ময়মনসিংহ পলিটেকনিক ইন্সটিটিউট

মেকানিক্যাল টেকনোলজি

Practical on the subject of Mechatronics (67076)

Presented by –
Inzamam ul Islam
Workshop Super (Mechanical)

Today's Exp. No. : 01

Name of the Experiment:

মেকাট্রনিক্স বিষয়ের বেসিক যন্ত্রংশের পরিচিতি।

Name of the Experiment: Construct a control system incorporating electrical, mechanical and electronic components.

Sensors and Actuators

- **Sensor**

  A device that converts an environmental condition into an electrical signal.

- **Actuator**

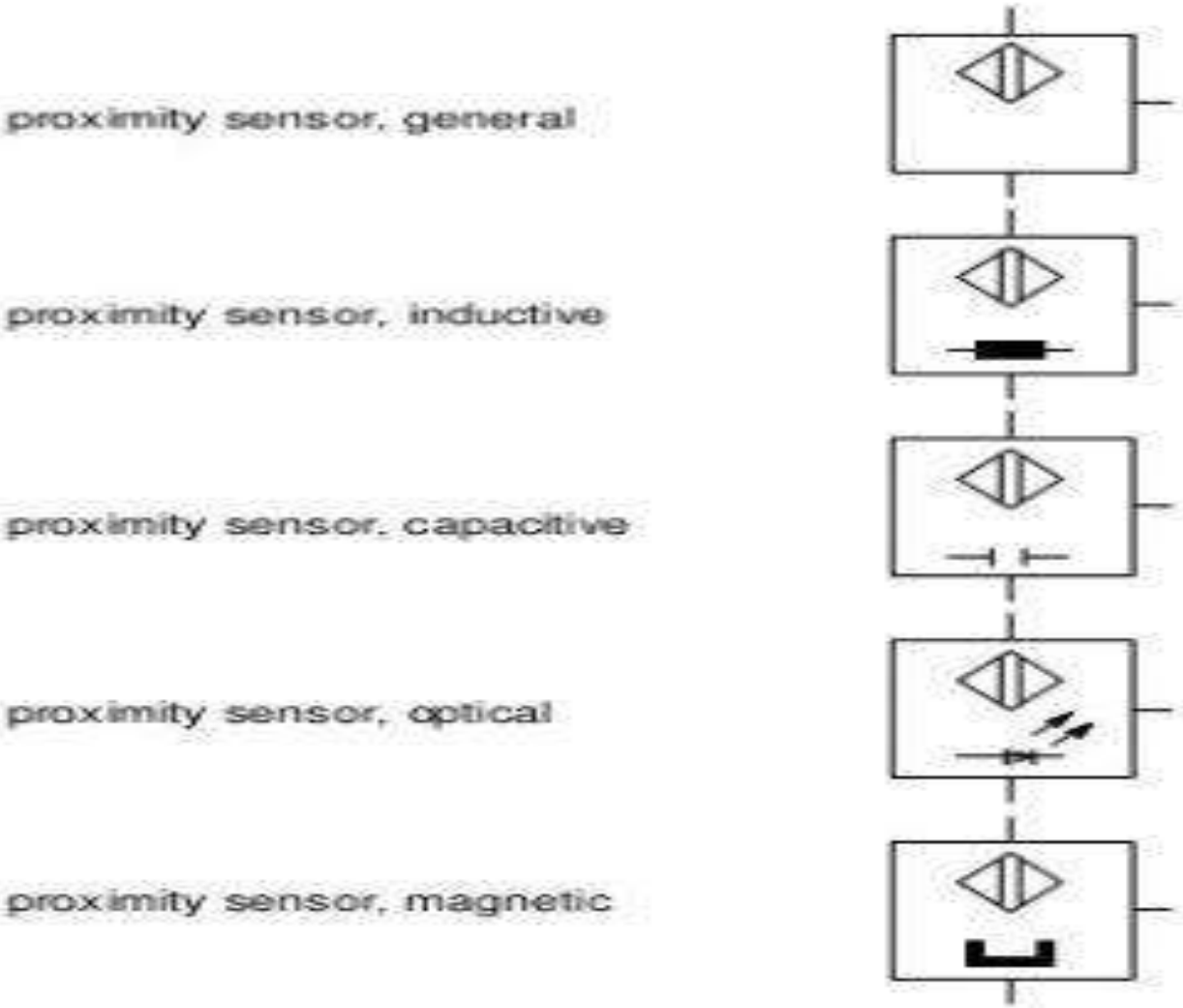
  A device that converts a control signal (usually electrical) into

  mechanical action (motion).

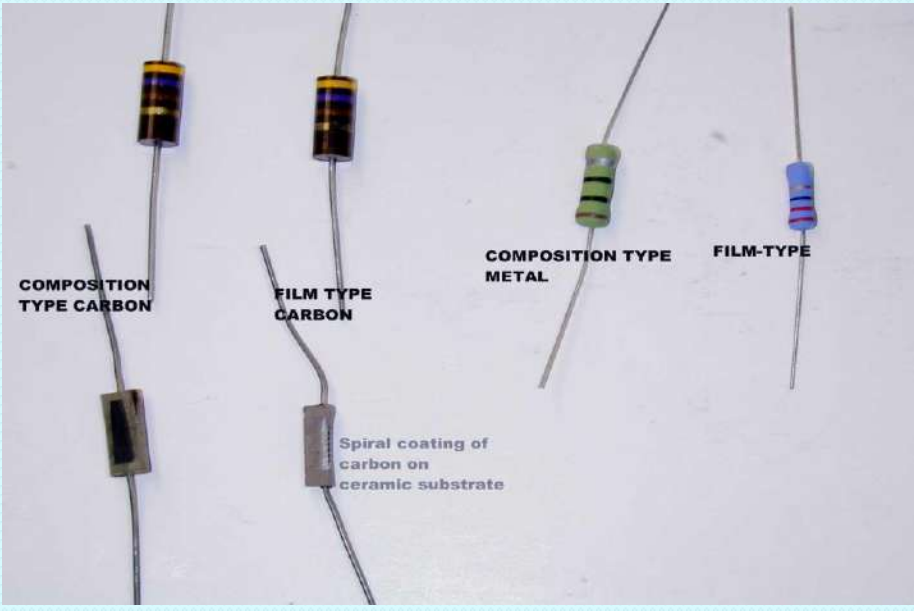
(Taken together, sensors, actuators, controllers, and power supply form the basic elements of a control system.)

Block symbols for Proximity sensors

Block symbols for proximity sensors



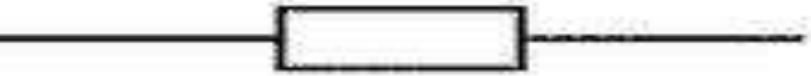
❖ রেজিস্টারের চিত্র

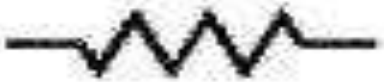

COMPOSITION
TYPE CARBON
FILM TYPE
CARBON
COMPOSITION TYPE
METAL
FILM-TYPE
Spiral coating of
carbon on
ceramic substrate

❖ রেজিস্টারের প্রতিক

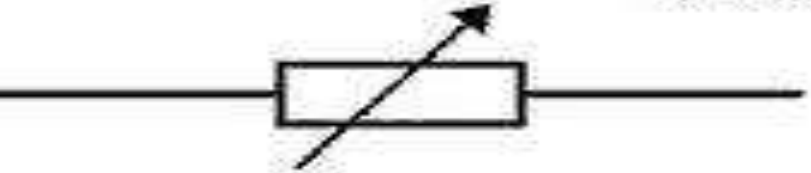
Resistor circuit symbols | **Old resistor symbols**

Fixed value resistor

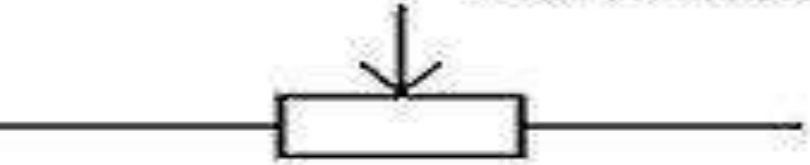


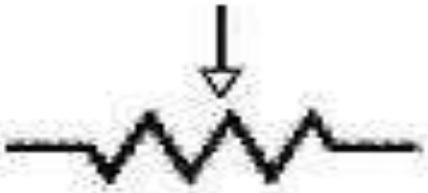


Variable resistor - Rheostat

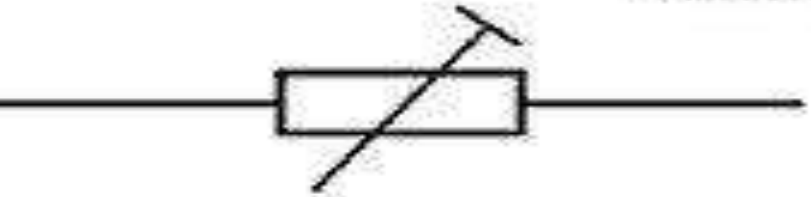


Variable resistor - Potentiometer

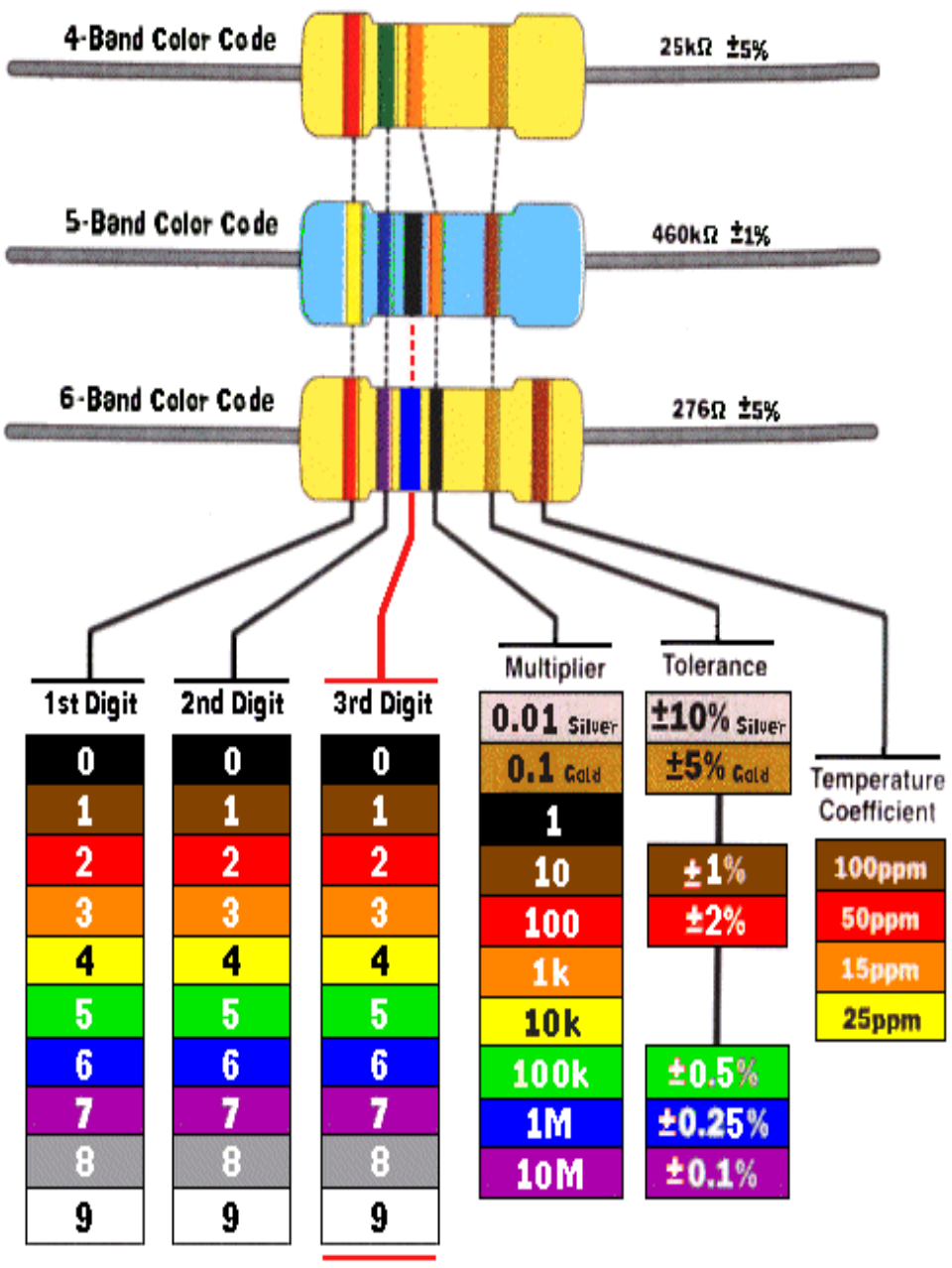


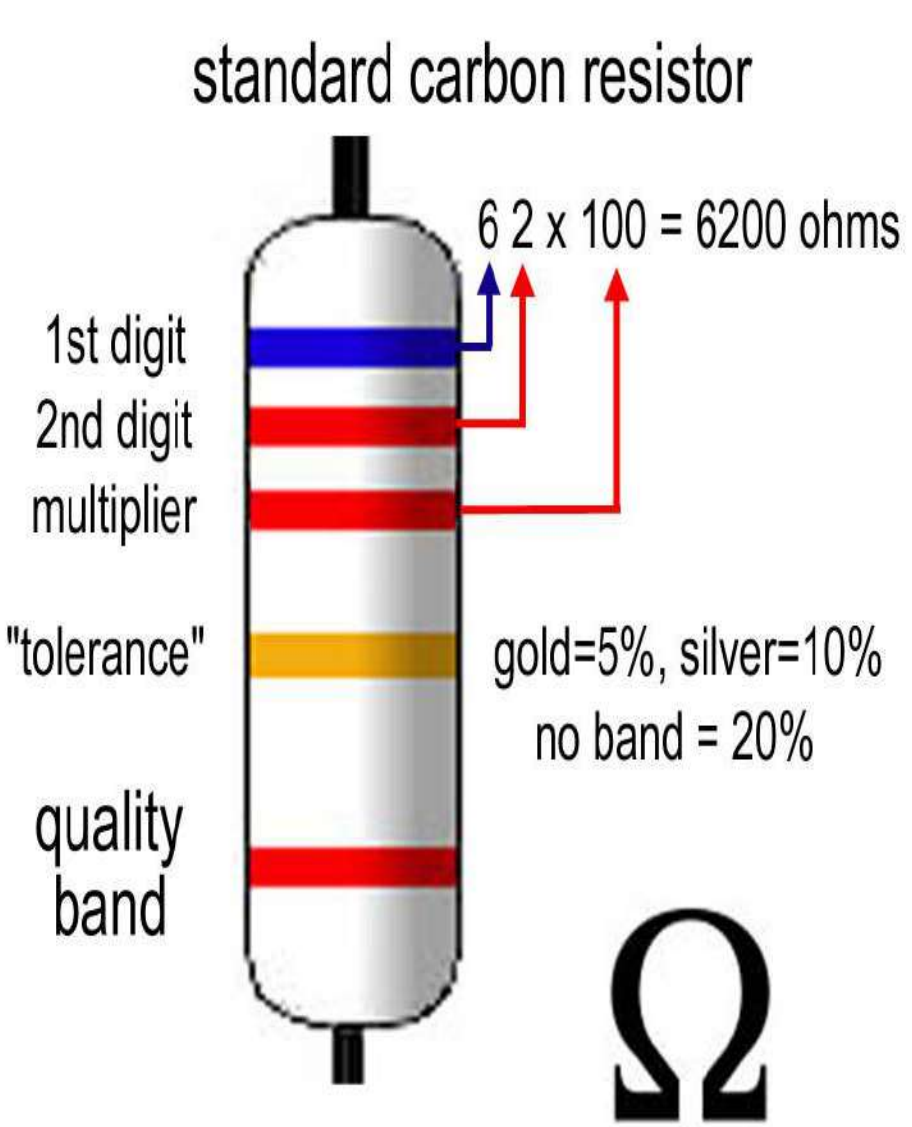


Variable resistor - Preset



❖ রেজিস্টার ও কালার কোড দেখে মান নির্নয়

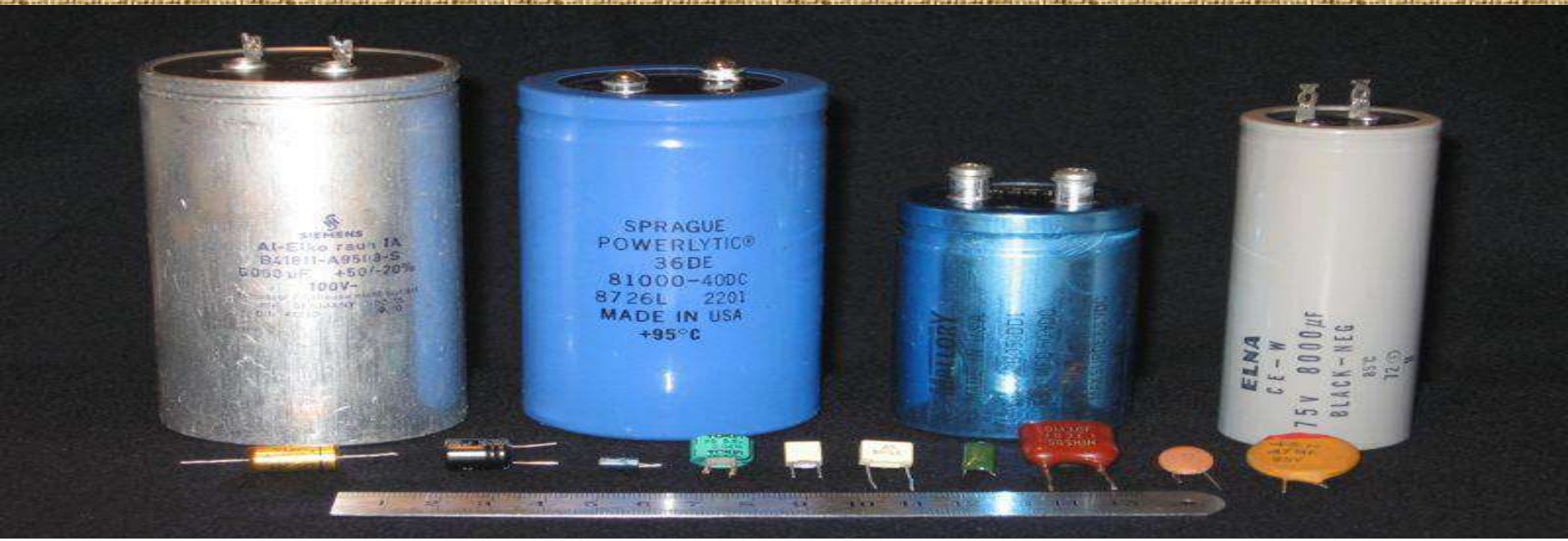


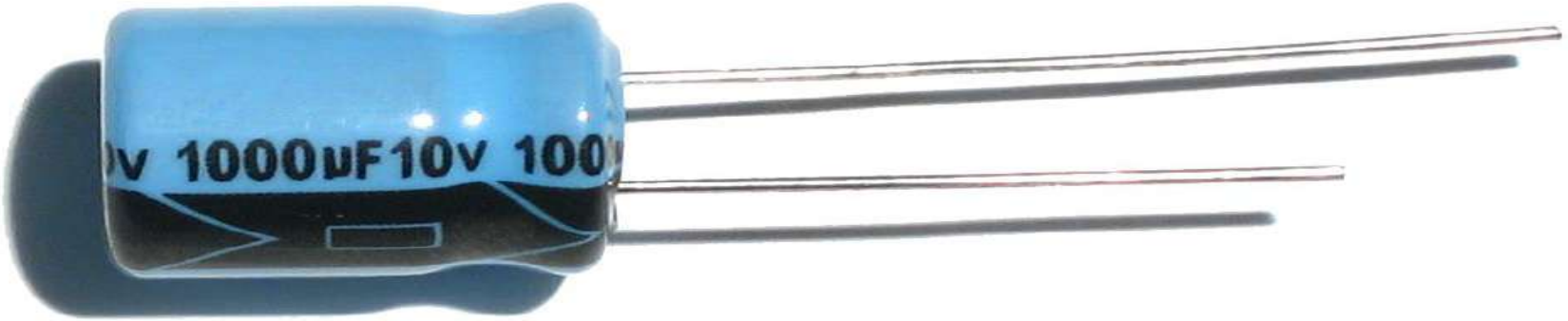


❖ ভ্যারিঅ্যাবল (পরিবর্তনশীল মান) রেজিস্টরের চিত্র

❖ ক্যাপাসিটরের চিত্র

❖ ক্যাপাসিটরের চিত্র

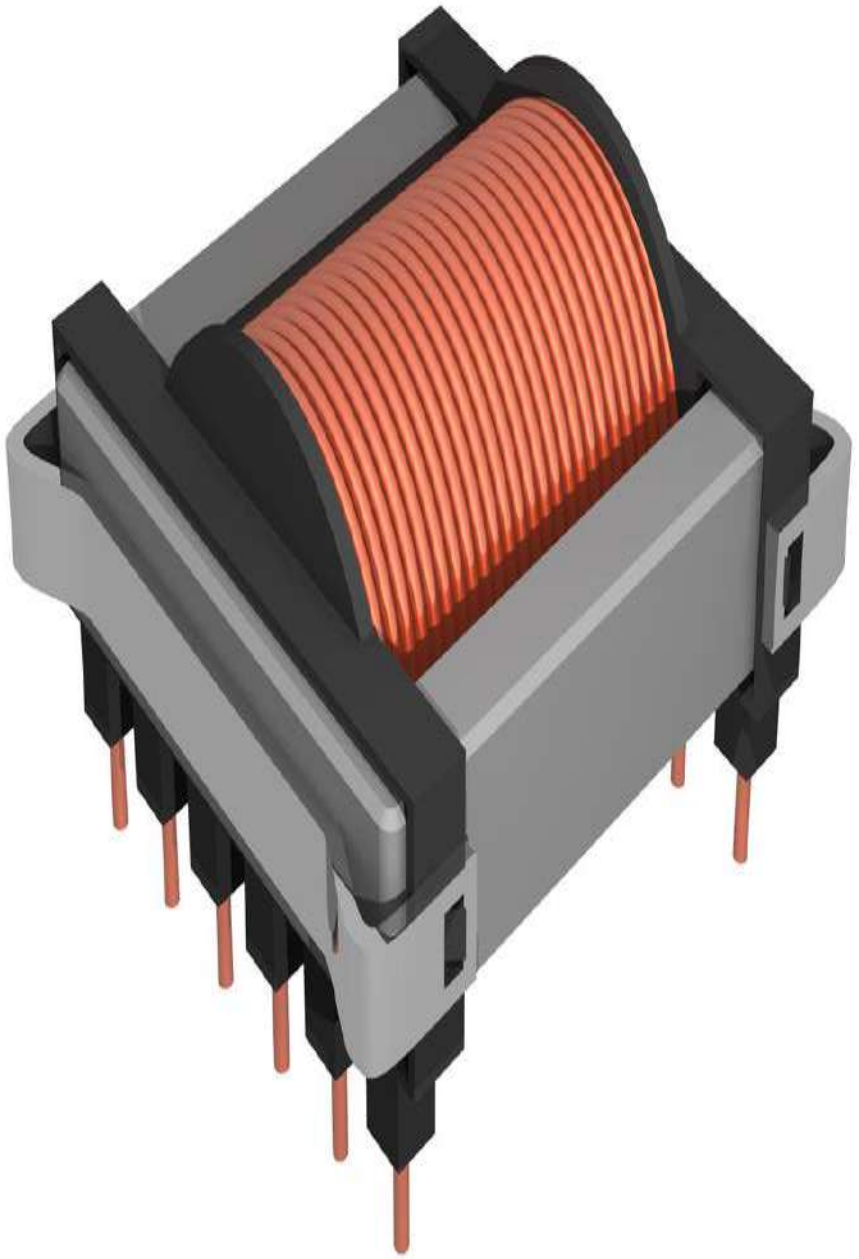

SPRAGUE
POWERLYTIC®
36DE
81000-40DC
8726L 2201
MADE IN USA
+95°C
ELNA
CE-W
75V 8000µF
BLACK-NEG


1000µF10v

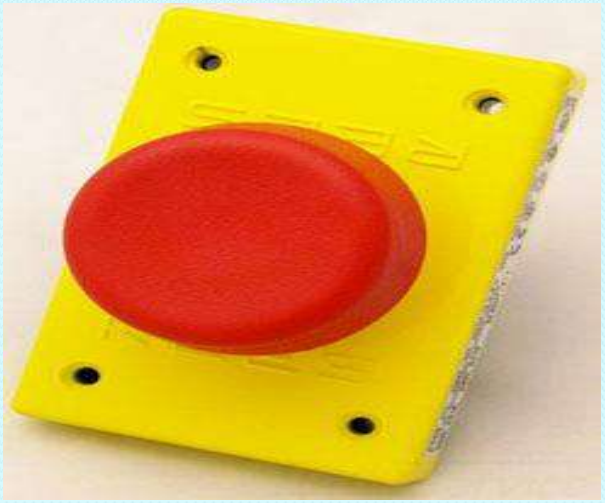
◆ ইন্ডাক্টরের ছবি

❖ ইন্ডাক্টরের চিত্র

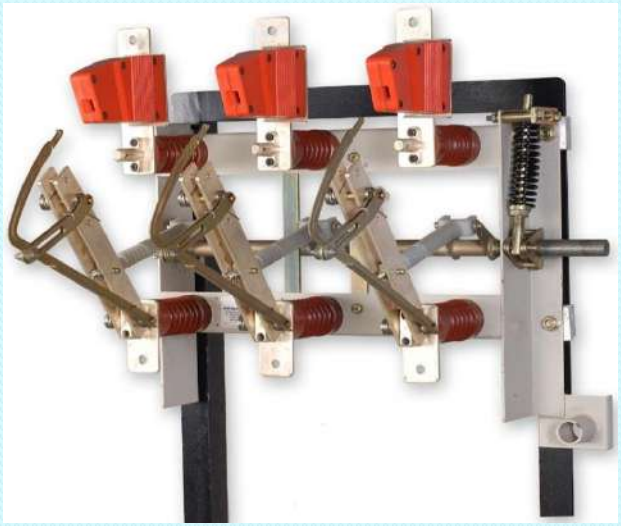
❖ ইন্ডাক্টরের চিত্র



❖ স্লো –ব্রেক সুইচ



❖ কুইক –ব্রেক সুইচ



Ammeter

- Measures The amount of Current flow through the circuit

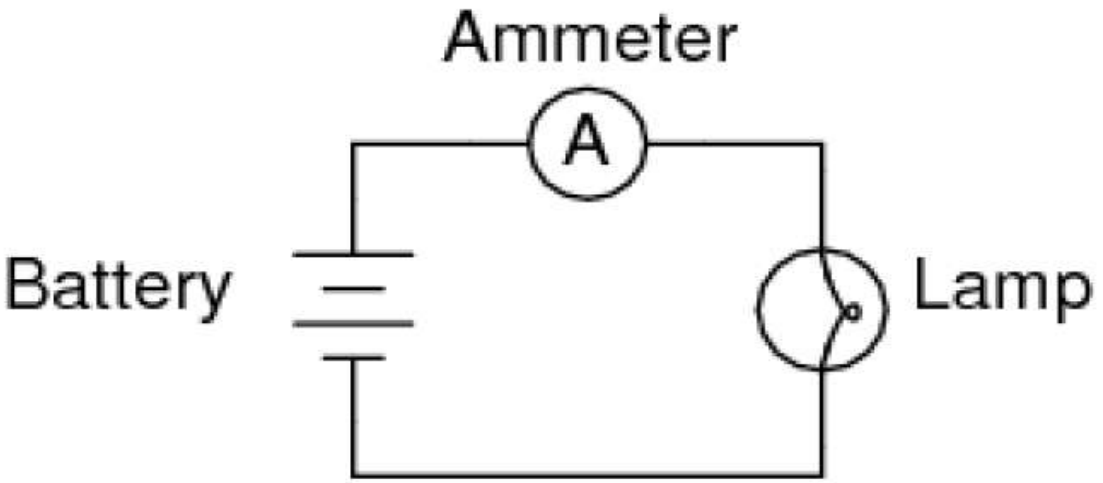
Types:

1. DC Ammeter
2. AC Ammeter

❖ অ্যামিটারের স্কেমেটিক চিত্র

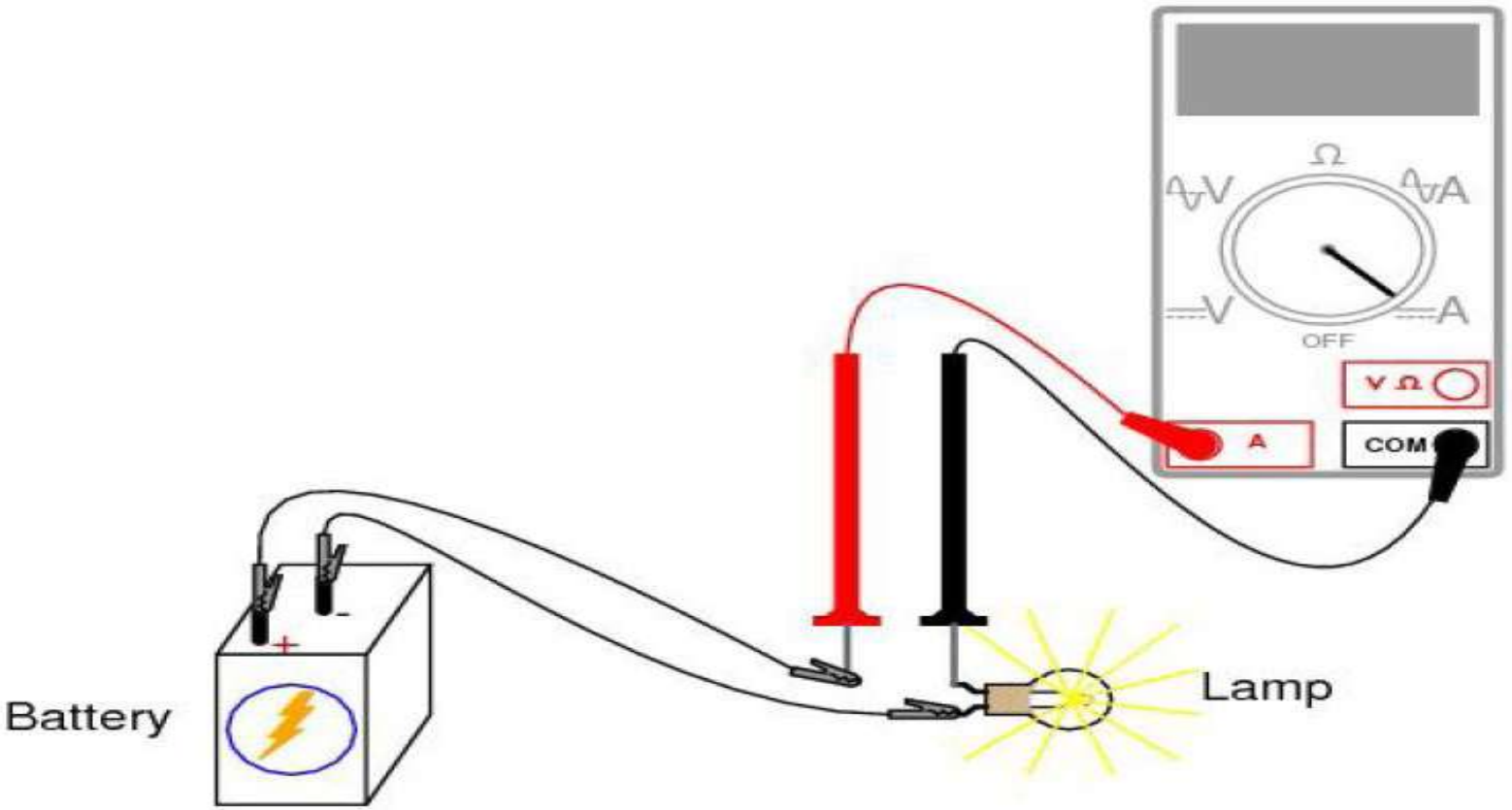
Schematic Diagram of Ammeter:

Ammeter Should be always connected in Series with Load



❖অ্যামিটারের সংযোগ চিত্র

Connection Diagram of Ammeter:



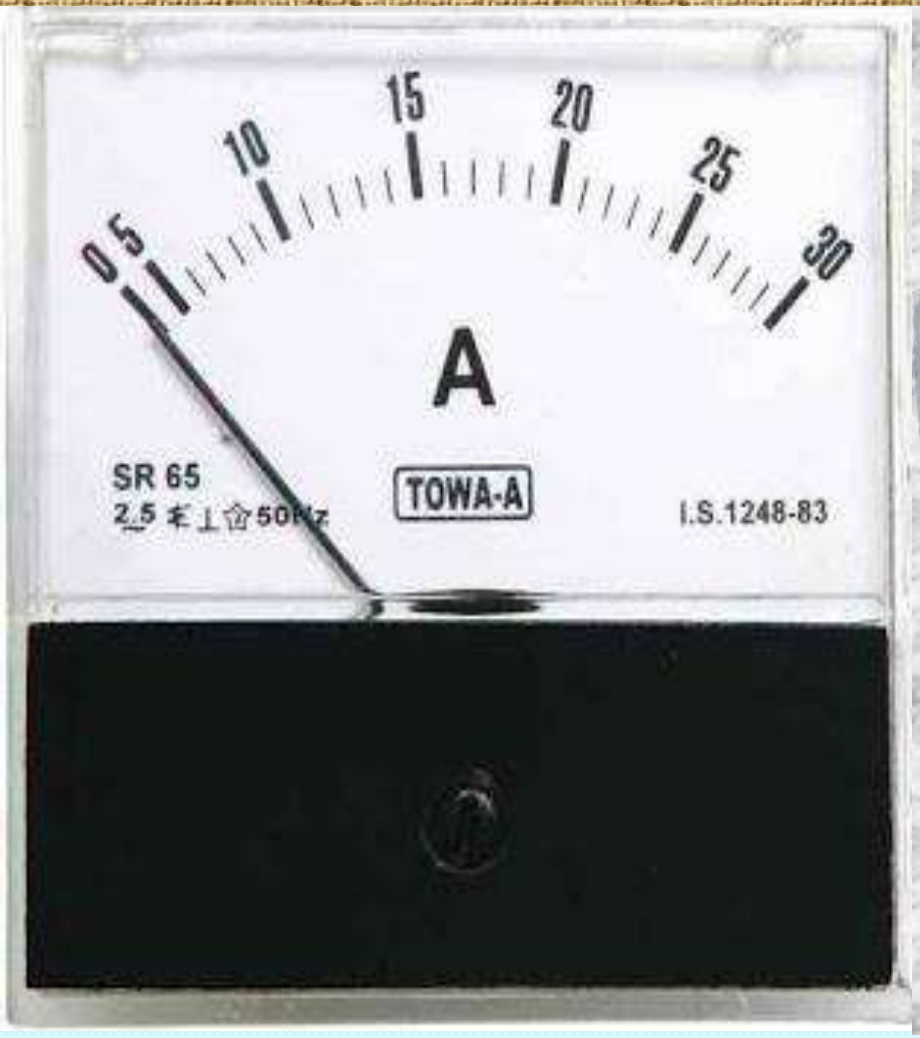
ডিসি ও এসি অ্যামিটারের চিত্র (চলবে.....।)

Pictorial View of DC & AC Ammeter

DC Ammeter

AC Ammeter

❖ ডিসি ও এসি অ্যামিটারের ছবি (চলবে....)



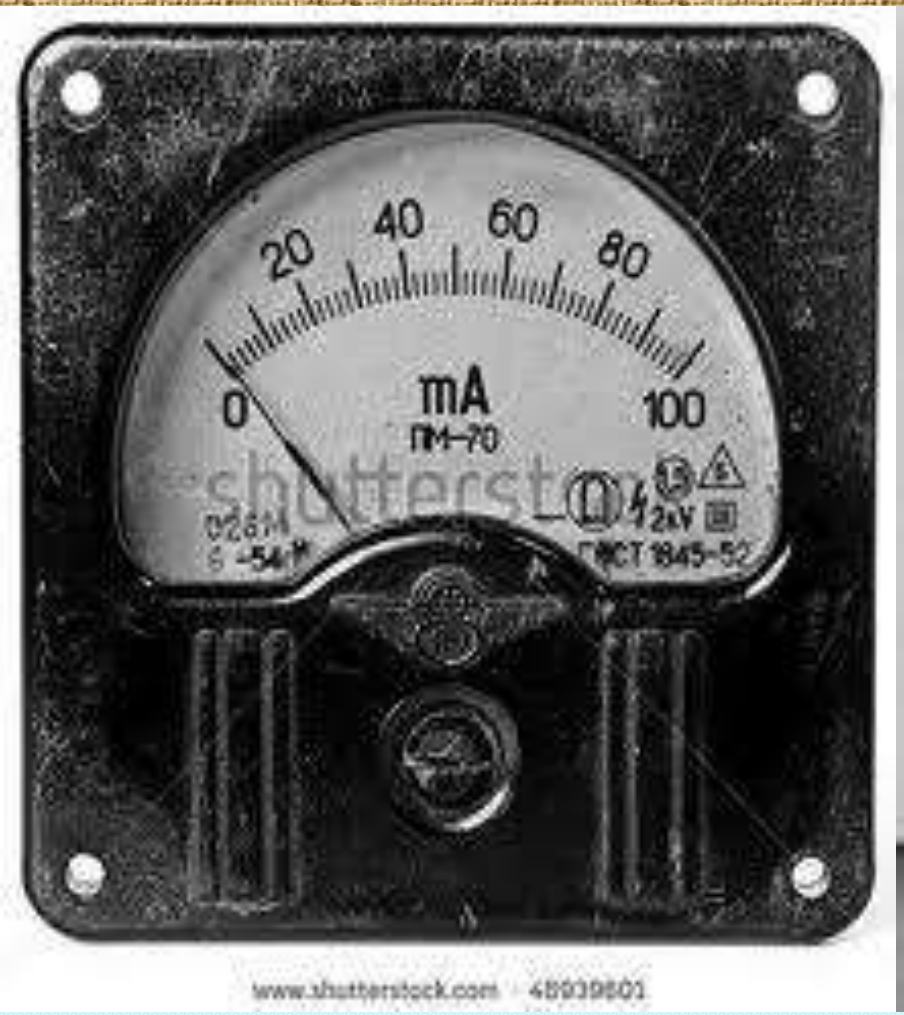
এসি অ্যামিটার

ডিজিটাল অ্যামিটার

❖ ডিসি ও এসি অ্যামিটারের ছবি (চলবে....)

ডিসি আমিটার

❖ ডিসি ও এসি অ্যামিটারের ছবি



Old Type

Voltmeter

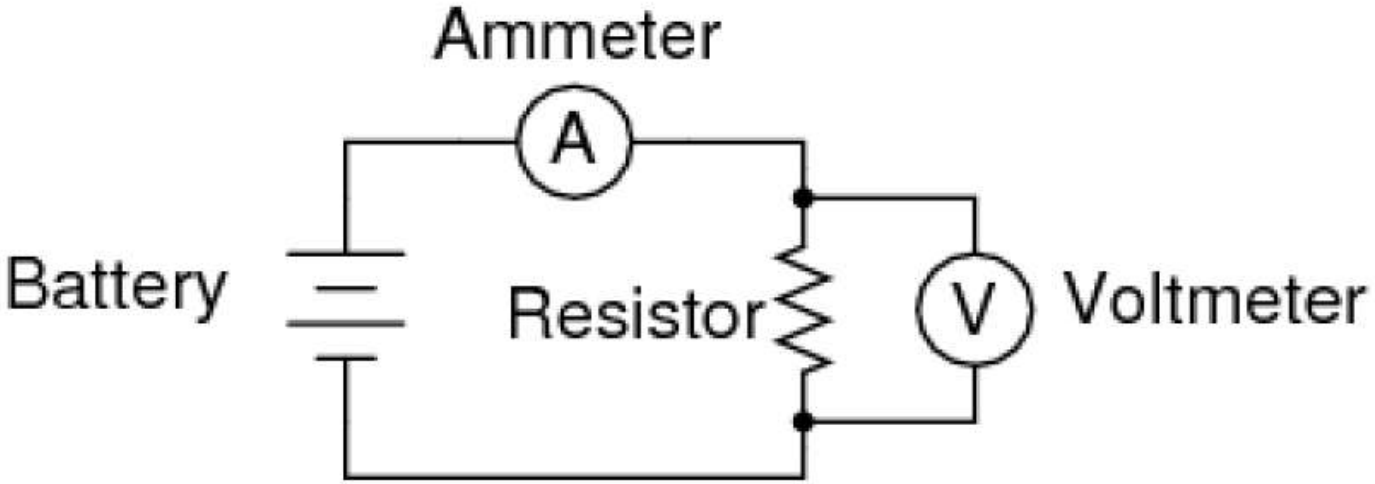
- used for measuring Electrical potential difference between two points in an electric circuit

Types:

1. DC Voltmeter
2. AC Voltmeter

❖ ভোল্টমিটারের স্কেমেটিক চিএ

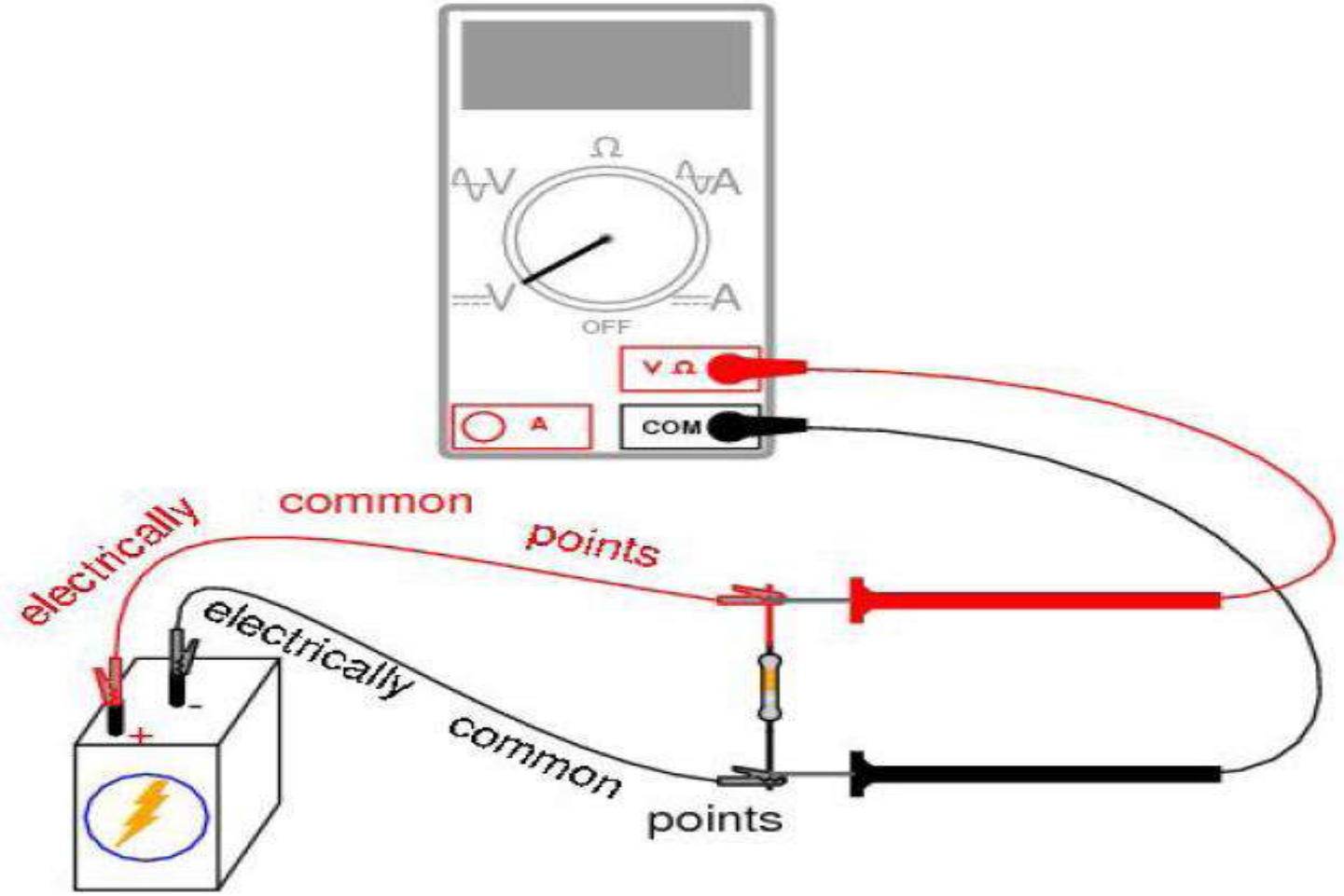
Schematic Diagram of Voltmeter:



Voltmeter must be connected in Parallel with Load

❖ ভোল্টমিটারের সংযোগ চিত্র

Connection Diagram of Voltmeter:



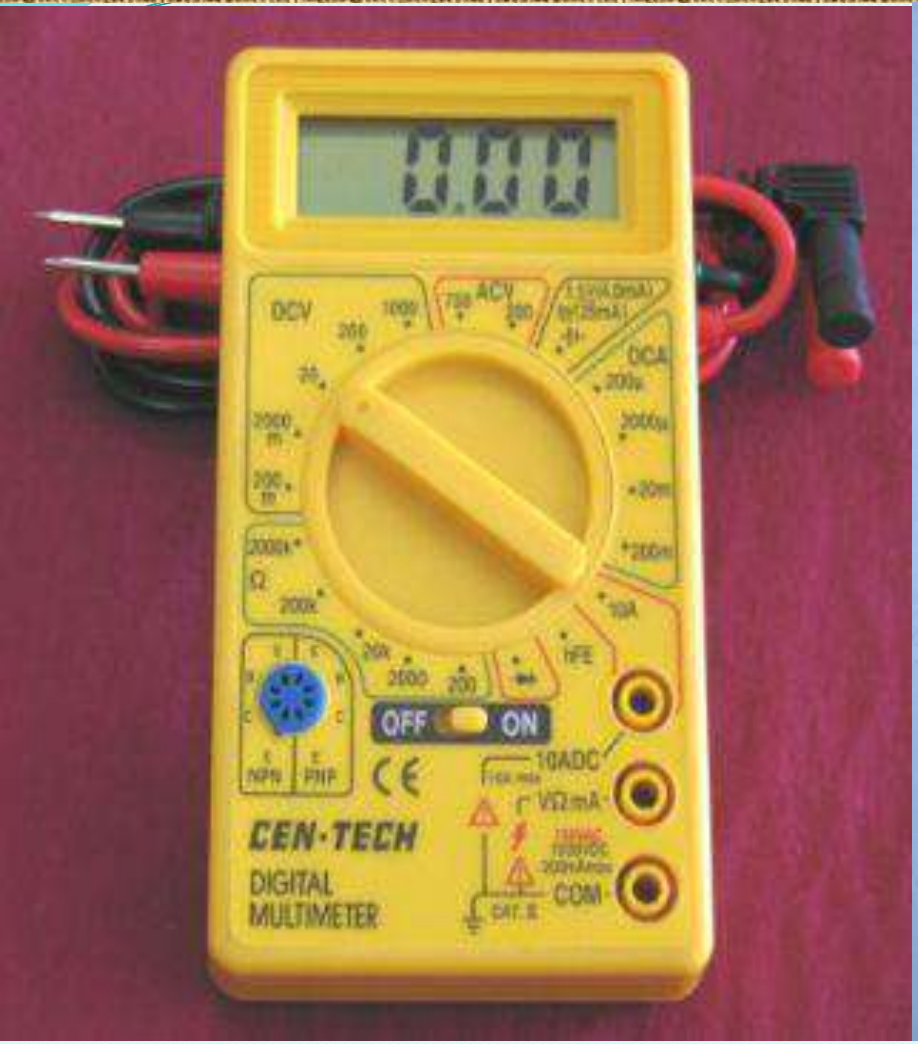
❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)

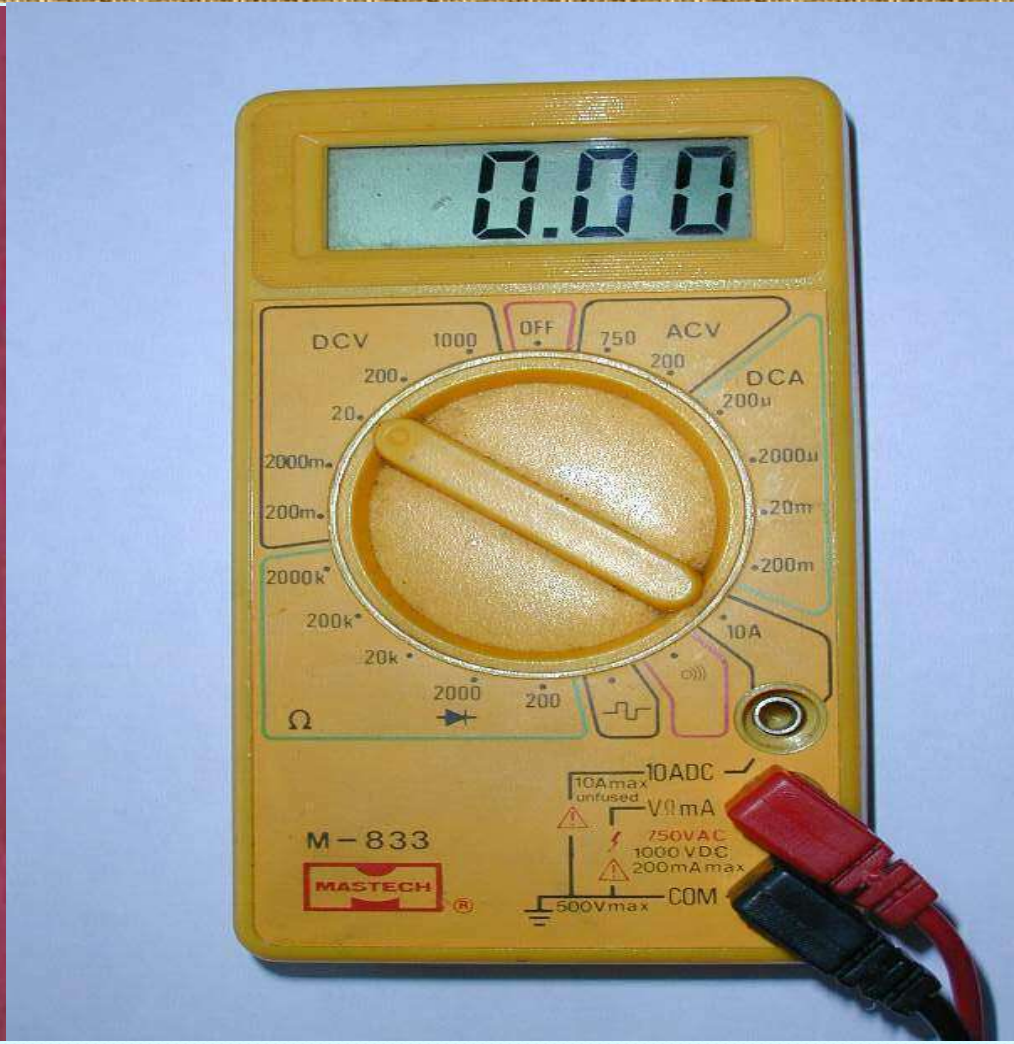
Pictorial View of DC & AC Voltmeter

DC Voltmeter

AC Voltmeter

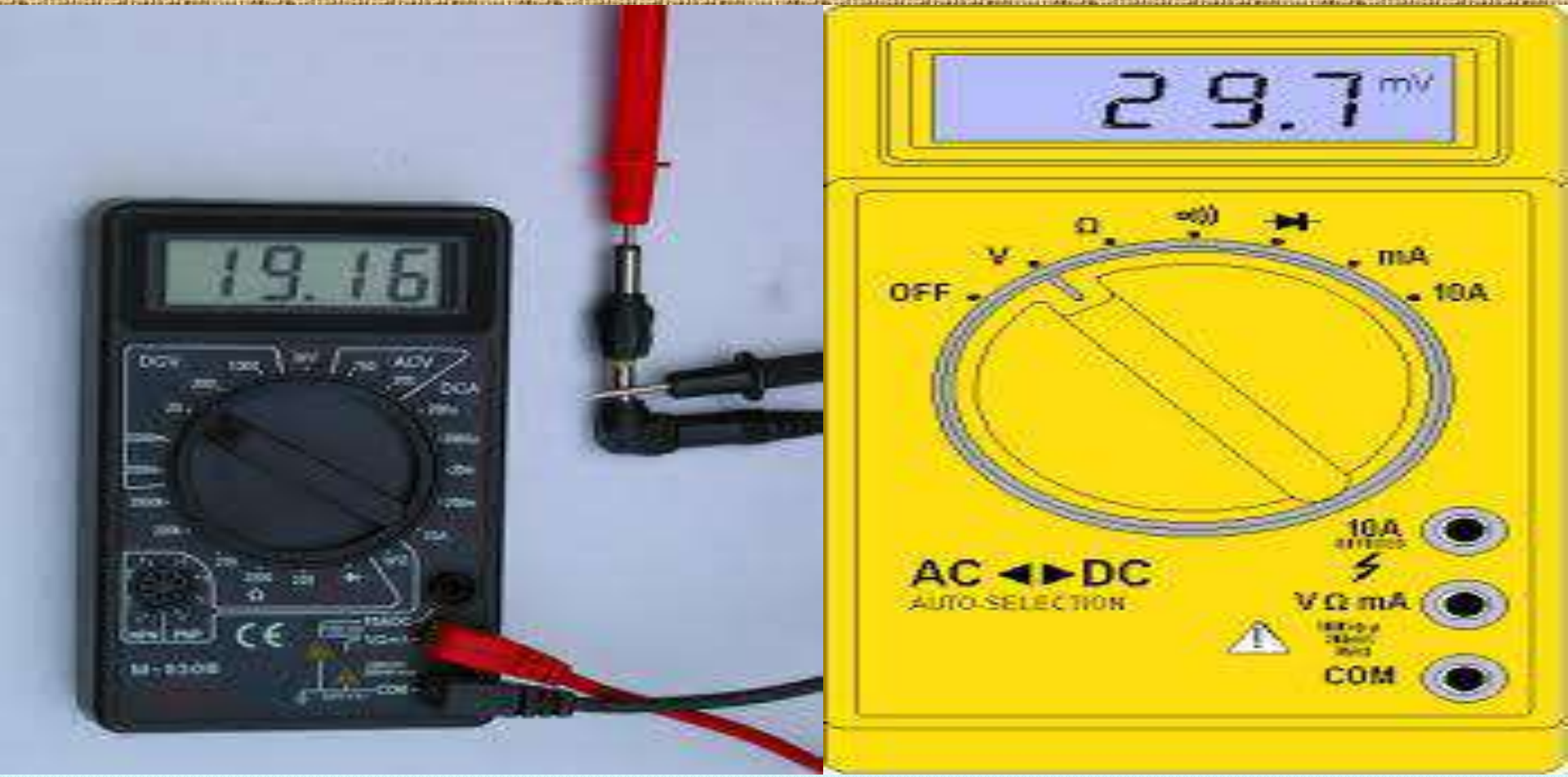
❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)





ডিজিটাল ভোল্টমিটার

❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)



ডিজিটাল ভোল্টমিটার

❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)

ডিজিটাল ভোল্টমিটার

❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)

ডিসি ভোল্টমিটার

❖ ডিসি ও এসি ভোল্টমিটারের ছবি(চলবে....)

ডিসি ভোল্টমিটার

❖ ডিসি ও এসি ভোল্টমিটারের ছবি

এসি ভোল্টমিটার

❖ মাল্টিমিটারের ছবি(চলবে.....)

Multimeter/AVO meter:

Analog multimeter

Digital multimeter

➢ মাল্টিমিটার দিয়ে ভোল্টেজ, কারেন্ট, রোধ তিনটিই পরিমাপ করা যায়

❖ মাল্টিমিটারের ছবি(চলবে.....)

Analog Type

❖ মাল্টিমিটারের ছবি

Digiital Type

Wattmeter

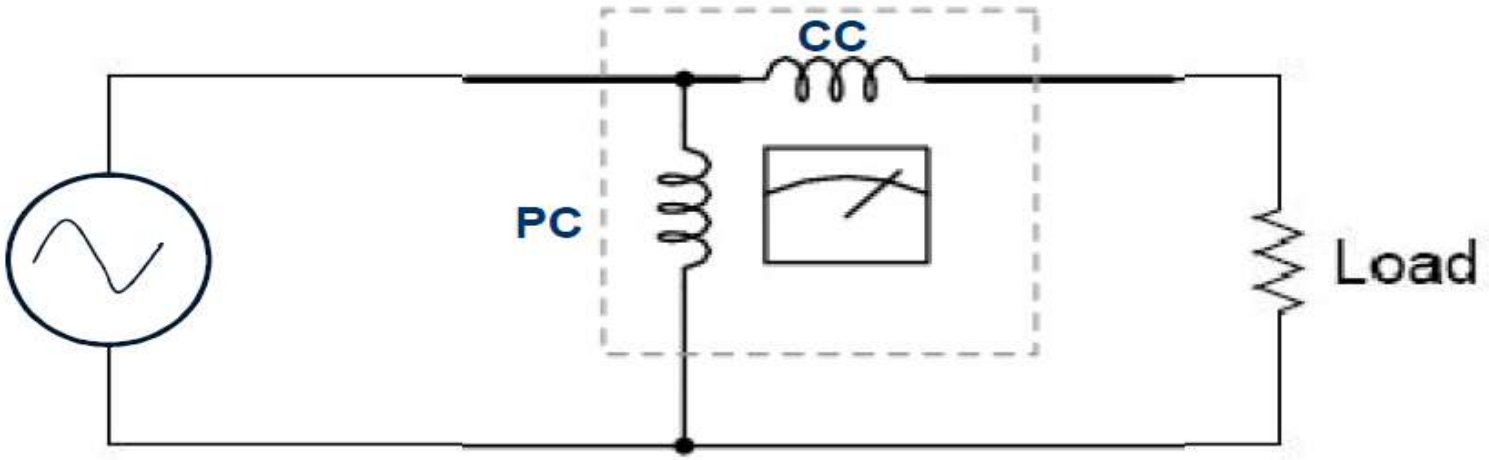
Measures the Electric power in watts

Types:

1. Analog Wattmeter
2. Digital Wattmeter

❖ ওয়াটমিটারের স্কেমেটিক চিত্র

Schematic Diagram of Wattmeter:

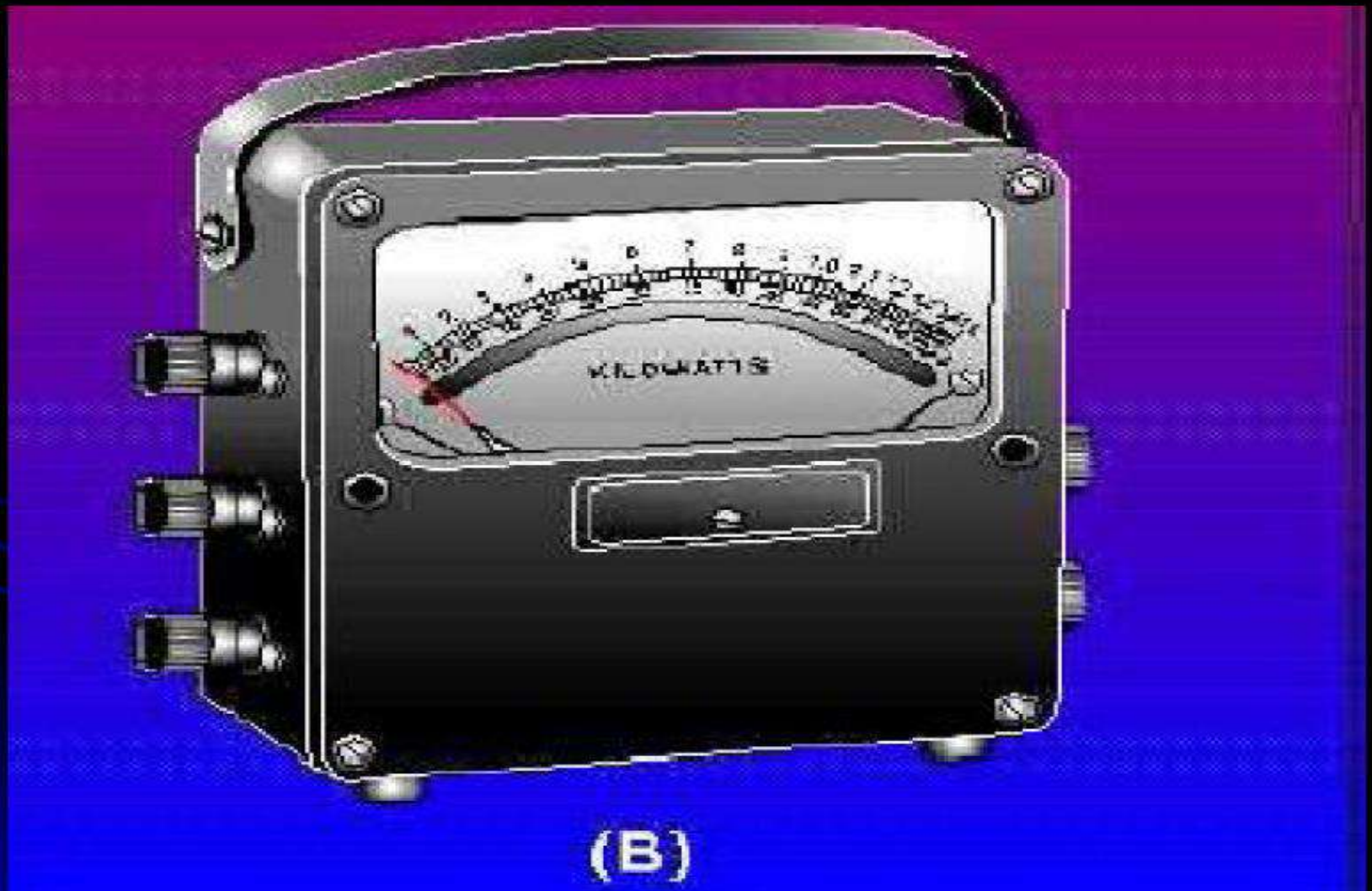


Measured Power, $P=VI\ Cos\Theta$

Θ= angle between v and i

❖ ওয়াটমিটারের ছবি(চলবে.....)

Pictorial View of Wattmeter:

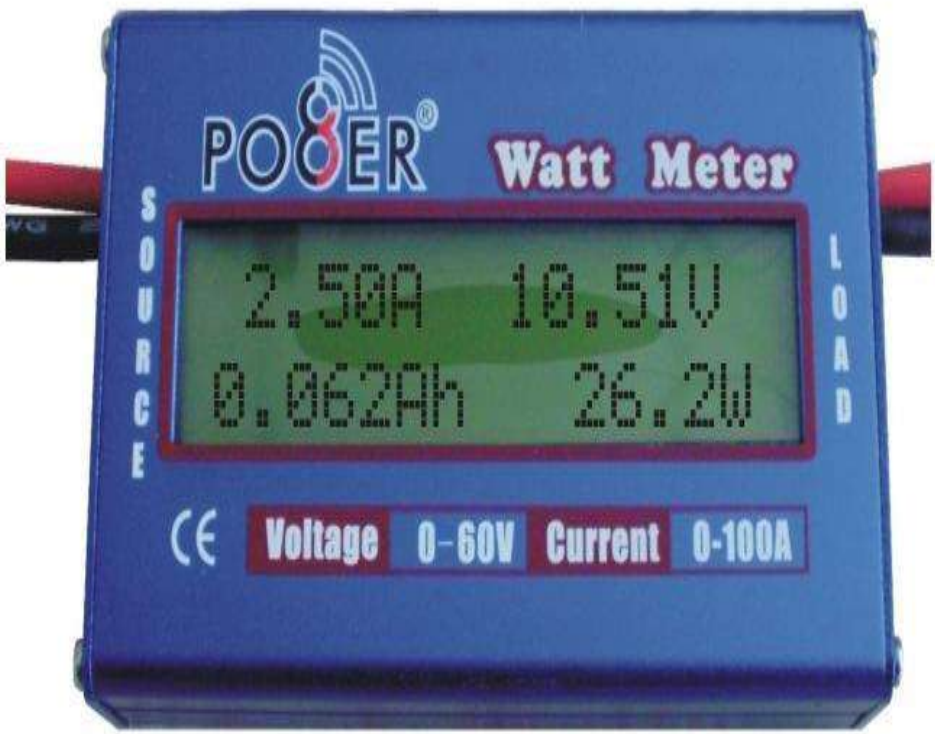


❖ ওয়াটমিটারের ছবি(চলবে.....)

http://www.mcpsh.com

ডিজিটাল ওয়াট মিটার

❖ ওয়াটমিটারের ছবি (চলবে.....)

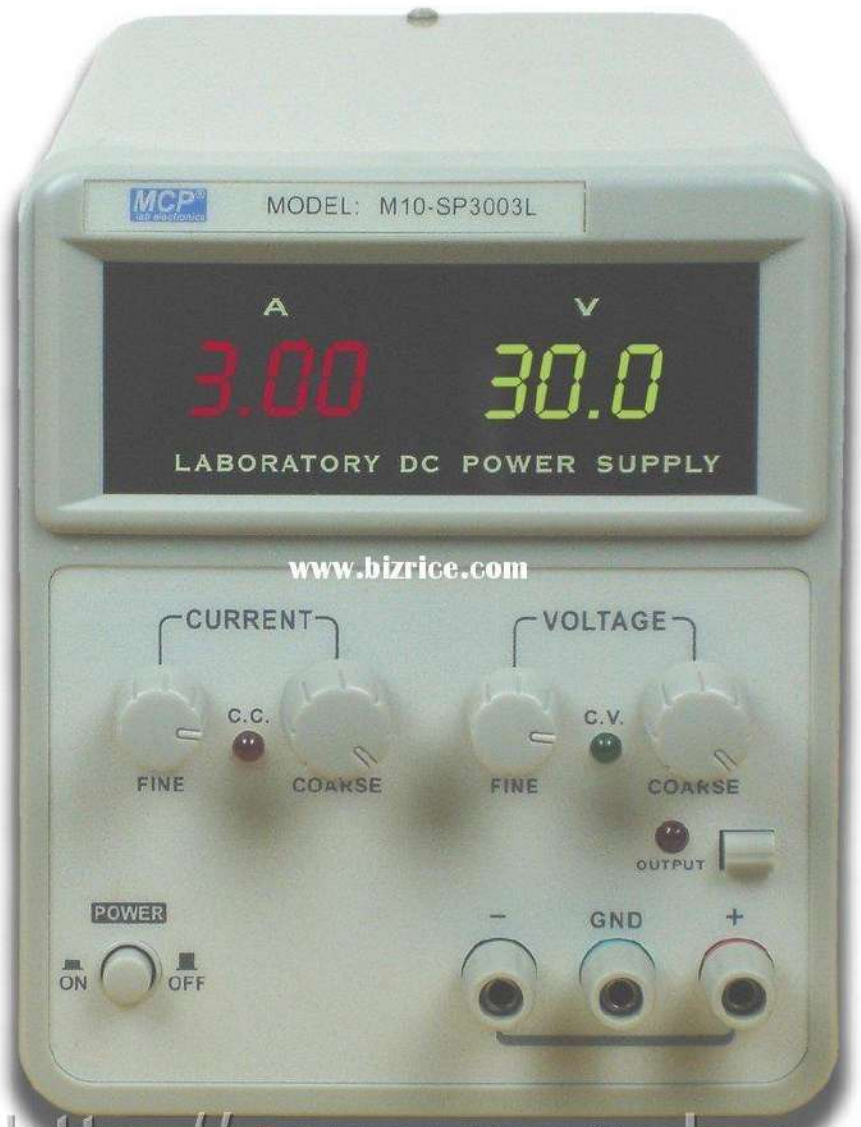


ডিজিটাল ওয়াট মিটার

❖ ওয়াটমিটারের ছবি

Old Type(Analog)

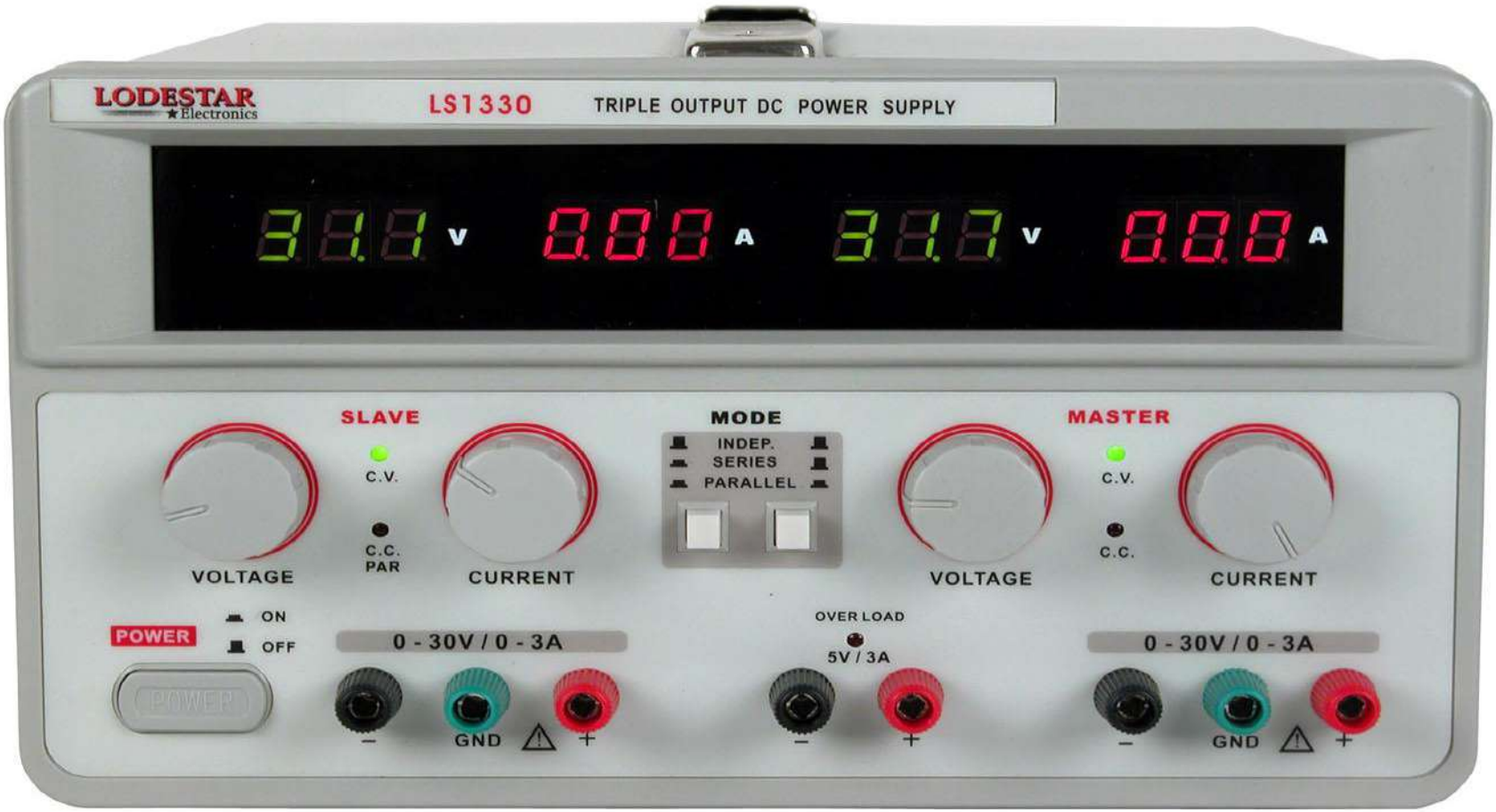
❖ ডিসি পাওয়ার সাপ্লাইয়ের ছবি



http://www.mcpsh.com
> more details
http://www.mcpsh.com

❖ ডিসি পাওয়ার সাপ্লাইয়ের ছবি

❖ ডিসি পাওয়ার সাপ্লাইয়ের ছবি



Dual port

ধন্যবাদ


শুভেচ্ছা
ও
স্বাগতম
মহাম্মদ সাদাত উল্লাহ্

Today's Exp. No. : 02

Name of the Experiment:

রিলে, টাইমার ও ম্যাগনেটিক কন্ট্রাক এবং সেন্সর এর কার্যপ্রনালী পরীক্ষণ।

Name of the Experiment: **Function of Relay, Timer Magnetic contact & sensor with application**

Relay: Relay একটি electrically operated switch. অনেক রিলে Electromagnet ধর্মের ভিত্তিতে কাজ করে।

Relay type:

- Latching Relay ,
- Read Relay,
- Mercury Relay,
- Mercury-watted Relay,
- Polarized Relay,
- Machine tool Relay,
- Co axial Relay,
- contatctor Relay,
- Solid-state Relay,
- Solid-state contatctor Relay,
- Buchholr Relay,
- Forced-guided Relay,
- Contaces Relay,
- Over load Relay,
- Proctaction vacuum Relay অন্যতম।

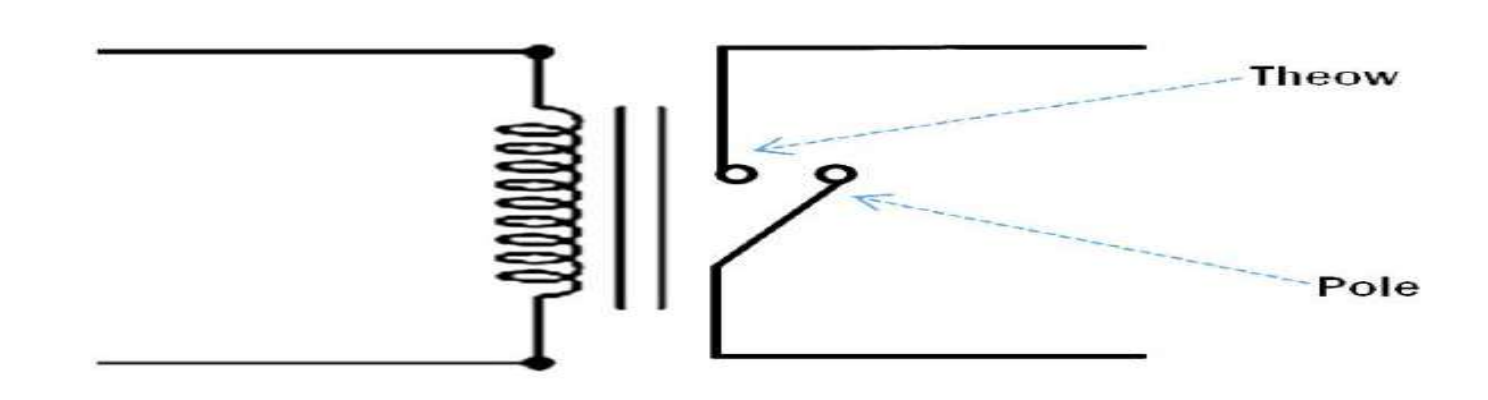
Construction of Relay

Relay সাধারনত Relay, coil, pole & throw এর সমন্বয়ে গঠিত।

নিচে উল্লেখিত Relay এর পদবী গুলো বেশি ব্যাবহৃত হয়...

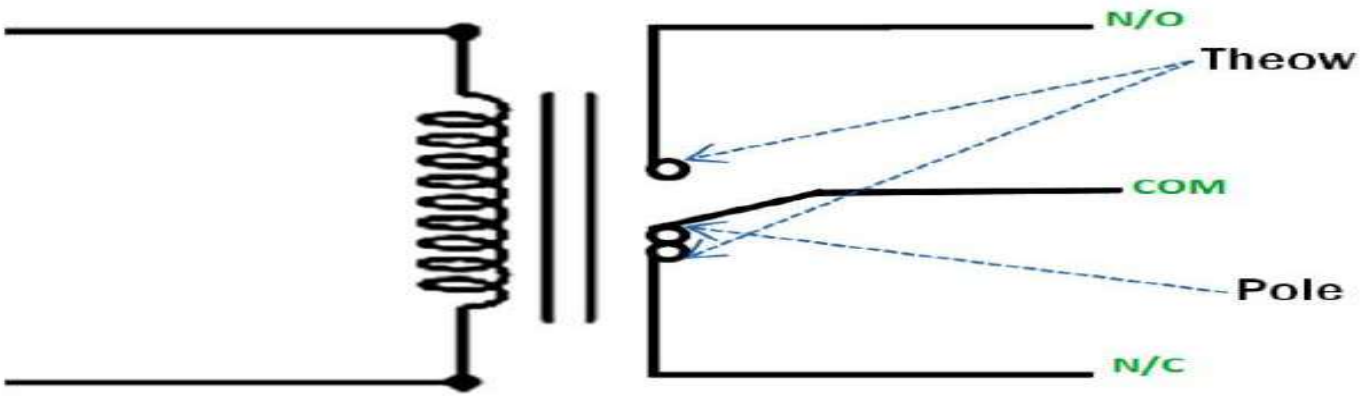
- SPST: (Single Pole Single Throw)
- SPDT: (Single Pole Double Throw)
- DPST: (Double Pole Single Throw)
- DPDT: (Double Pole Double Throw):

SPST: (Single Pole Single Throw)



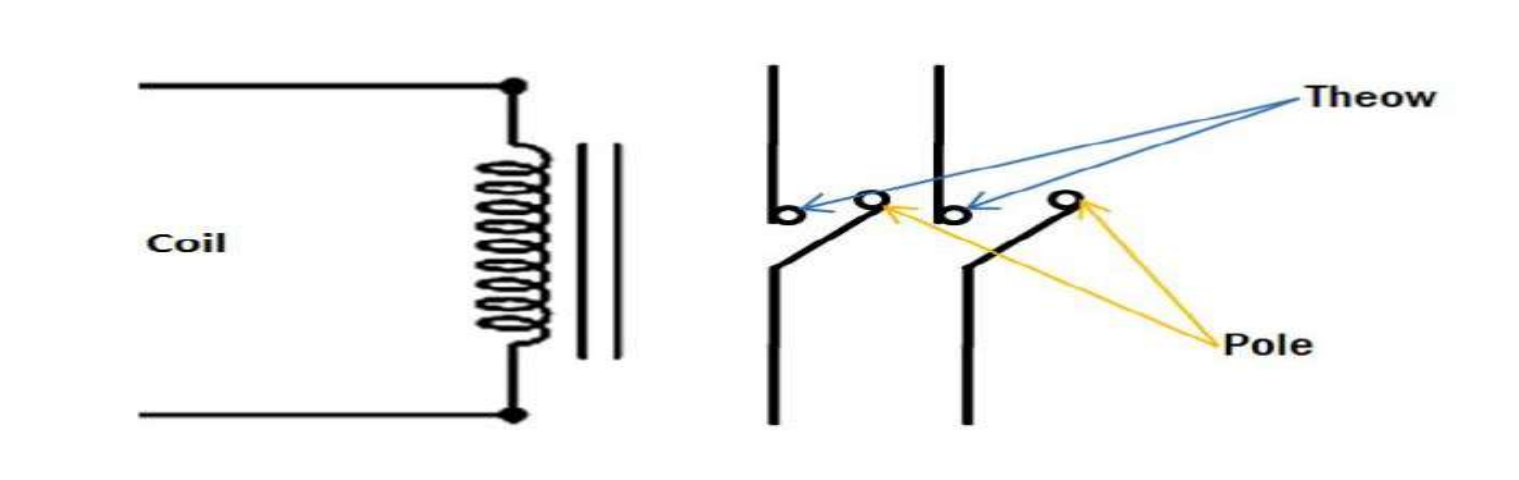
এই Relay এর pin সংখ্যা থাকে ৪টি এই ৪টি pin এর মধ্যে ২টি pin থাকে coil এর জন্য, যেখানে supply দেওয়া হয়, এবং ২টি pin switching এর জন্য ব্যাবহৃত হয়, যাদের একটি pole এবং একটি throw থাকে।

SPDT: (Single Pole Double Throw)



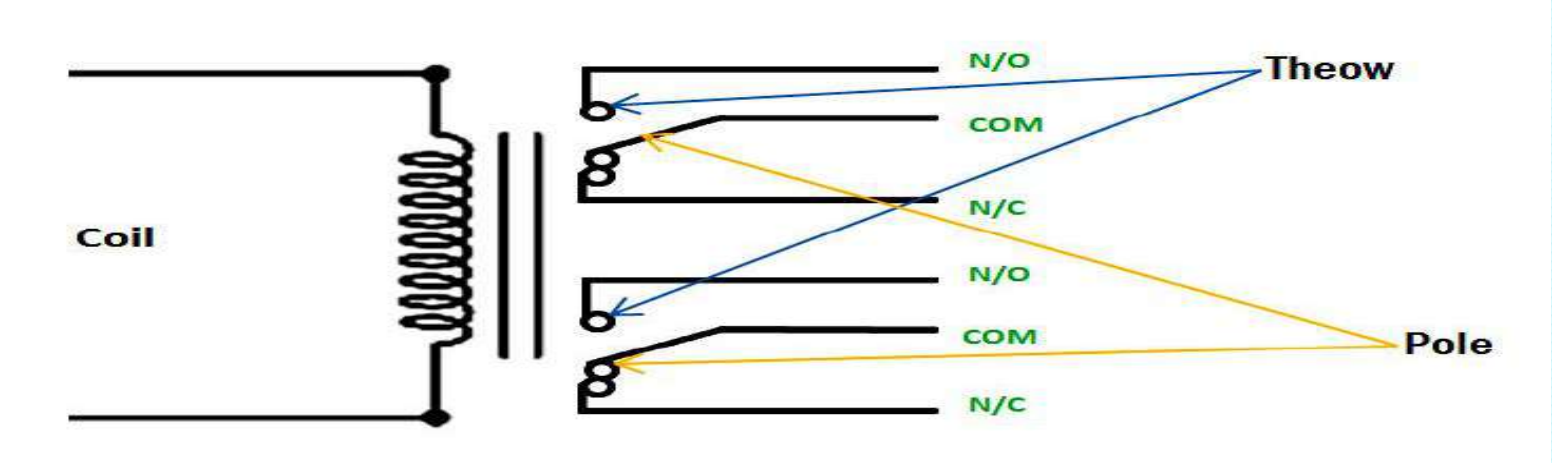
- এই Relay এর pin সংখ্যা থাকে ৫টি, এই ৫টি pin এর মধ্যে ২টি pin থাকে coil এর জন্য, যেখানে supply দেওয়া হয়এবং ৩টি pin switching এর জন্য ব্যাবহৃত হয়, যাদের একটি pole এবং দুইটি throw থাকে।

DPST: (Double Pole Single Throw)



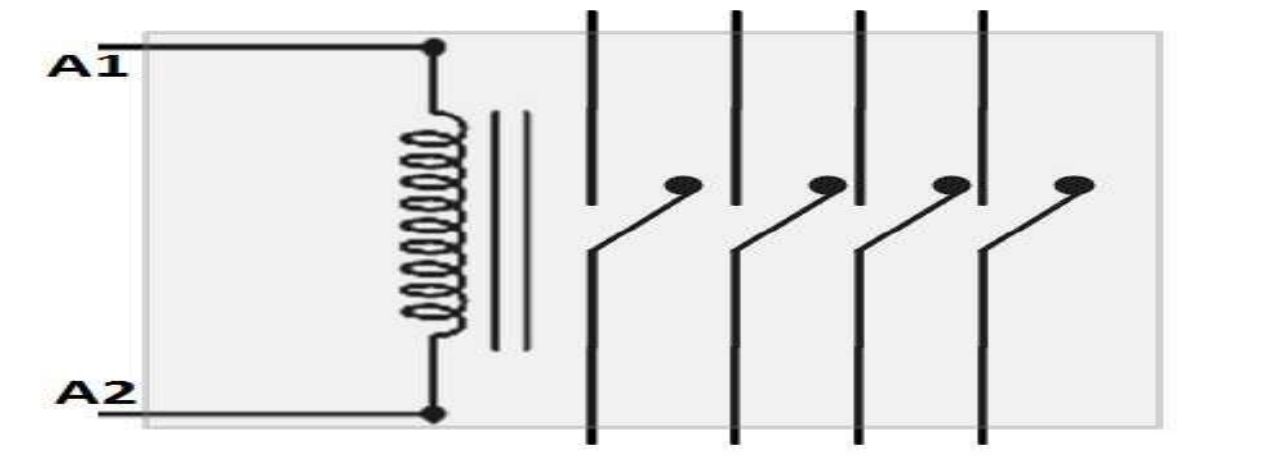
- এই Relay এর pin সংখ্যা থাকে ৬টি এই ৬টি pin এর মধ্যে ২টি pin থাকে coil এর জন্য, যেখানে supply দেওয়া হয়, এবং ৪টি pin switching এর জন্য ব্যাবহৃত হয়, যাদের দুইটি pole এবং দুইটি throw থাকে।

DPDT: (Double Pole Double Throw):



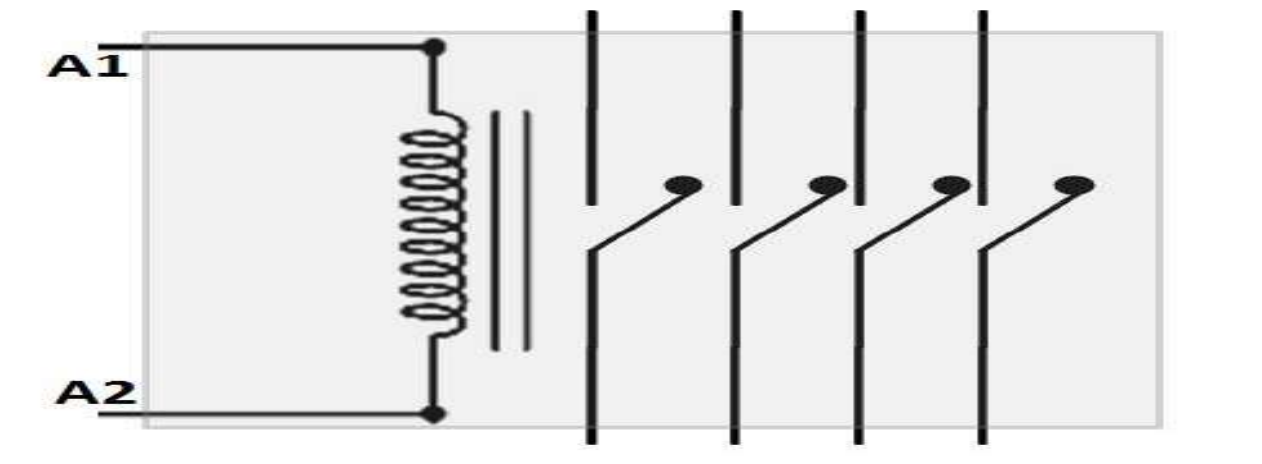
- এই Relay এর pin সংখ্যা থাকে ৮টি এই ৮টি pin এর মধ্যে ২টি pin থাকে coil এর জন্য, যেখানে supply দেওয়া হয়।
- এবং ৬টি pin switching এর জন্য ব্যাবহৃত হয়, যাদের তিনটি pole এবং তিনটি throw থাকে।

Magnatic Contac:



- Magnatic contac ও একটি automatic switching device যা electromagnatic ধর্মের ভিত্তিতে কাজ করে, এর coil এ সবসময় AC ভোল্টেজ supply দেওয়া হয়। একটি Magnetic contact একসাথে ৪টি port কে switching করে এর coil এর ২ টি প্রান্ত কে A1 এবং A2 বলা হয়, এর coil এর ২ প্রান্তে AC220v supply দেওয়া হলে এর কোরটি magnet এ রুপান্তরিত হয়, ফলে একসাথে ৪ টি port switching হয়।

Magnatic Contac:



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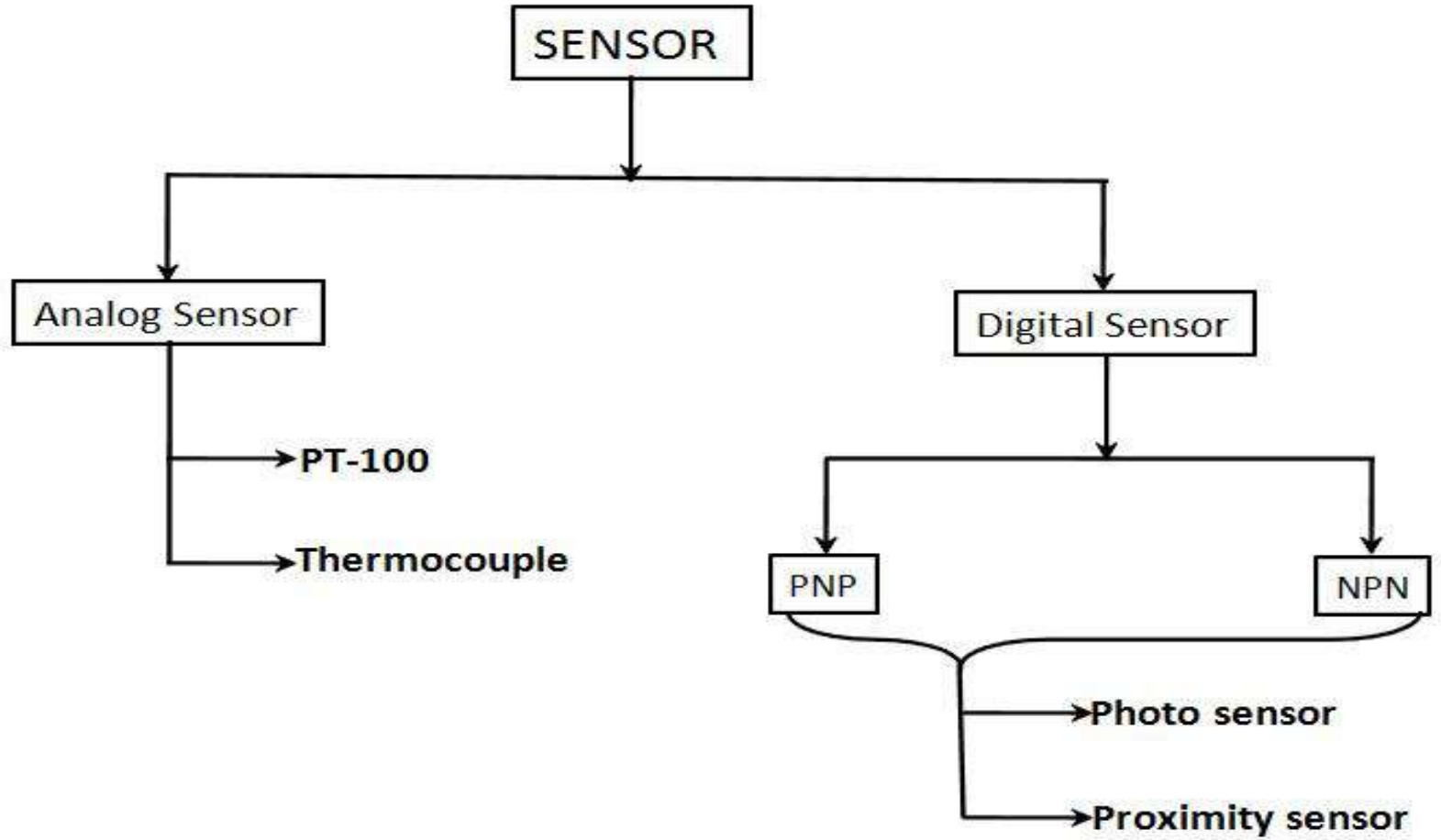
Different Type of sensor with application



Sensor 2 ধরনের হয়ে থাকে

1. Analog Sensor
2. Digital Sensor

Digital Sensor আবার ২ ধরনেরঃ

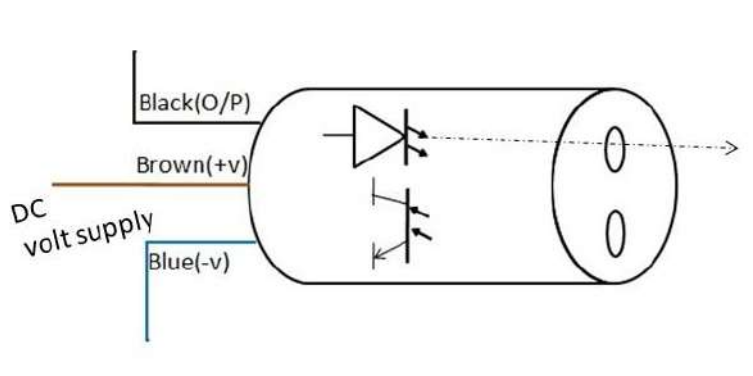
1. **Photo sensor**
2. **Proximity sensor**

Photo sensor ২ ধরনের হয়ে থাকে।

- **Transriver Photo Sensor.**
- **Transmitter Receiver Pair Photo Sensor.**

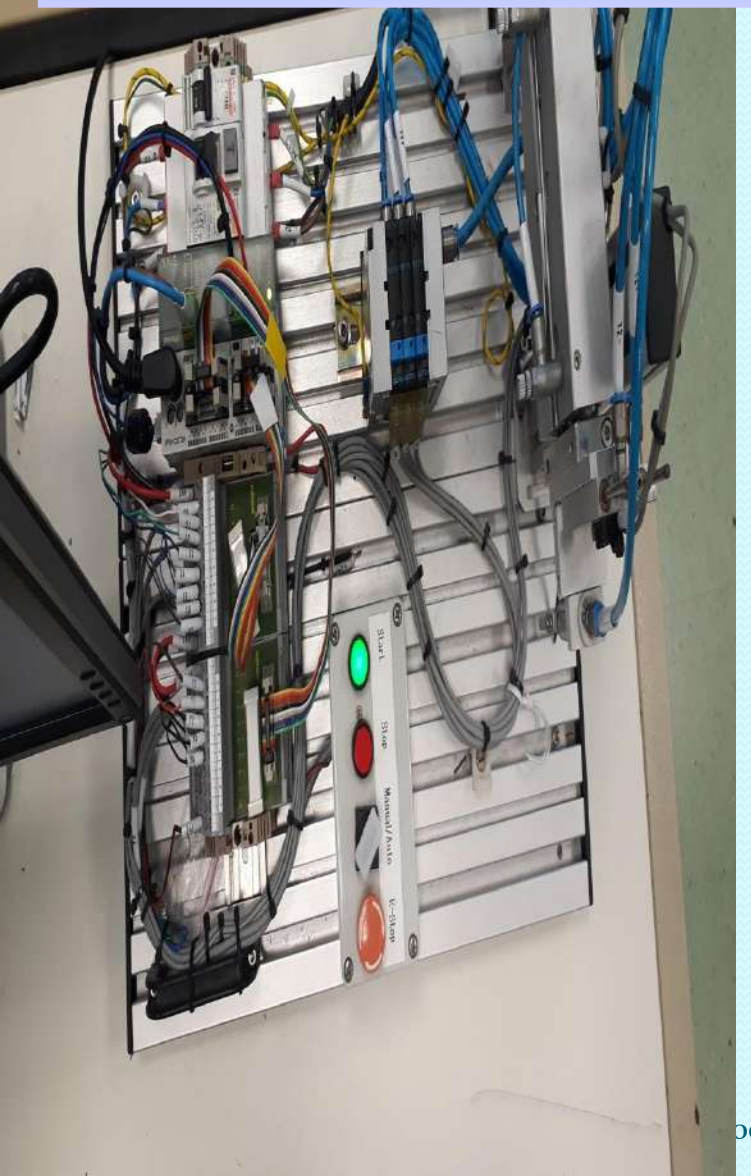
Transriver Photo Sensor

যে Photo sensor এ transmitting এবং Receiving ব্যাবস্থা একত্রে থাকে তাকে Transriver Photo Sensor বলে। এক্ষেত্রে Transmitter হিসেবে Photo Diode এবং Receiver হিসেবে Photo Transistor ব্যবহৃত হয়।



ধন্যবাদ

Practical on the subject of Mechatronics & PLC



Presented by –
Engr. Muhammad Shadat Ullah
Workshop Super (Mechanical)

Topic

C

- Physical principles of Pneumatic and Electrical system
- Functions and use of Electro-Pneumatic components
- Recognizing and drawing of pneumatic and Electro-Pneumatic symbols and circuit diagrams
- Representation of motion sequences and operating status
- Drawing of pneumatic and electrical circuits diagrams
- Direct and indirect manual controls
- Direct and indirect stroke-dependent controls
- Logical AND/OR function of switch-on signals

What is Pneumatics?

- PNEUMA - Greek root term means *"breath"*

- It is the industrial implementation and application of air powered actuators (***cylinders and motors***) and their control devices (***valves***) needed in their operation.

- Branch of science which deals with the study of gases especially air, its properties and application at pressure higher (***compressed***) or lower (***vacuum***) than atmospheric.

Compressed Air as a Working Medium

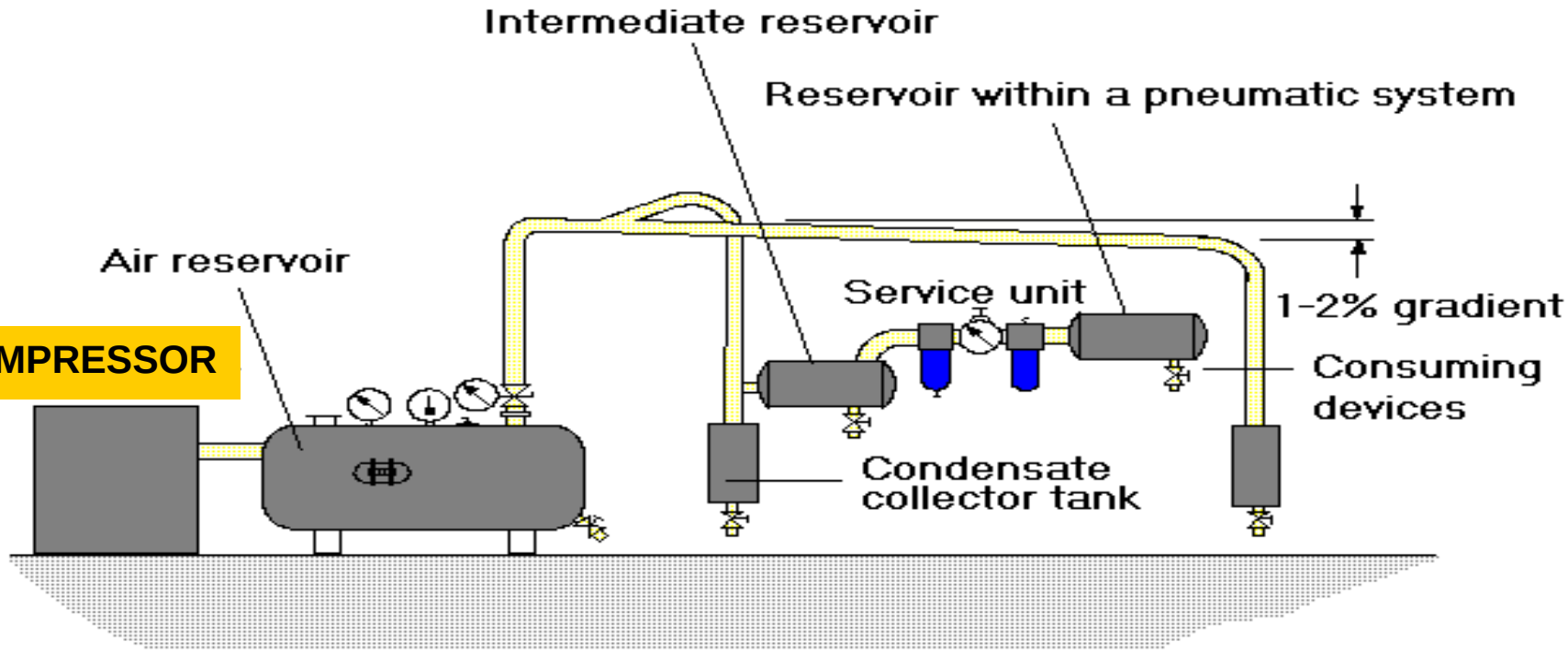
ADVANTAGES:

- Air is available everywhere
- Compressed air is easily conveyed in pipelines over large distances
- Compressed air is insensitive to temperature fluctuations
- Compressed air need not be returned
- Compressed air is explosion proof
- Compressed air is clean
- Compressed air is fast
- Straight line movement can be produced directly

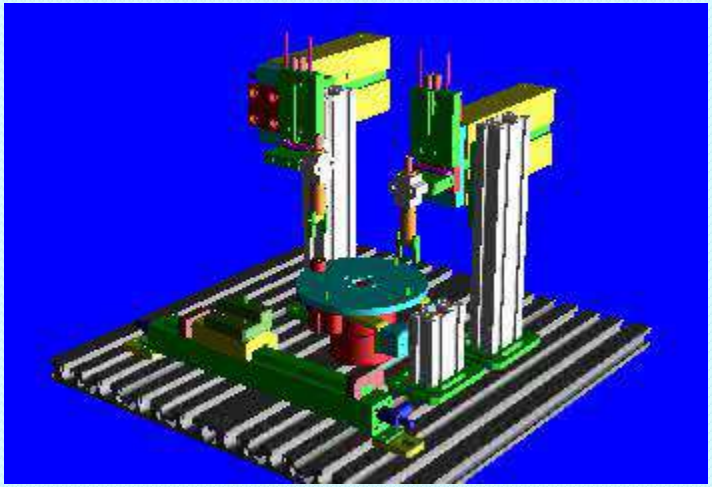
Compressed Air as a Working Medium

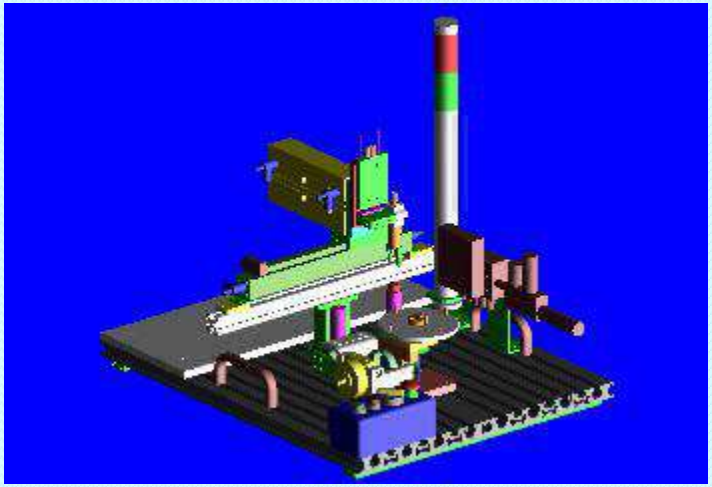
DISADVANTAGES

- Compressed air is a relatively expensive means of conveying energy
- Compressed air requires good conditioning
- It is only economical up to a certain force expenditure
- Air is compressible
- Exhaust air is loud (reduced by using silencers)
- The oil mist mixed with air for lubricating purposes exhaust or escapes to the atmosphere


Intermediate reservoir
Reservoir within a pneumatic system
Air reservoir
Service unit
1-2% gradient
Consuming devices
Condensate collector tank

COMPRESSOR



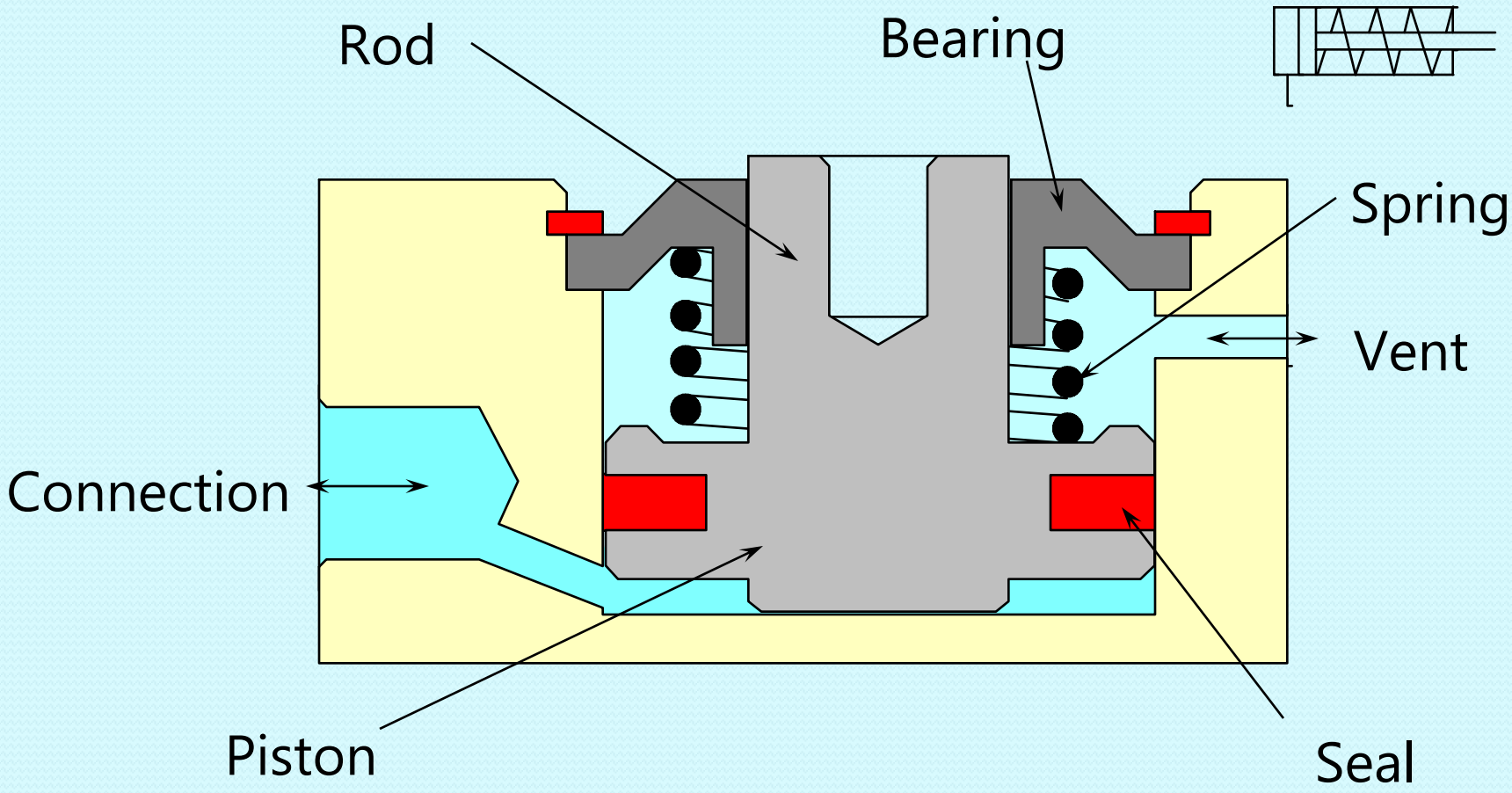


Single acting cylinder

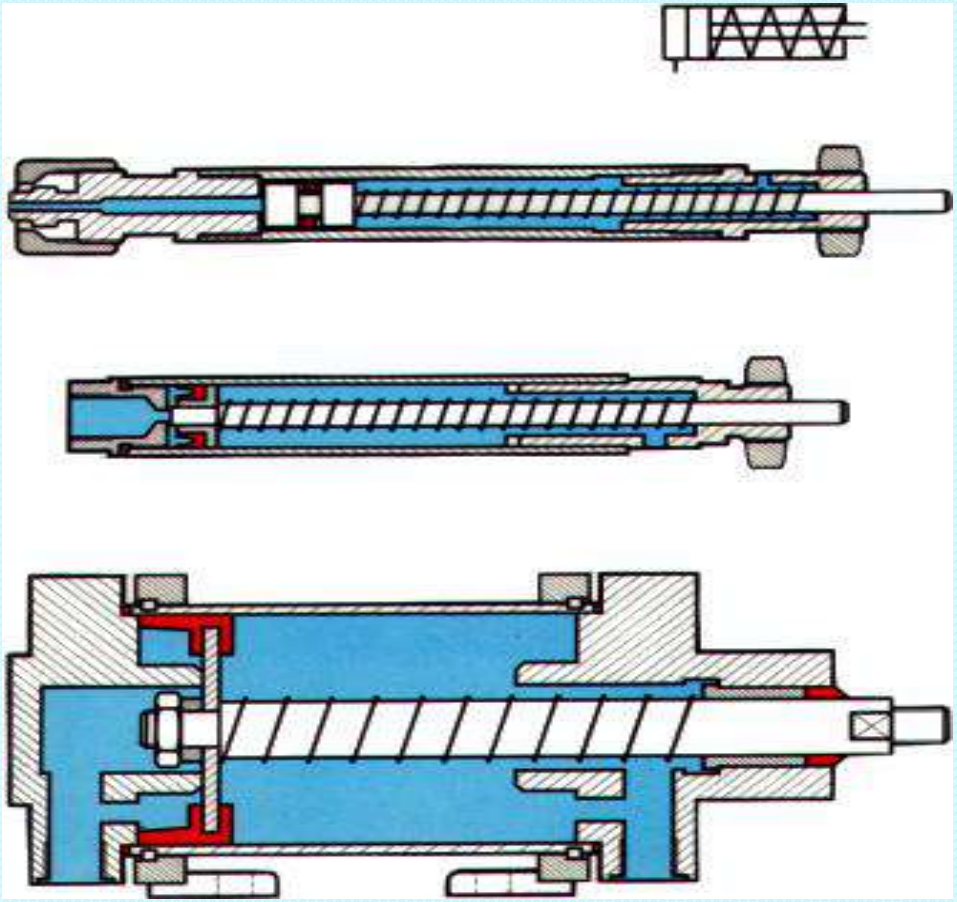
Sample of Single Acting Cylinders

Single Acting Cylinder

Diameters	10mm to 32mm
Stroke Lengths	5mm to 50mm


Rod
Bearing
Spring
Vent
Connection
Piston
Seal

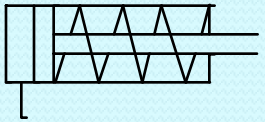
Single Acting Cylinders

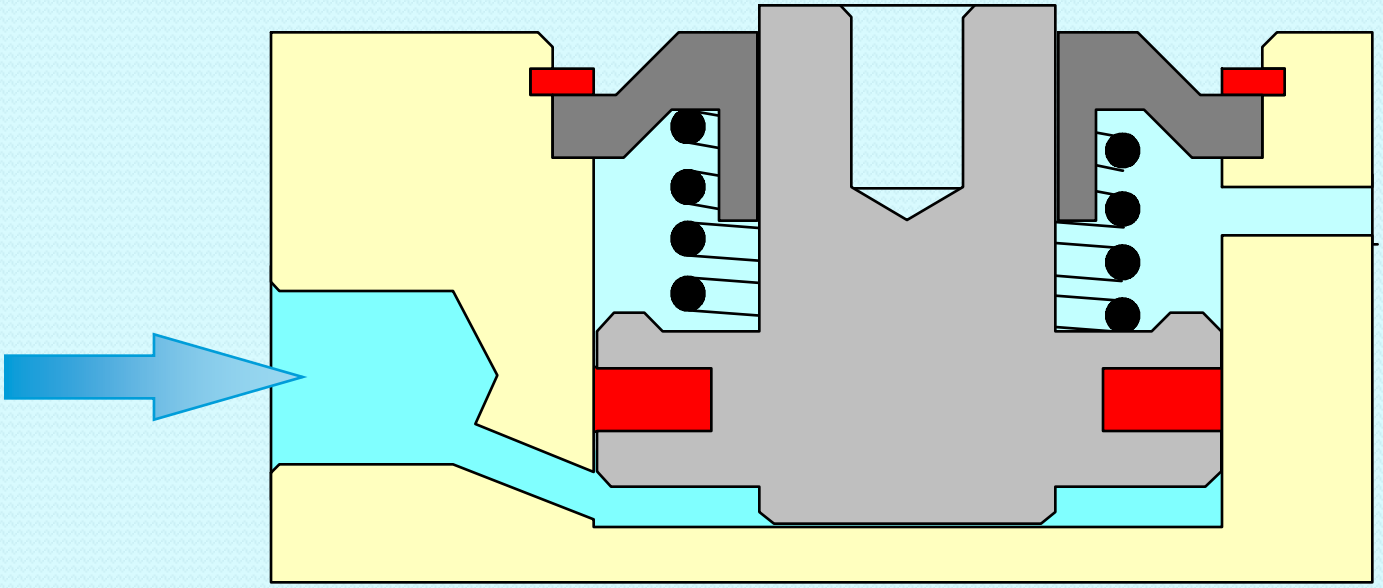


If compressed air is supplied, air hits the piston surface and the piston rod moves out. When air is released, the return spring moves the piston to its initial position.

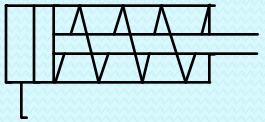
Single acting cylinders do work in one way, therefore they are ideal for tensioning, ejecting, compressing etc.

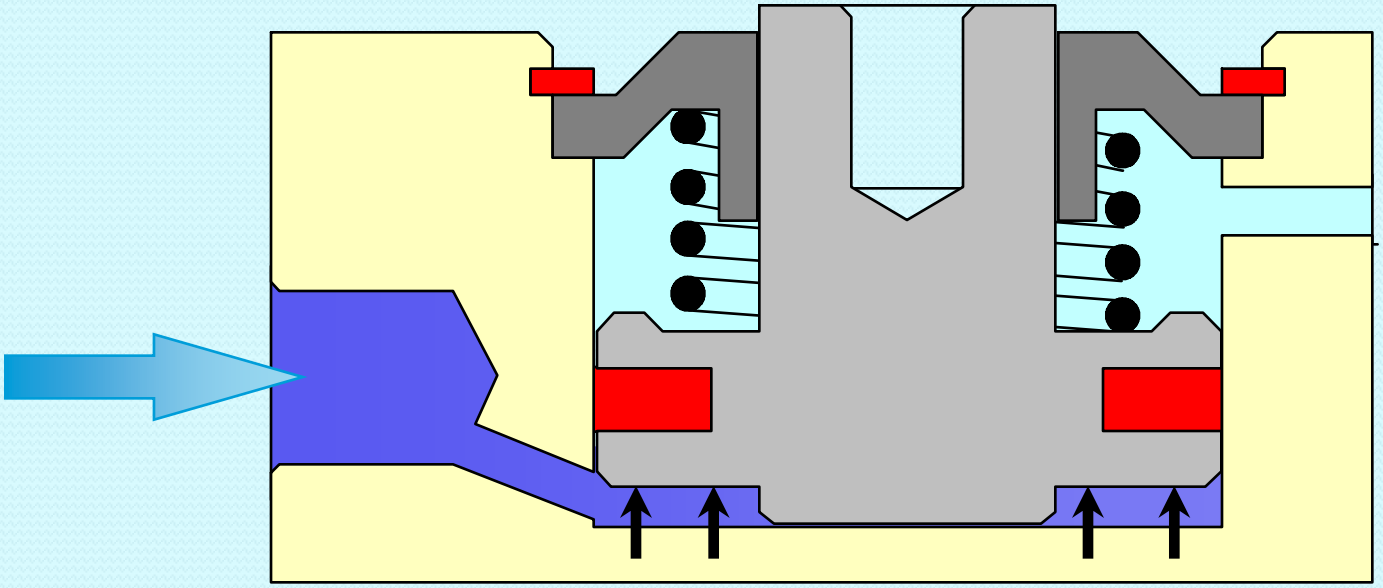
Operation of Single Acting Cylinders





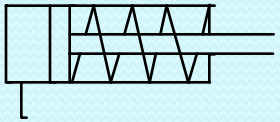
Operation of Single Acting Cylinders

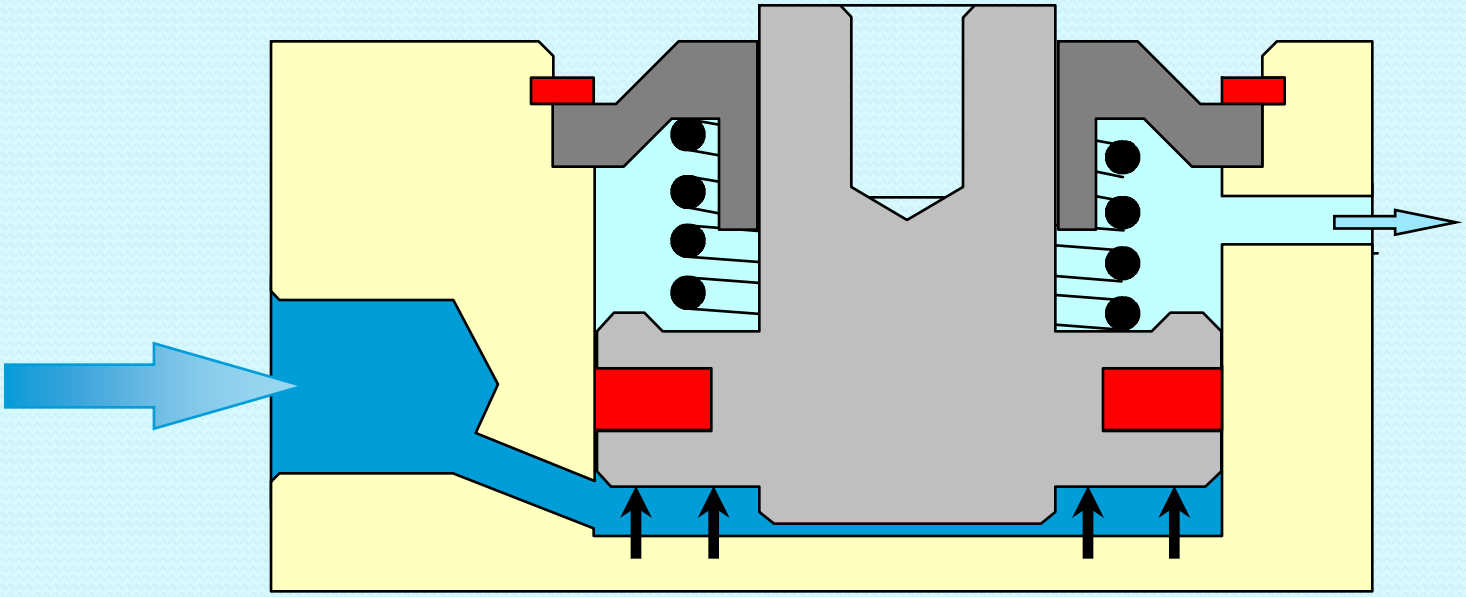




Force = Pressure x Area (piston)

Operation of Single Acting Cylinders





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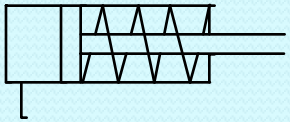
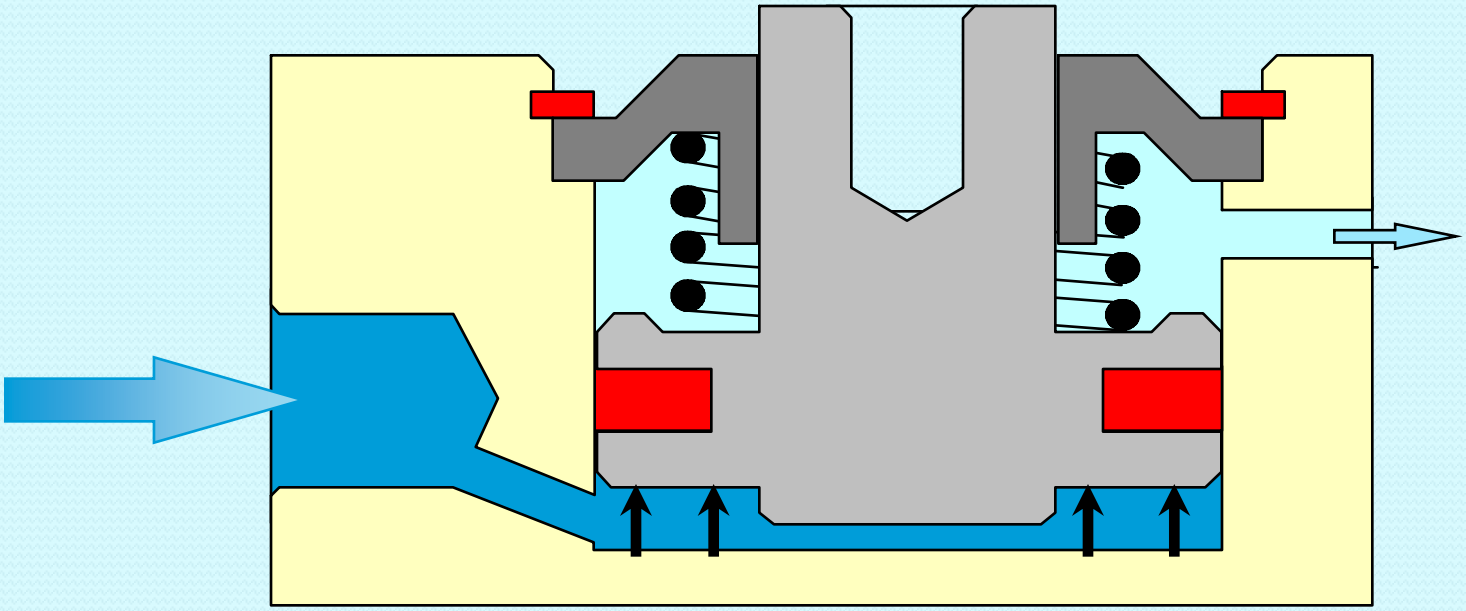
Operation of Single Acting Cylinders





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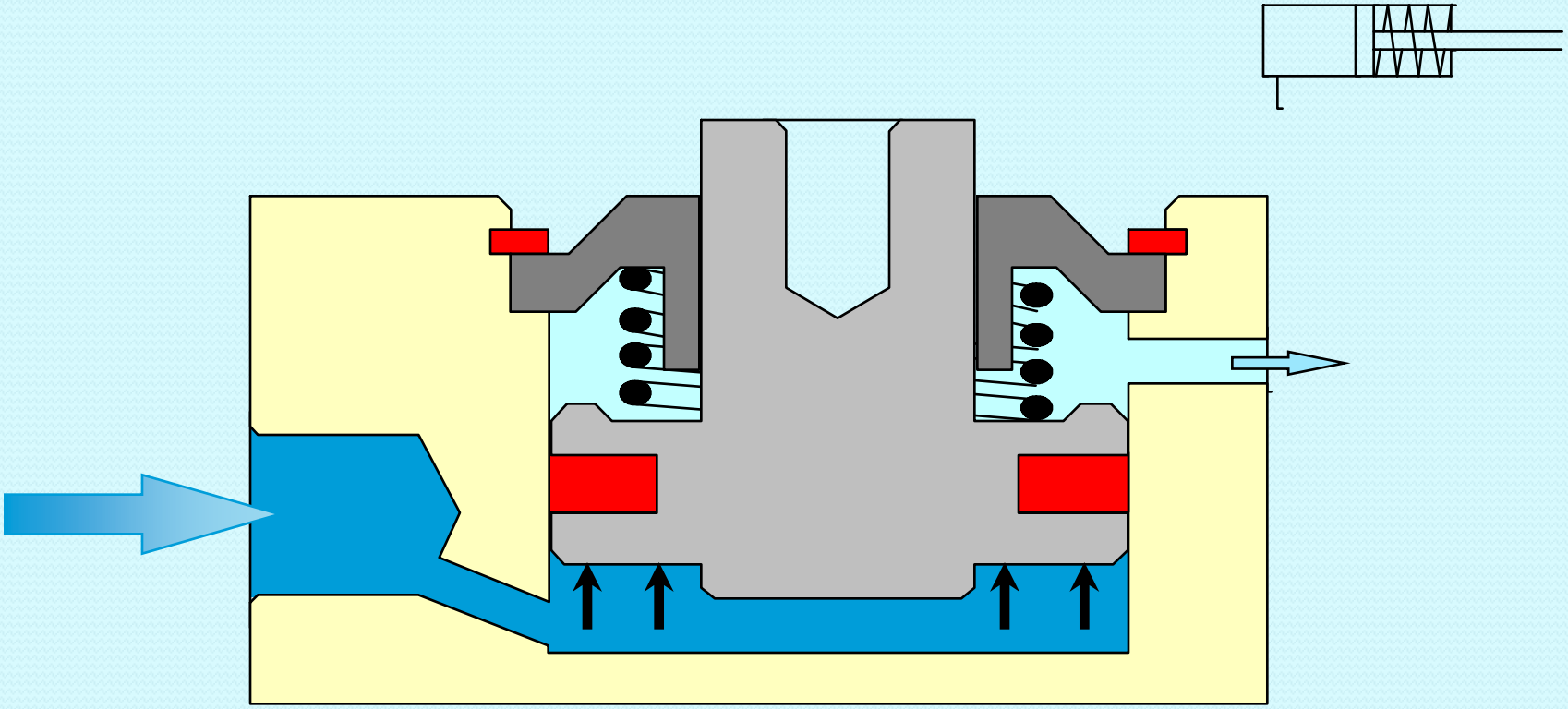
Operation of Single Acting Cylinders



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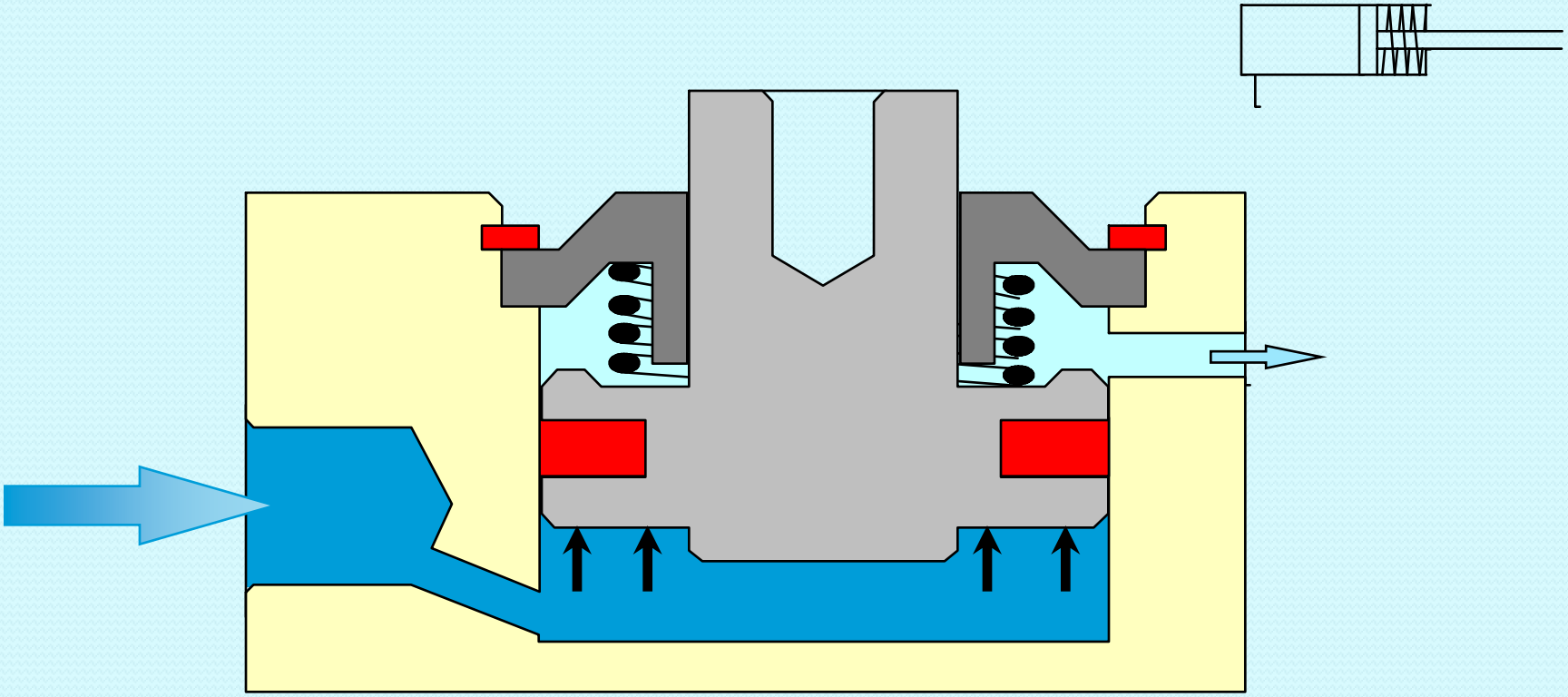
Operation of Single Acting Cylinders



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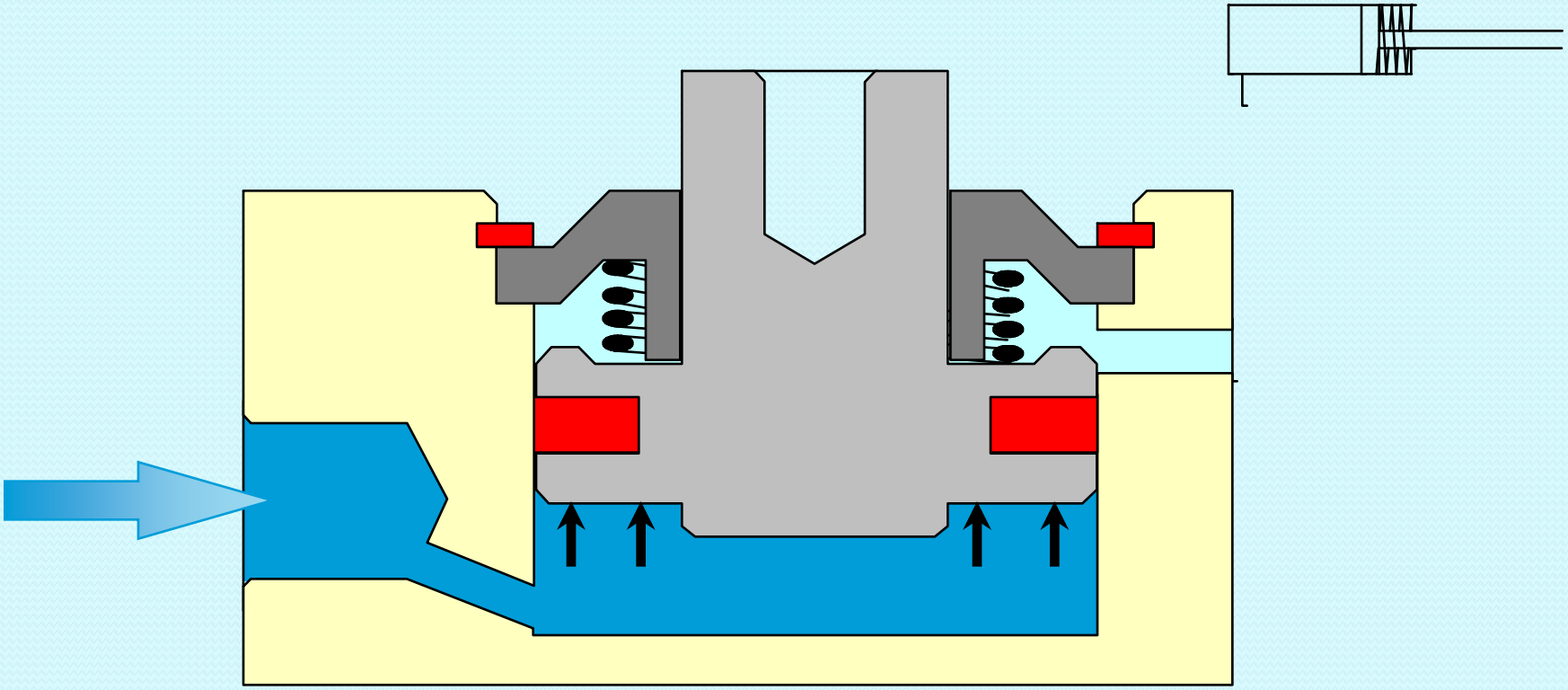
Operation of Single Acting Cylinders



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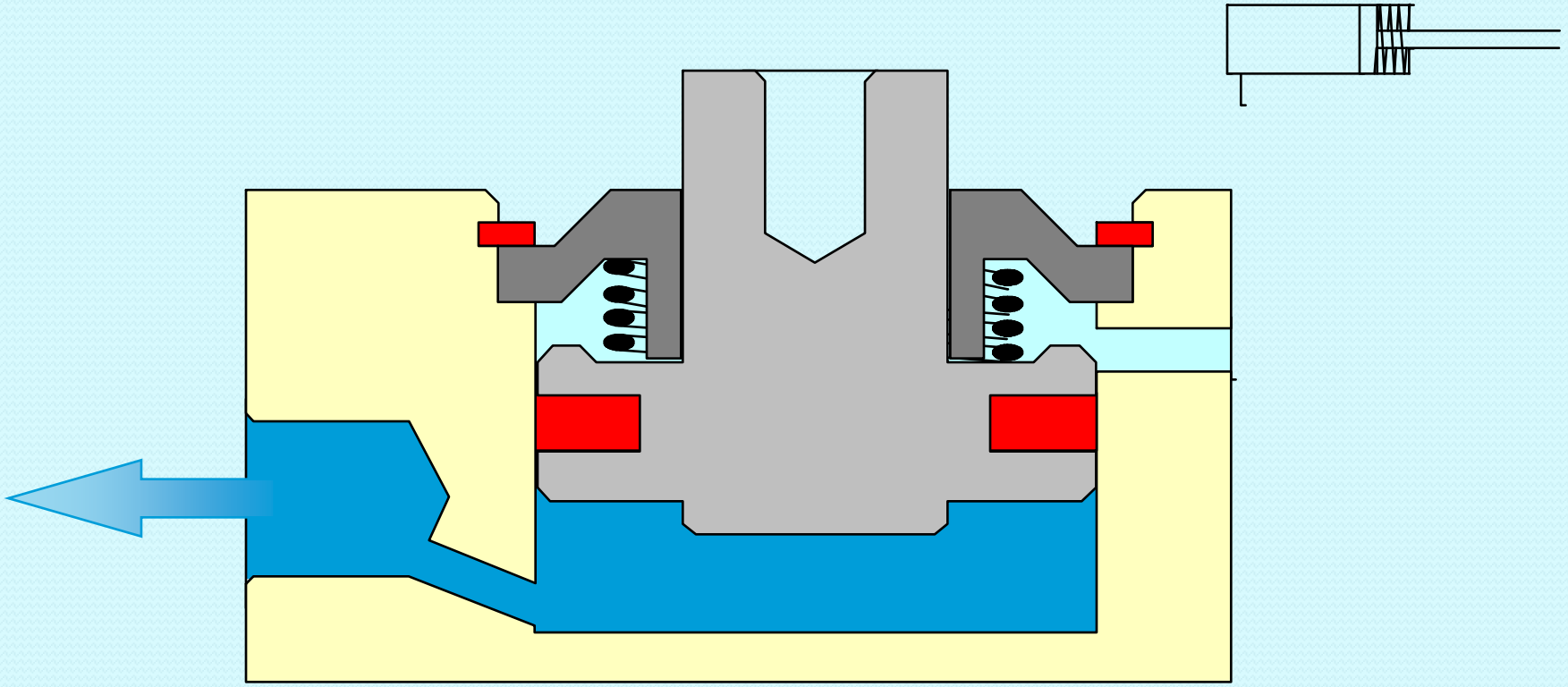
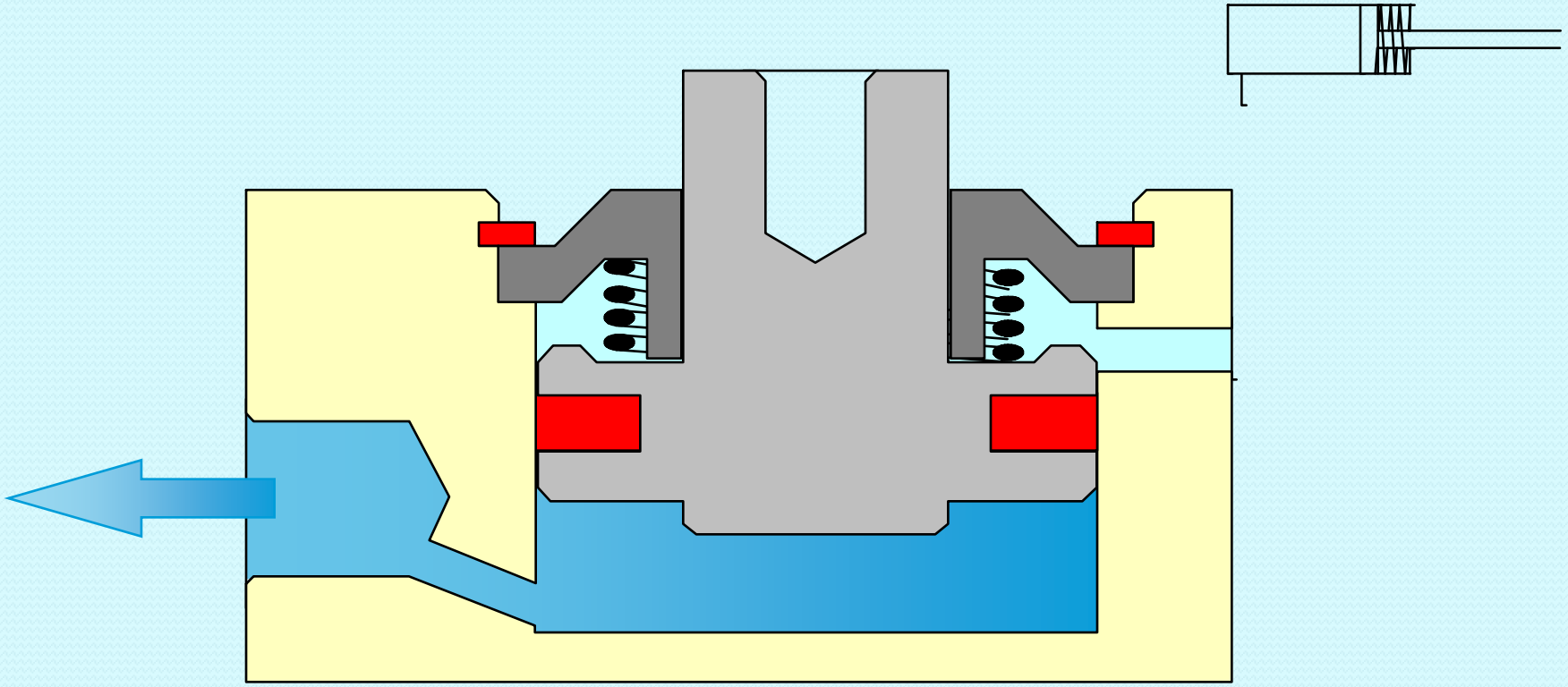
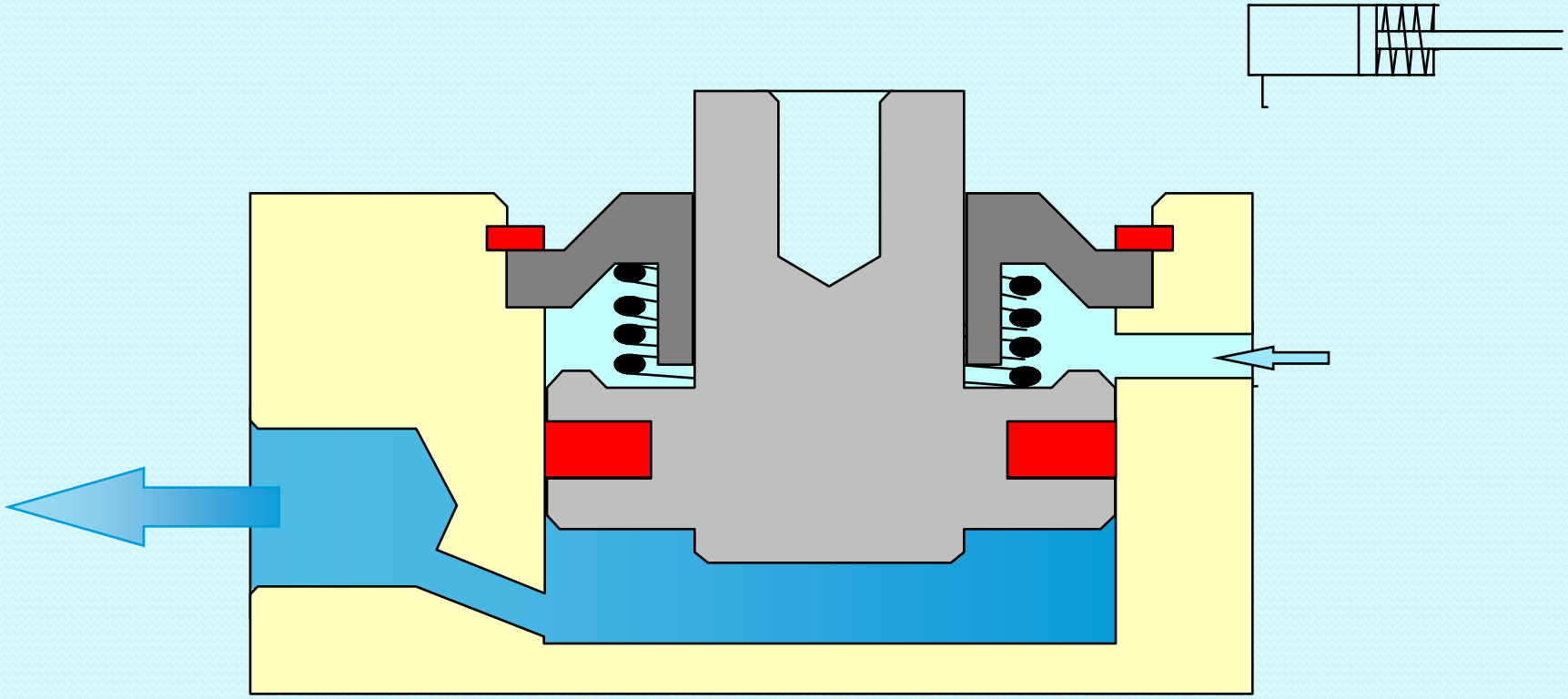


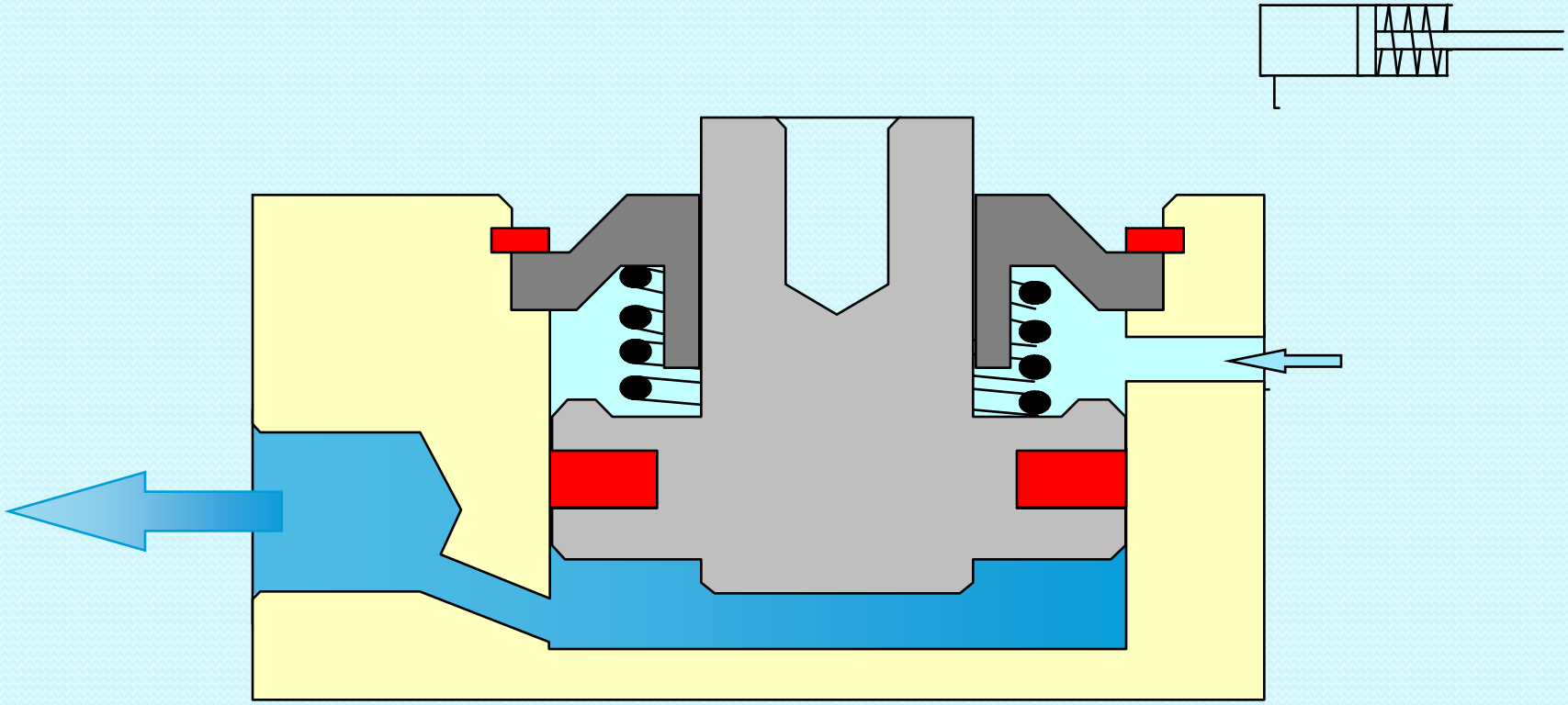
Operation of Single Acting Cylinders



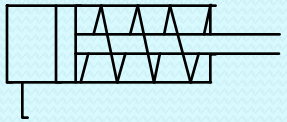
Operation of Single Acting Cylinders

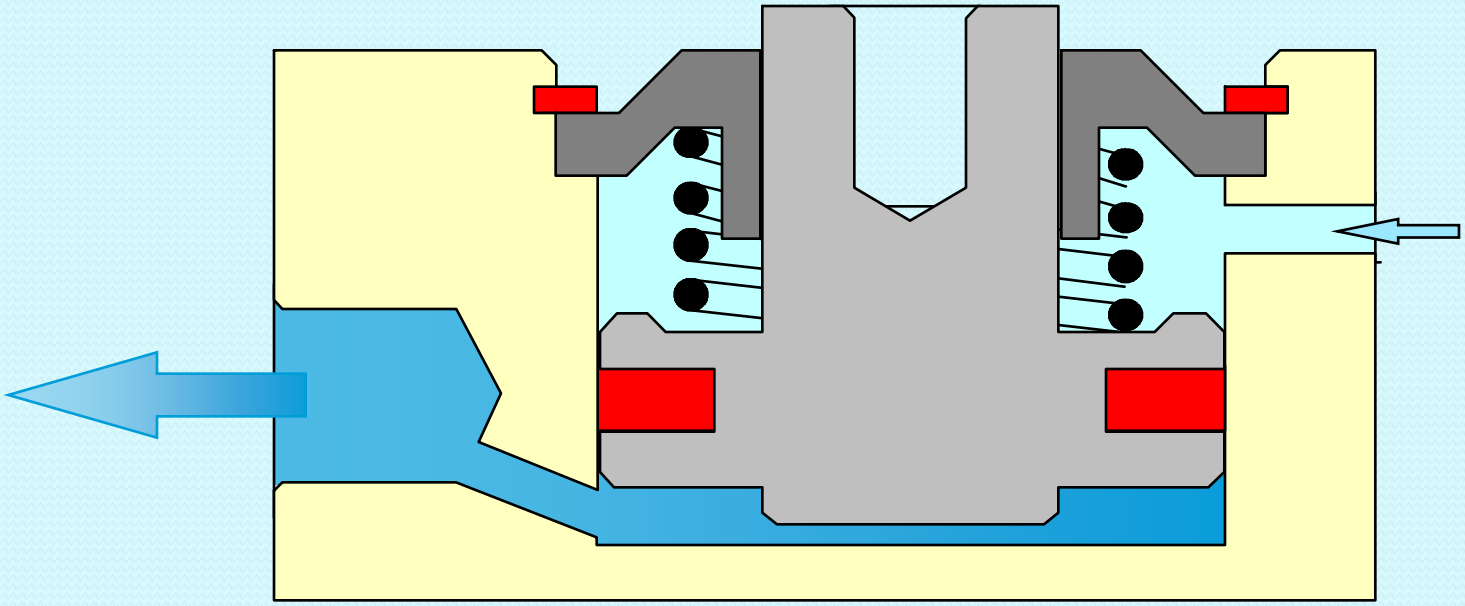


Operation of Single Acting Cylinders



Operation of Single Acting Cylinders





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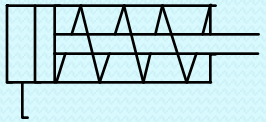
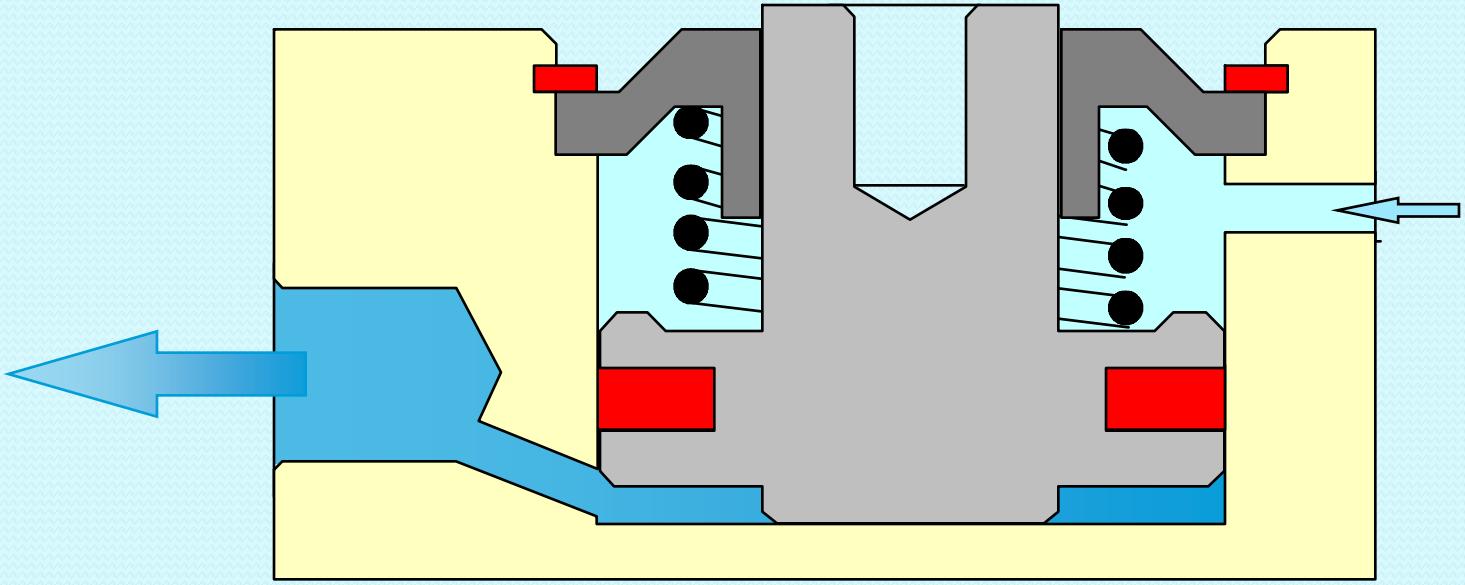
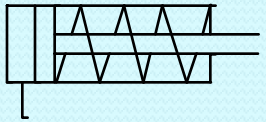
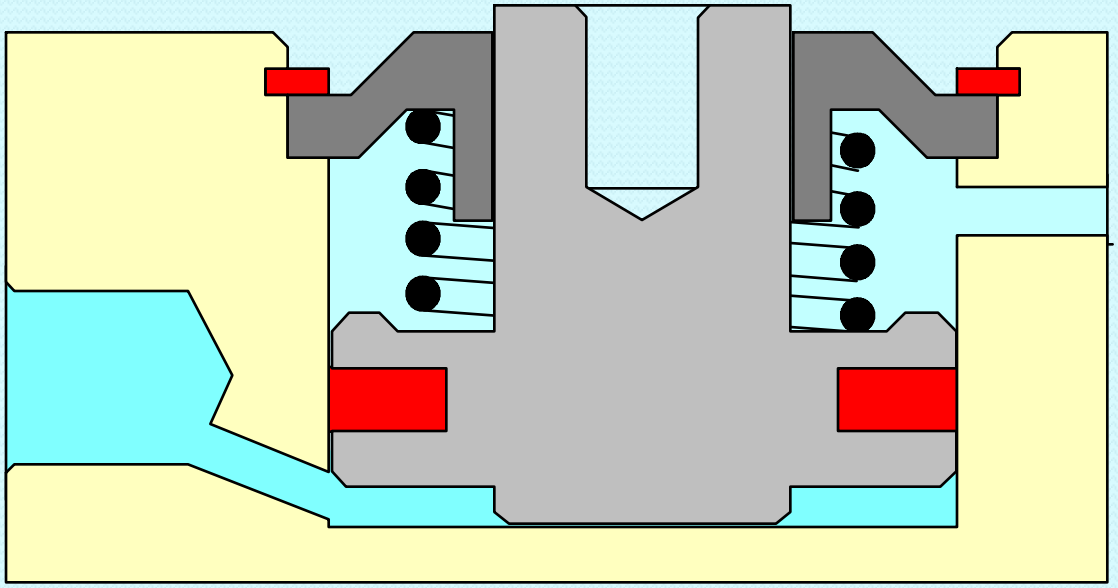




Operation of Single Acting Cylinders

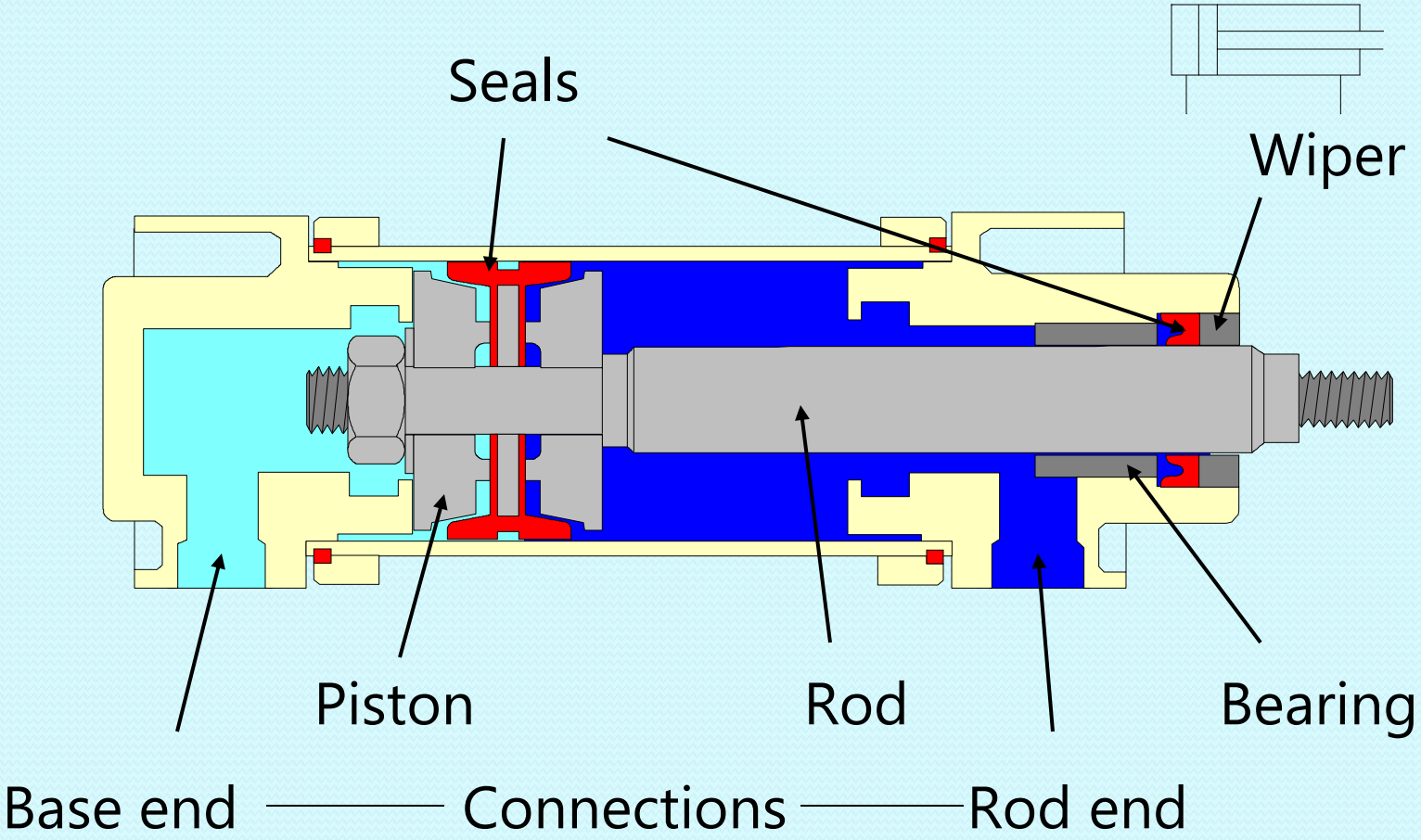




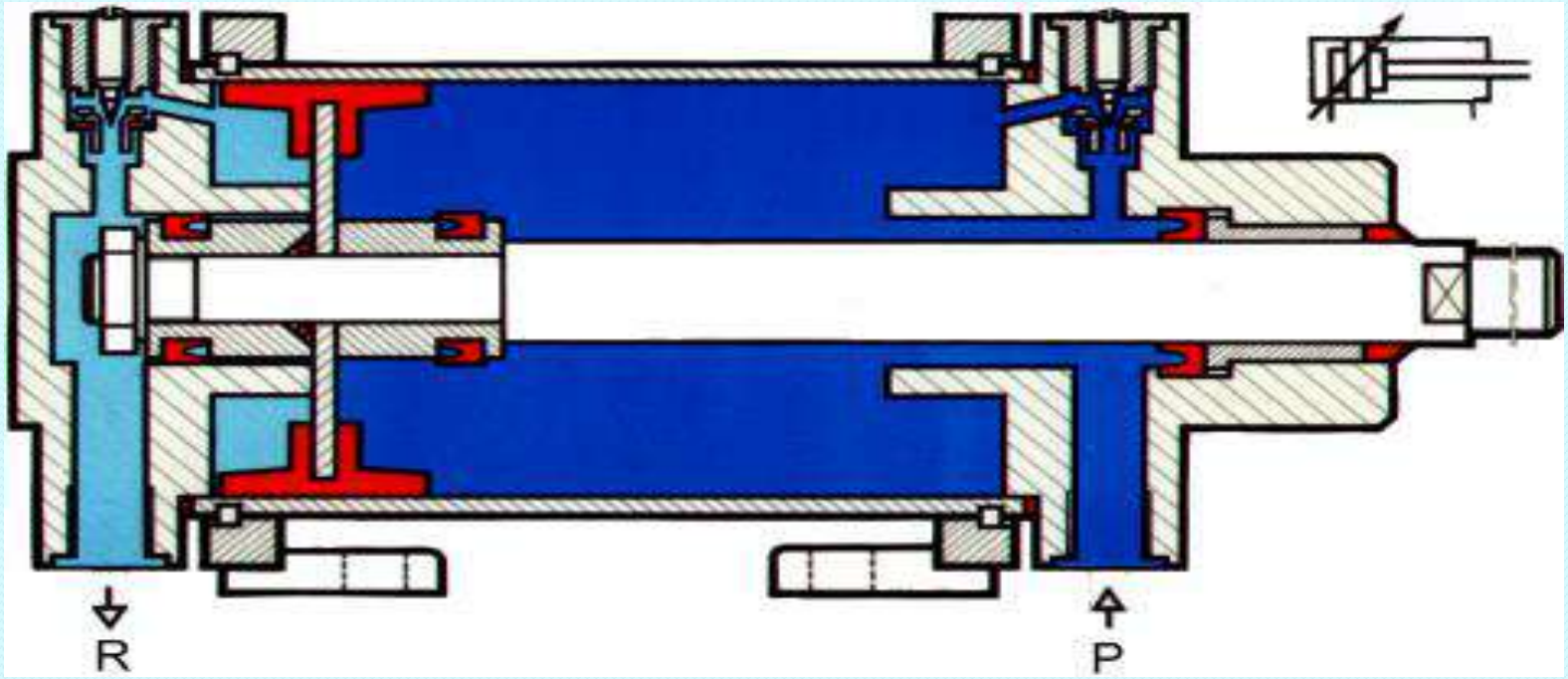
Double acting cylinder

DOUBLE-ACTING CYLINDERS

Stroke Length 100mm (max)

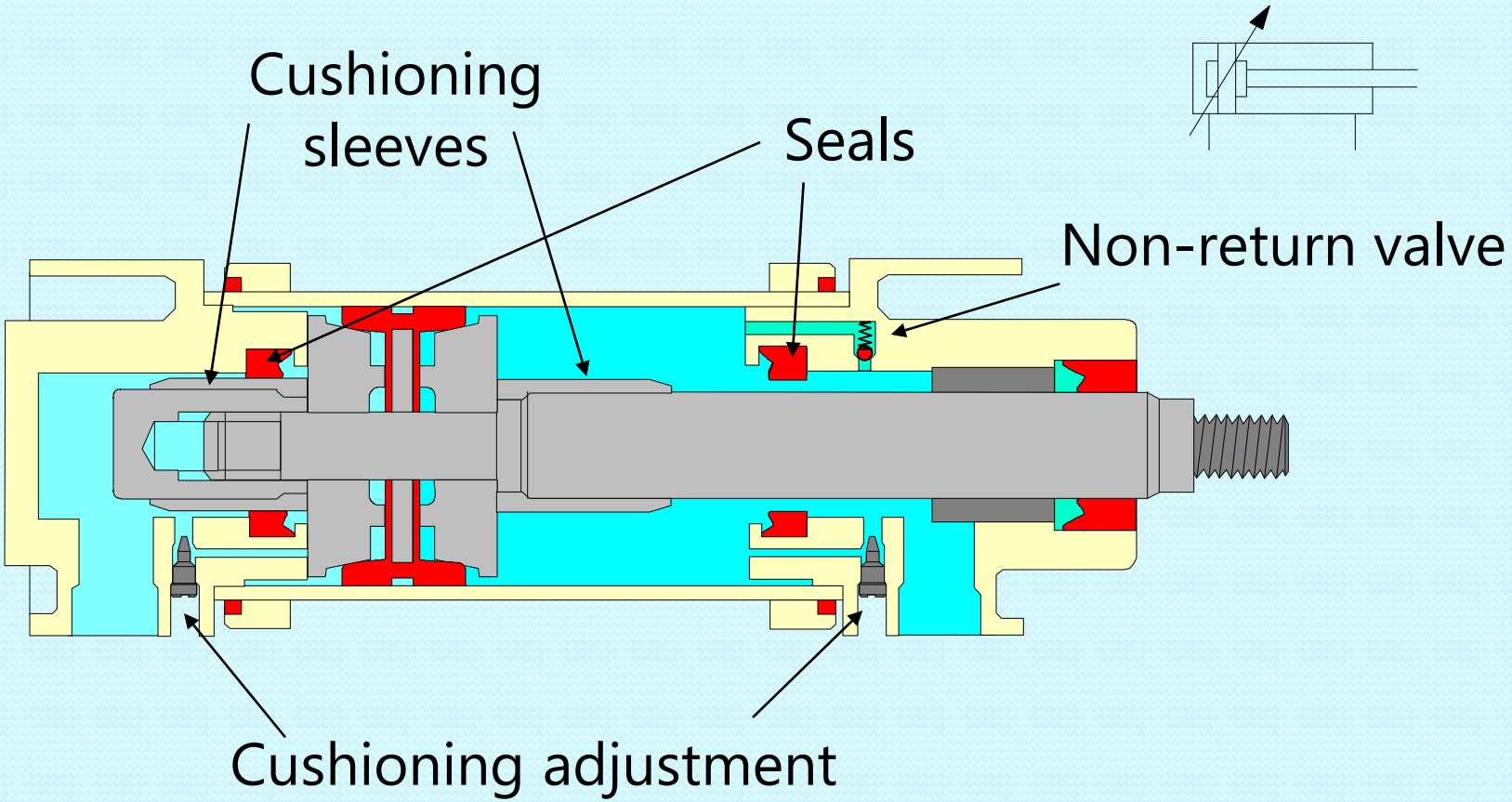

Seals
Wiper
Piston
Rod
Bearing
Base end
Connections
Rod end

Double Acting Cylinders with Air Cushioning

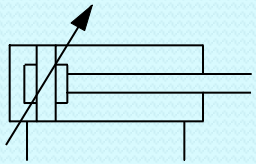


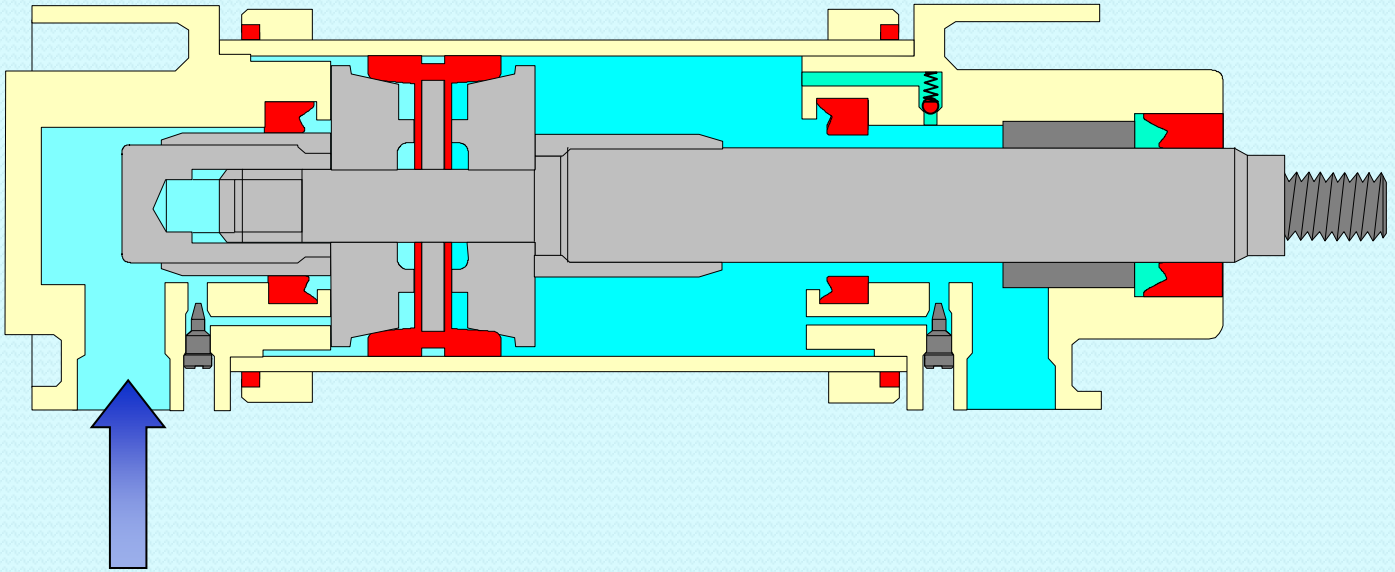
When the piston approaches its final position, the damping piston shuts off the direct air-outlet. Excess pressure sets up an air-cushion in the remaining cylinder volume and kinetic energy is converted into pressure. At this stage, air may only leave the cylinder through a controlled cross section of stream discharge.

Operation of Double Acting Cylinders with Air Cushioning

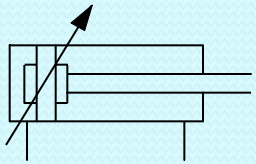


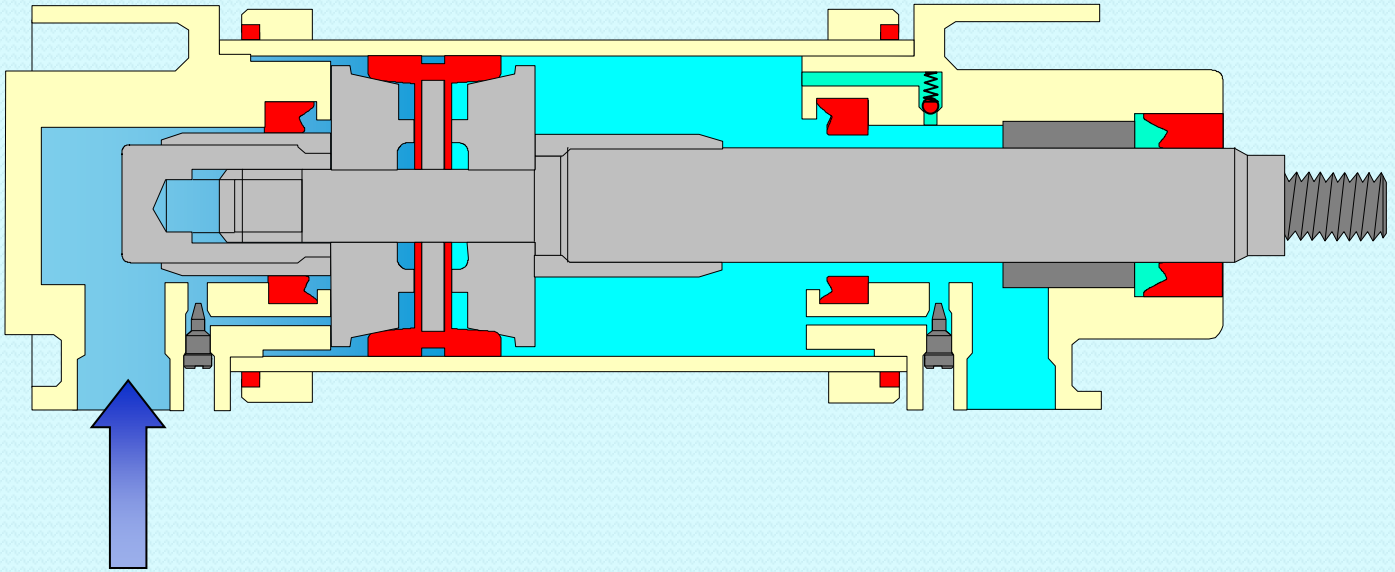
Operation of Double Acting Cylinders with Air Cushioning



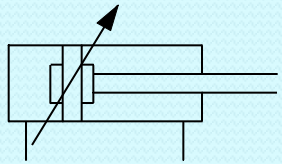


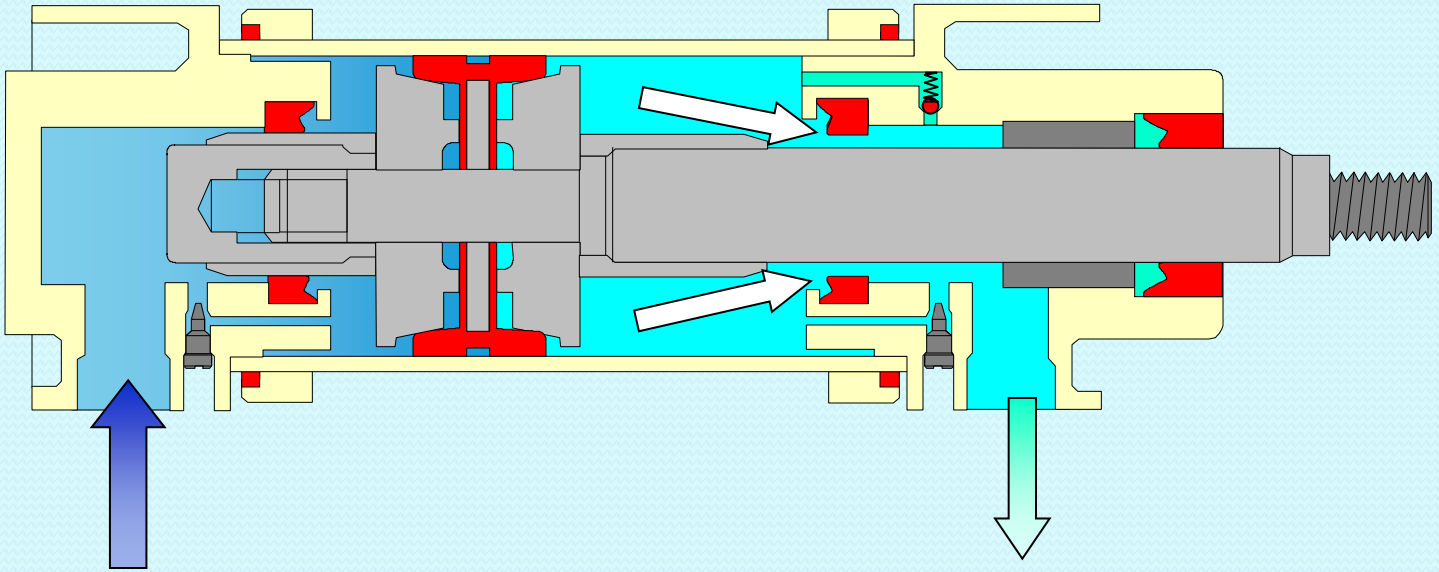
Operation of Double Acting Cylinders with Air Cushioning



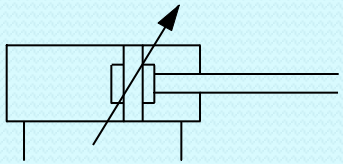


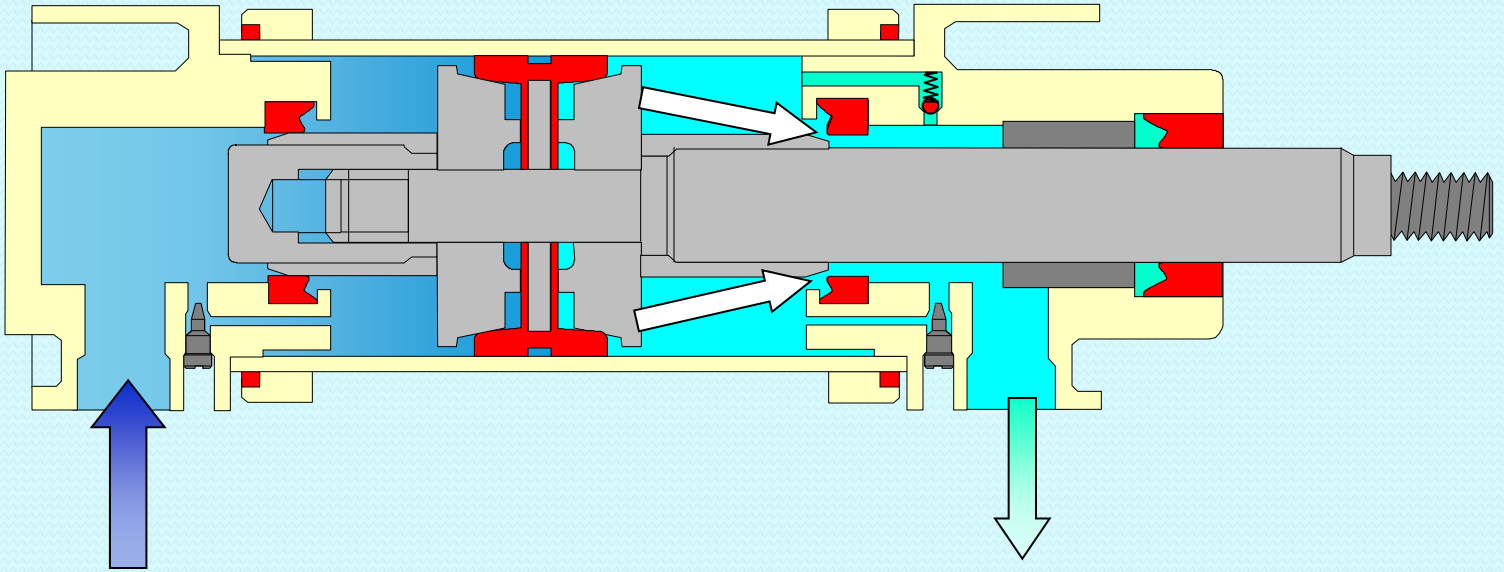
Operation of Double Acting Cylinders with Air Cushioning



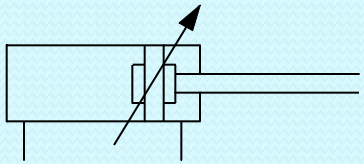


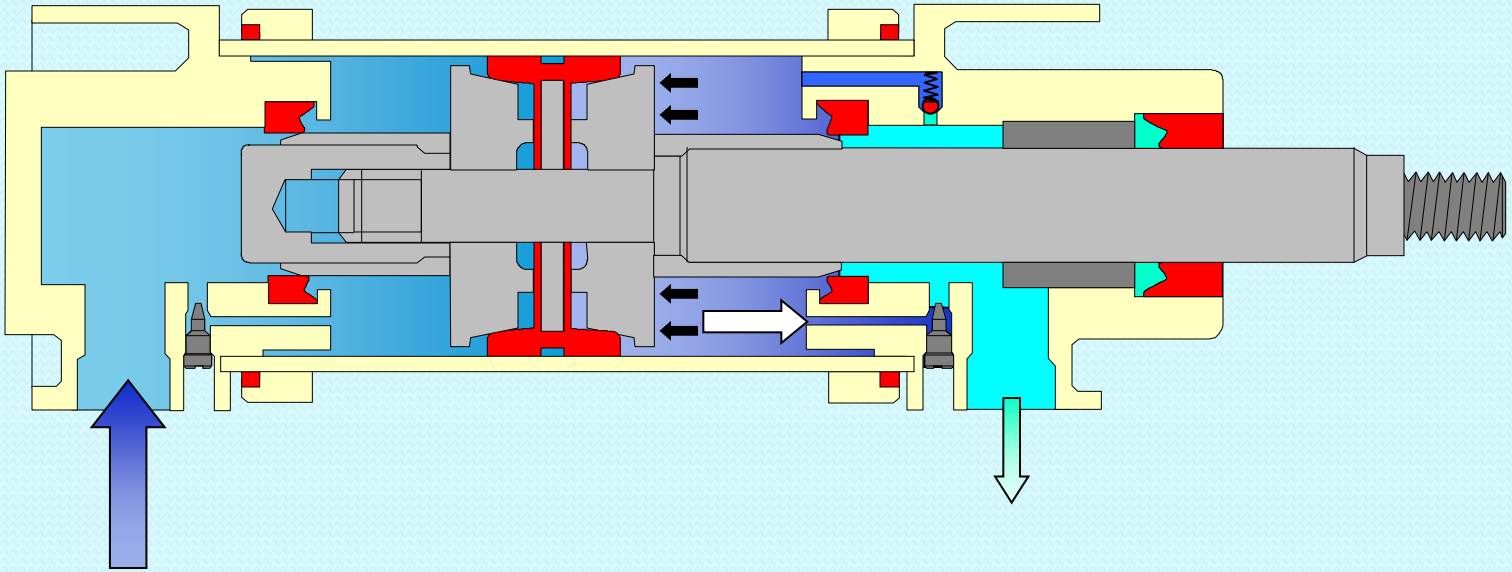
Operation of Double Acting Cylinders with Air Cushioning



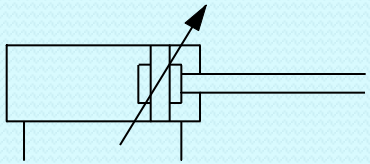


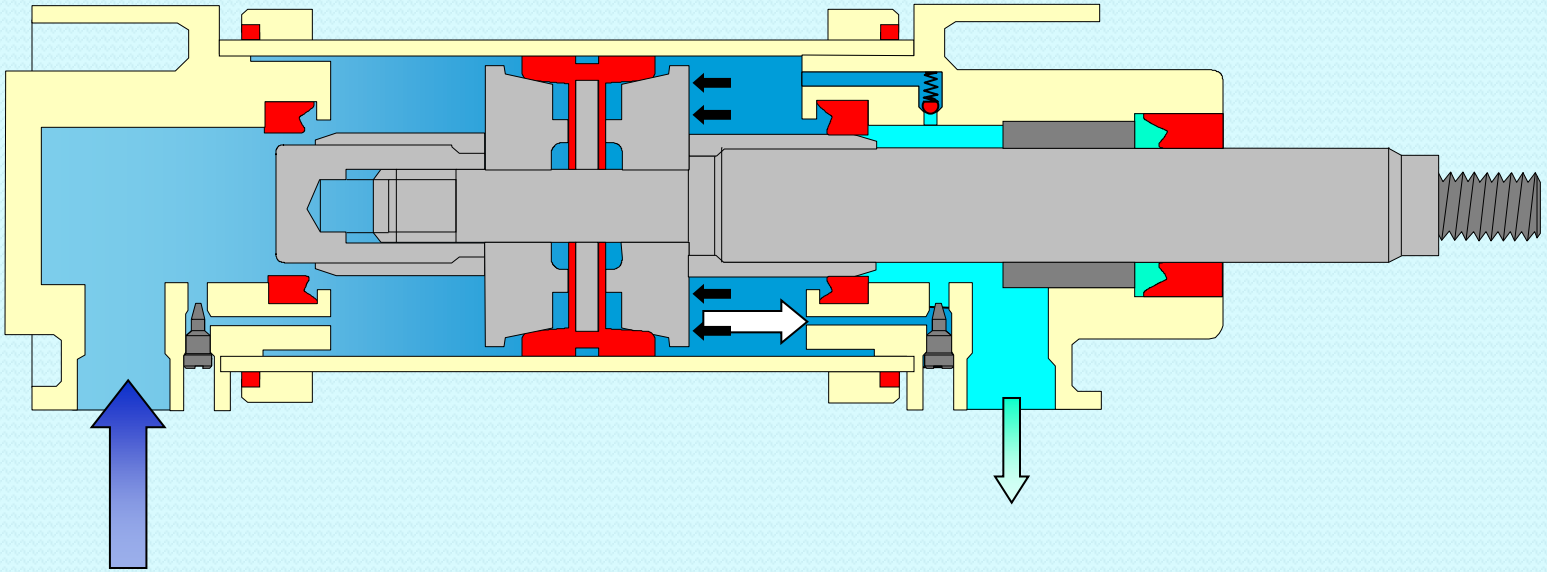
Operation of Double Acting Cylinders with Air Cushioning



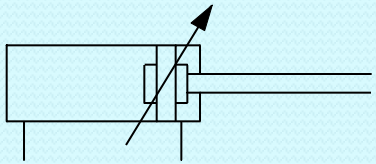


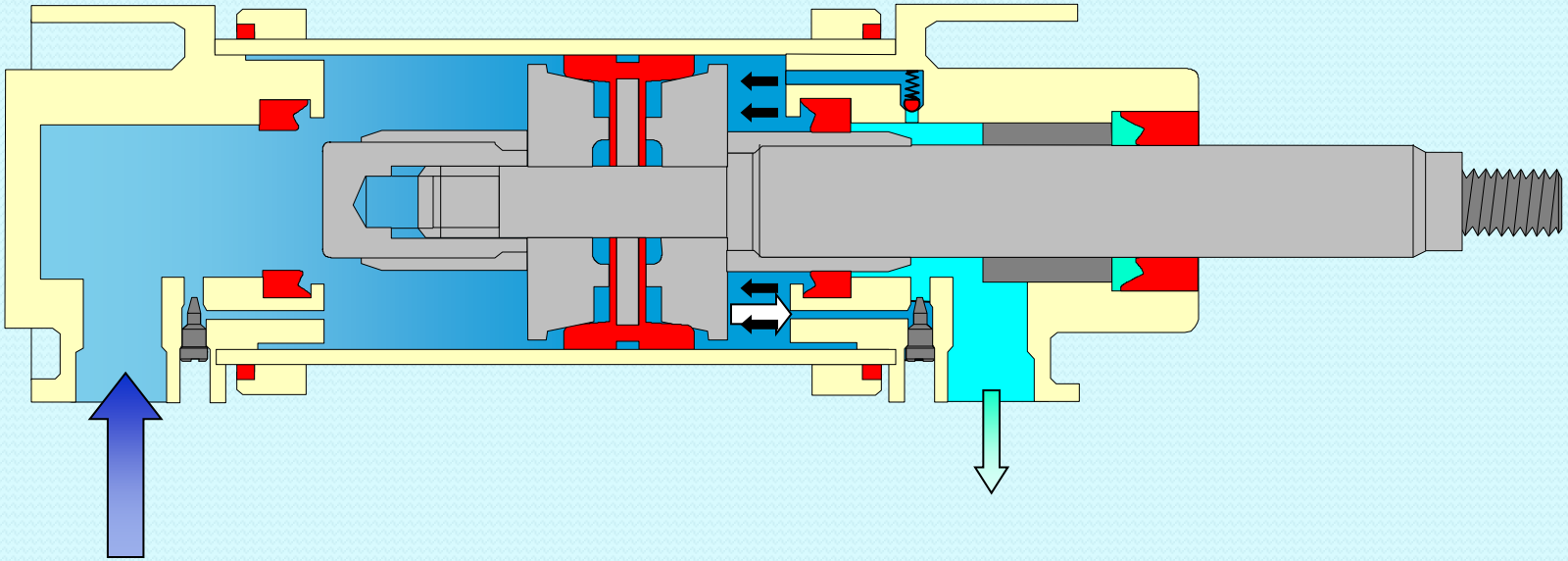
Operation of Double Acting Cylinders with Air Cushioning



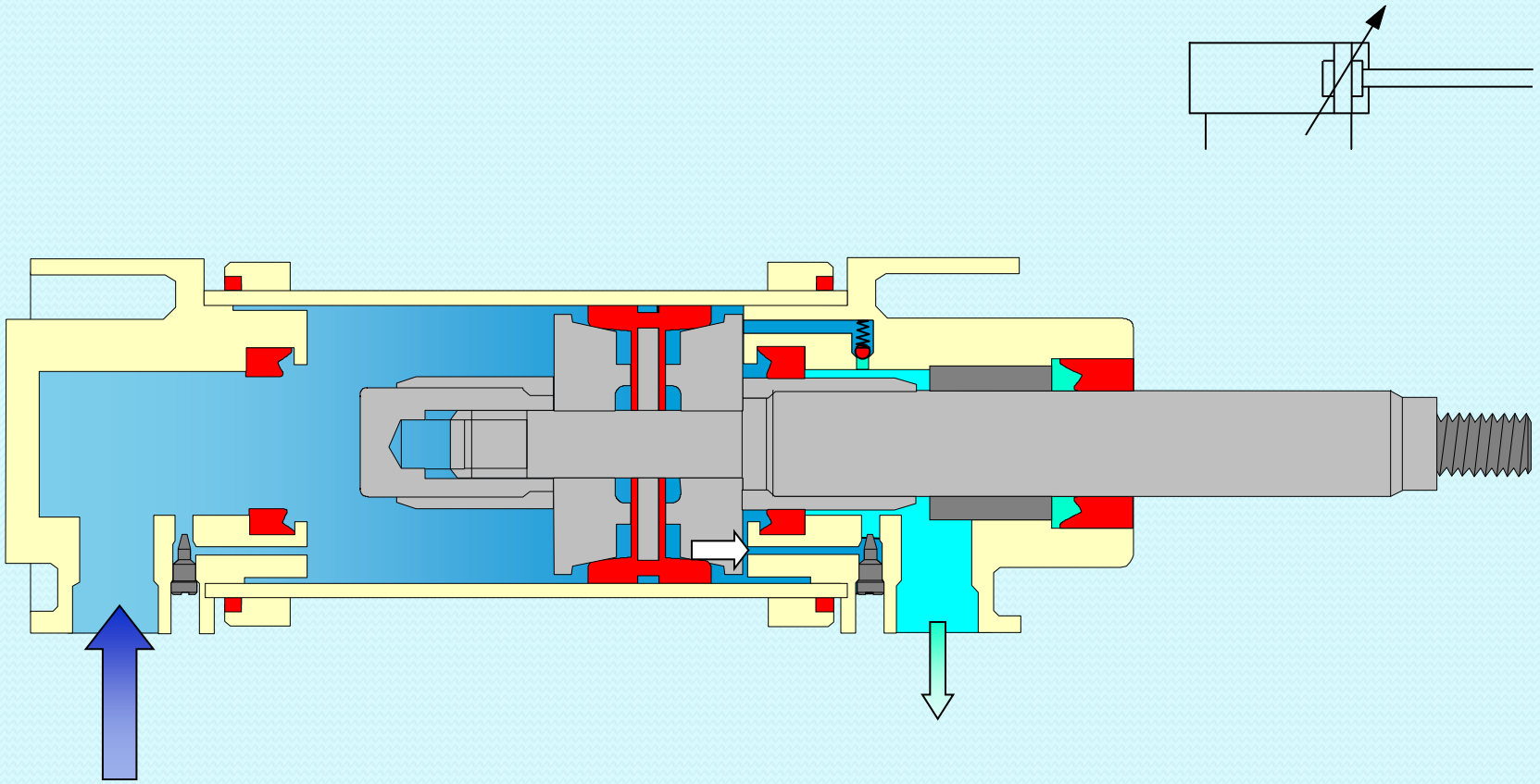


Operation of Double Acting Cylinders with Air Cushioning

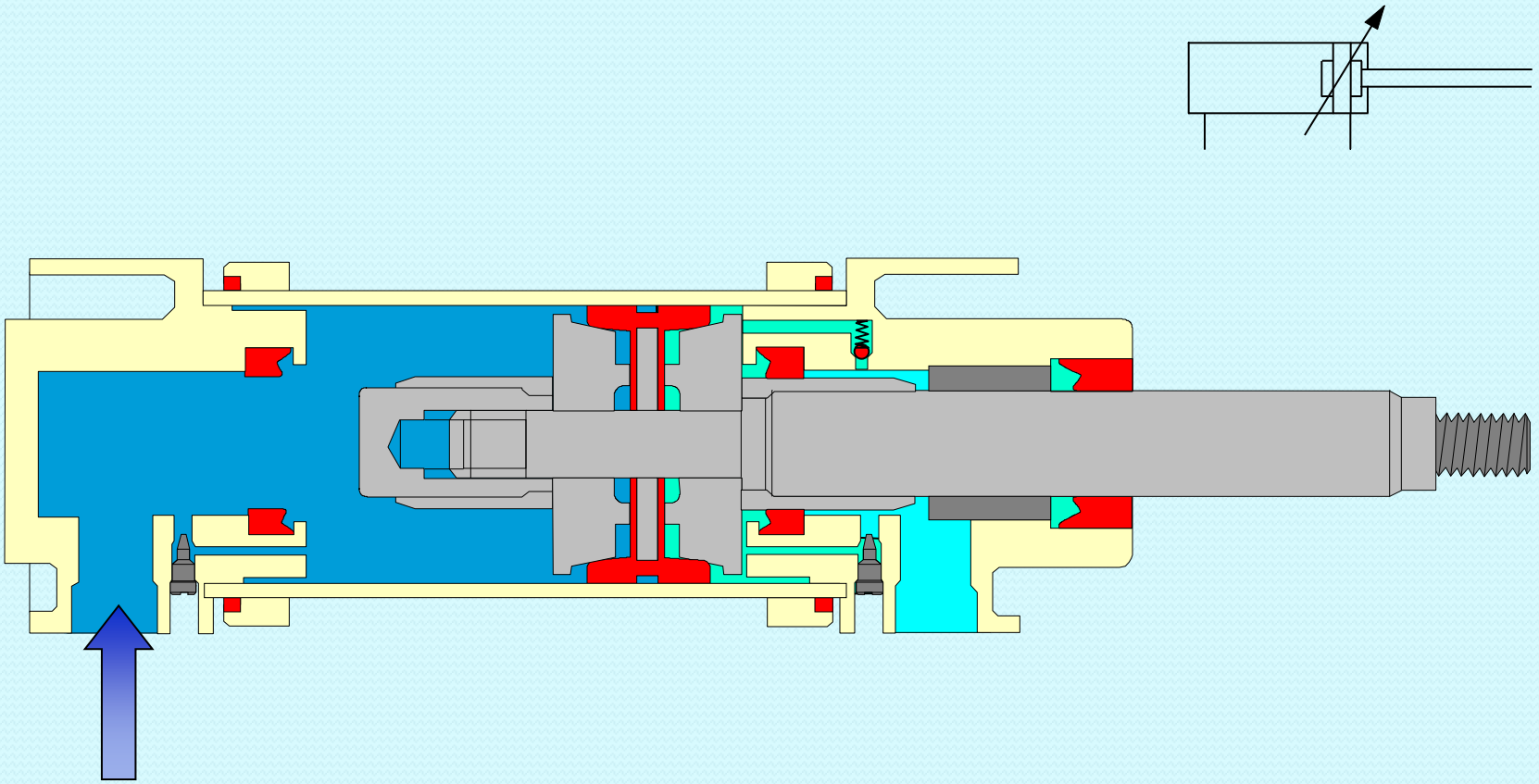




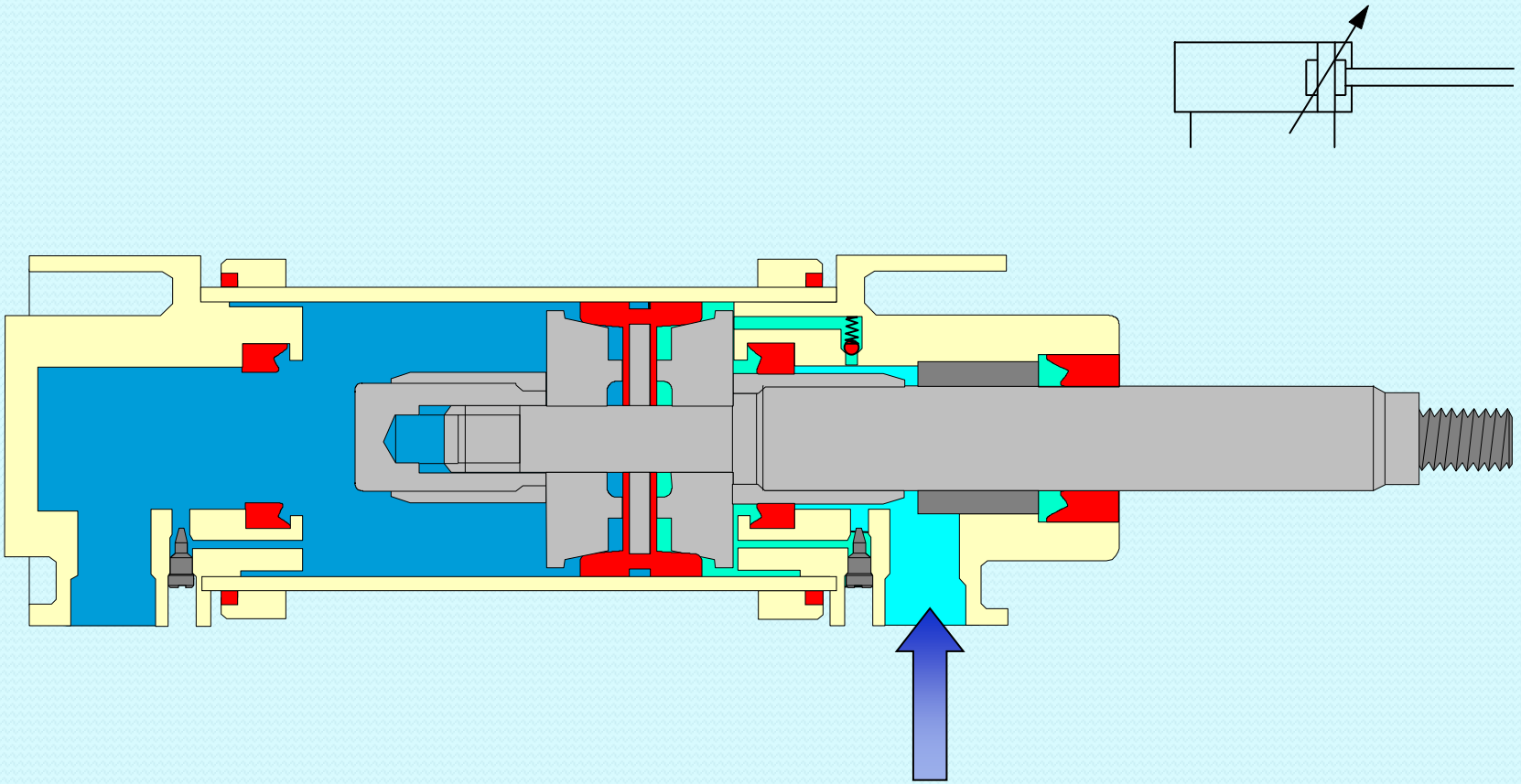
Operation of Double Acting Cylinders with Air Cushioning



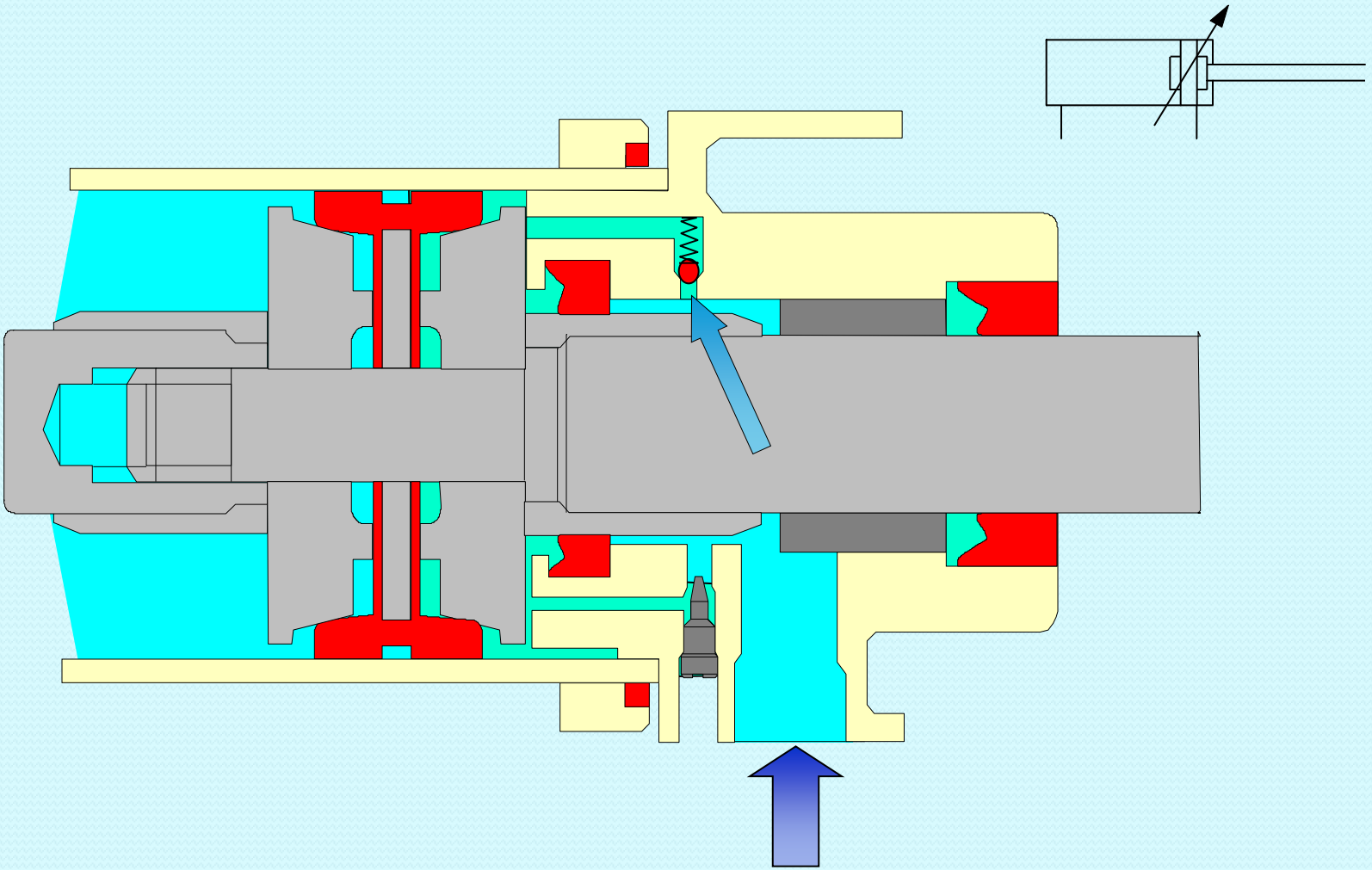
Operation of Double Acting Cylinders with Air Cushioning



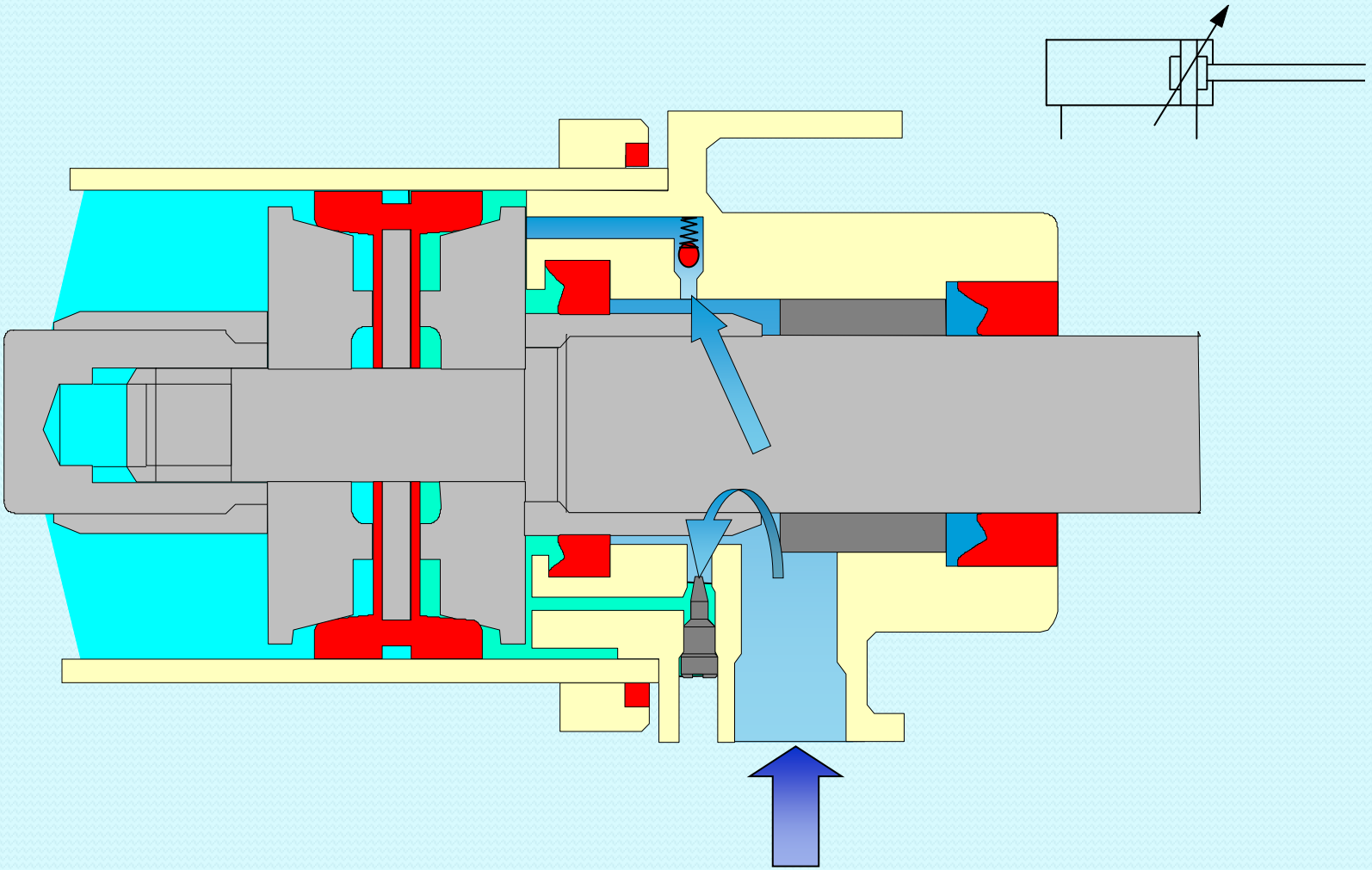
Operation of Double Acting Cylinders with Air Cushioning



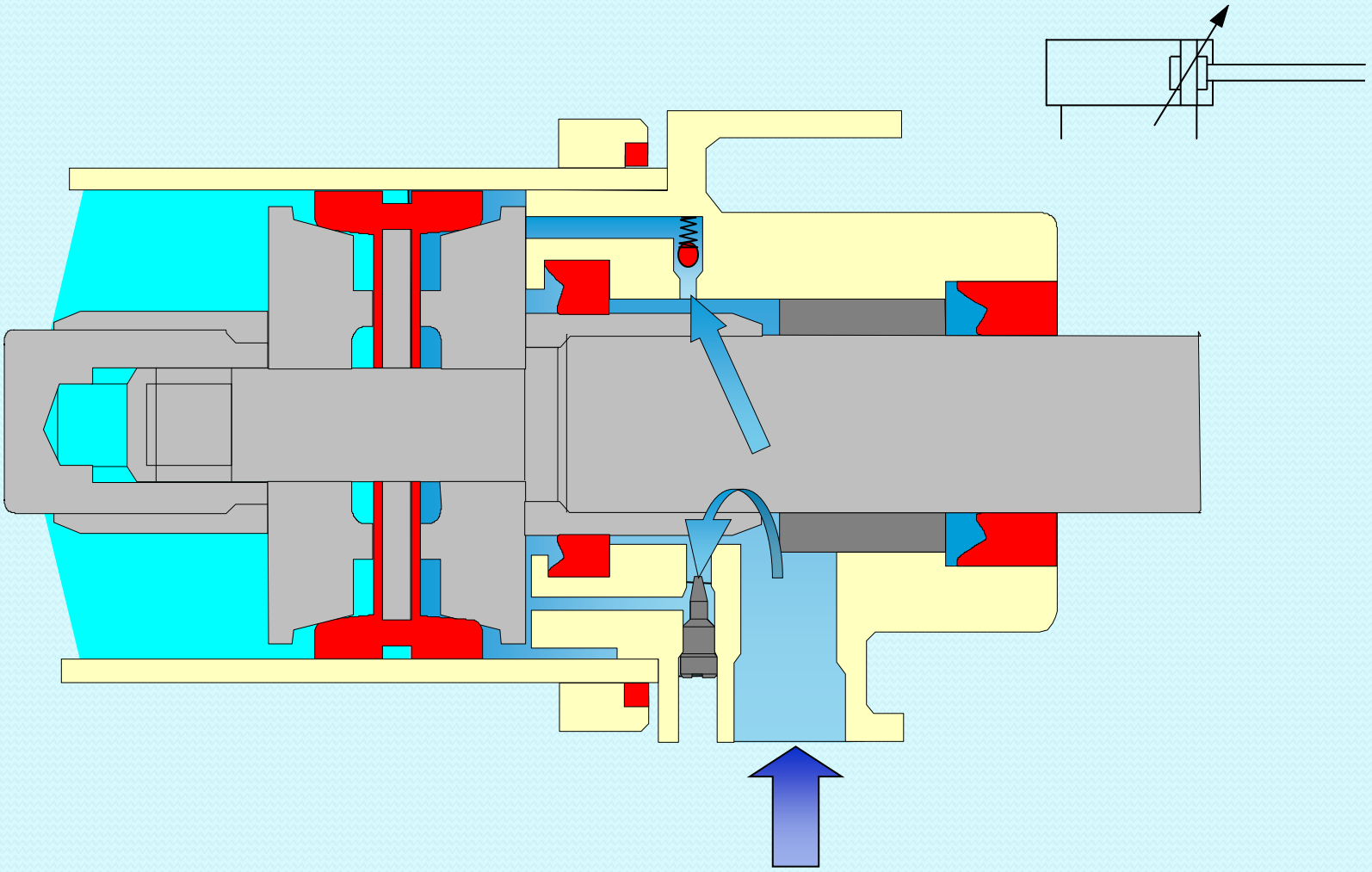
Operation of Double Acting Cylinders with Air Cushioning



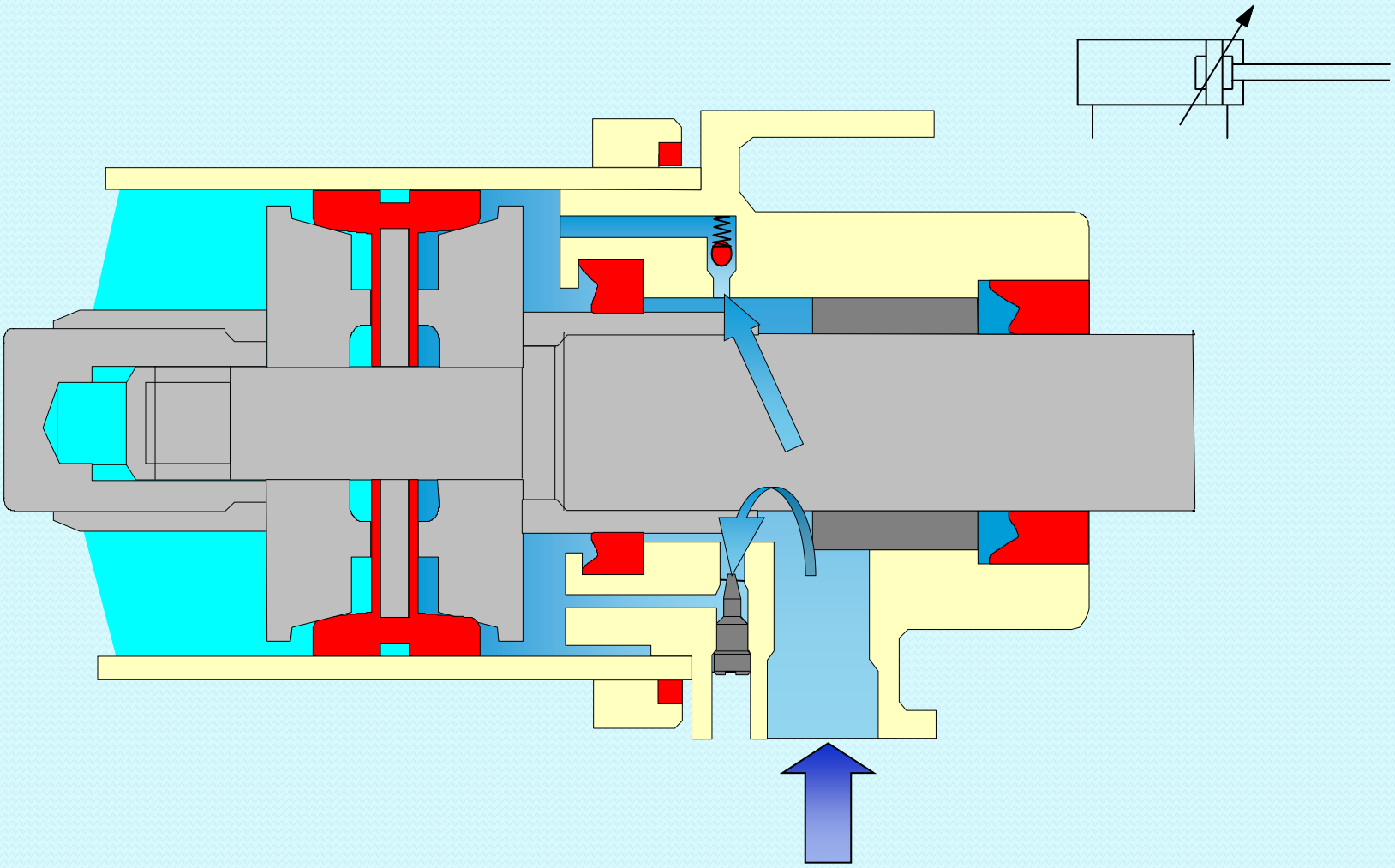
Operation of Double Acting Cylinders with Air Cushioning



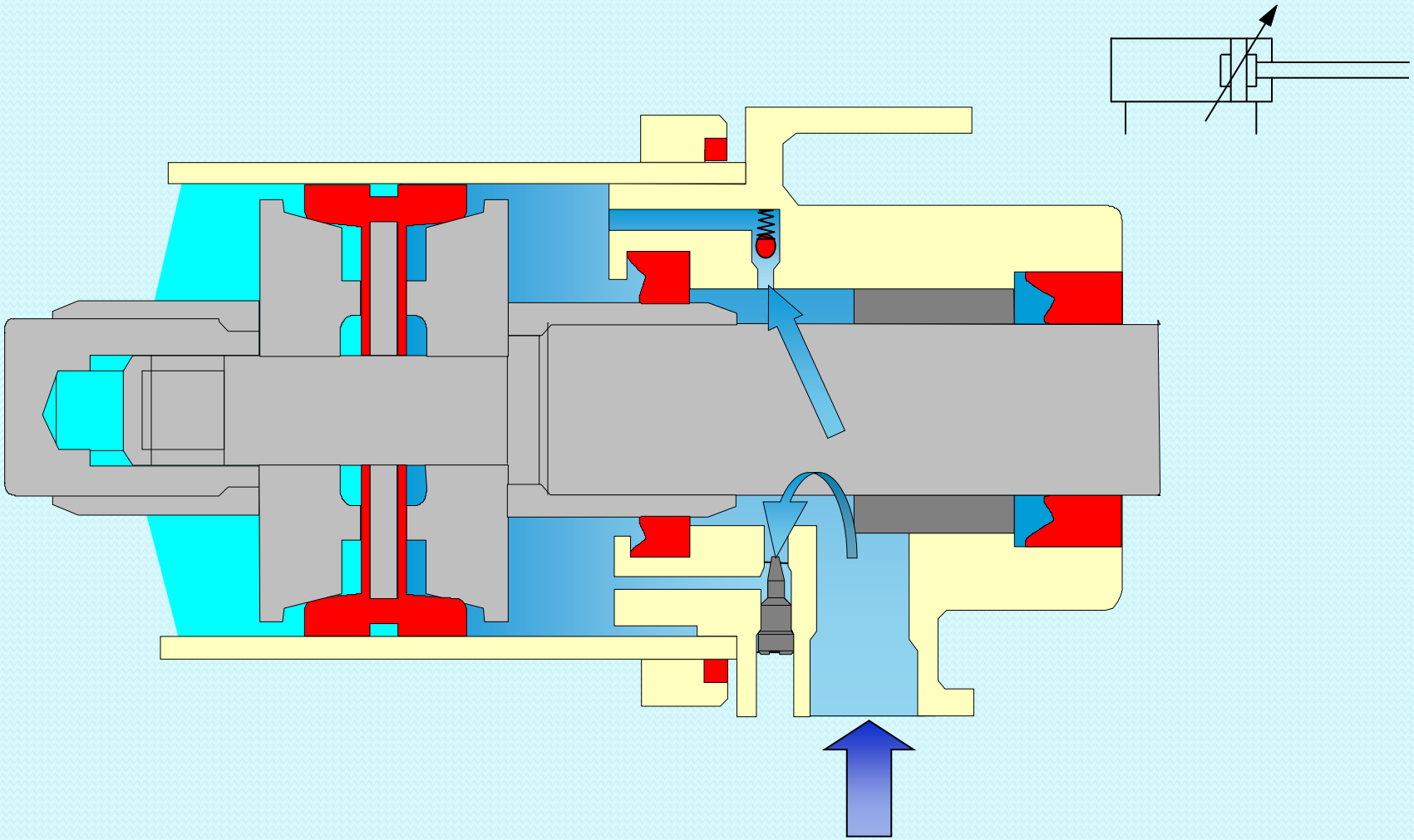
Operation of Double Acting Cylinders with Air Cushioning



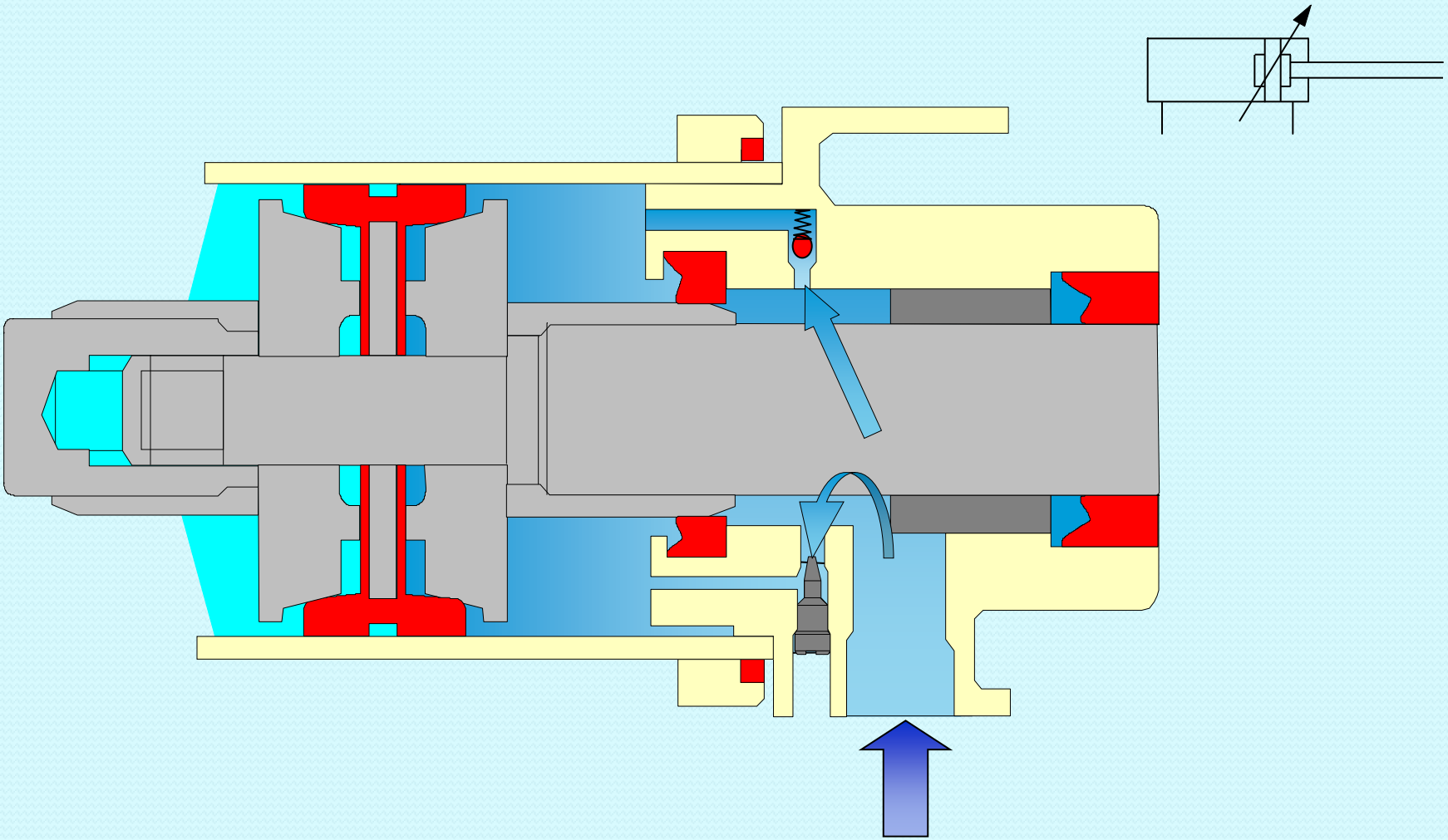
Operation of Double Acting Cylinders with Air Cushioning



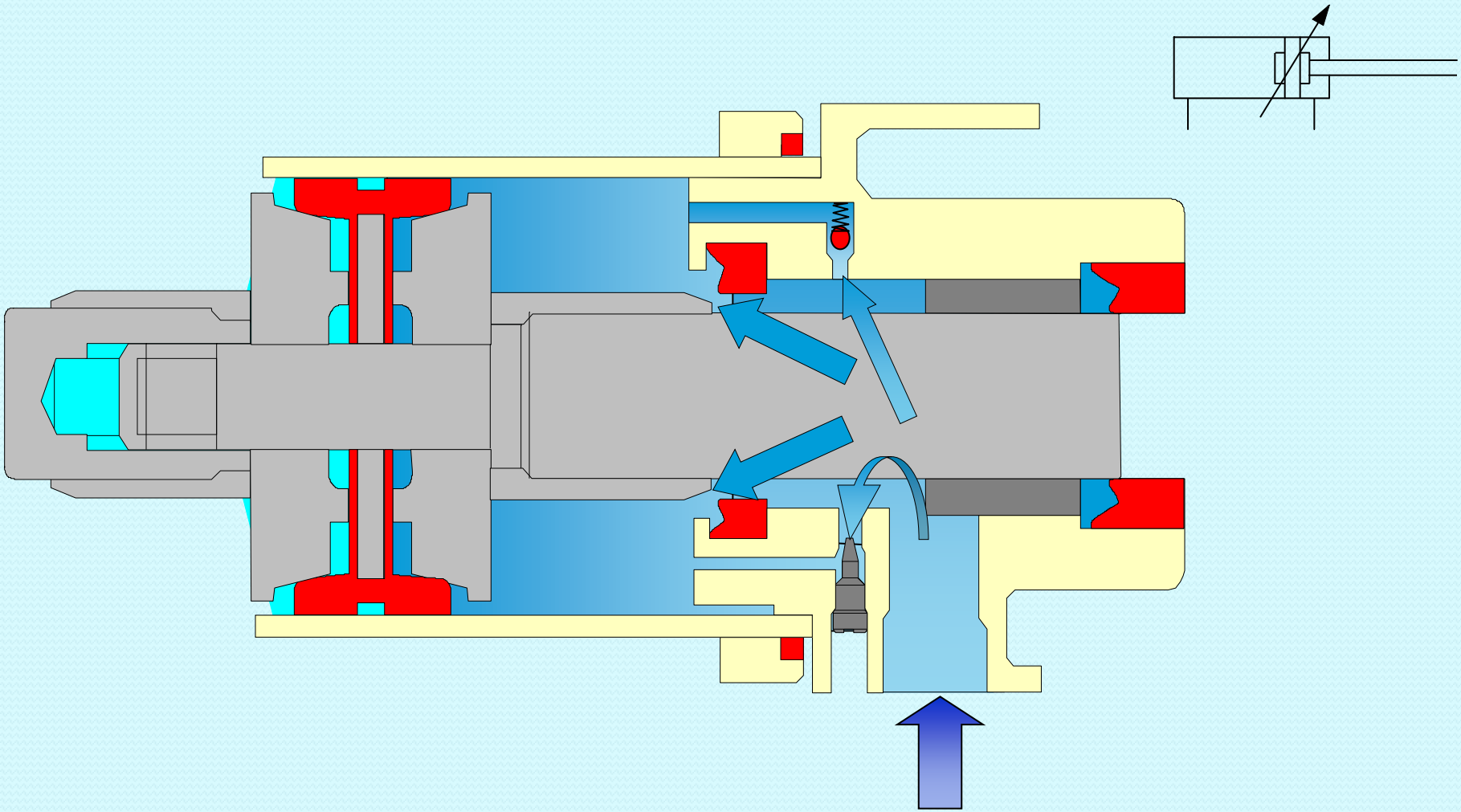
Operation of Double Acting Cylinders with Air Cushioning



Operation of Double Acting Cylinders with Air Cushioning

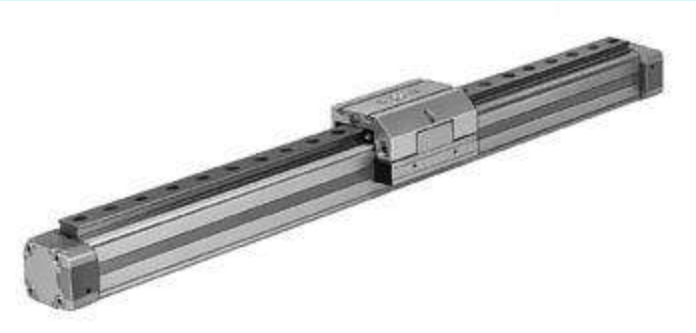


Operation of Double Acting Cylinders with Air Cushioning



Rodless Cylinders

Rodless cylinders or Linear Drives are used when long strokes are required or little fitting space is available.

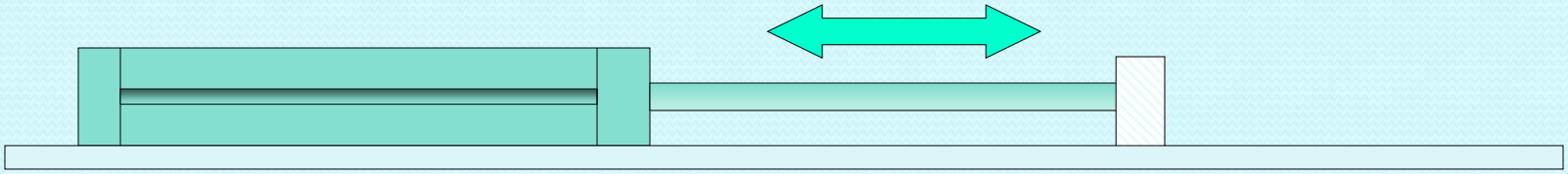


Mechanically coupled

Magnetically coupled

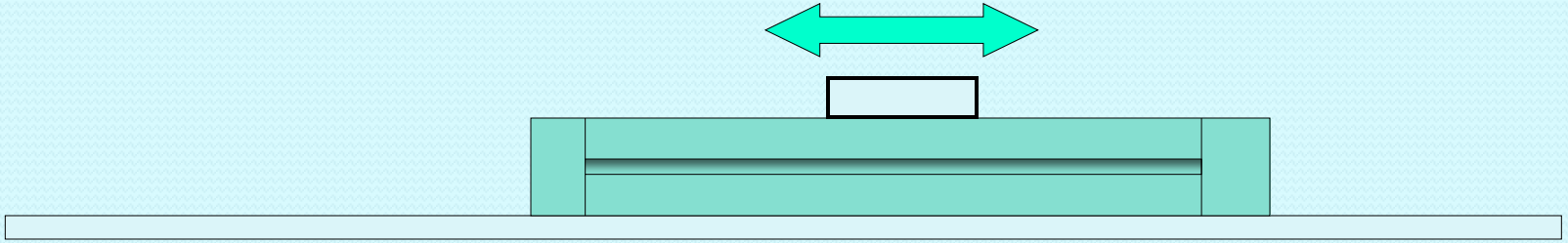
Conventional Double Acting Cylinders require space to house the cylinder.

Plus space to carry out the work.



More effective use of the available space can be made by using

Rodless Cylinders



PNEUMATIC VALVES

FUNCTIONS :

- open and close flow paths

- regulate pressure

- directs flow to various paths

- adjust flow volume

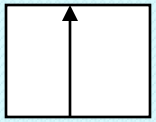
Directional control valves

SWITCHING SYMBOLS FOR VALVES

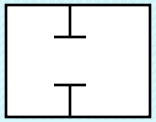
The valve switching position is shown by a square.

The number of squares corresponds to the number of switching position.

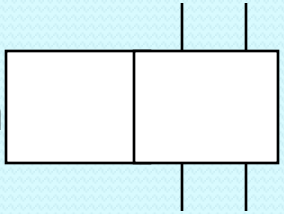
Lines indicate the flow paths, arrows indicate the direction of flow.



Closed ports are shown by two lines drawn at right angles to one another.



The connecting lines for supply and exhaust air are drawn outside th square.



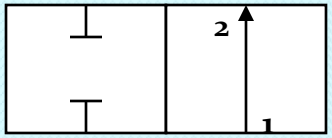
Ports and Switching

Number of ports

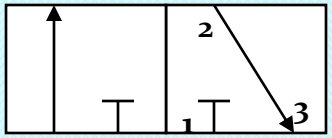
Number of switching positions

Position

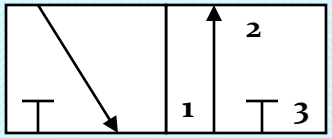
2/2 – way valve, normally open position



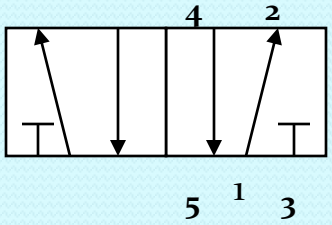
3/2 – way valve, normally closed position



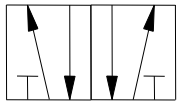
3/2 – way valve, normally open position



5/2 – way valve, flow from 1-2 and from 4-5



Actuation methods

?  ?

MANUAL

General

Push Button

Lever

Pedal

Detent

MECHANICAL

Spring

Button

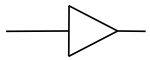
Roller

Idle Roller

ELECTRICAL

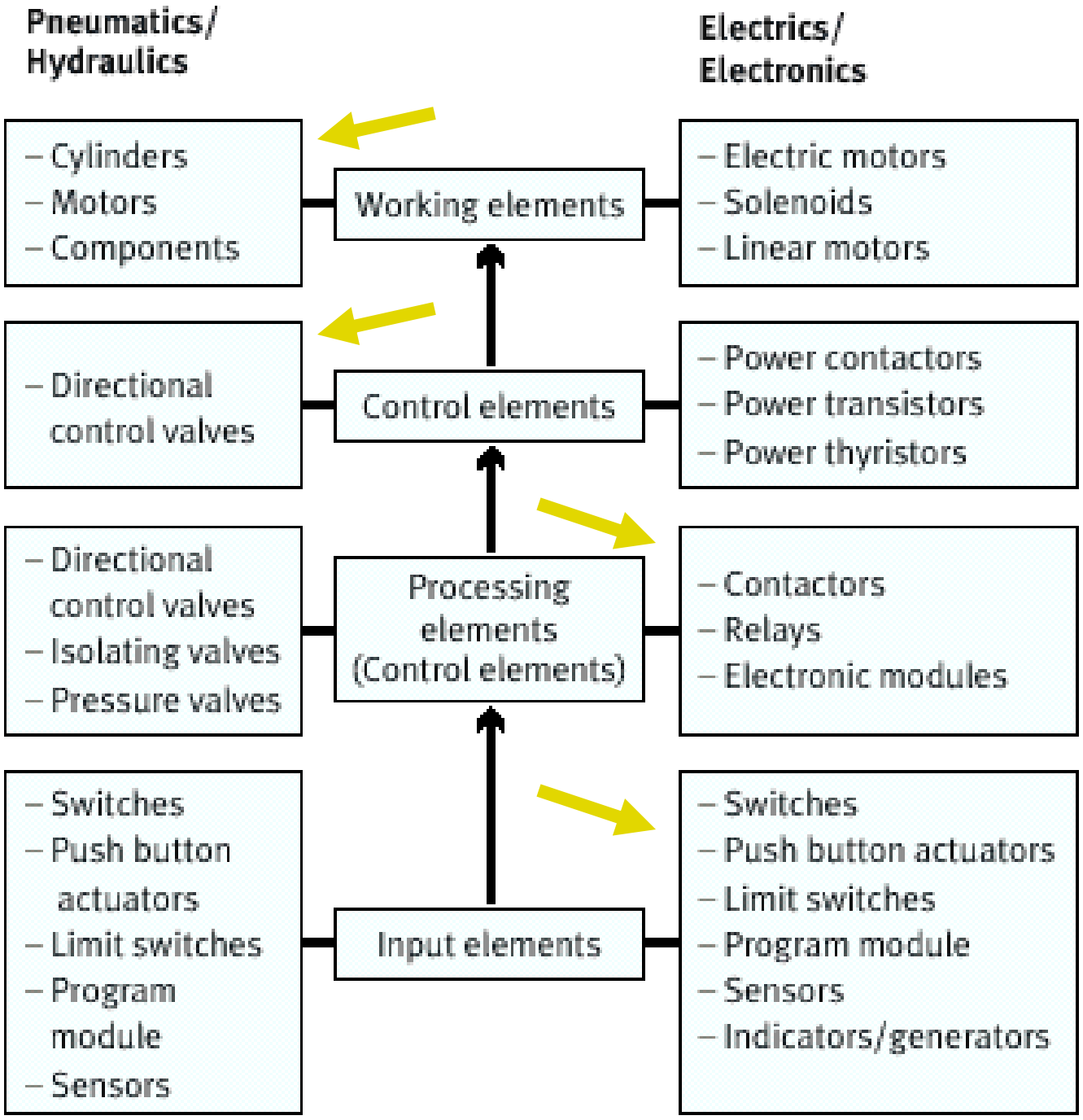
Solenoid

PNEUMATIC



Pneumatic

ELECTRO PNEUMATICS


Pneumatics/
Hydraulics
Electrics/
Electronics
– Cylinders
– Motors
– Components
Working elements
– Electric motors
– Solenoids
– Linear motors
– Directional
control valves
Control elements
– Power contactors
– Power transistors
– Power thyristors
– Directional
control valves
– Isolating valves
– Pressure valves
Processing
elements
(Control elements)
– Contactors
– Relays
– Electronic modules
– Switches
– Push button
actuators
– Limit switches
– Program
module
– Sensors
Input elements
– Switches
– Push button actuators
– Limit switches
– Program module
– Sensors
– Indicators/generators

SWITCHES

POSITONS :

➔normally open

➔normally closed

CONTACT CONFIGURATIONS :

➔normally open contact

➔normally closed contact

➔changeover contact

Contact load----------1A (max)
Power consumption------0.48W

Solenoid Valves

SOLENOIDS

DEFINITION:

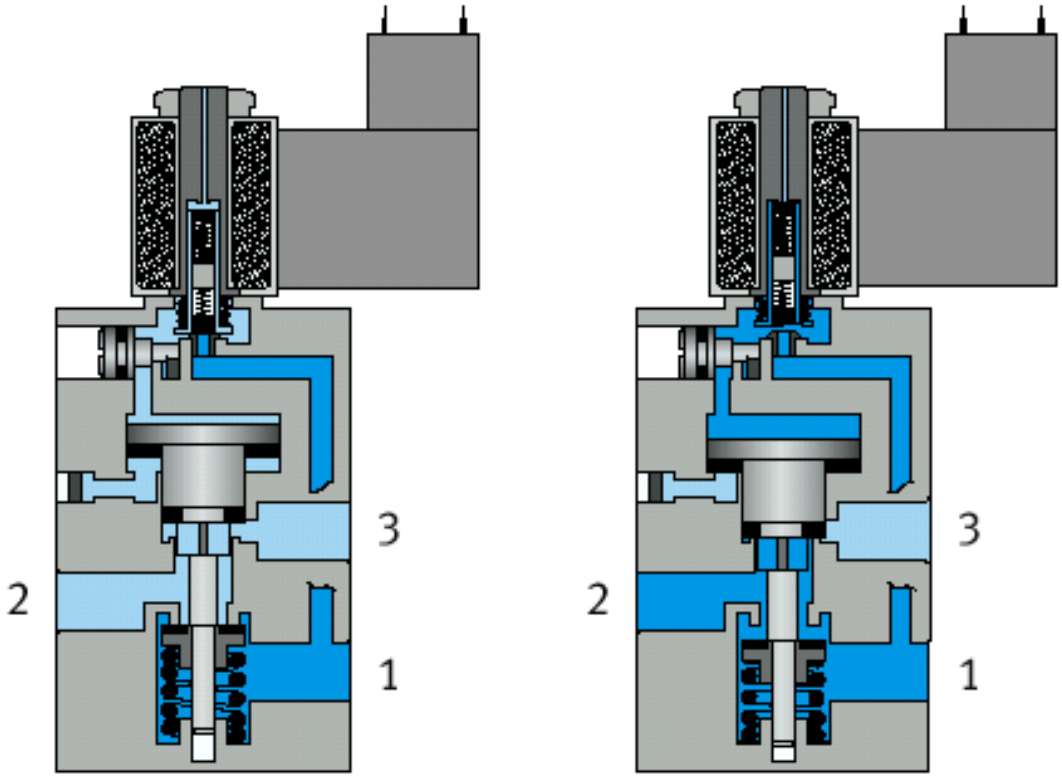
➔a device which is primarily used as an electromagnet used to drive a plunger for the purpose of control actuation.

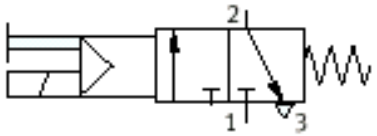
OPERATING PRINCIPLE:

➔passing an electric current through a coil of copper wire generates an electromagnetic field

➔adding turns to the coil strengthens the EMF while the lines of force are concentrated through the circular form of the coil and the EMF is greatly increased

3/2 - way Directional Control Valve, Solenoid Actuated, Spring Returned





When an electric current is applied to the coil, an EMF is generated which lifts the lower sealing lips of the armature and opens the passage for pilot air. Pilot air then applies pressure on the diaphragm which then causes the valve to switch its position.

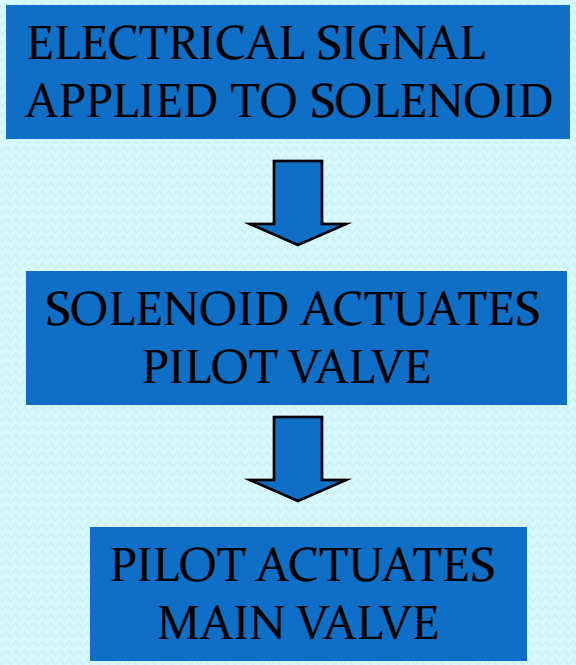
Upon removal of the current, the pilot air passage closes and a spring returns the valve to its normal switching position.

PILOT SIGNAL FLOW

By using pilot control, the size of the solenoid Can be kept to a minimum.

Main Advantages :

@ It reduced power consumption
@ it reduced heat generation

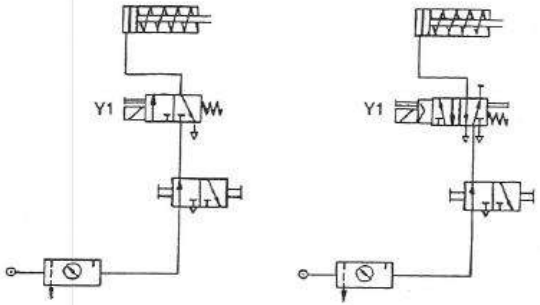


Seminar EP 211
Electro-Pneumatics Control

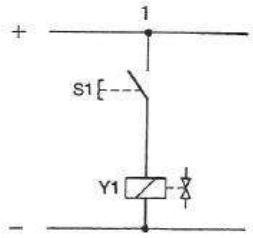
FESTO DIDACTIC

Solution: 1 Sorting device

Circuit diagram, pneumatic



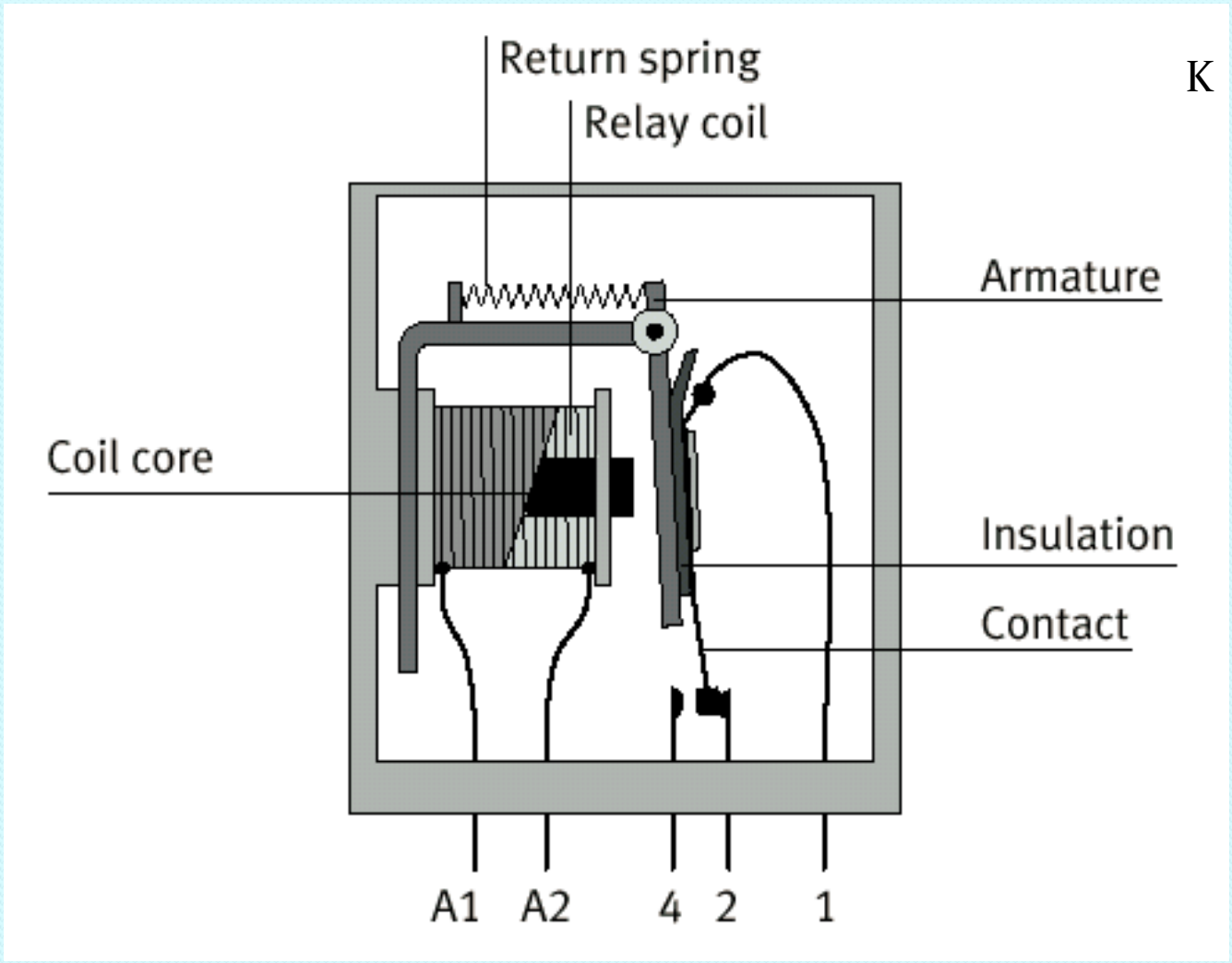
Circuit diagram, electric

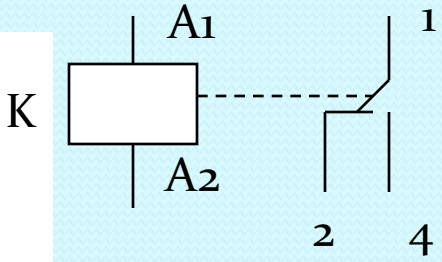


Relays

Relays are electro-magnetically actuated switches. They consist of a housing with electromagnet and movable contacts. An electromagnetic field is created when a voltage is applied to the coil of the electromagnet. This results in attraction of the movable armature to the coil core. The armature actuates the contact assembly.This contact assembly can open or close a specific number of contacts by mechanical means. If the flow of current through the coil is interrupted, a spring

Relays


Return spring
Relay coil
Armature
Coil core
Insulation
Contact
A1
A2
4
2
1


A1
1
K
A2
2
4

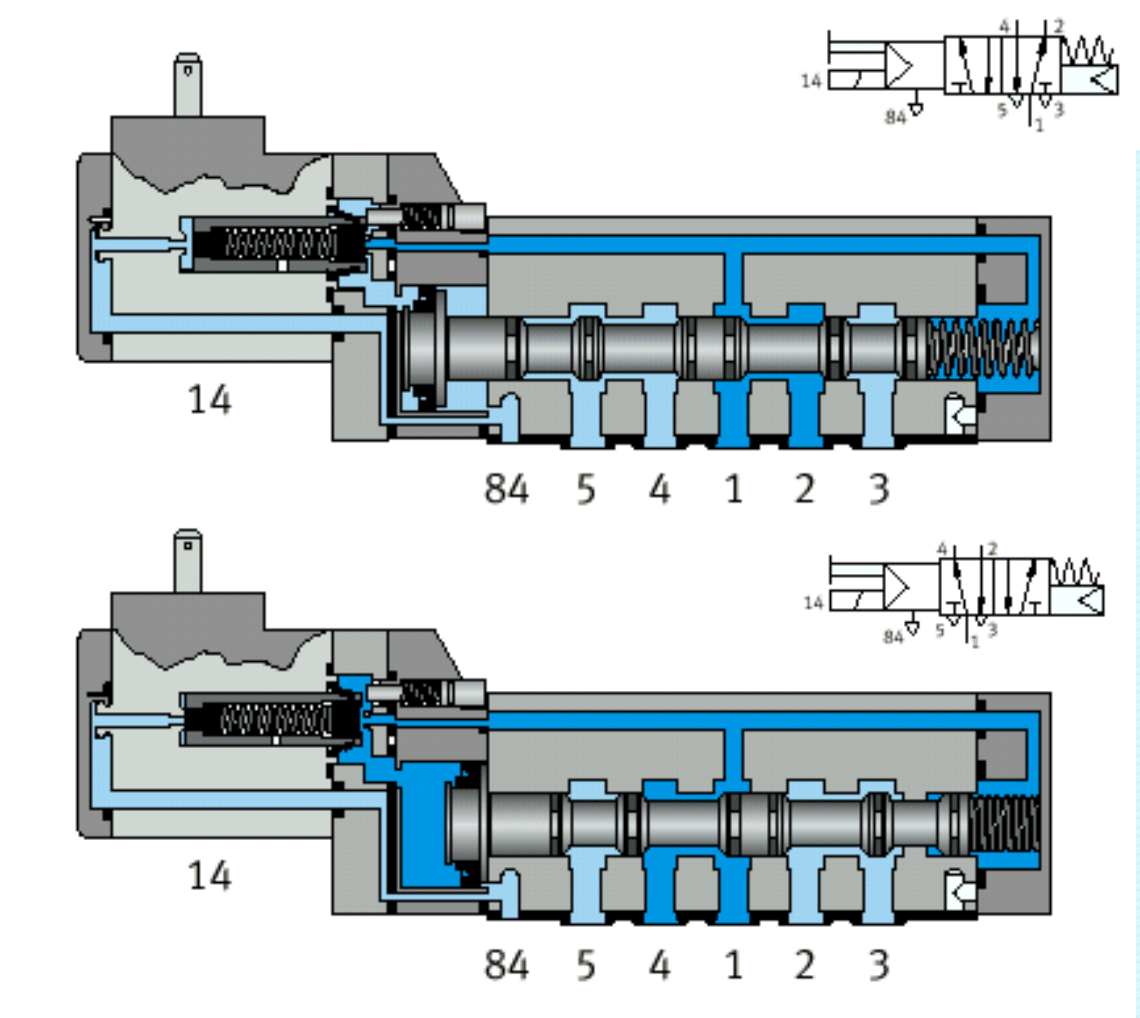
Advantages of Relays

- Easily adapted to various operating voltages
- Not much affected by the temperature of their surroundings
- Relatively high resistance between contacts in the off state
- Several independent circuits can be switched

Disadvantages of Relays

- Working surface of contacts wear through oxidation
- Large space requirement compare to transistors
- Noise is created during the switching operation
- The contacts are affected by contamination
- Limited switching speed of 3ms - 17ms

5/2 - way Directional Control Valve, Solenoid Actuated, Spring Returned

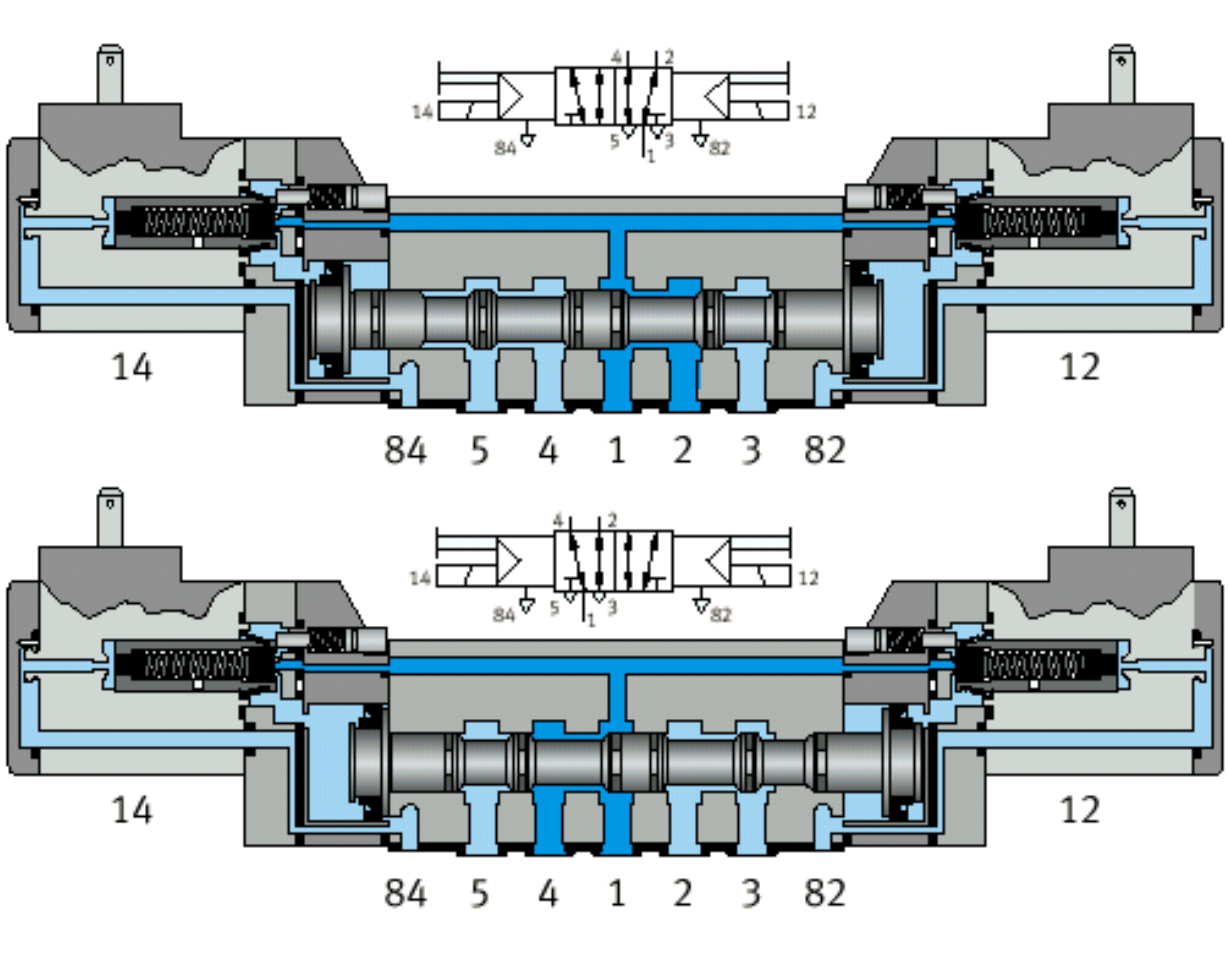


When the solenoid is energized, the armature moves and the pilot air passage opens. The pilot air applies pressure to the left side of the valve piston resulting to the valve switching its position.

Upon removal of the electrical signal, a spring returns the valve to its neutral switching position.

Used for the control of double acting cylinders.

5/2 - way Directional Control Valve, Double Solenoid Actuated



Because of the absence of a return spring, double solenoid actuated valves retain the last signal administered to them. They remain in their last switched position even with power removed from both solenoids.

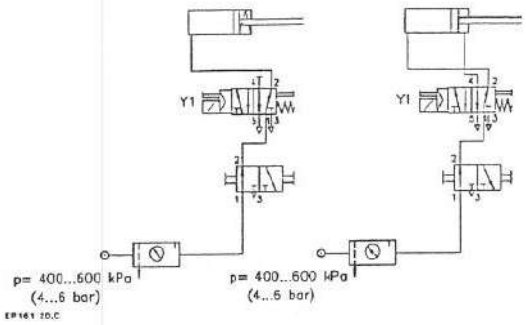
Effectively, this means that this valve has **“memory characteristic”**.

Seminar EP 211
Electro-Pneumatics Control

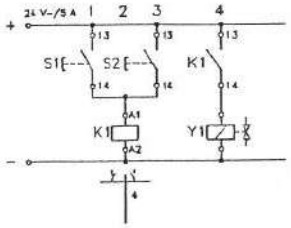
FESTO DIDACTIC

Solution: 3 Tipping device

Circuit design, pneumatic



Circuit design, electric

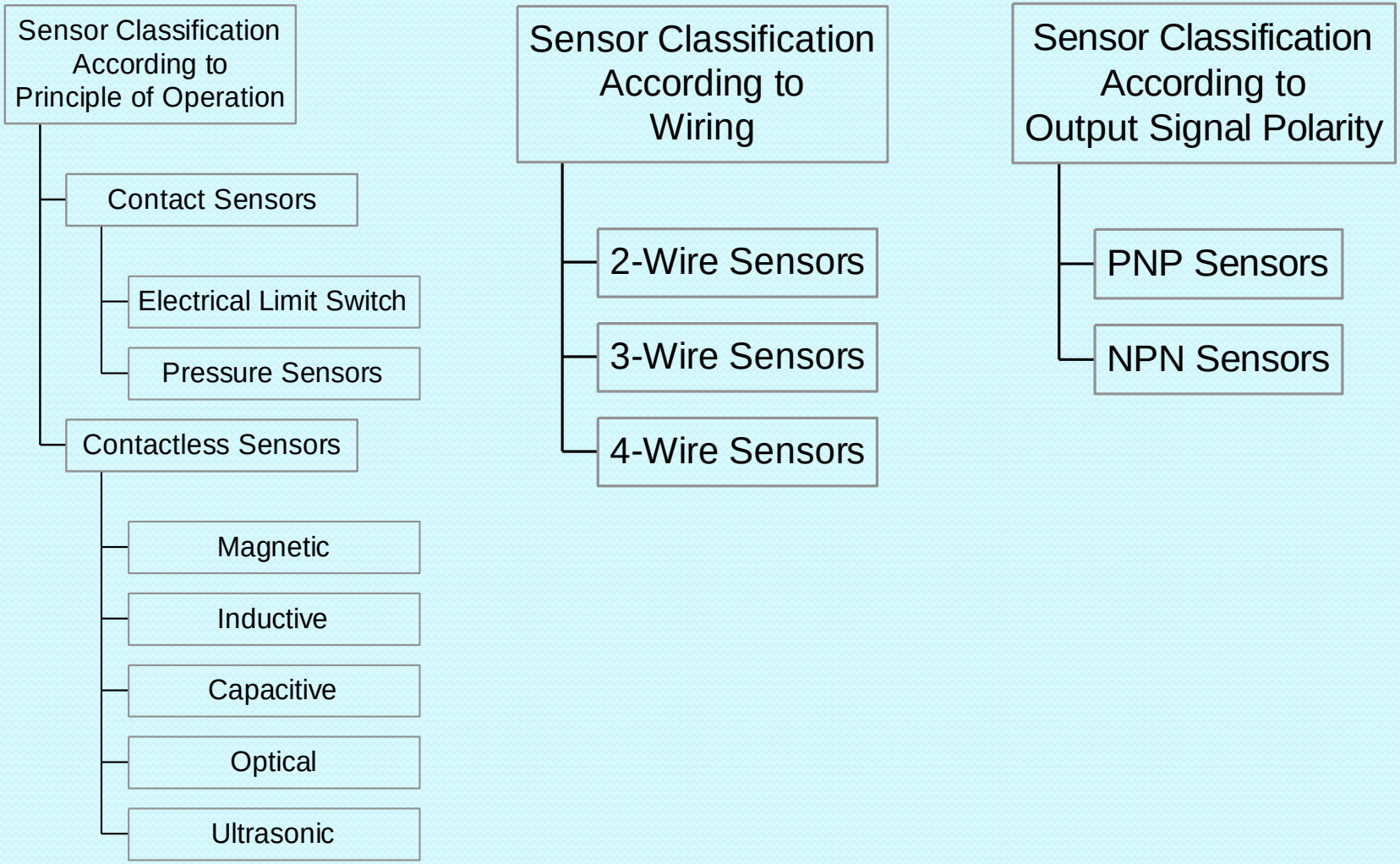


Sensors

What are sensors?

A sensor is a technical converter, which converts a physical value such as temperature, pressure, flow, or distance, into a different value which is easier to evaluate. This is usually an electrical signal such as voltage, current, resistance or frequency of oscillation.

Sensor Classifications



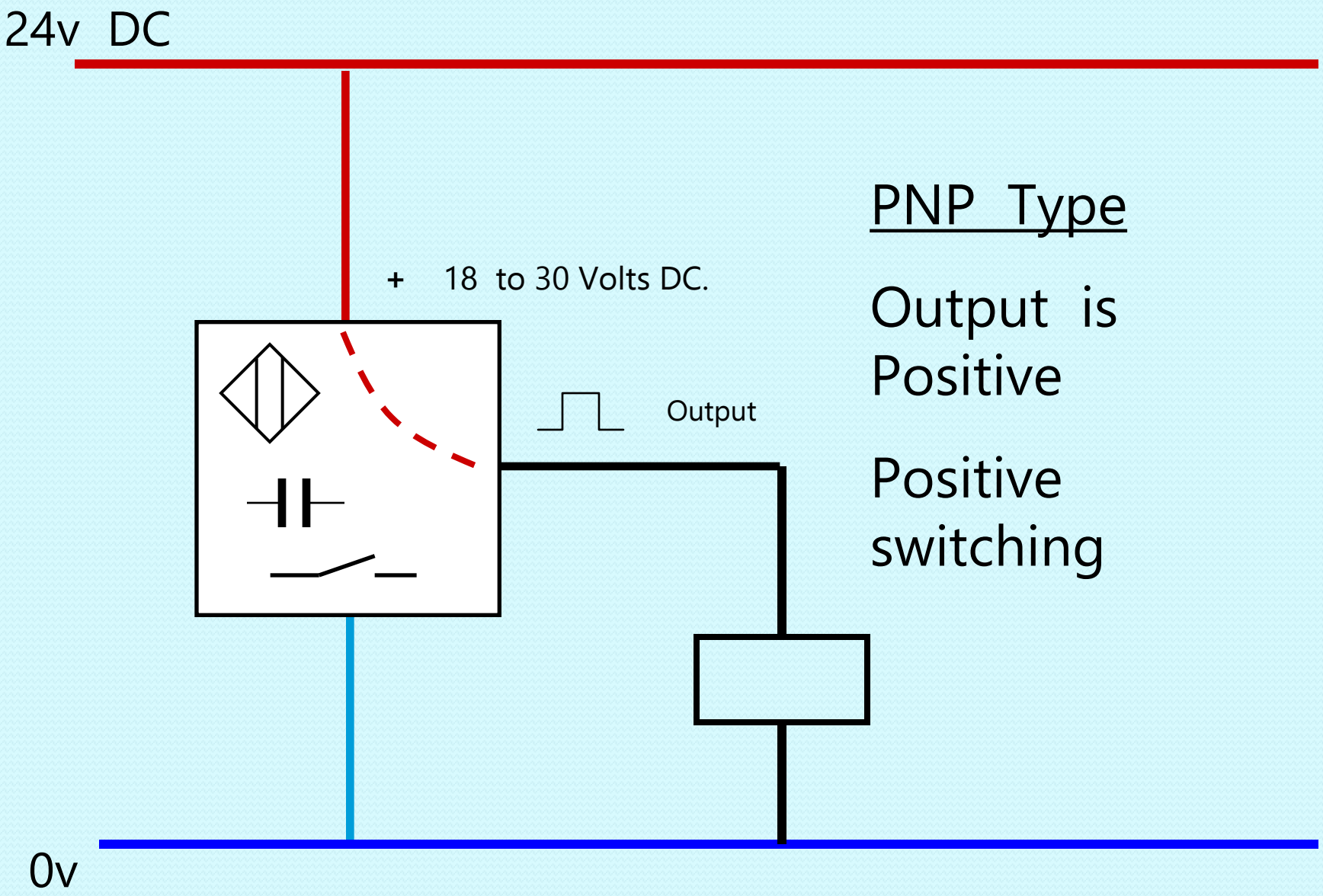
SENSORS

Devices which convert physical variables into form of electrical signals to gather data, monitor or control a process.

TYPES:

Contact Sensors – mechanical in nature, subject to mechanical wear and with predictable failure rate. Contact sensors include limit switches, roller switches, and pressure sensors.

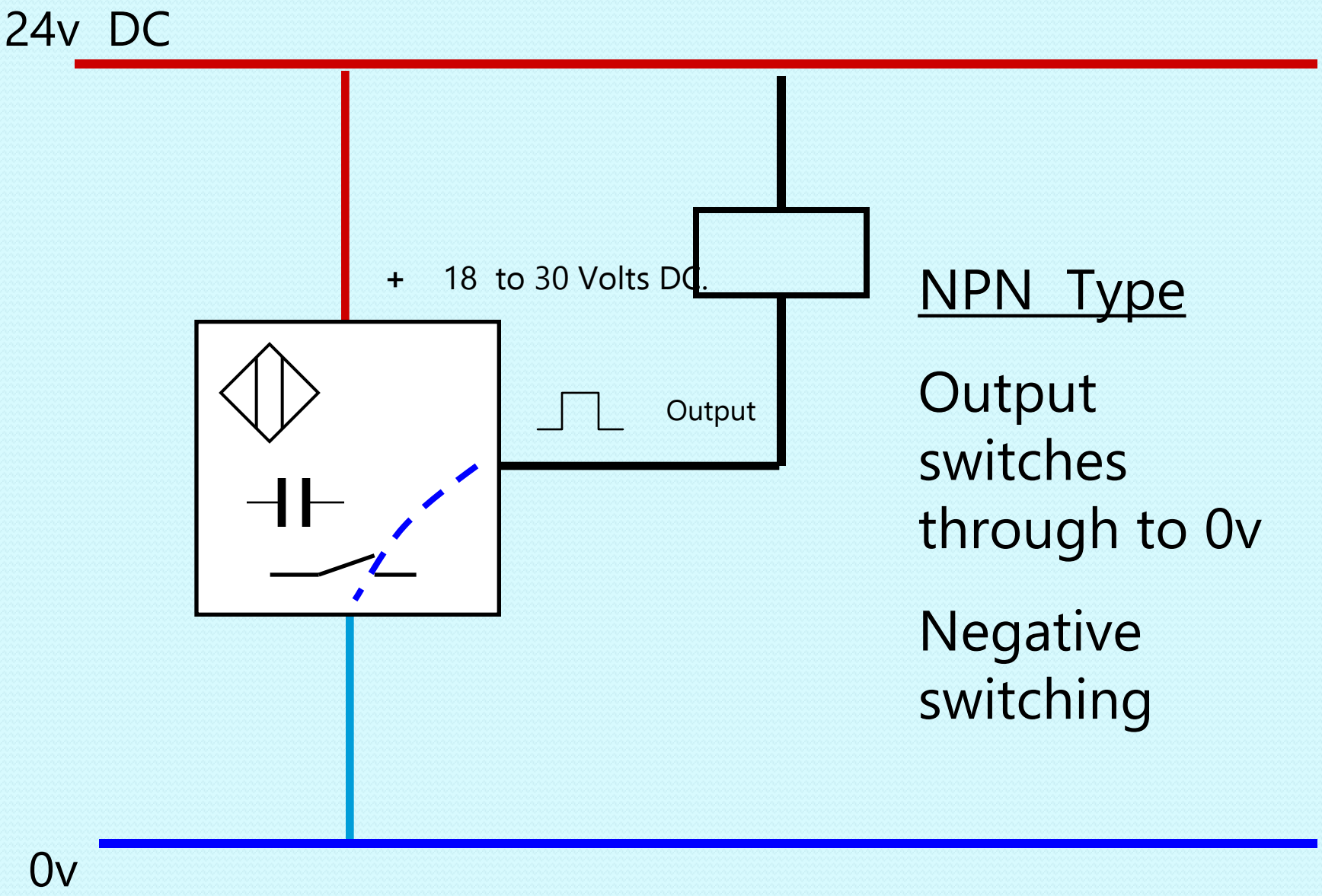
Contactless Sensors – Proximity sensors (reed switch, inductive, capacitive, and optical sensors).



PNP Type

Output is Positive

Positive switching



NPN Type

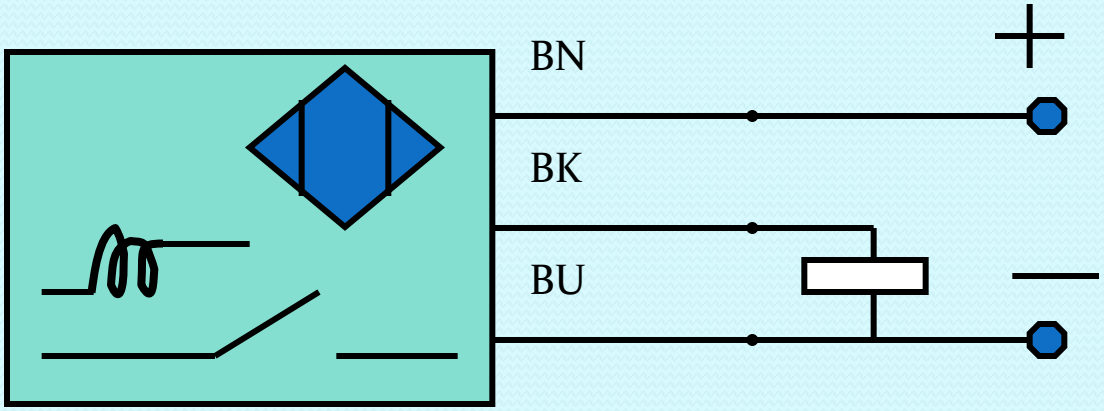
Output switches through to 0v

Negative switching

INDUCTIVE PROXIMITY SENSORS

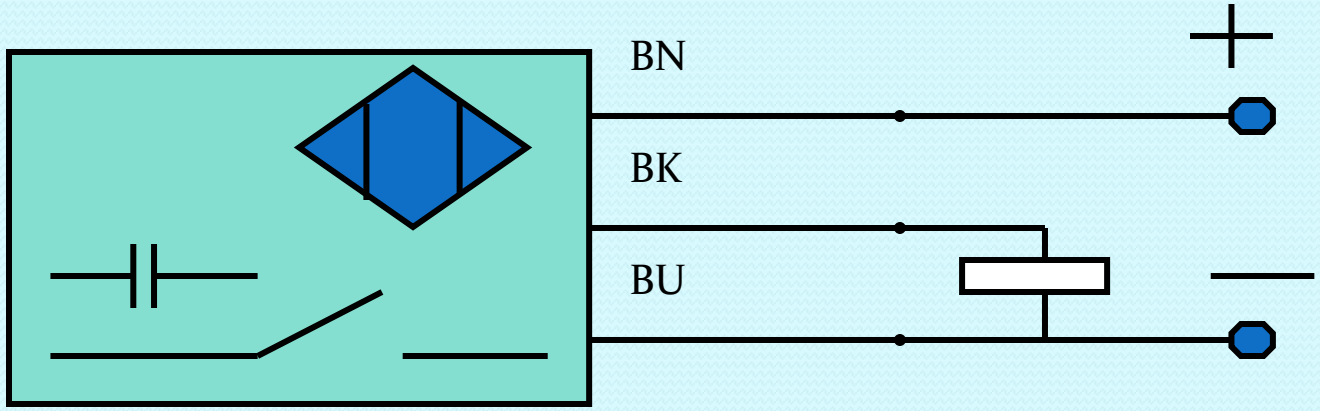
Note:

For metallic materials only



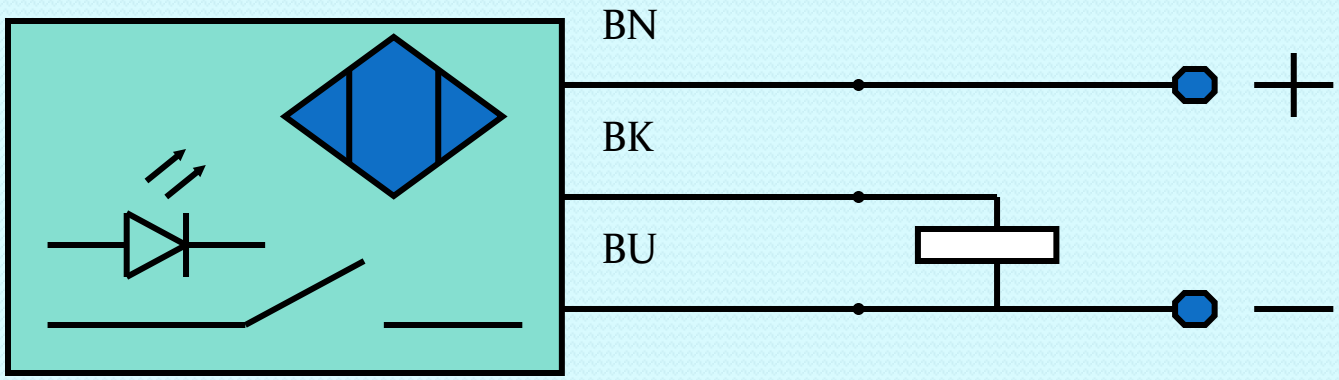
Switching Voltage ---------- 10-30 V DC
Nominal switching distance ---------- 4mm
Switching frequency---------- 800Hz (max)
Output function ---------- NO contact, PNP switching
Output current ---------- 400 mA (max)

CAPACITIVE PROXIMITY SENSORS



Switching Voltage ---------- 10-30V DC
Nominal switching distance ---------- 4mm
Switching frequency ---------- 100 Hz (max)
Output function ---------- NO contact, PNP switching
Output current ---------- 200mA (max)

OPTICAL PROXIMITY SENSORS



Switching Voltage ----------10-30 V DC
Nominal Switching distance ---------- 0-100 mm (adjustable)
Switching frequency ---------- 200 Hz (max)
Output function ---------- NO contact, PNP switching
Output current ---------- 100mA (max)

SENSORS

Inductive Sensor

Optical Sensor

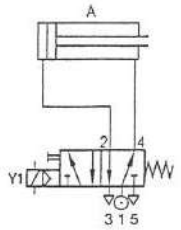
Optical Sensor

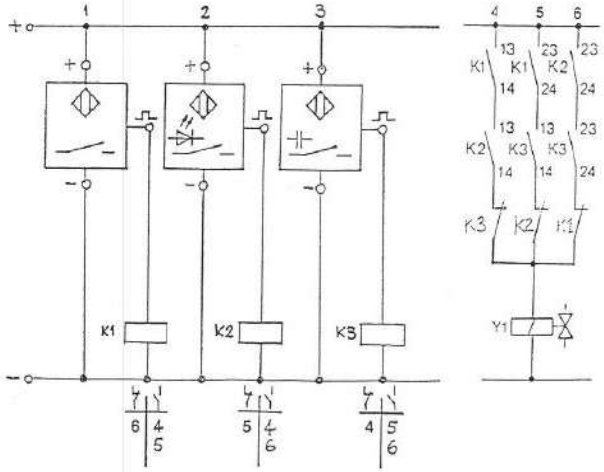
Magnetic Sensor

Seminar EP 211
Electro-Pneumatics Control

FESTO DIDACTIC

Solution: 4 Punching device





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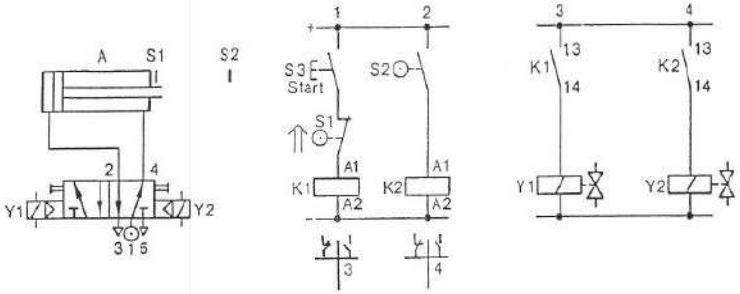
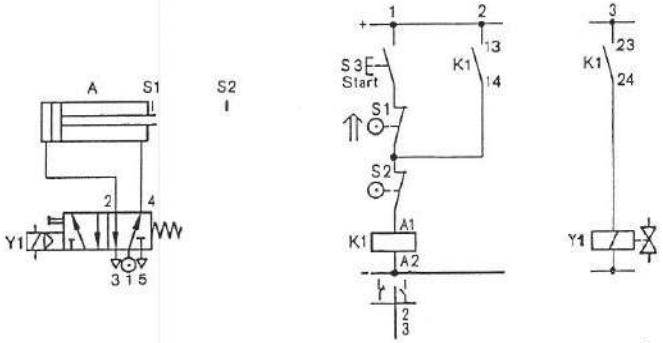
Electro-Pneumatics Control

FESTO DIDACTIC

Solution: 7 Ejecting workpiece





Seminar EP 211
Electro-Pneumatics Control

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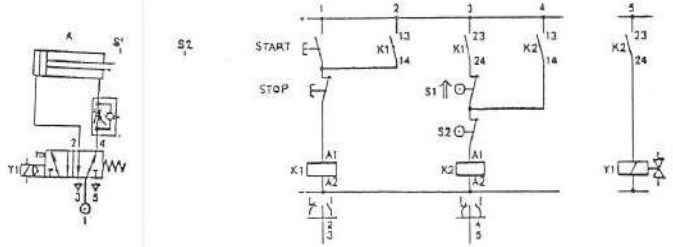
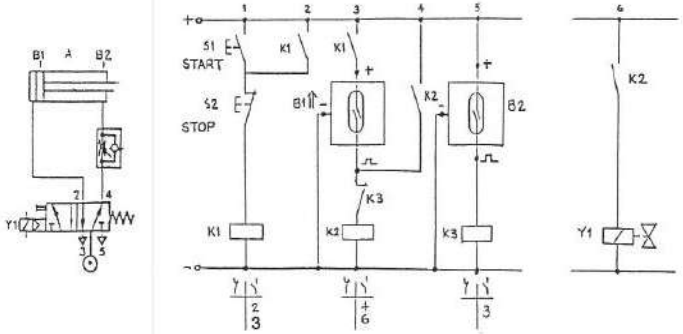
Solution : 9 Automatic washing system





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Electro-Pneumatics Control

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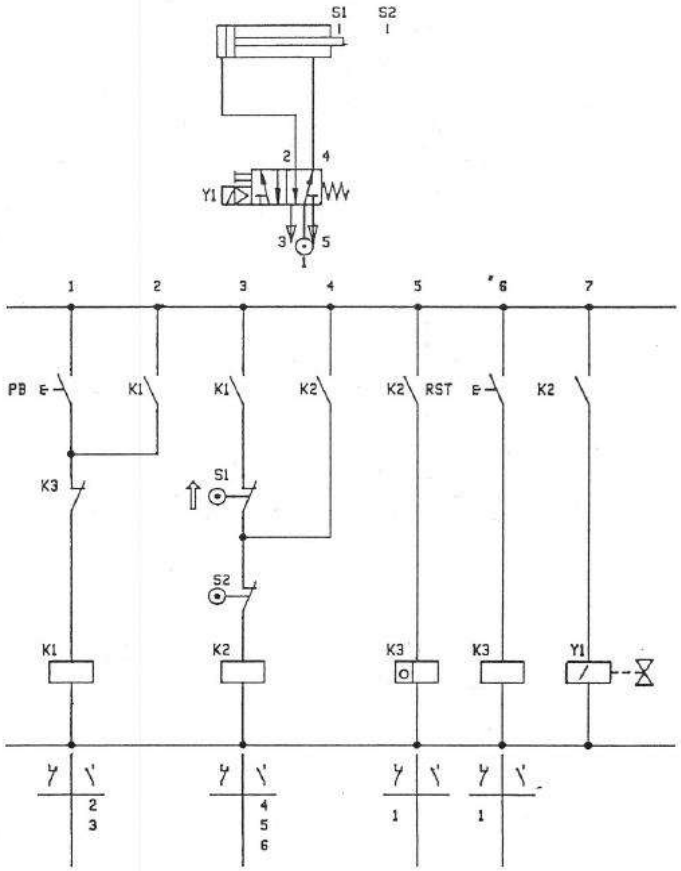
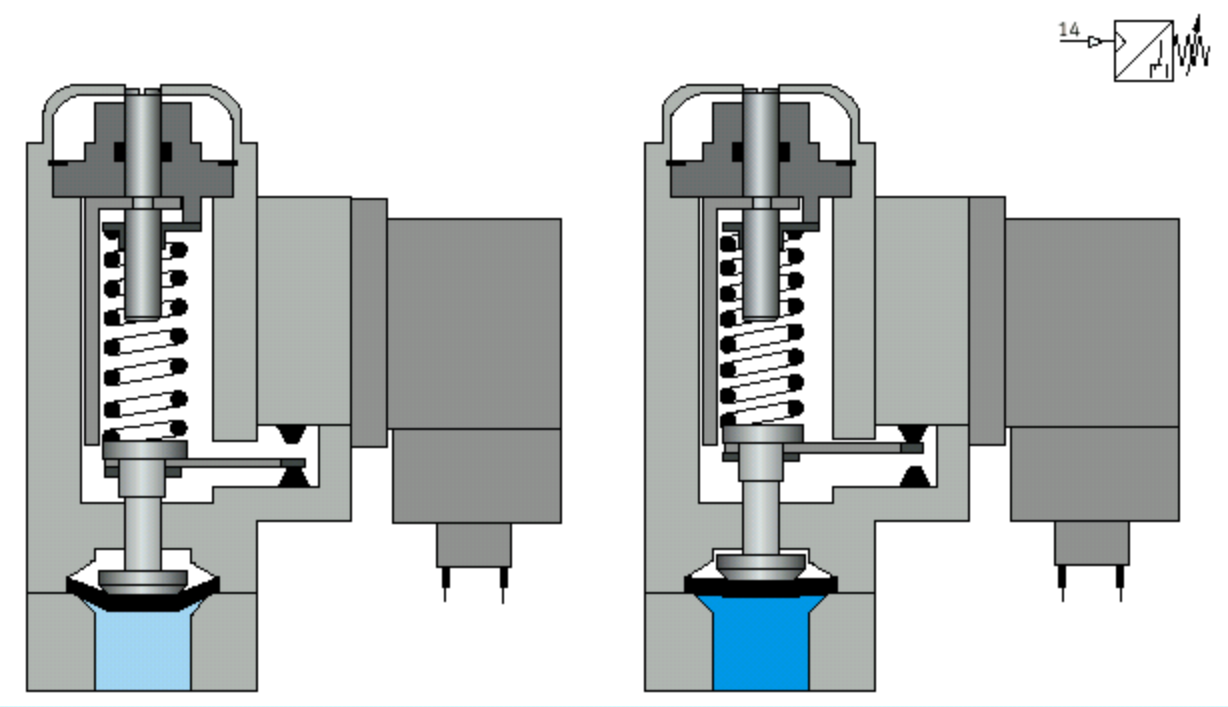
Solution: 12 Automatic Washing System (Counter)



Pneumatic-Electric Converter



When a pneumatic signal of sufficient pressure to overcome the spring force is applied to the diaphragm, the resultant force operates the stem. The force required to operate the stem is controlled by the adjusting screw. Movement of the stem actuates a micro switch via a switching lever which results to switching of contacts.

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Electro-Pneumatics Control

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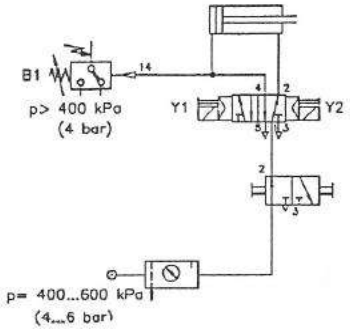
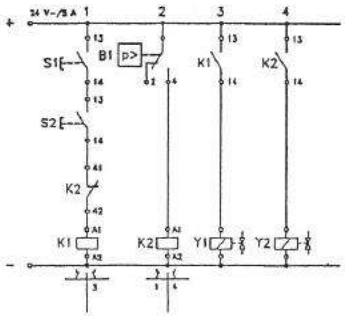
Solution: 10 Stamping device

Circuit design, pneumatic



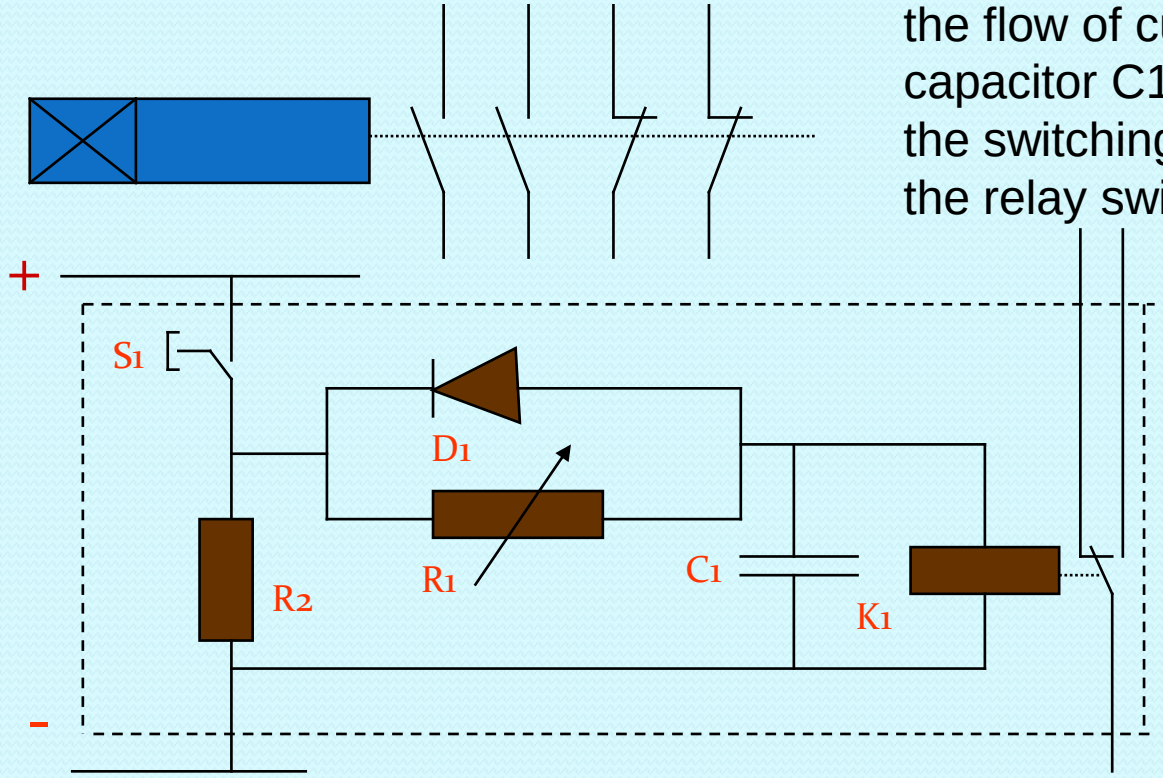
Circuit design, electric



Electrical Timers

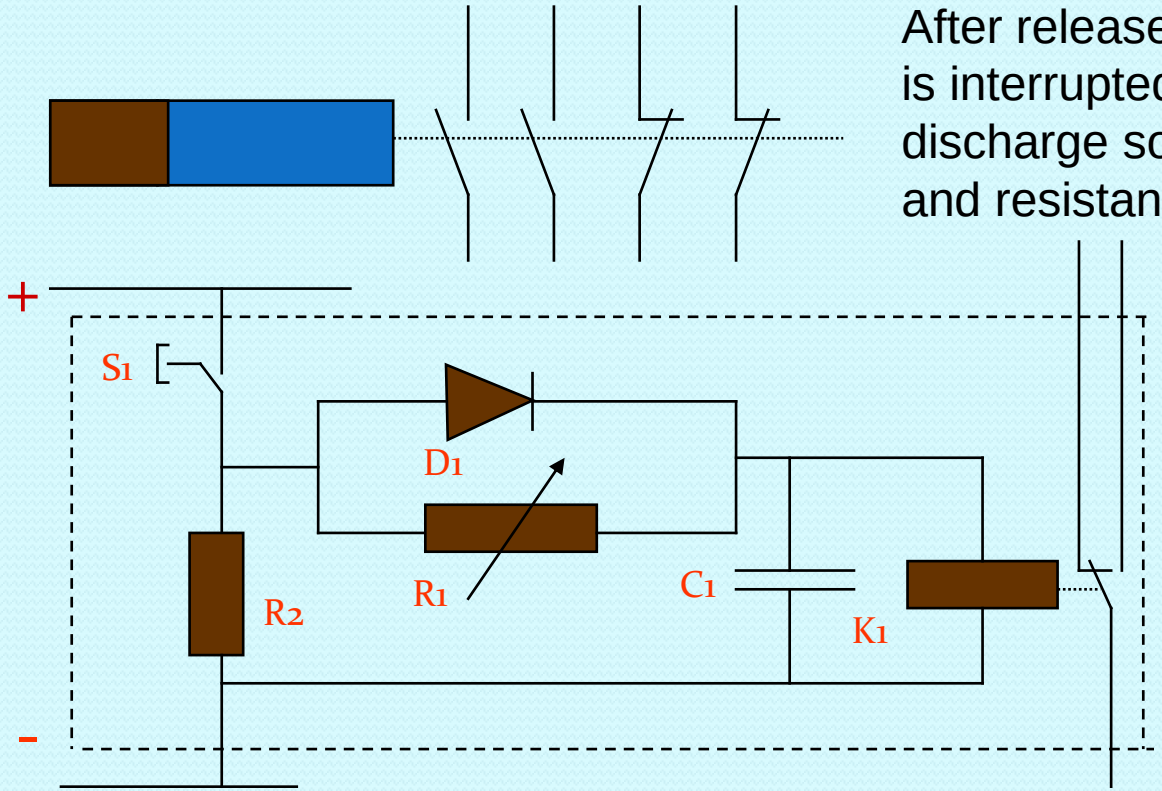
- *Time relay with switch on delay*
- *Time relay with switch off delay*

Switch on Delay Timer



When S1 is actuated, current flows to capacitor C1 through adjustable resistance R1. Diode D1, which is connected in parallel, does not permit the flow of current in this direction. After capacitor C1 has become charged to the switching voltage of the relay K1, the relay switches.

Switch off Delay Timer



When S1 is actuated, the current flows through diode D1, which is connected in the free flow direction, to capacitor C1 and the relay K1. The relay switches at once. After release of pushbutton S1, the circuit is interrupted. Capacitor C1 can now discharge solely via adjustable resistor R1 and resistance R2.

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Electro-Pneumatics Control

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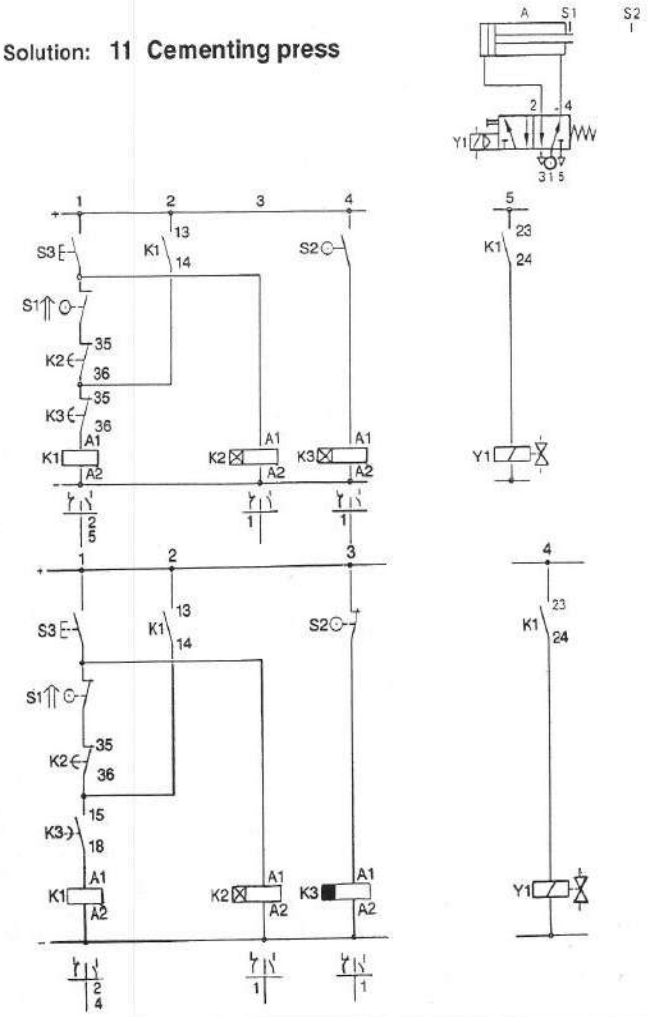
Solution: 11 Cementing press



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Electro-Pneumatics Control

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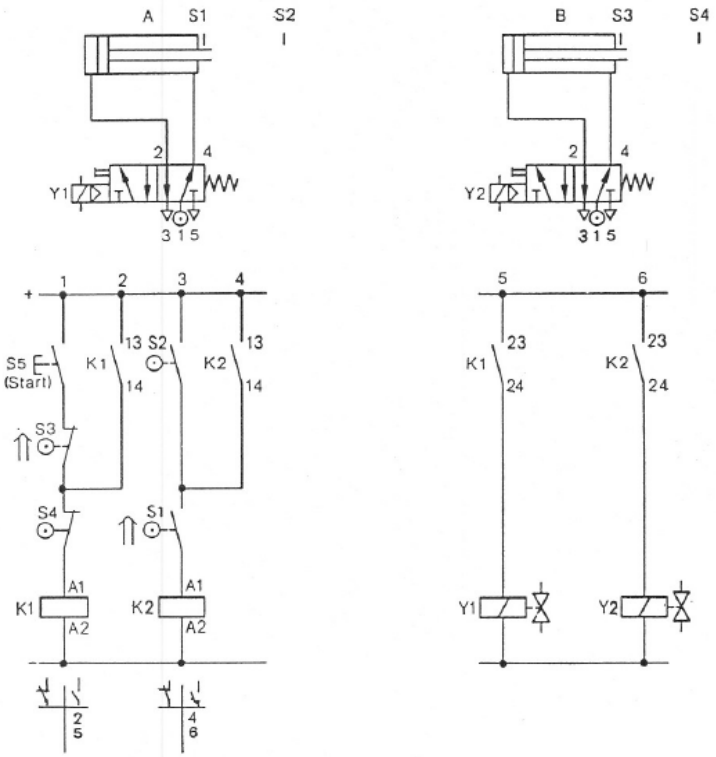
Solution: **13 Lifting device for boxes**



SUGGESTED PATTERN IN DESIGNING SEQUENCE CONTROL USING RELAYS

1. The CONTROL CIRCUIT is the part of the relay ladder, which processes input signals.

2. The POWER CIRCUIT is the part of the relay ladder, which directly controls the electrical loads. (ie., solenoid coils, motors, lamps, buzzers)

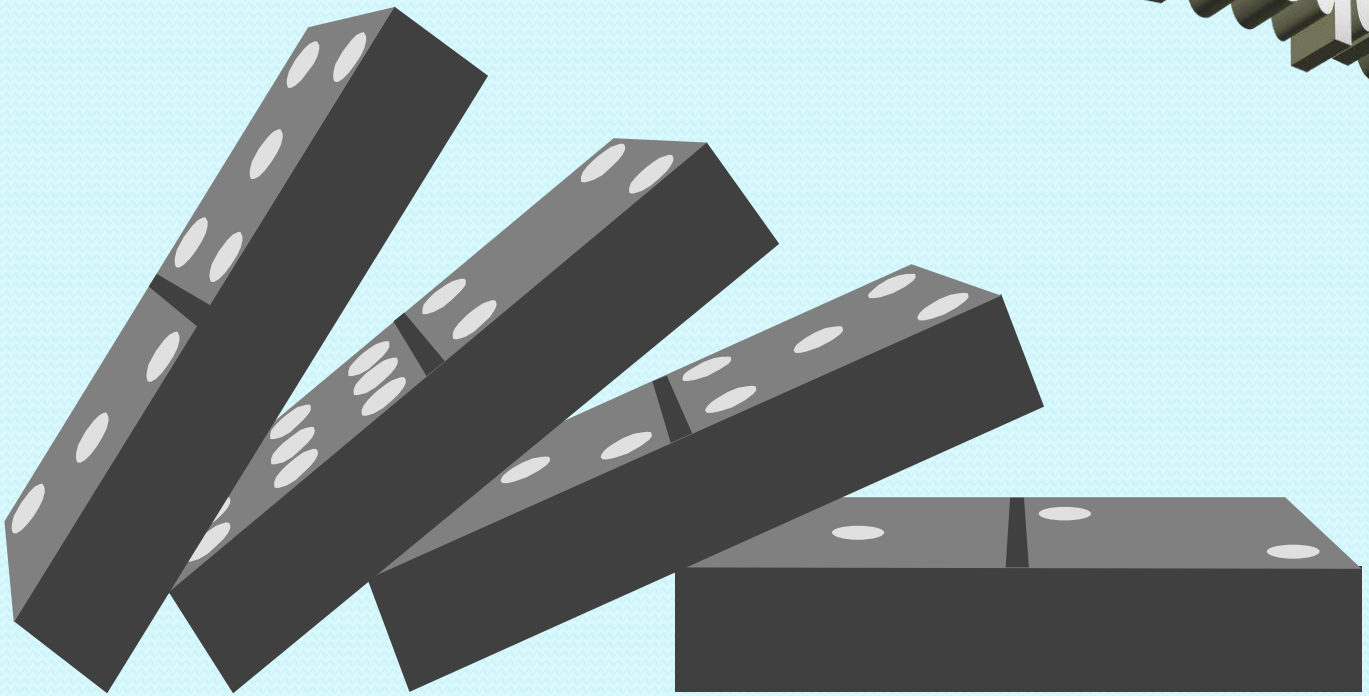
3. In the control circuit, each working step is assigned its own STEP RELAY.

4. Each step relay, except the last step relay, employs a self holding contact.

5. A NO contact of the step relay N is placed in series with the first step relay.

6. A NC contact of the last step relay is placed in series with the first step relay.

Motion Sequences



Sequence Control System

This is a control system using a mandatory step by step sequence, in which the sequencing from one step to the next programmed step depends on certain conditions being satisfied.

Representations

- Chronological Order

Cylinder 1.0 extends and lifts the box

Cylinder 2.0 extends and pushes the box

Cylinder 1.0 retracts, then

Cylinder 2.0 retracts

- Tabular Form

Work Step	Motion of Cylinder 1.0	Motion of Cylinder 2.0
1	out	-
2	-	out
3	in	-
4	-	in

Representations

- Vector Diagram

Extension represented by 

Retraction represented by 

1.0 

2.0 

1.0 

2.0 

- Abbreviated Notation

Extension represented by : +

Retraction represented by : -

1.0 +

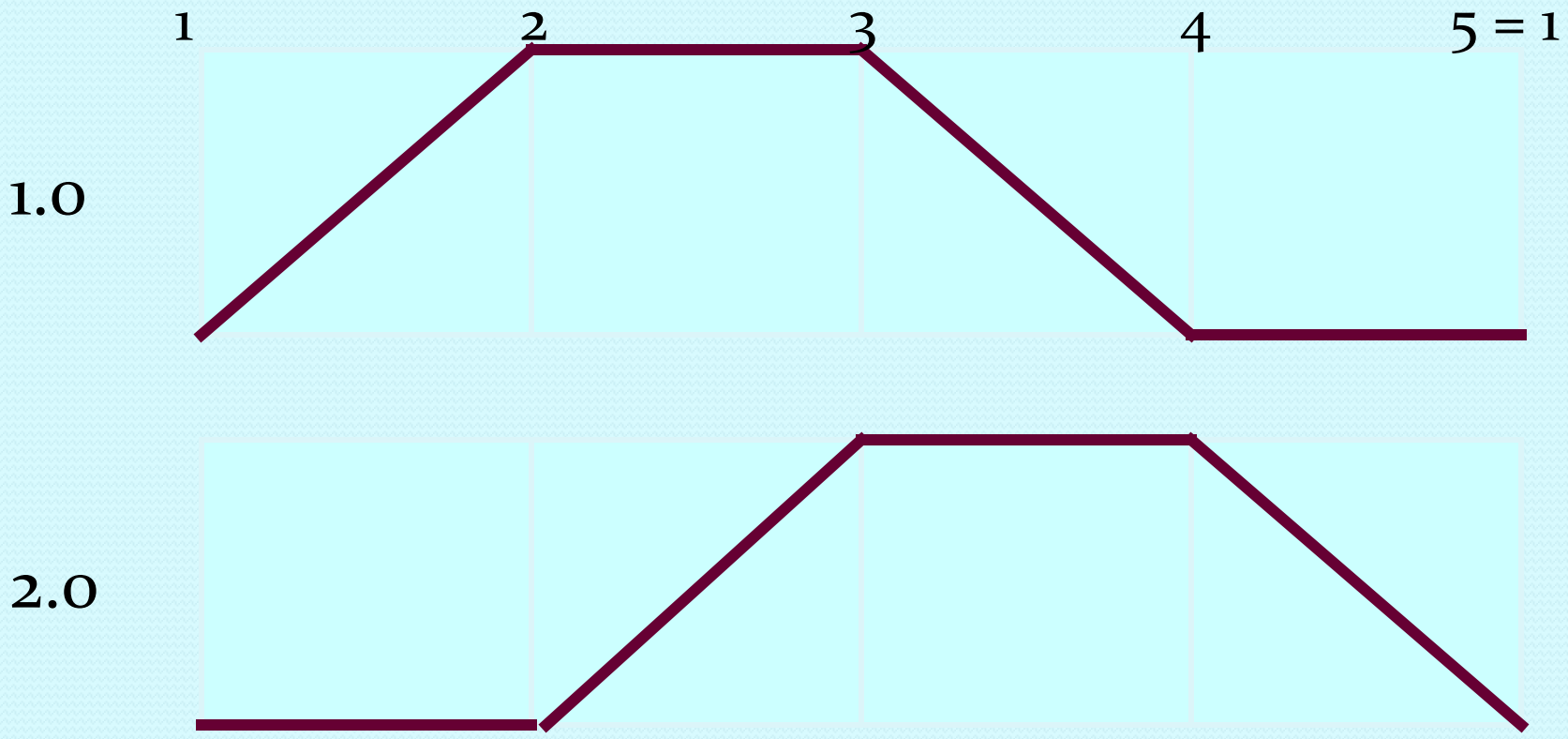
2.0 +

1.0 -

2.0 -

Representations

- Motion Step Diagram



Seminar EP 211
Electro-Pneumatics Control

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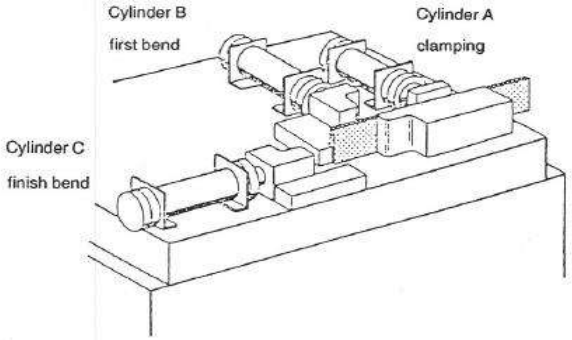
Problem sheet 15 Bending device

Problem:

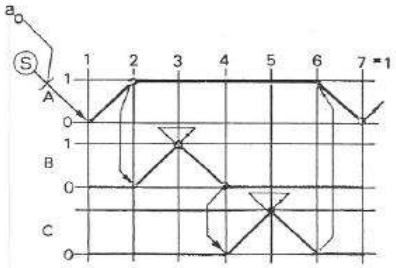
The bending tool is used to bend metal strips.

The strip is inserted manually. After pressing the START pushbutton, cylinder A clamps the workpiece, cylinder B bends the part and returns to its initial position, and cylinder C completes the bending operation. After cylinder C has returned to its initial position, cylinder A releases the part.

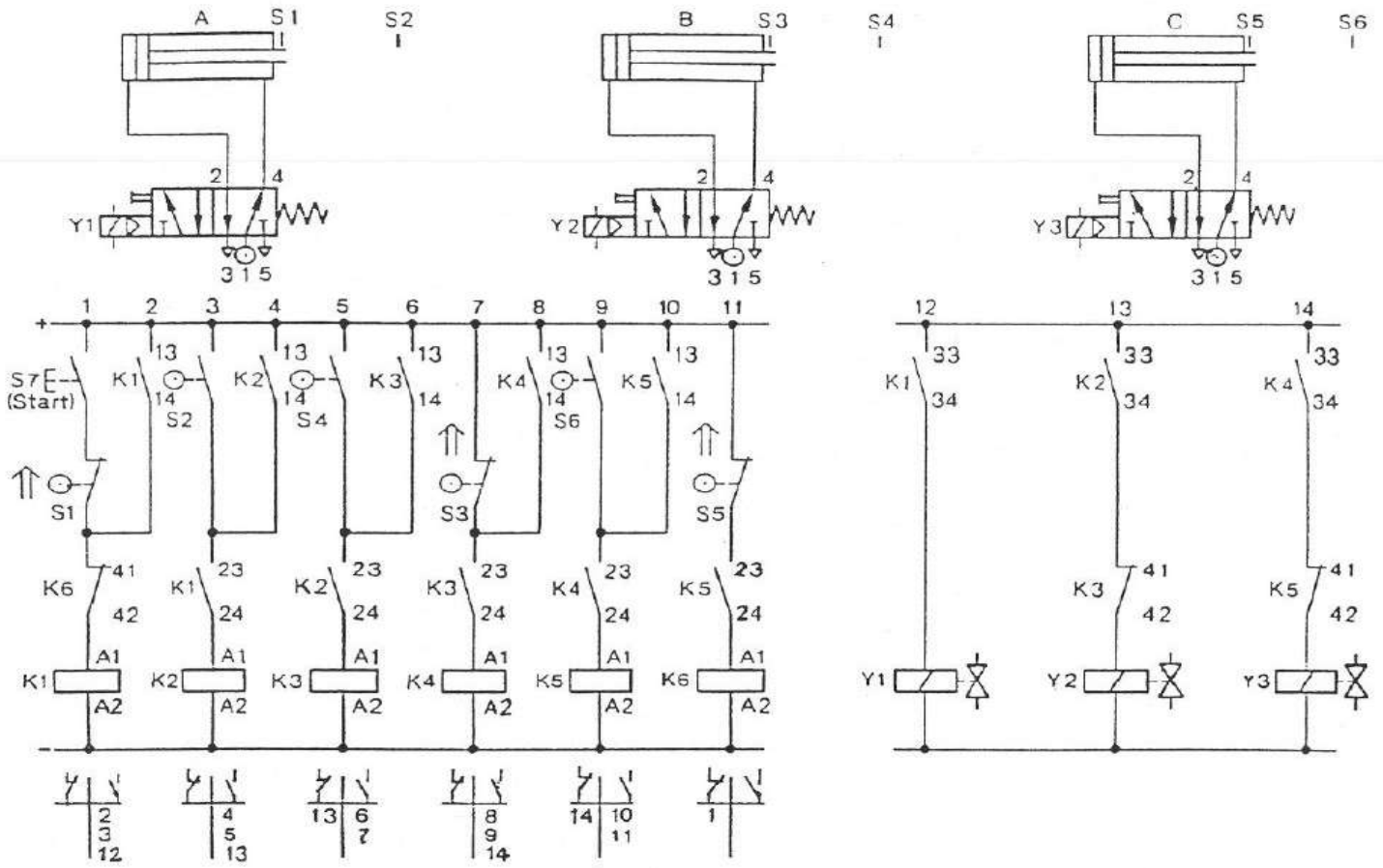
Positional sketch:



Motion-step diagram:



Solution: 15 Bending device



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Electro-Pneumatics Control

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Modular Production System MPS