequence Valves and Reducing Valves**

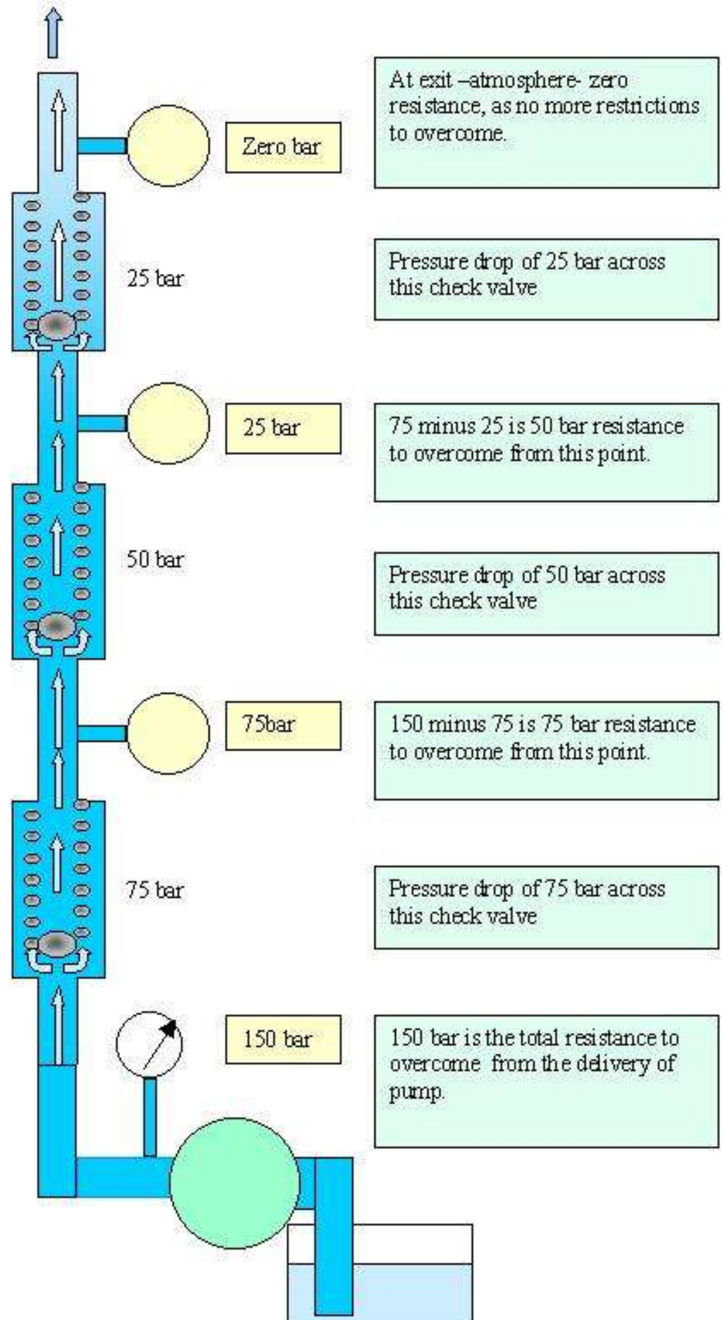
Hydraulic and pneumatic sequence valves



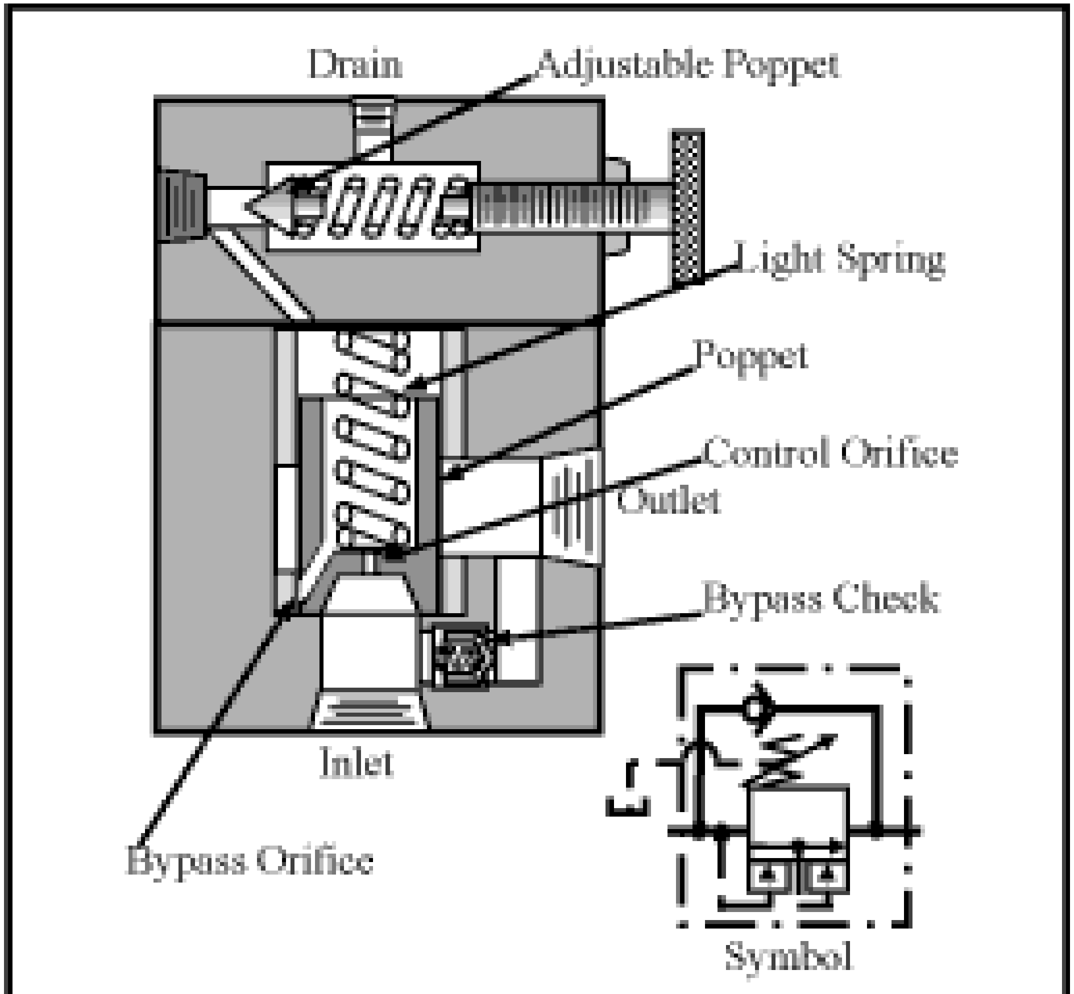
Typical hydraulic sequence valve circuit



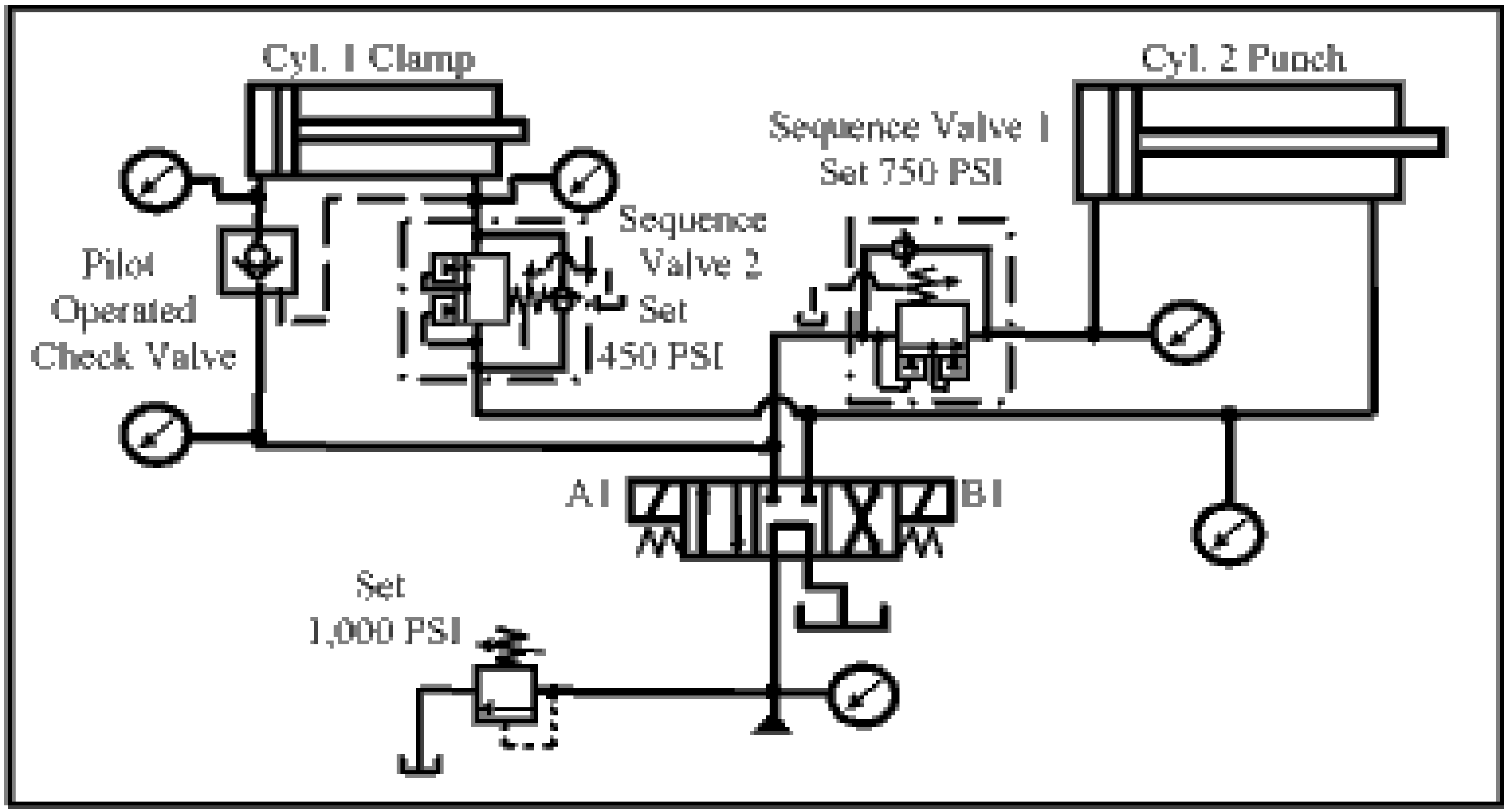
SERIES RESISTANCE add pressure



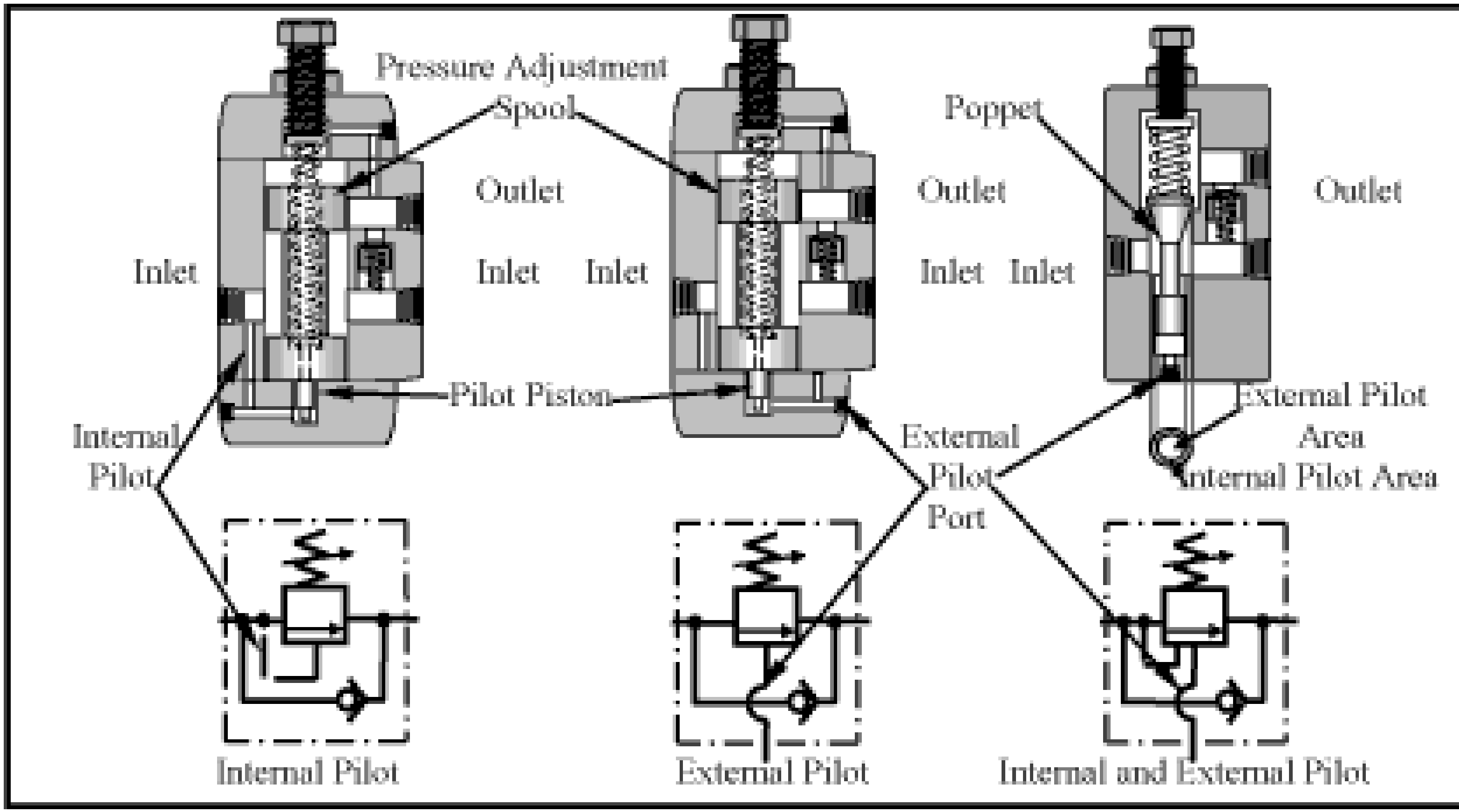
Kick-down sequence valve



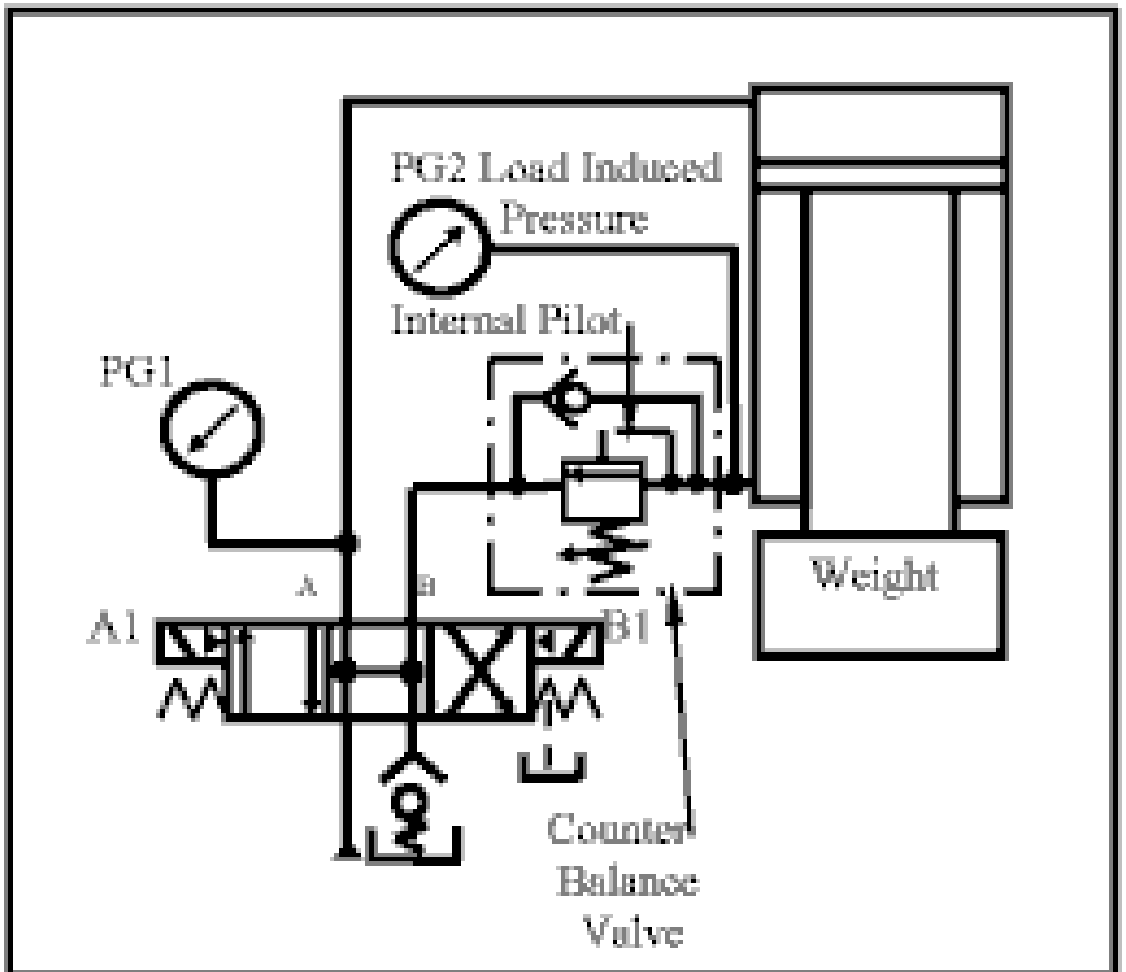
Hydraulic circuit with kick-down sequence valves



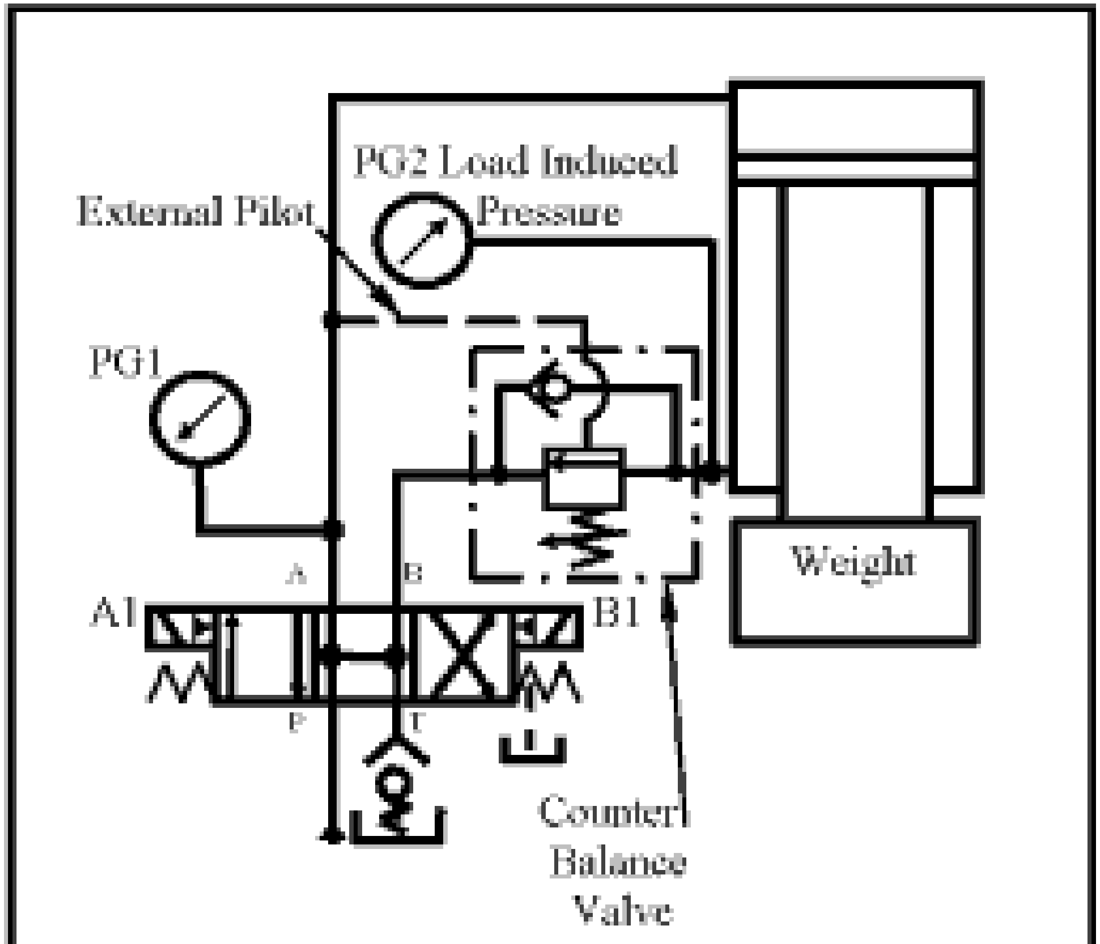
Three types of counterbalance valves



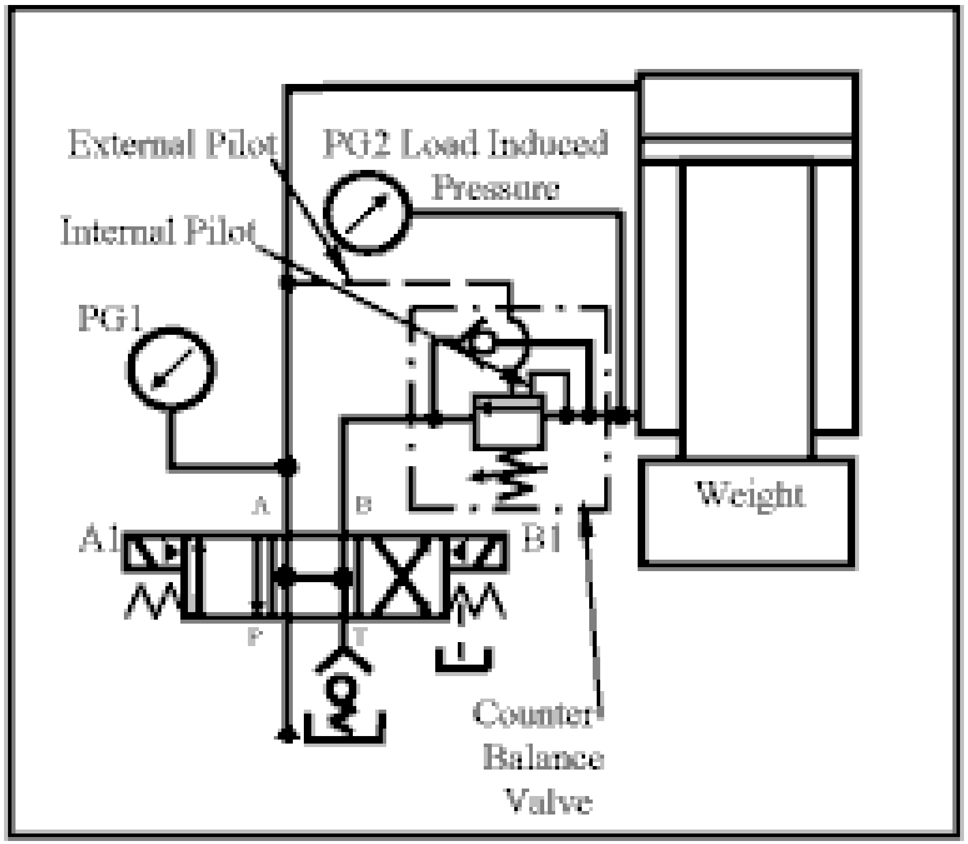
Internally pilot-operated counterbalance valve circuit



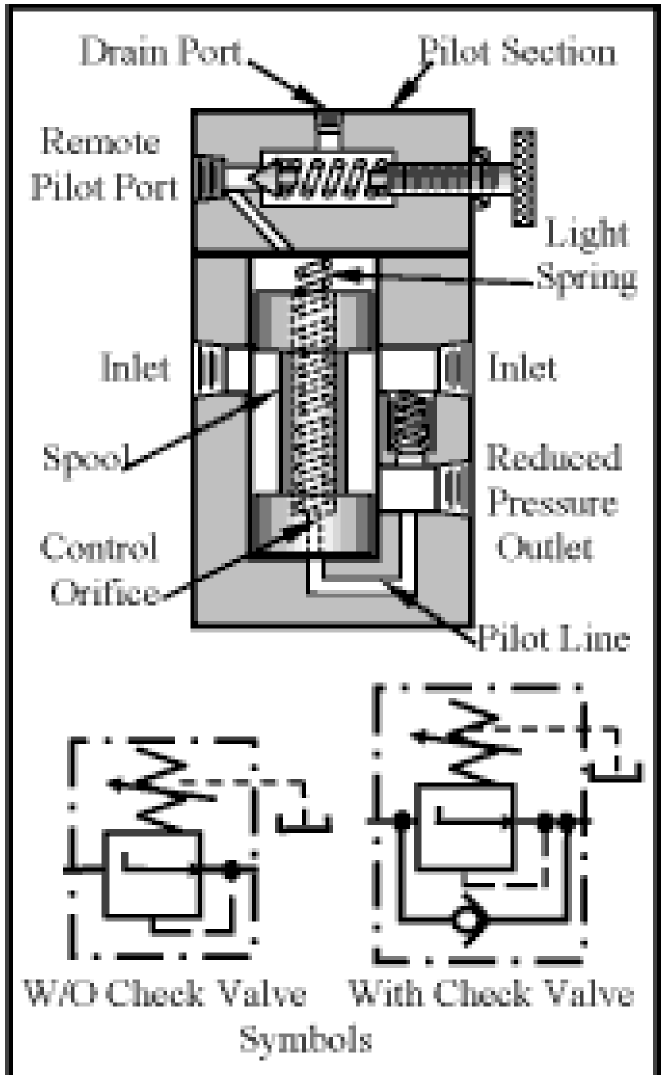
Externally pilot-operated counterbalance valve circuit



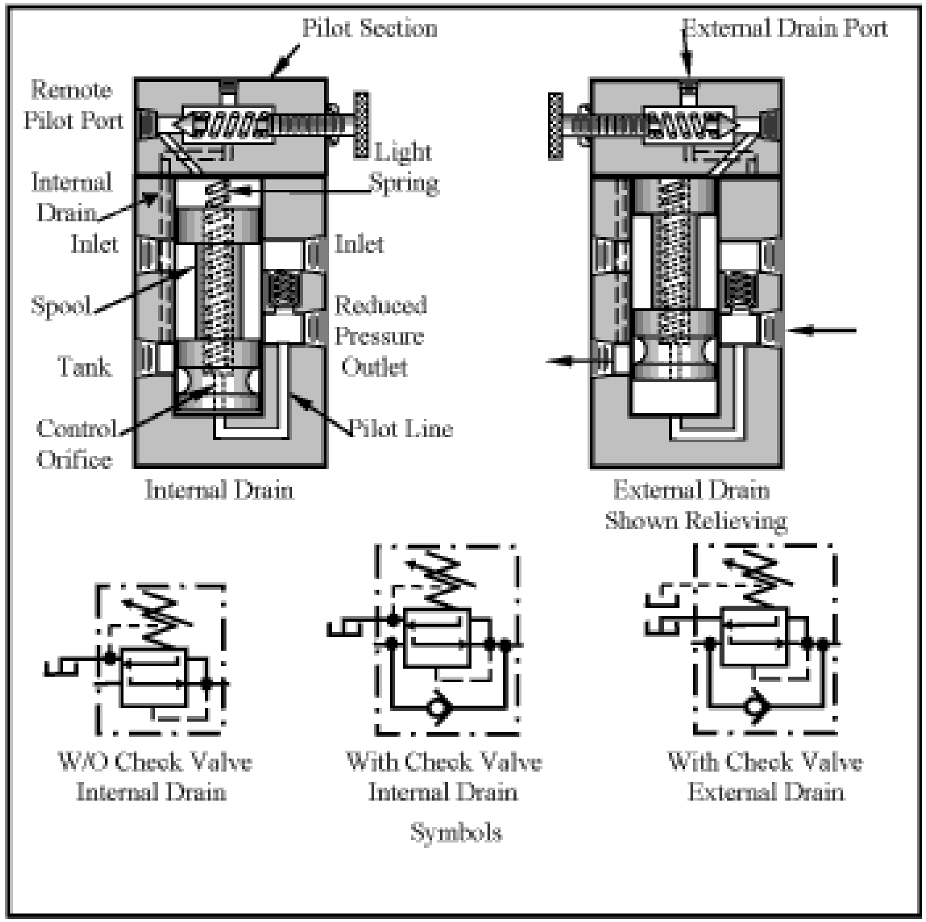
Internally and externally pilot-operated counterbalance valve circuit



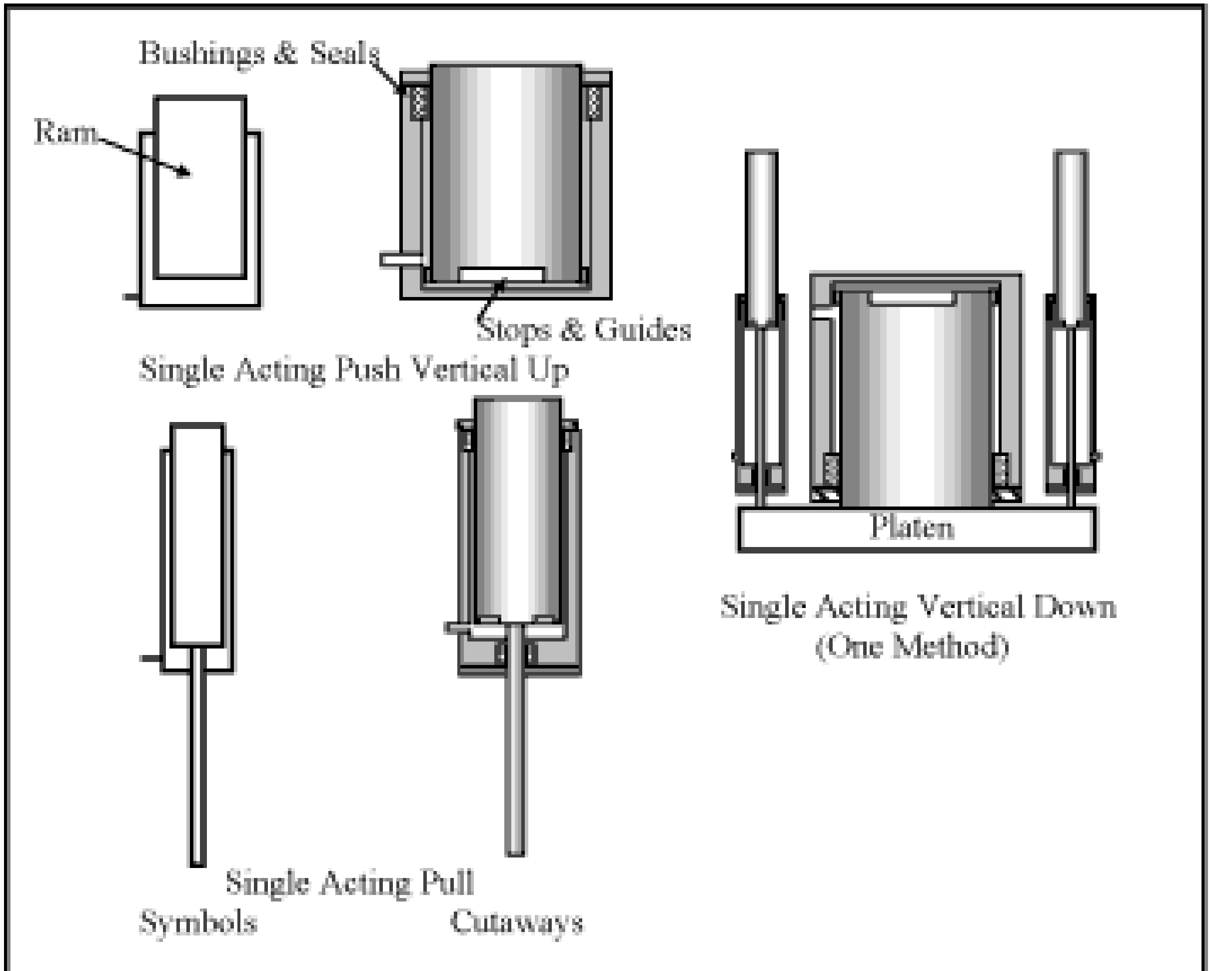
Pilot-operated reducing valve



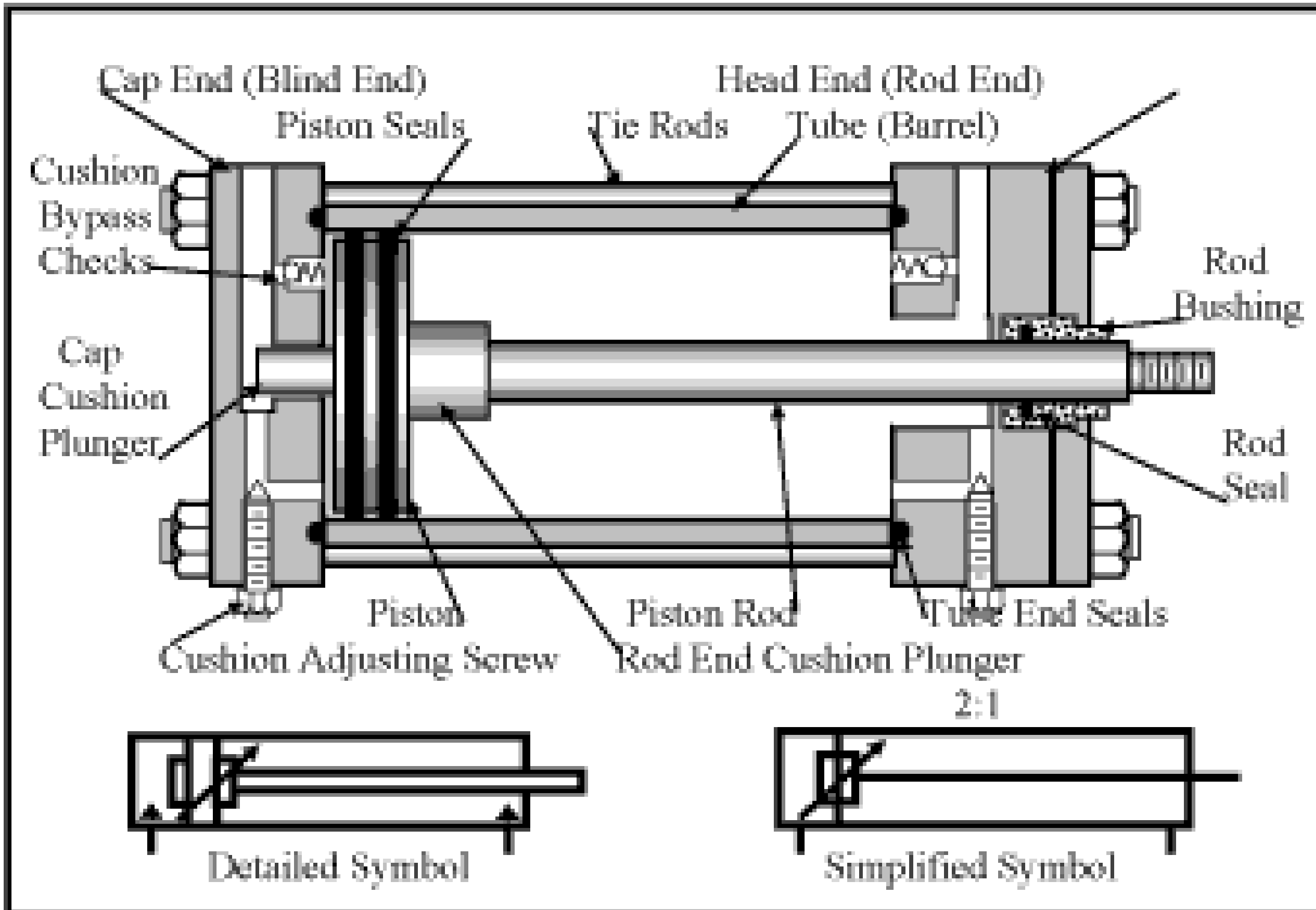
Pilot-operated reducing/relieving valves



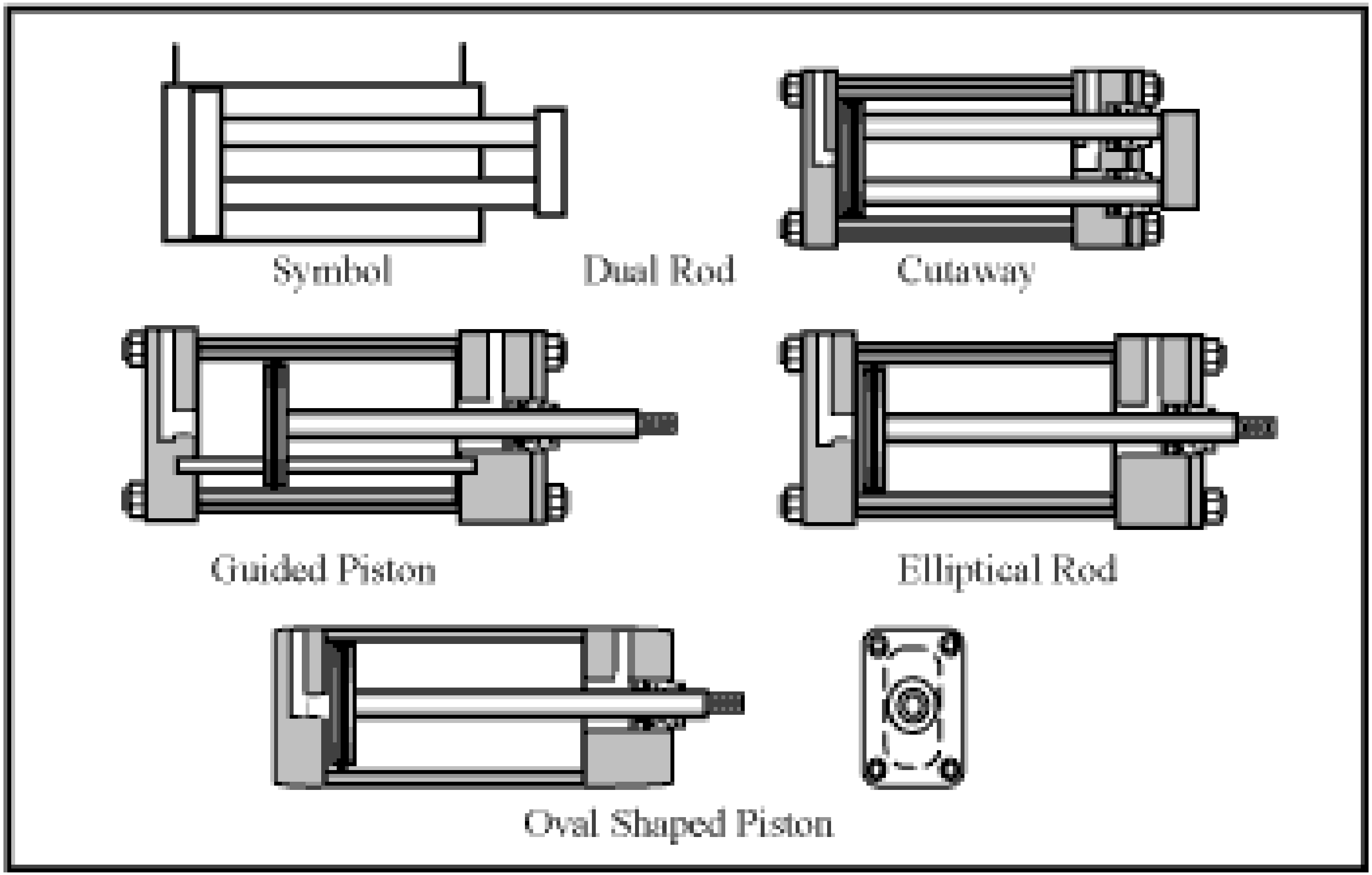
Single-acting ram cylinders for push and pull applications



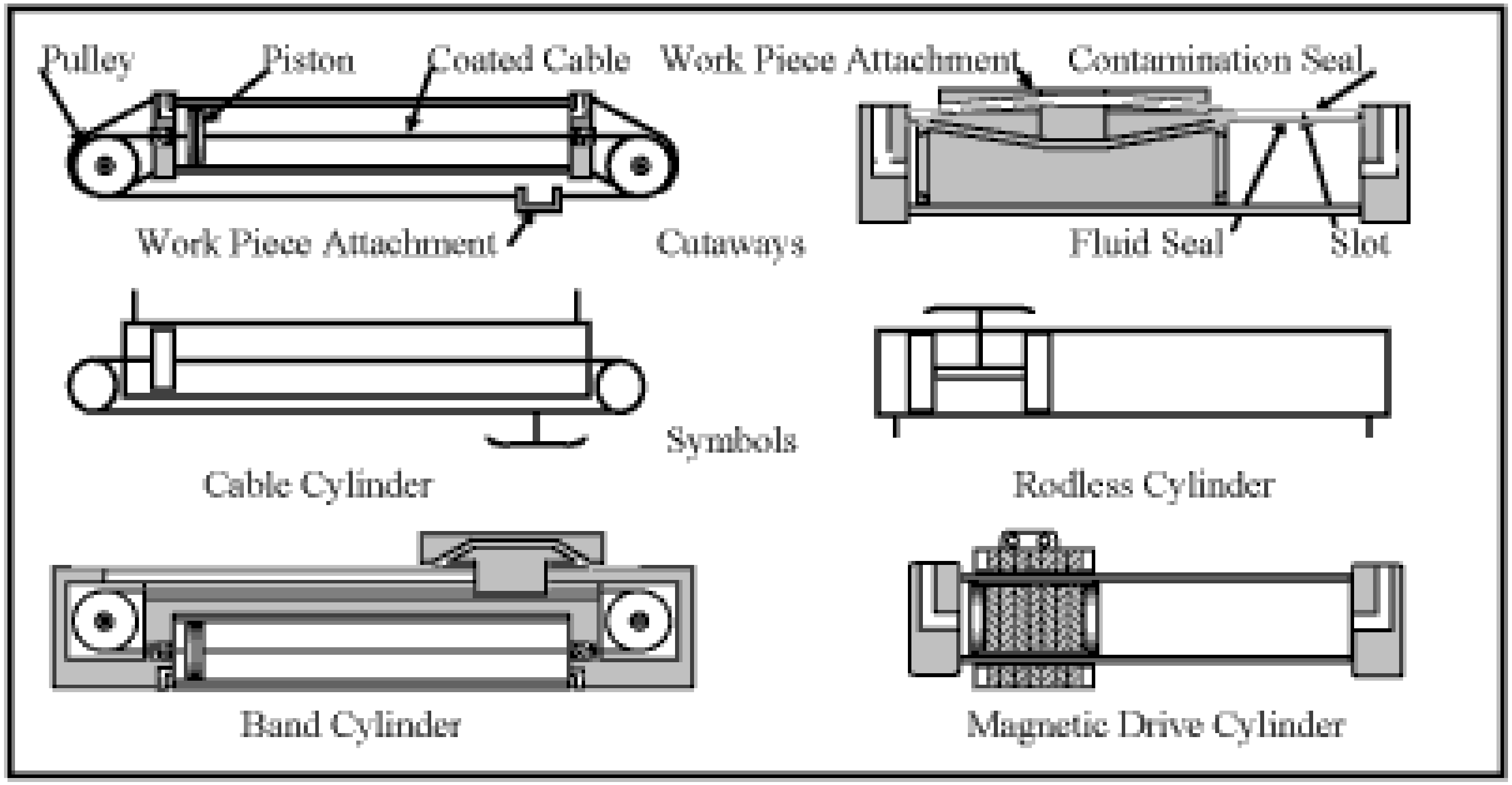
Typical industrial-grade single-rod end tie-rod cylinder



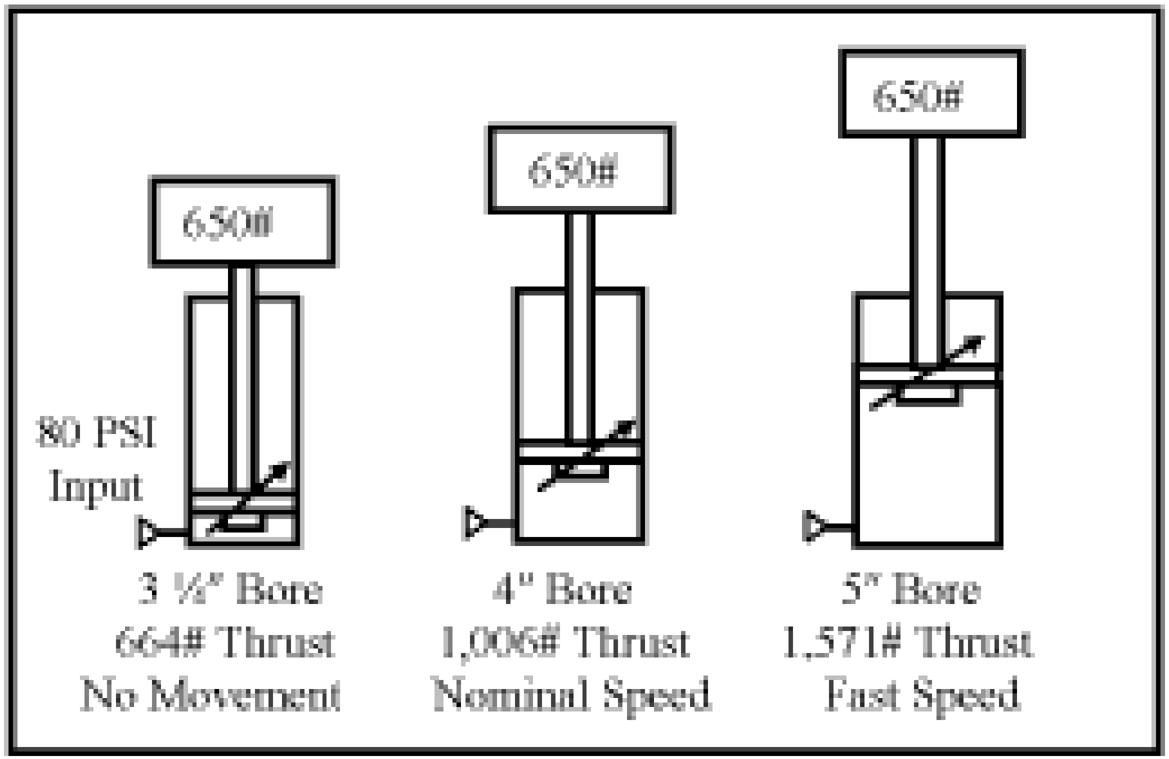
Non-rotating rod cylinders



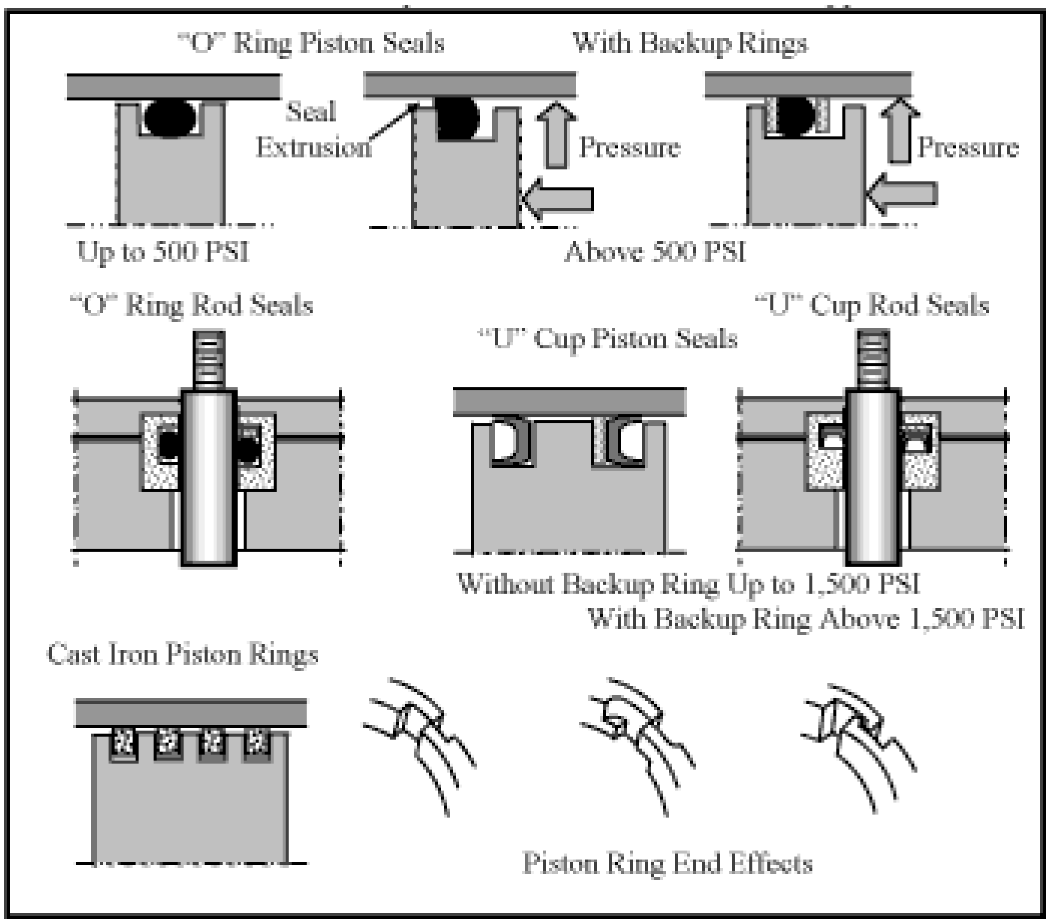
Cylinders for long-stroke applications



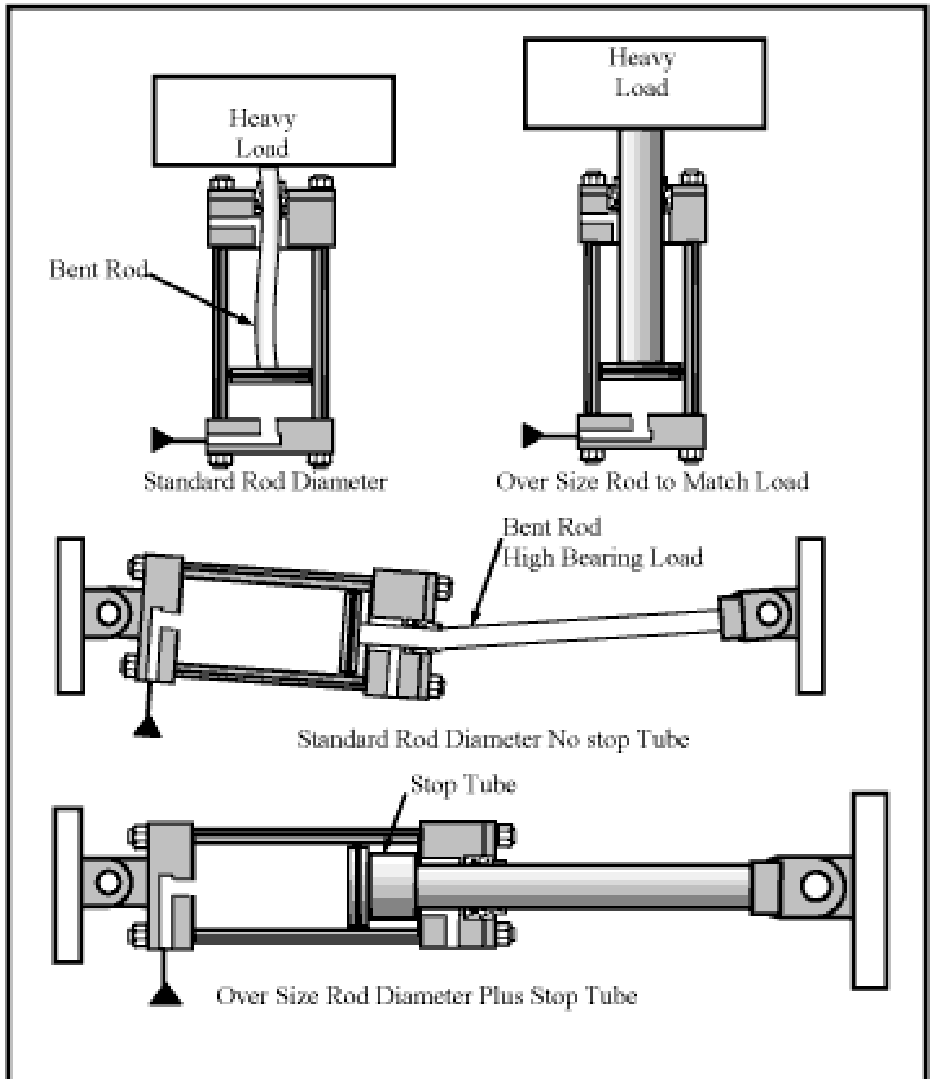
Air cylinder sizing



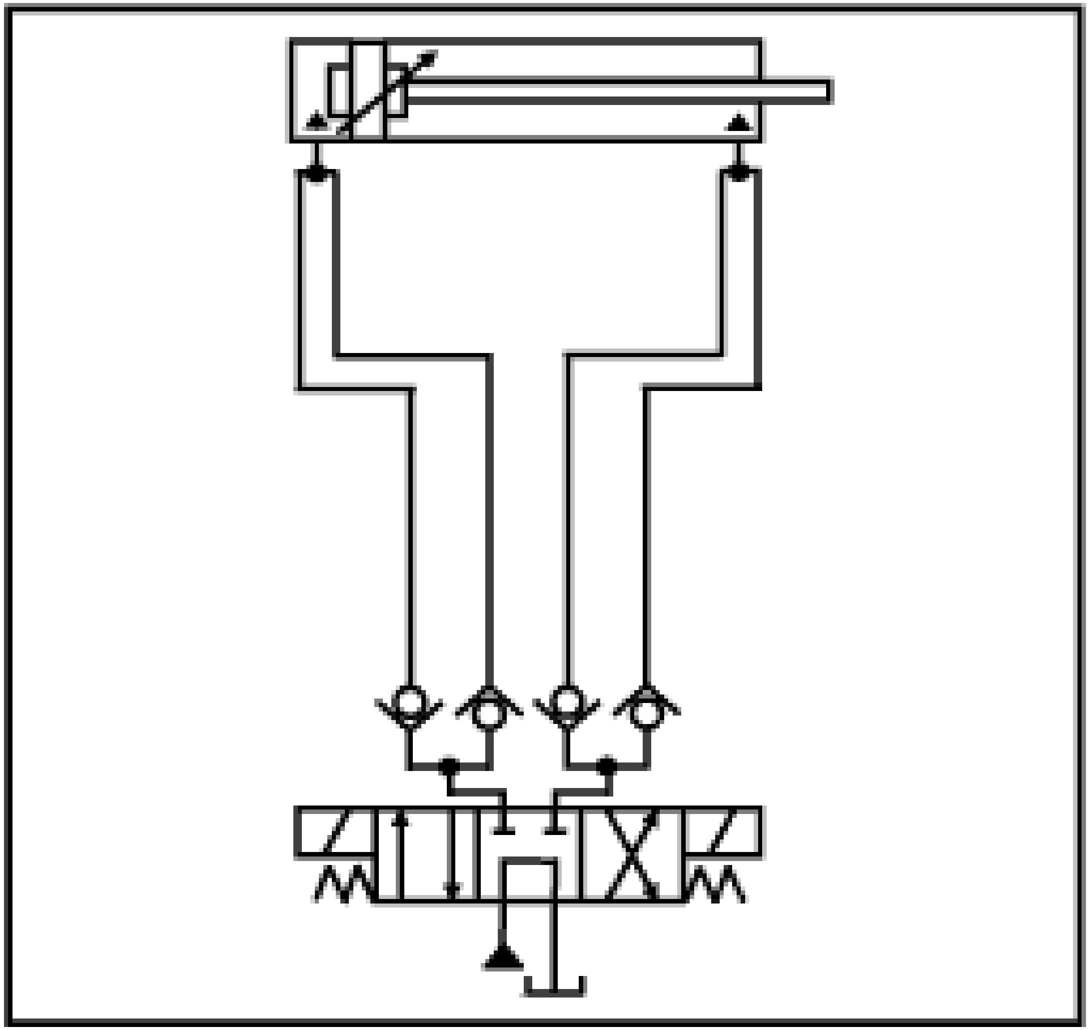
Standard options for sealing pistons and rods from fluid bypass



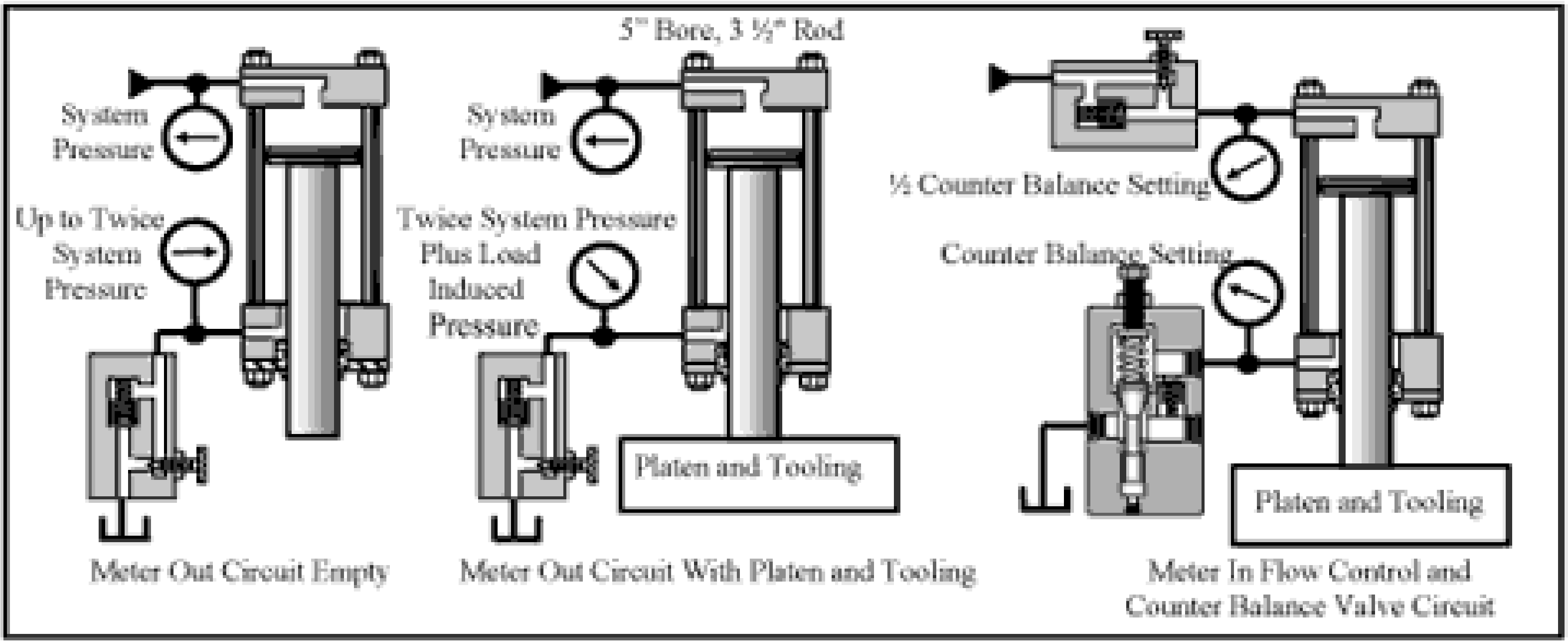
Cylinders with greater than 20-in. strokes



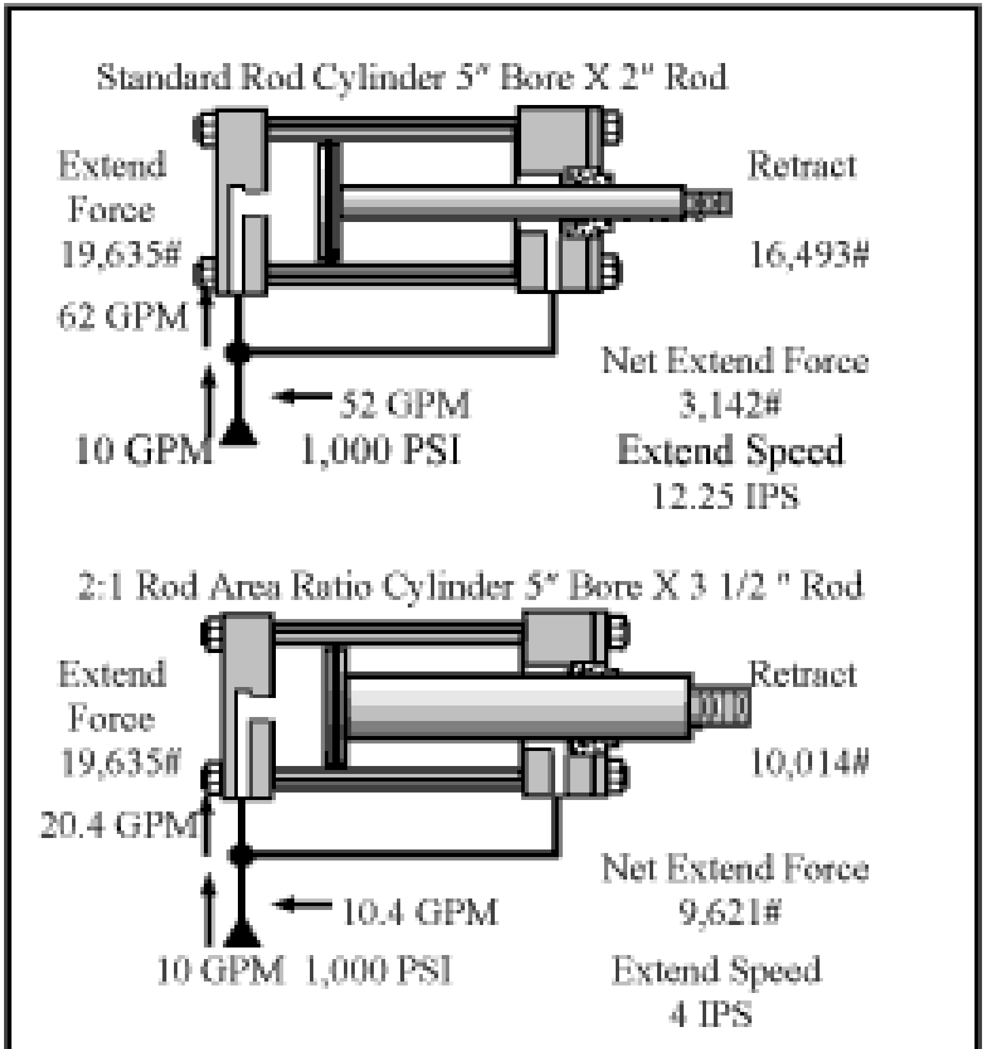
Cylinder flushing circuit



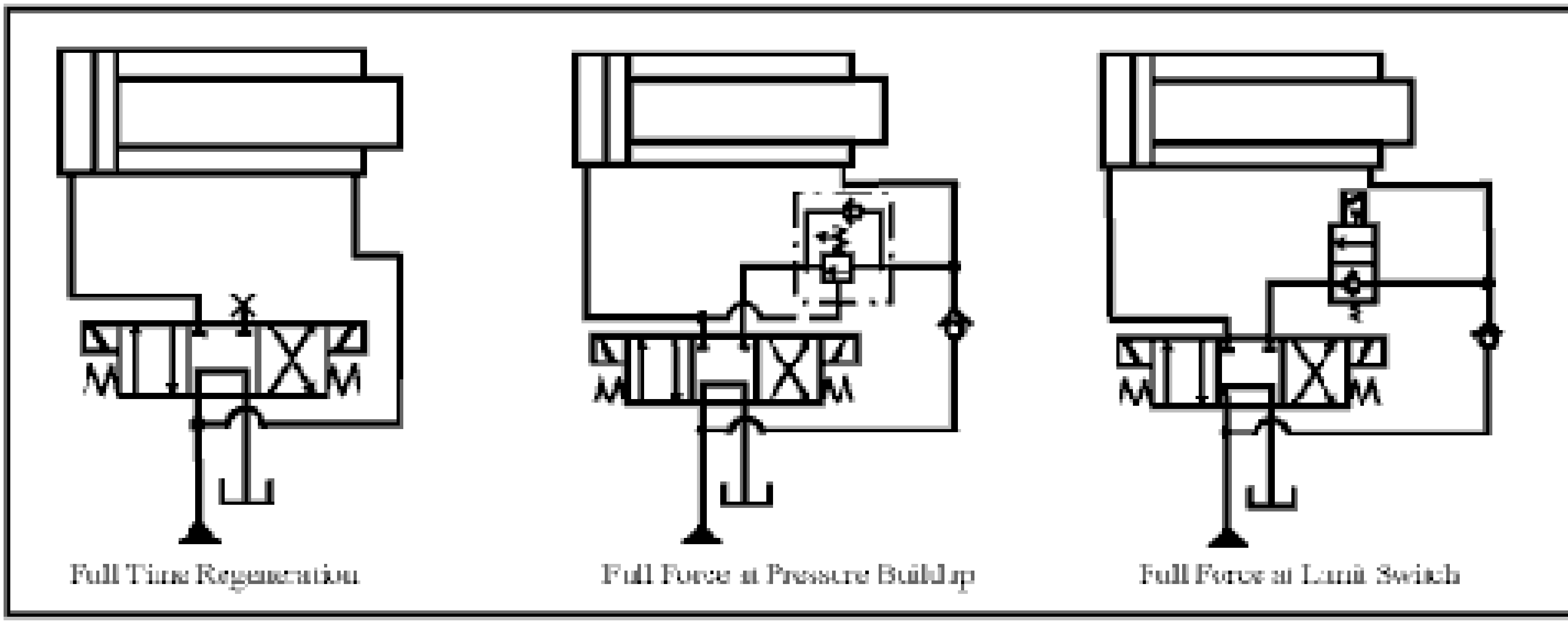
Pressure intensification on an oversize rod cylinder



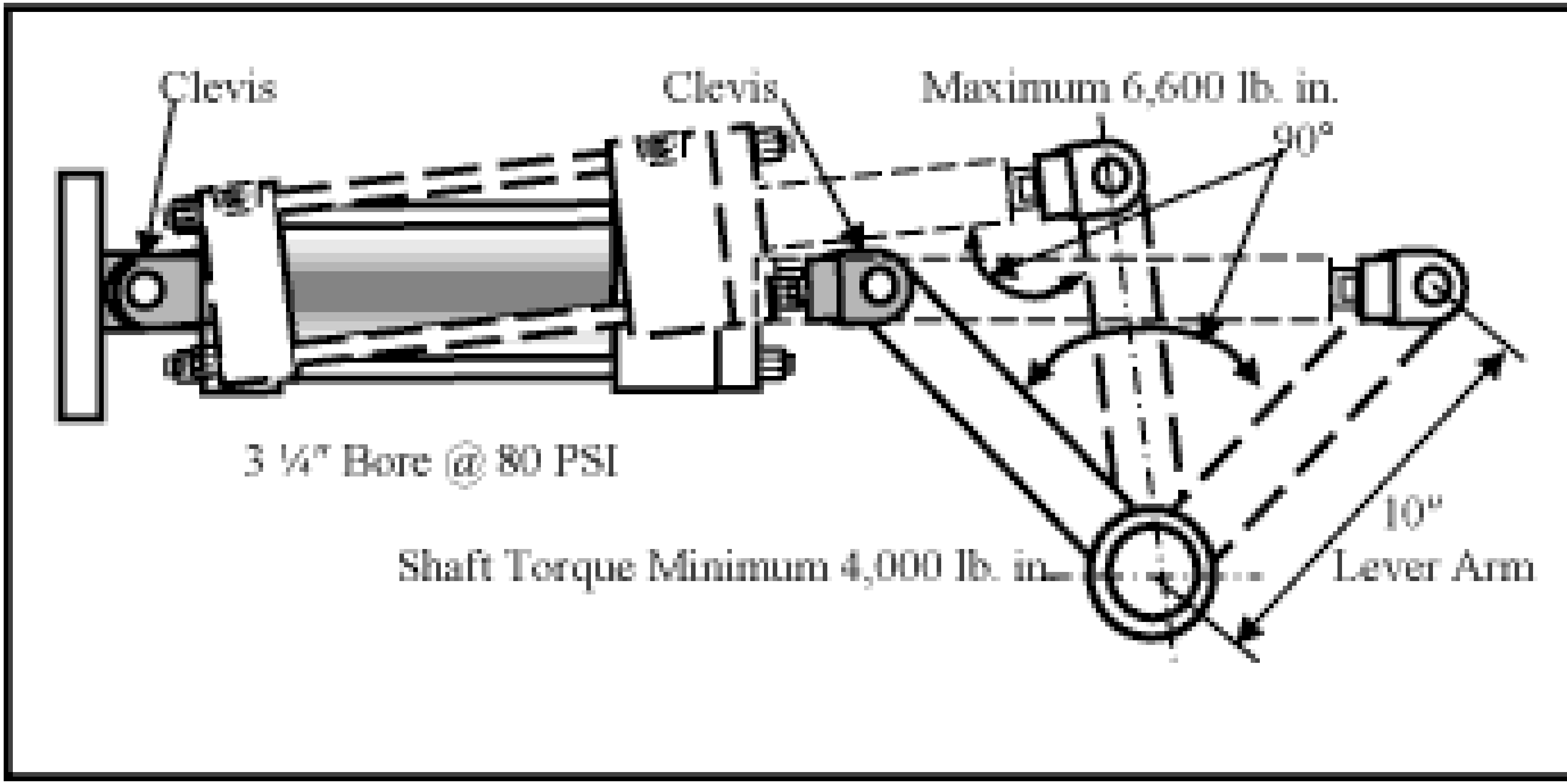
Single-rod cylinder regeneration



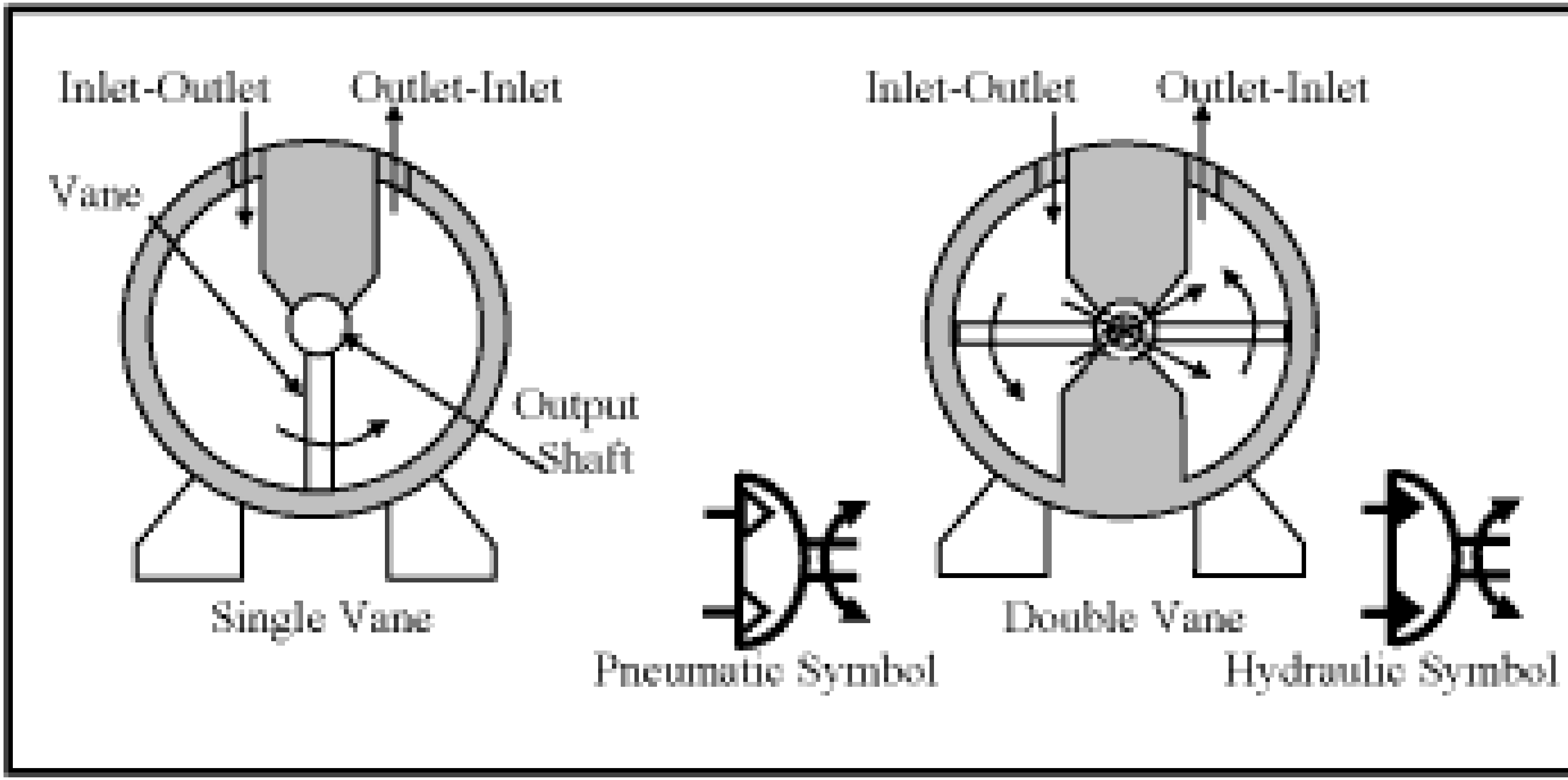
2:1 rod cylinders in regeneration circuit



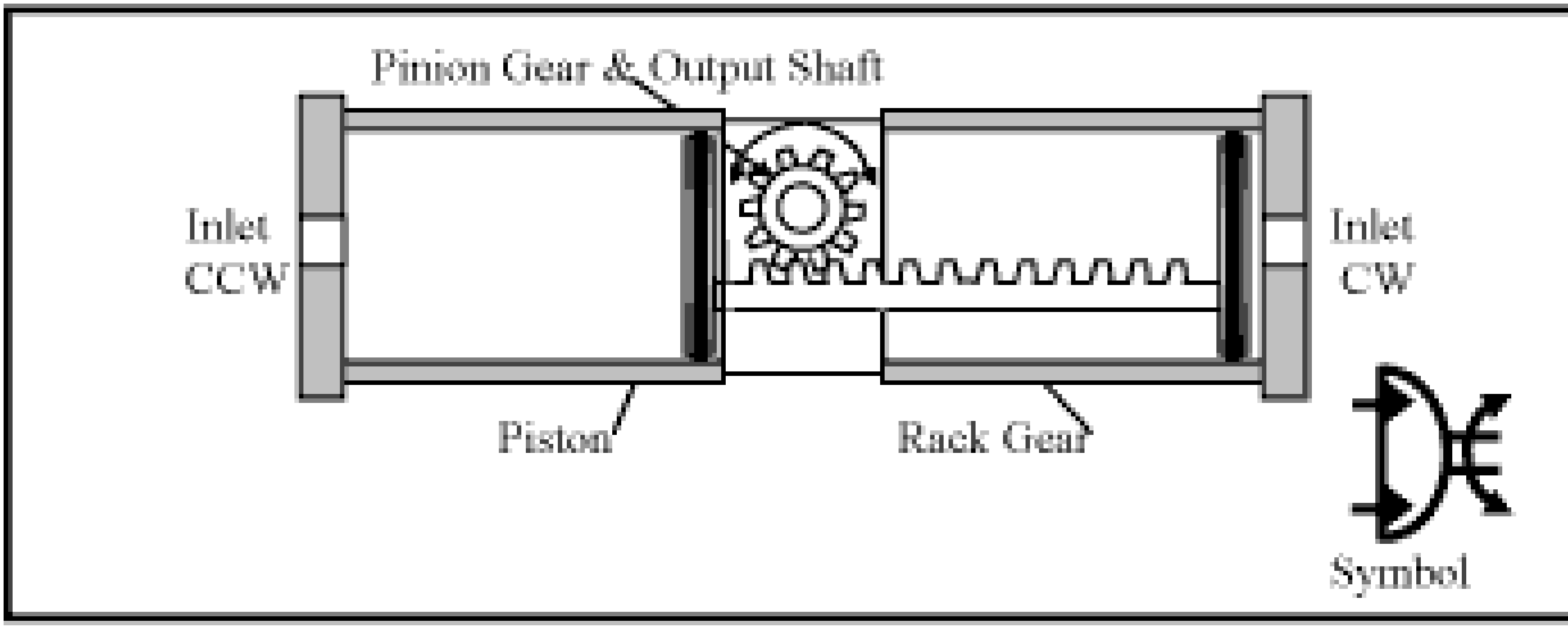
Clevis-mounted cylinder for rotary action



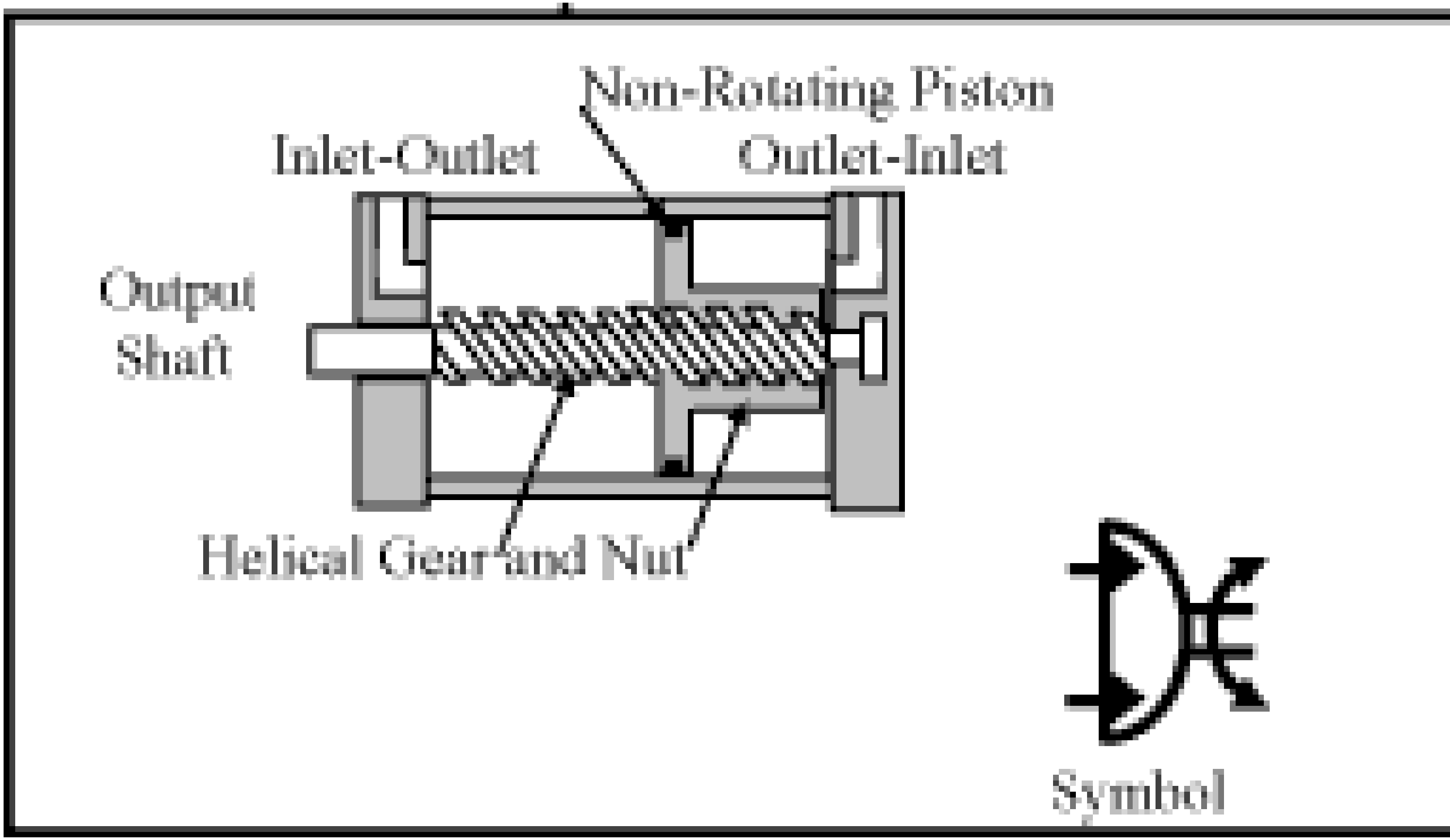
Vane-type rotary actuator



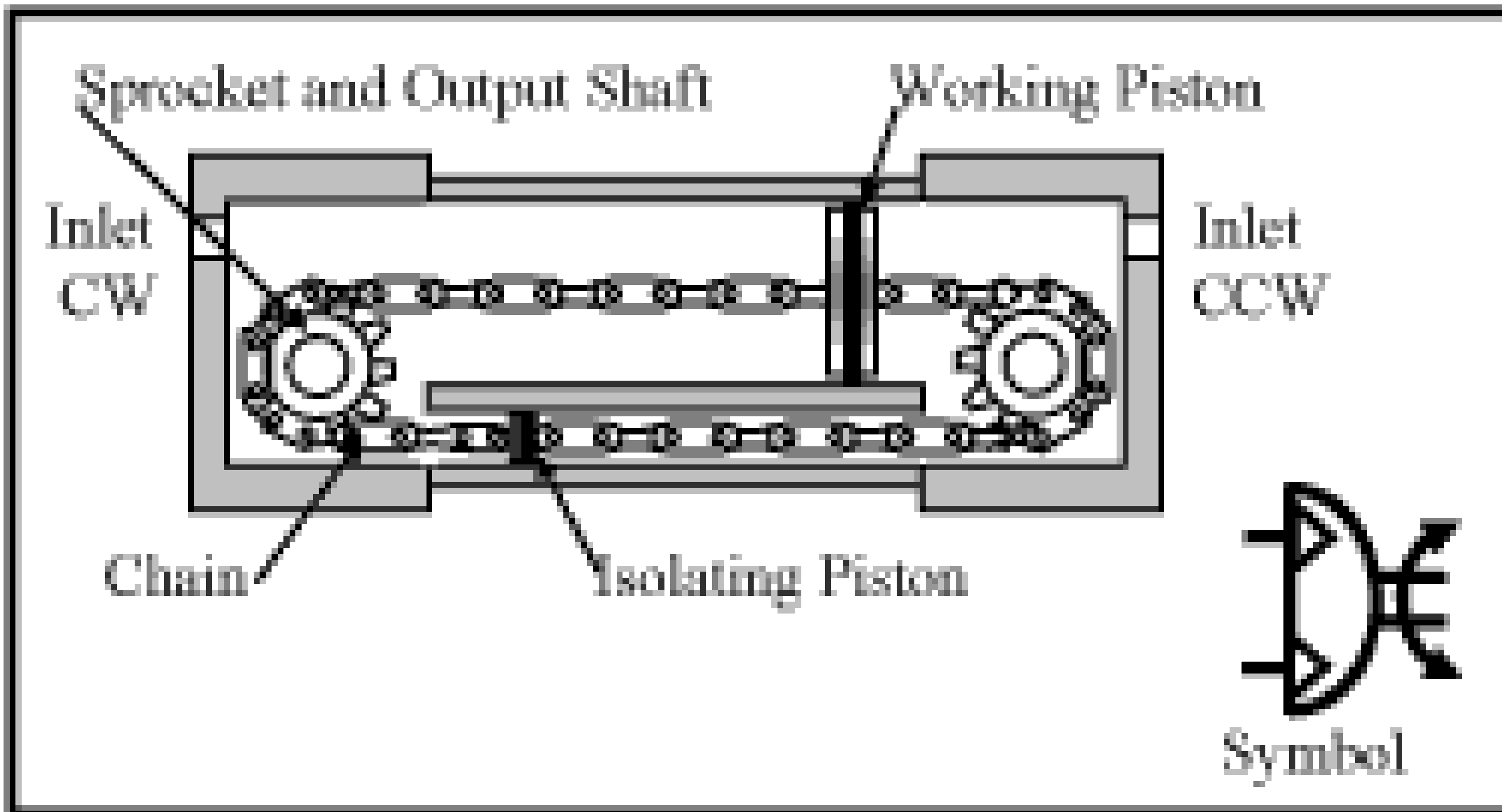
Single-cylinder, rack-and-pinion rotary actuator



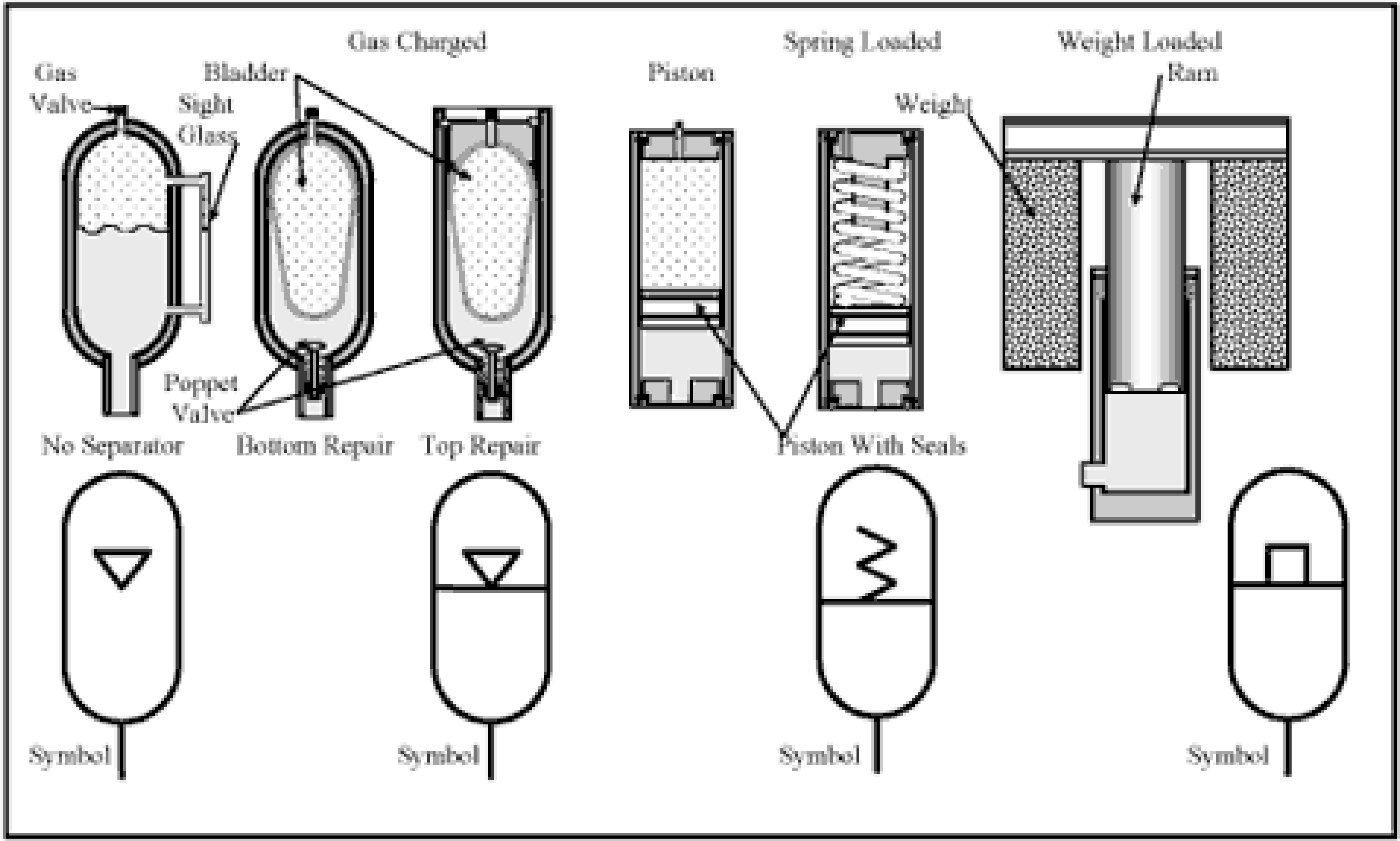
Helical gear rotary actuator



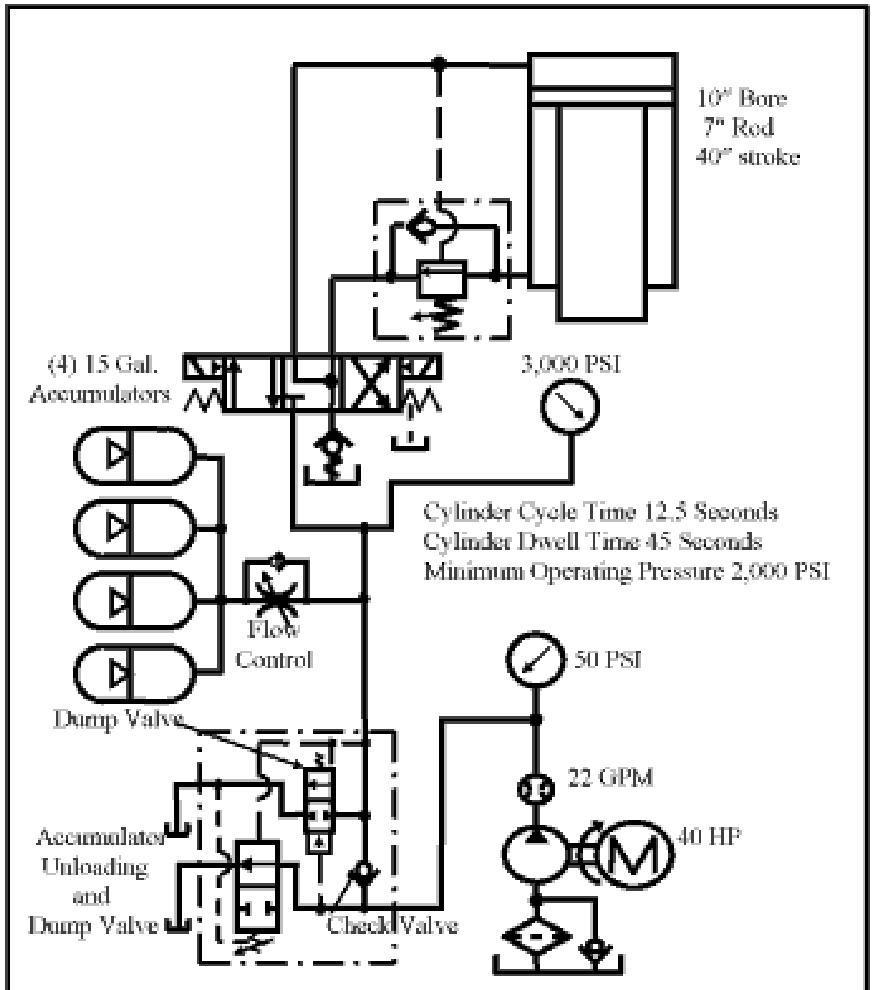
Chain-and-sprocket rotary actuator



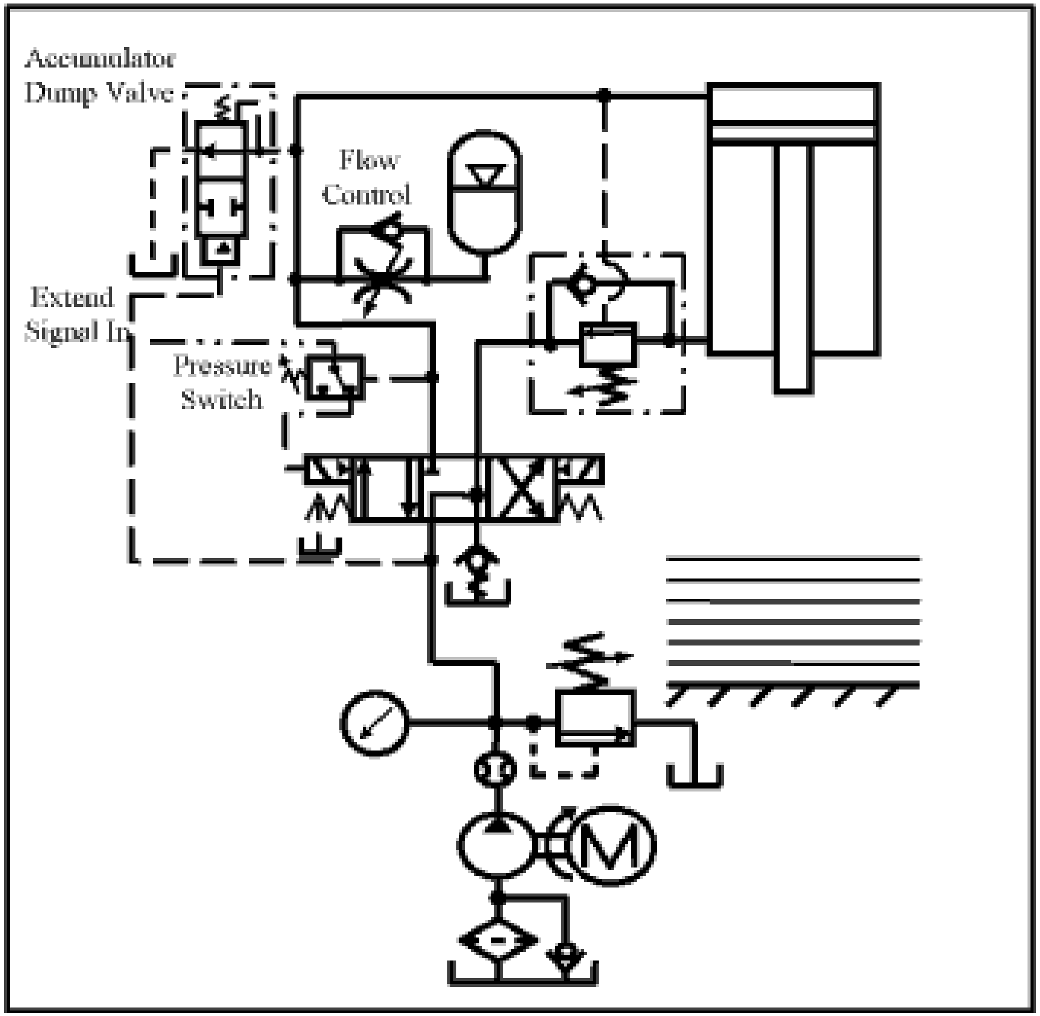
Hydraulic accumulators



Accumulator circuit that supplements pump flow



Using an accumulator to maintain pressure and/or make up for leakage



Using an accumulator to eliminate shock caused by a sudden flow stoppage