

Pneumatik Dasar

Oleh:

Totok Heru TM.

MATERI

- ❖ **DEFINISI “PNEUMATIK”**
- ❖ **SIFAT, KEUNTUNGAN, DAN KERUGIAN UDARA BERTEKANAN**
- ❖ **HUKUM-HUKUM FISIKA DALAM PNEUMATIK**
- ❖ **PEMAHAMAN DAN PENGGAMBARAN SIMBOL KOMPONEN PNEUMATIK SESUAI DENGAN STANDARISASI **ISO 1219****
- ❖ **PENGENALAN KOMPONEN PNEUMATIK YANG UMUM DIGUNAKAN**
- ❖ **PENGGAMBARAN DIAGRAM RANGKAIAN PNEUMATIK SESUAI DENGAN STANDARISASI **ISO 1219****

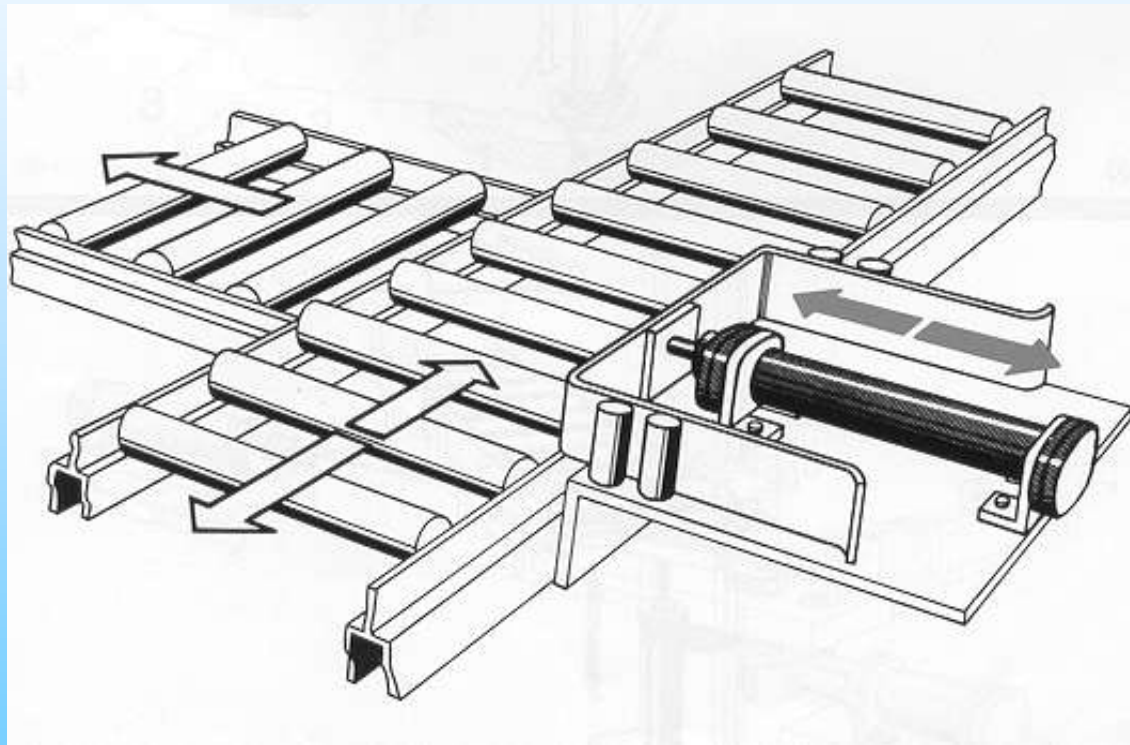


PNEUMATIK

- ❖ Istilah **Pneumatik** berasal dari kata “**Pneuma**” (Yunani Kuno) yang berarti tiupan atau angin dan juga jiwa dalam filosofi.
- ❖ Definisi **Pneumatik** adalah salah satu cabang ilmu fisika yang mempelajari fenomena udara yang dimampatkan sehingga tekanan yang terjadi akan menghasilkan gaya sebagai penyebab gerak atau aktuasi pada aktuator.

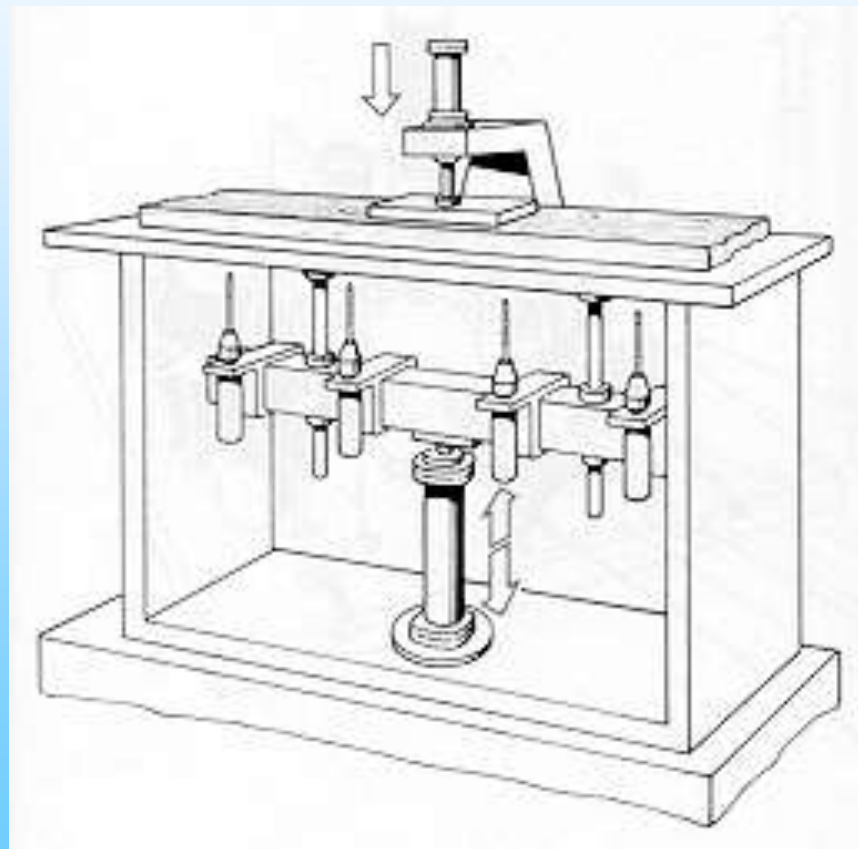
APLIKASI PNEUMATIK

Actuators used in Pushing



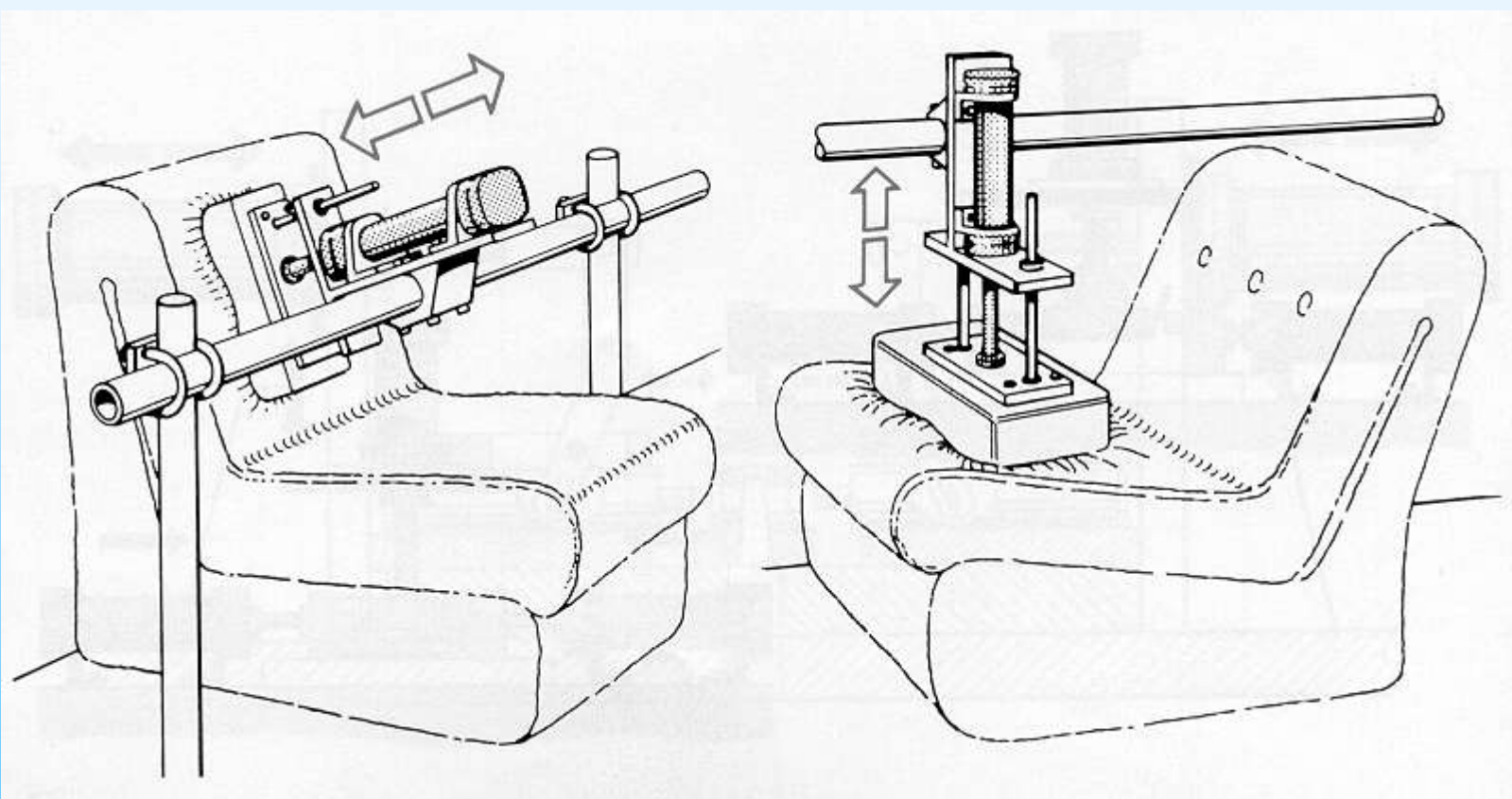
APLIKASI PNEUMATIK

Actuators used in Machining - Drilling



APLIKASI PNEUMATIK

Actuators used in Testing and Quality Control



KARAKTERISTIK



positif dan negatif



PNEUMATIK

Karakteristik Positif

- ❖ Tidak mempunyai bentuk yang khusus (bentuknya mudah berubah-ubah sesuai dengan wadahnya)
- ❖ Dapat dimampatkan (udara mempunyai jarak antar molekul yang renggang dan gaya tarik menarik antar molekul kecil)
- ❖ Memenuhi semua ruang dengan sama rata
- ❖ Tidak berbau dan berwarna
- ❖ Selalu mencari tekanan yang lebih rendah
- ❖ Jumlahnya tak terbatas
- ❖ Dapat dikontrol laju aliran, tekanan dan gayanya
- ❖ Transportasi mudah
- ❖ Penyimpanan mudah

bersambung.....



.....sambungan

- ❖ **Tahan ledakan**
- ❖ **Aman terhadap beban lebih**
- ❖ **Bersih**
- ❖ **Kecepatan kerja yang tinggi (1-2 m/detik)**



Karakteristik Negatif

- ❖ Biaya persiapannya tinggi
- ❖ Kompresibel
- ❖ Efisiensi gaya berada sekitar 2-3 ton
- ❖ Udara buang yang cukup keras



Satuan tekanan lainnya yang sering digunakan:

- Atmosfir, atm

(tekanan absolut dalam satuan sistem teknik)

$$1 \text{ at} = 1 \text{ kp/cm}^2 = 0.981 \text{ bar} (9.81 \text{ kPa})$$

- Pascal, Pa

$$1 \text{ Pa} = 1 \text{ N/m}^2 = 10^{-5} \text{ bar}$$

$$1 \text{ bar} = 10^5 \text{ N/m}^2 = 10^5 \text{ Pa} = 1.02 \text{ at}$$

- Atmosfir, fisik atm

(tekanan absolut dalam sistem satuan fisika)

$$1 \text{ atm} = 1.033 \text{ at} = 1.013 \text{ bar} = 101.3 \text{ kPa}$$

- mm pengukuran air, mm WG

$$10000 \text{ mm WG} = 1 \text{ at} = 0.981 \text{ bar}$$

- mm kolom air raksa, mm Hg

$$1 \text{ mm Hg} = 1 \text{ Torr}$$

$$1 \text{ at} = 736 \text{ Torr}, 1 \text{ bar} = 750 \text{ Torr}$$

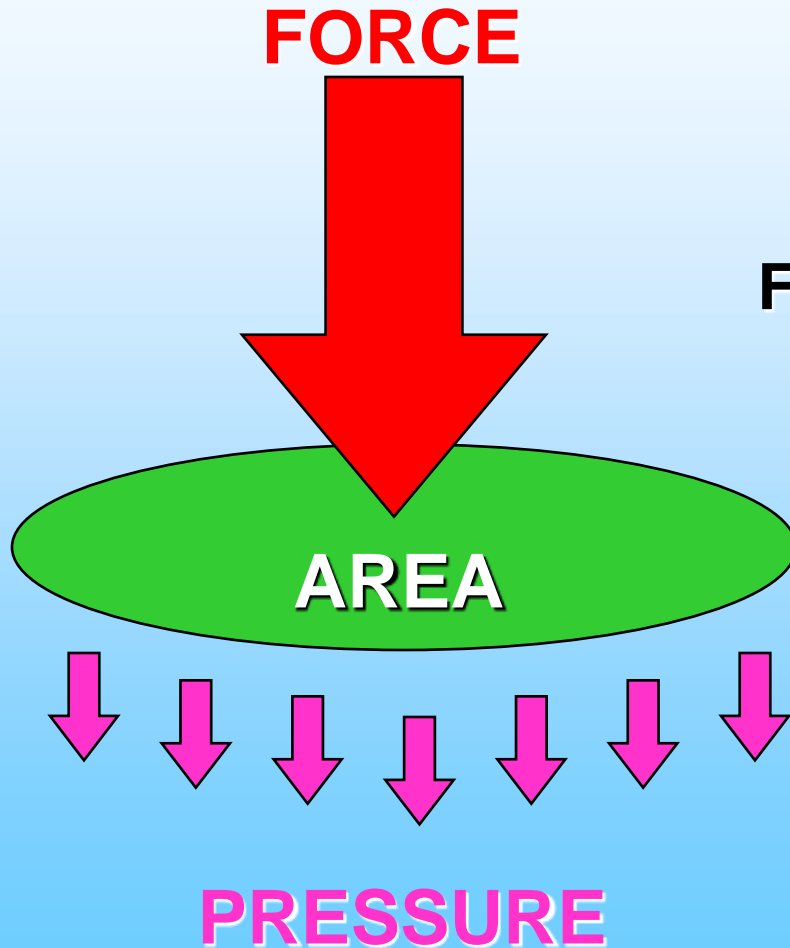
Karena segala sesuatu di bumi ini menerima tekanan yaitu tekanan absolut atmosfer (p_{at}), maka tekanan ini tidak bisa dirasakan. Pada umumnya tekanan atmosfer dianggap sebagai tekanan dasar



**APA YANG ANDA
KETAHUI MENGENAI
TEKANAN ITU ?**

DEFINISI TEKANAN

$$\text{FORCE} = \text{PRESSURE} \times \text{AREA}$$

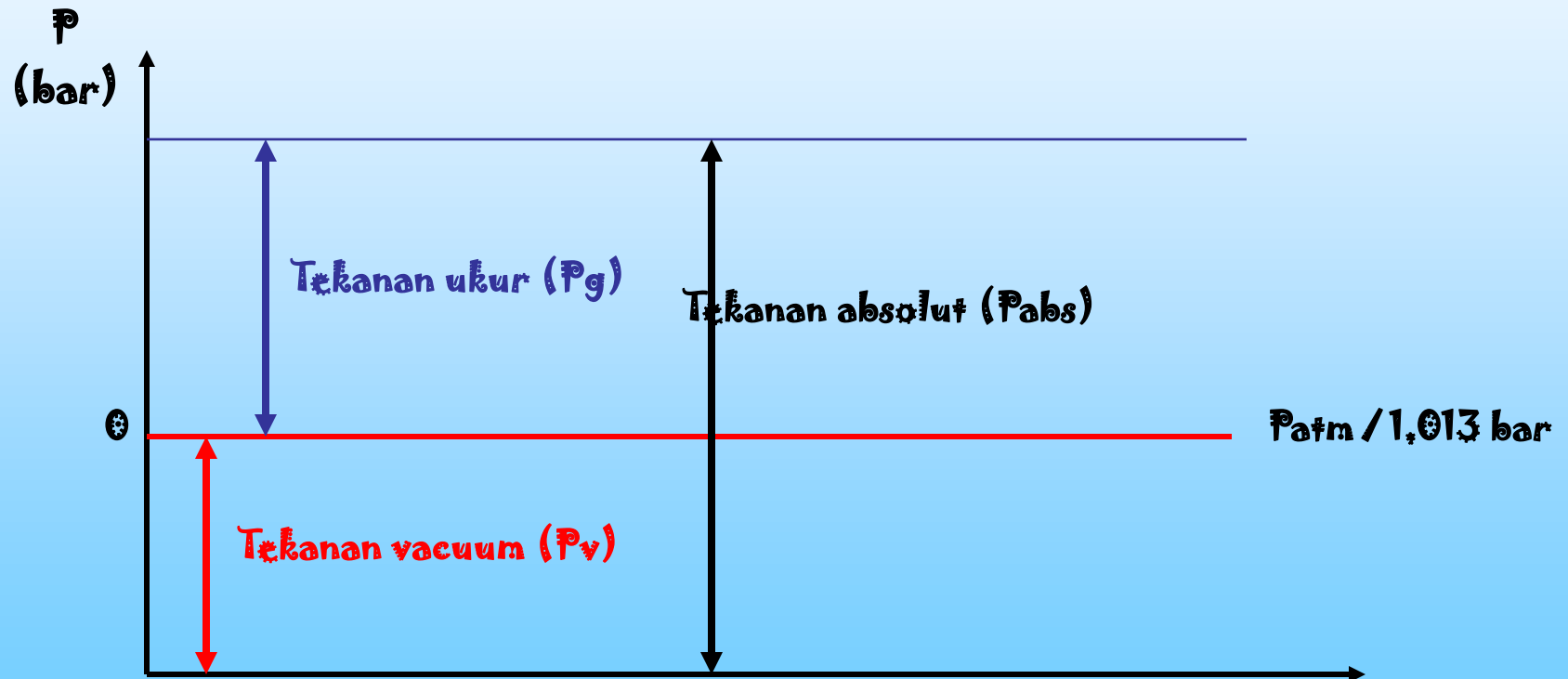


$$\text{PRESSURE} = \text{FORCE} \div \text{AREA}$$

- ❖ **TEKANAN** adalah besarnya gaya(F) per satuan luas penampang(A)

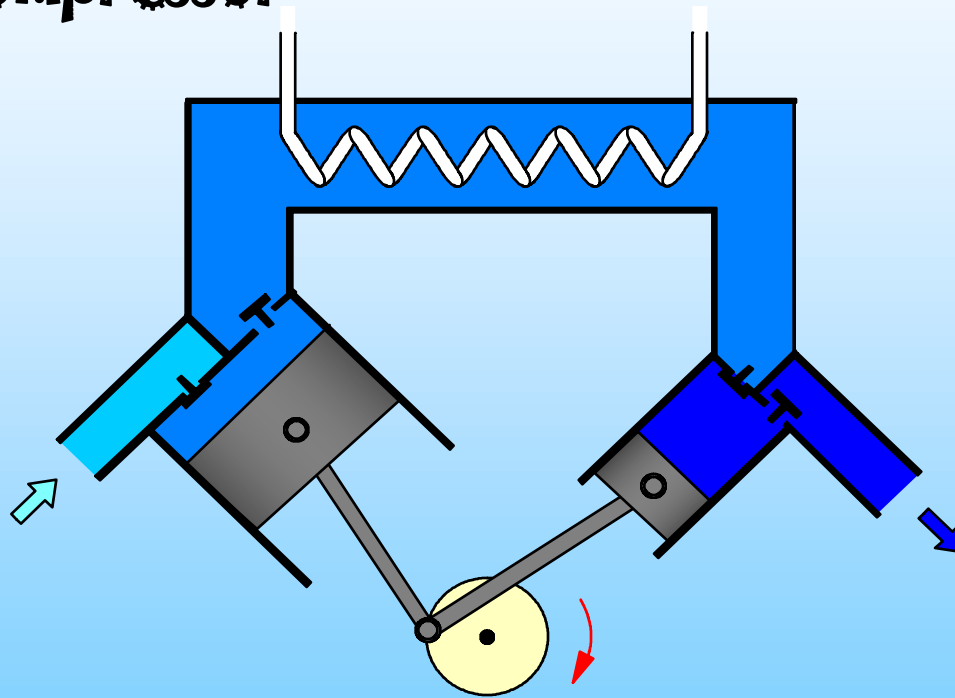
- ❖ **TEKANAN** terbagi 3 kategori :
 - ▶ Tekanan ukur
 - ▶ Tekanan absolut
 - ▶ Tekanan vacuum

Klasifikasi tekanan

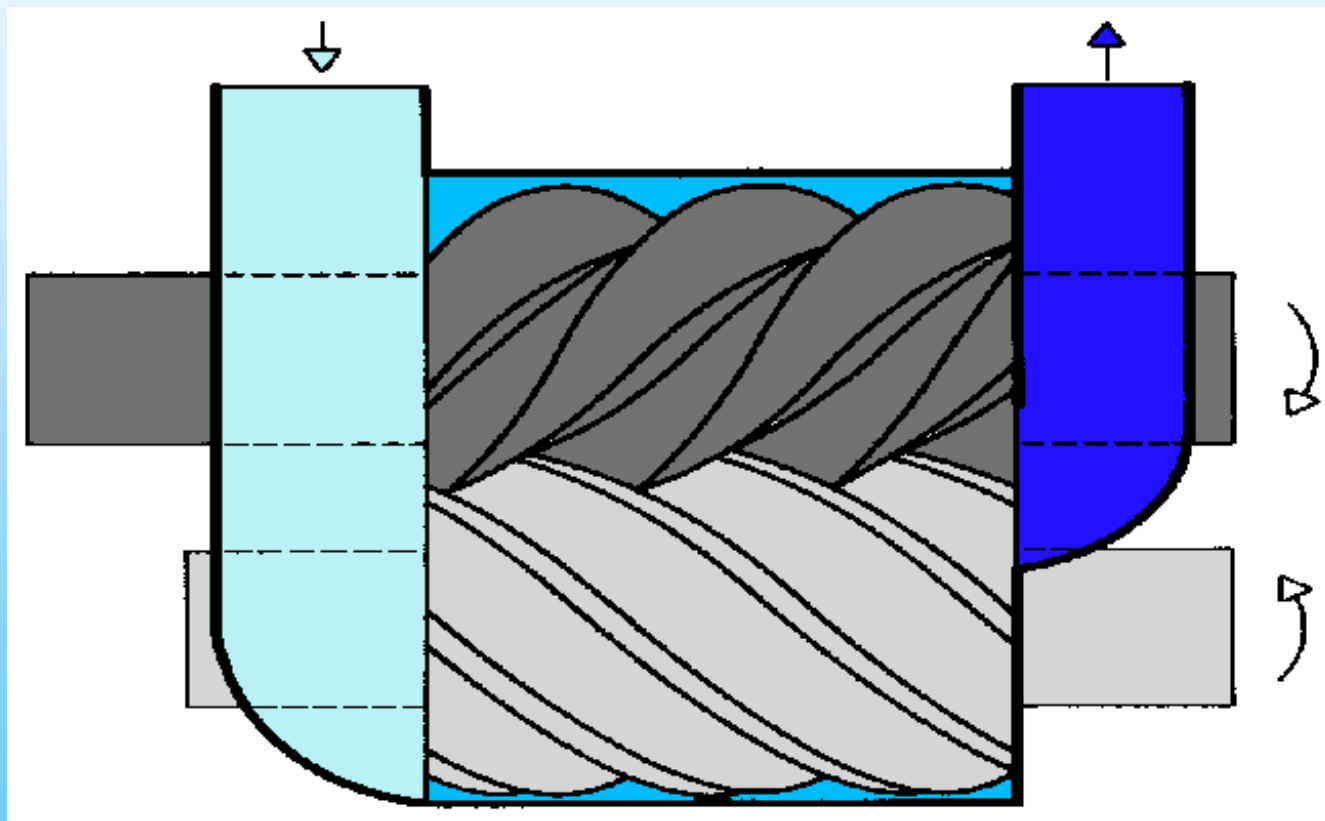


**PEMBANGKIT
TEKANAN DAN
DISTRIBUSI**

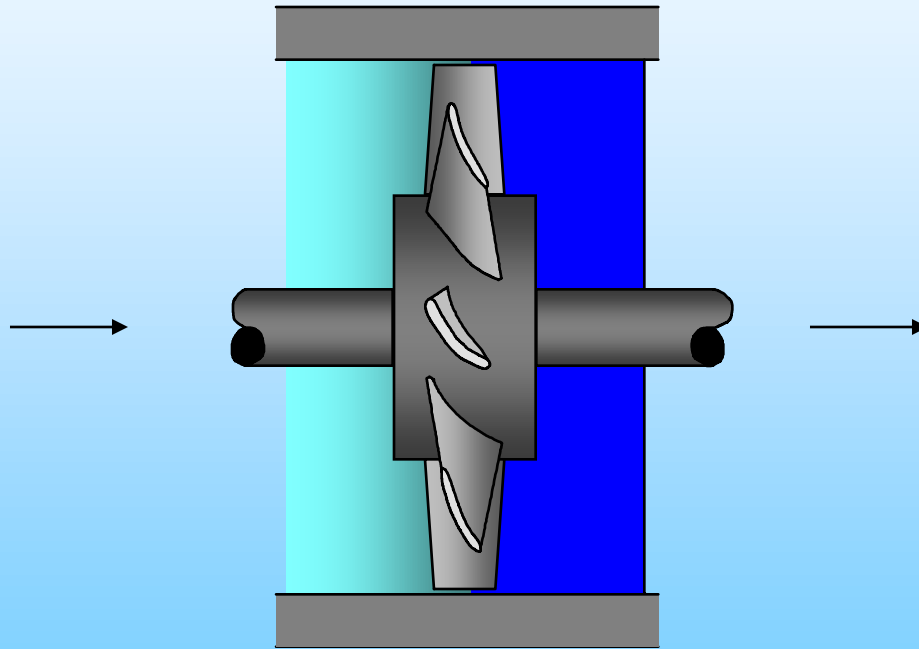
Piston Compressor



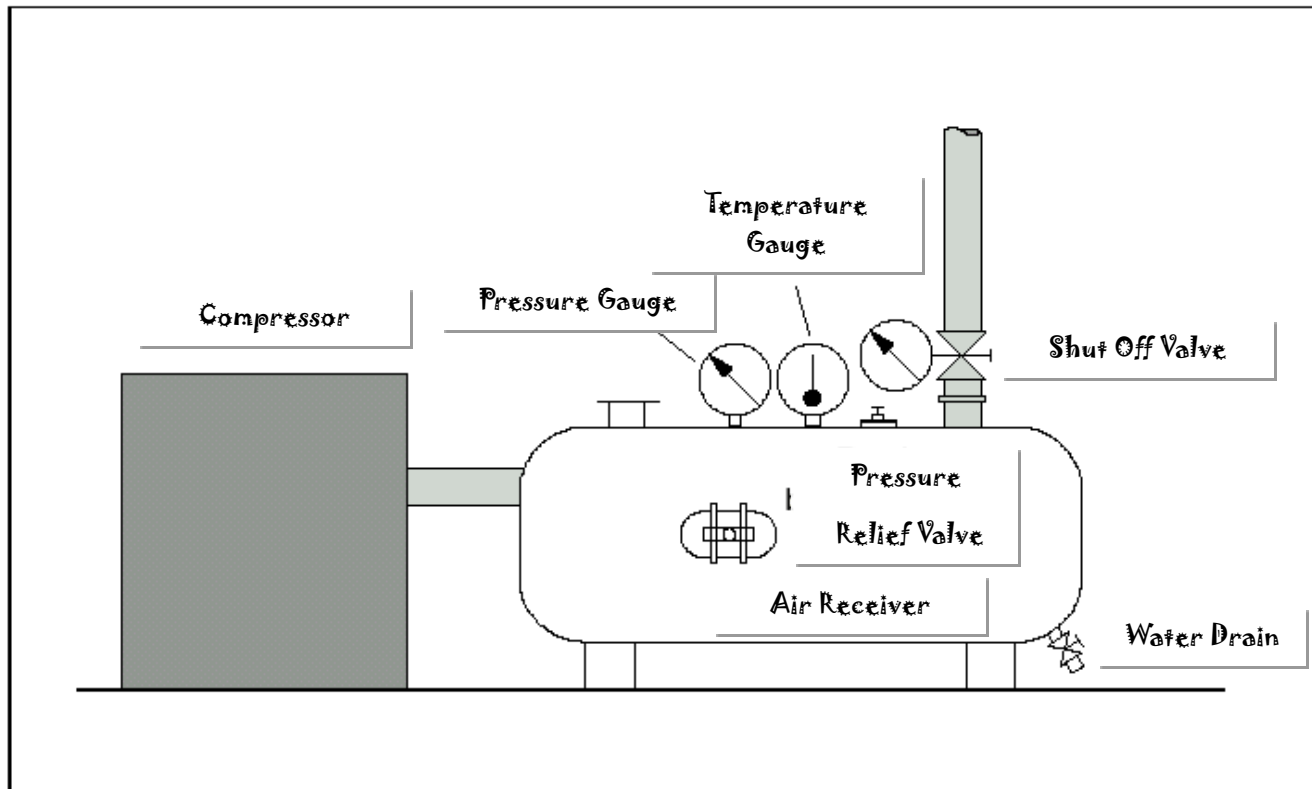
Screw Compressor



Axial Compressor



Tangki Udara



Tangki Udara

Tangki Udara digunakan untuk

- Menyediakan tekanan udara yang konstan terhadap adanya konsumsi yang berfluktuasi dalam sistem pneumatik
- Sebagai persediaan dalam keadaan darurat ke dalam sistem
- Sebagai pendingin udara karena luas permukaan yang besar
- Dipisahkannya kandungan air dalam udara

Pengering Udara

Air menghasilkan

- Mengerasnya seal yang terdapat pada komponen pneumatik
- Korosi
- Mencuci pelumas yang asli pada silinder
- Memuainya seal dan diafragma

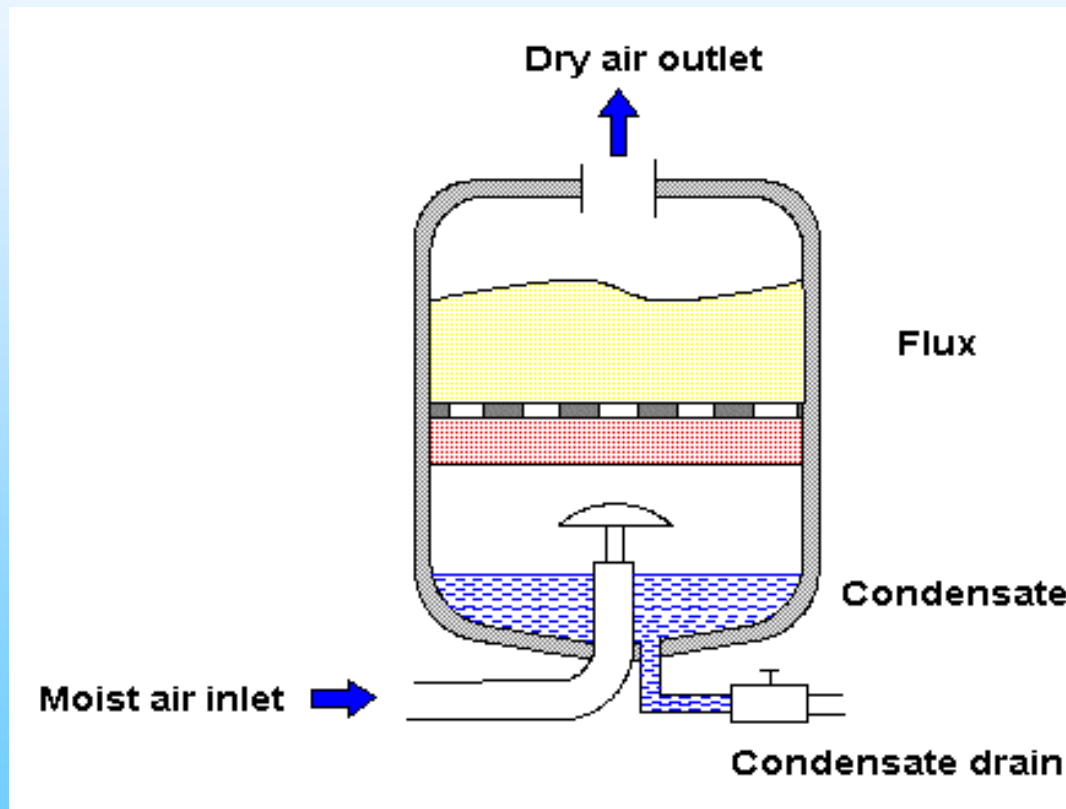
Maka dari itu pengering udara digunakan untuk mengurangi kandungan air dalam udara

Pengering Udara

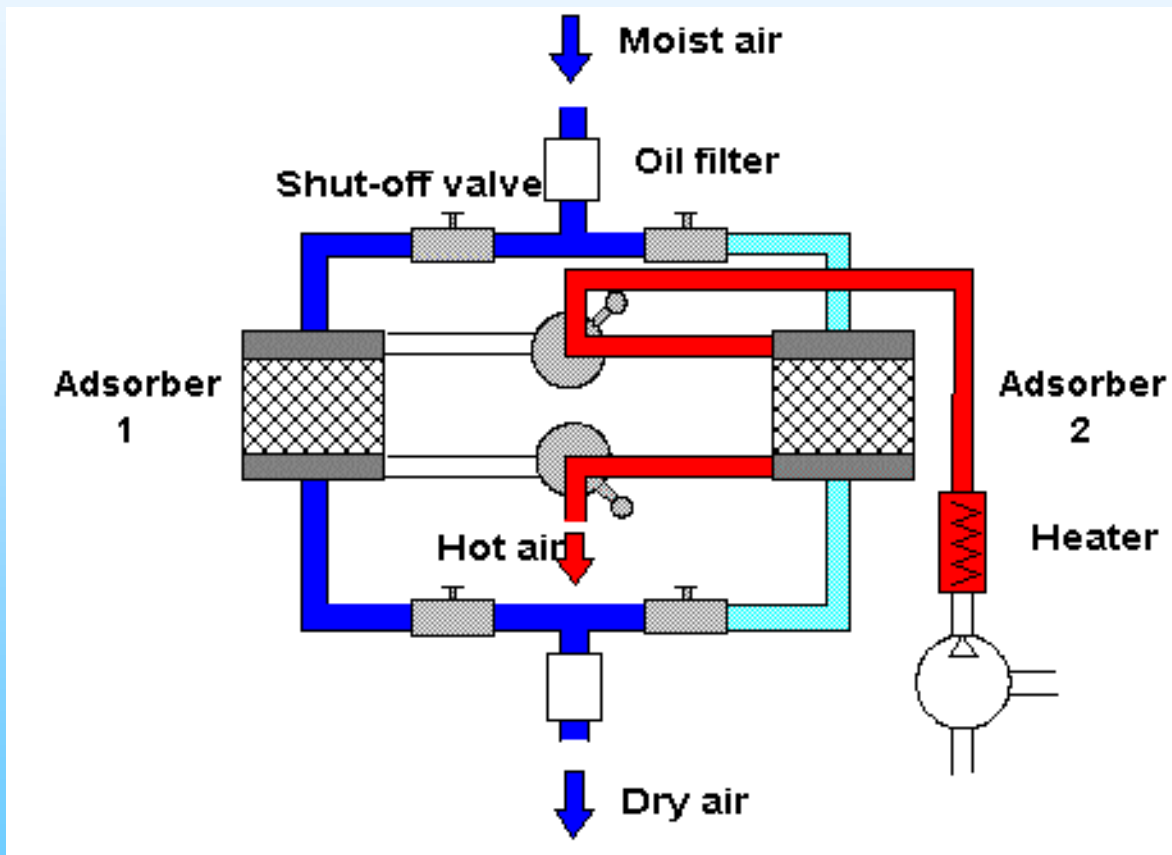
Jenis-jenis pengering udara yang umum dipakai:

- Pengering Absorpsi
- Pengering Adsorpsi
- Pengering suhu rendah

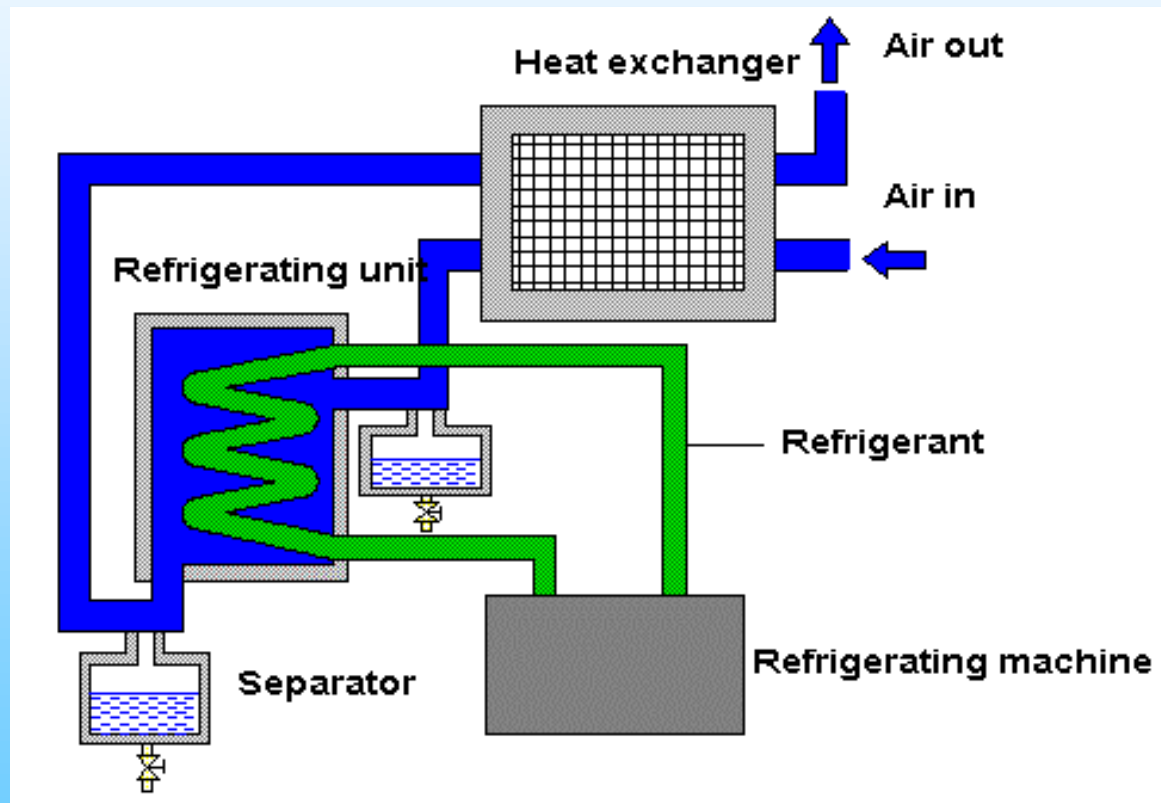
Absorption Drying



Adsorption Drying



Low Temperature Drying



Sistem Pemipaan (Distribusi Udara)

Diameter pipa tergantung pada:

- **Flow Volume**

i.e. volume \uparrow diameter \uparrow

- **Pipe Length**

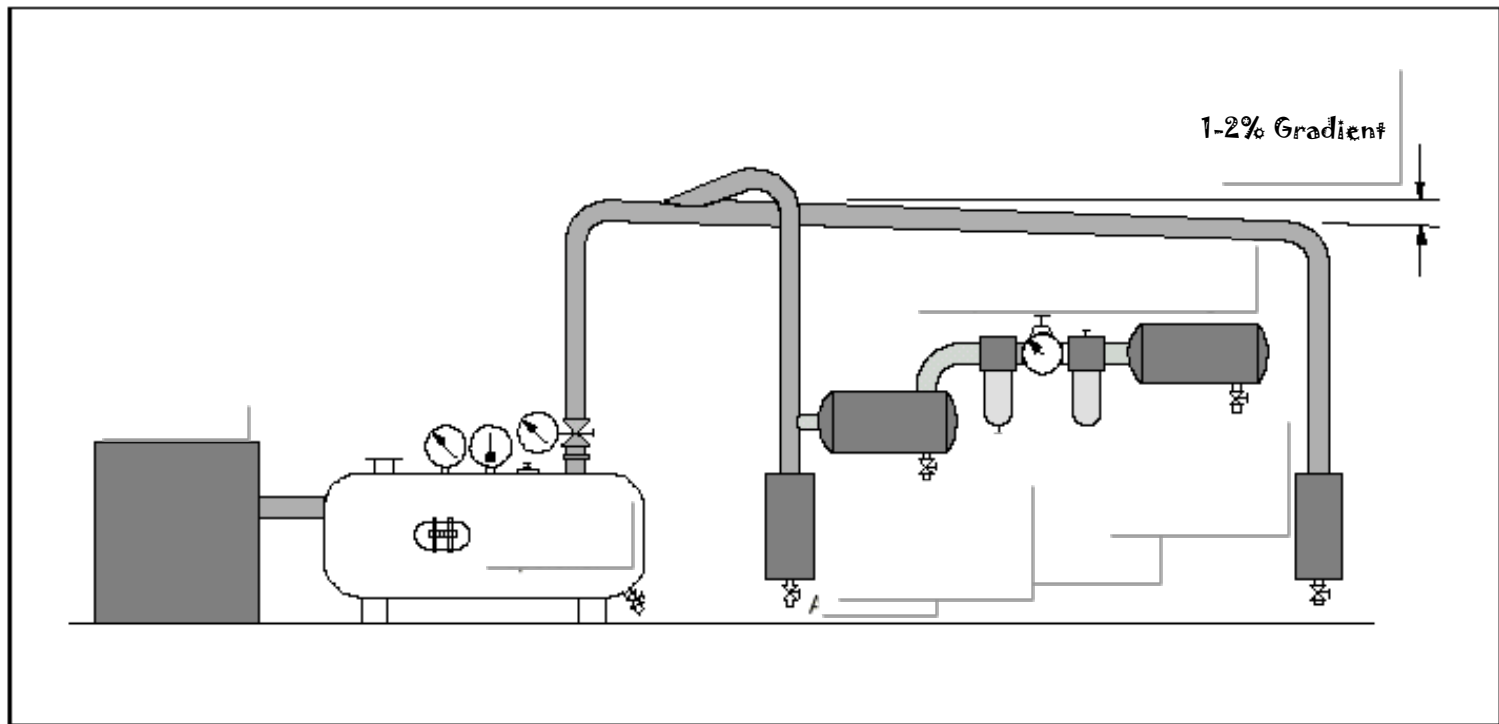
i.e. longer length \uparrow diameter \uparrow *

otherwise, pressure drop is high

- **Pressure Drop**

Permissible pressure drop between receiver and user should not be more than 0.1 bar

Air Distribution

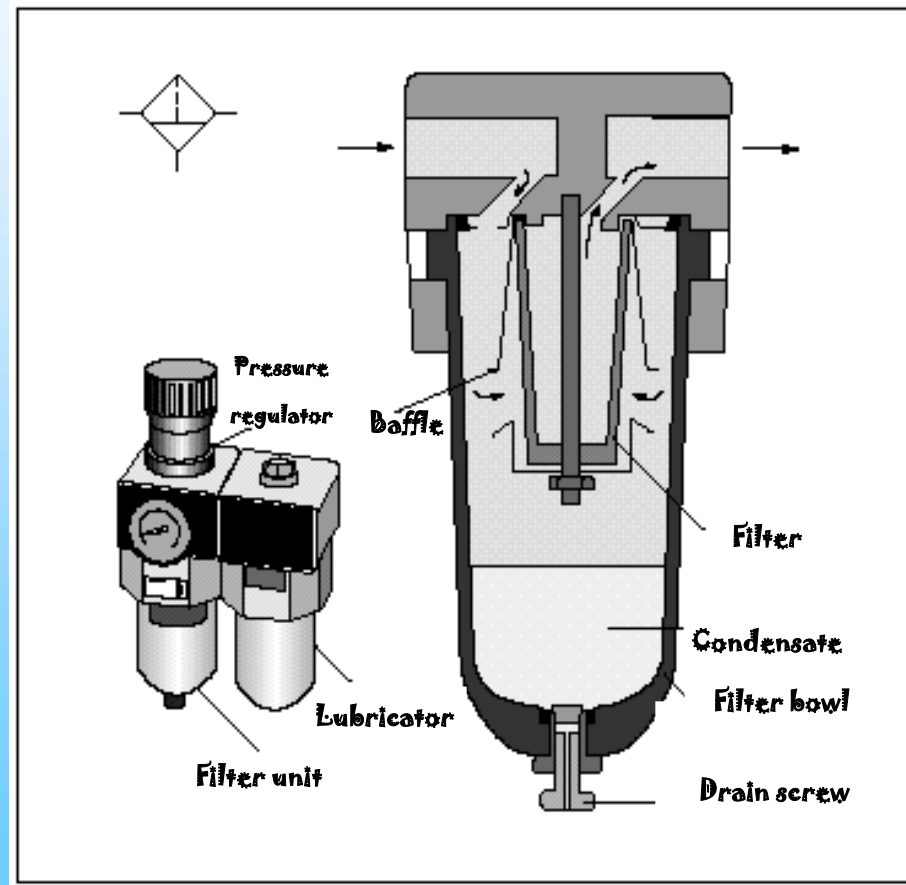


Air Service Unit (Unit Pelayanan Udara)

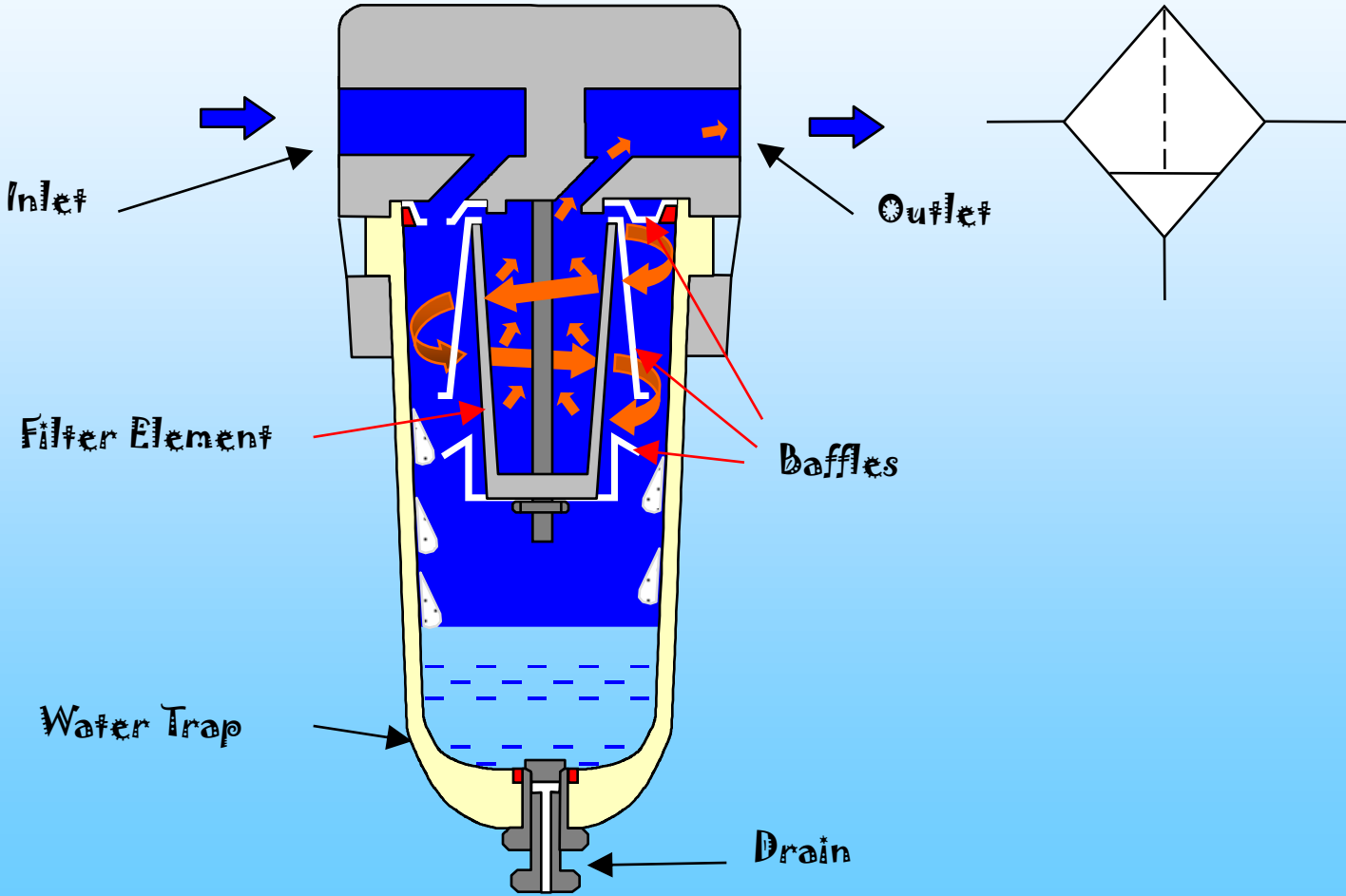
Filter udara digunakan untuk

- Mencegah partikel debu masuk ke dalam sistem
- Memisahkan kondensasi akibat udara bertekanan

Air Filter



Air Filter

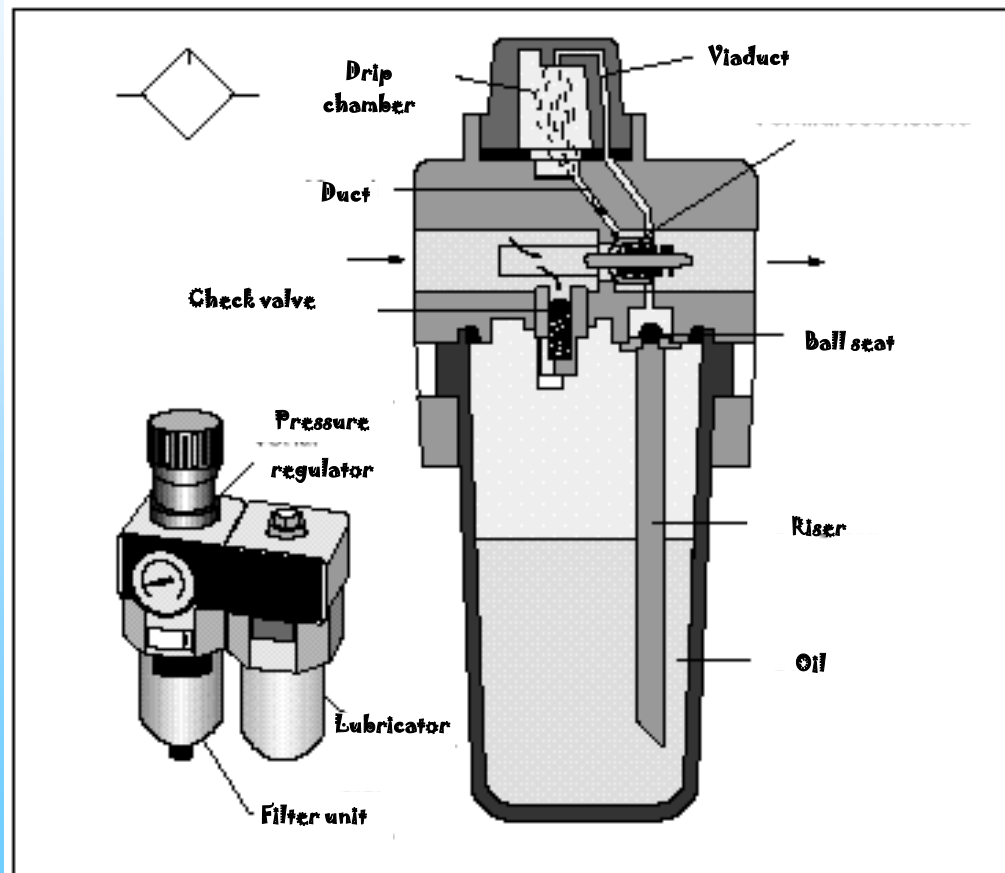


Air Lubricator

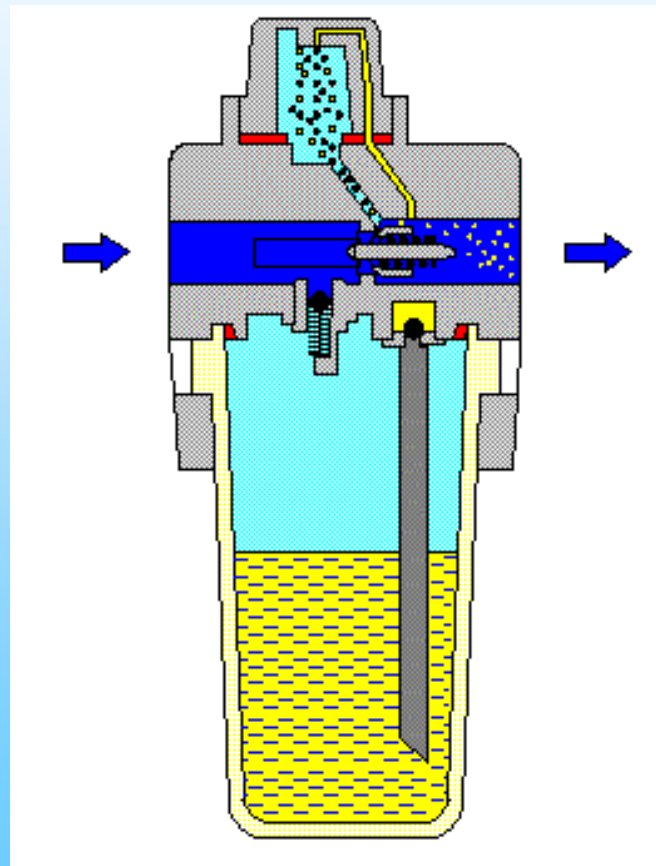
Air Lubricator digunakan

- Untuk gerakan silinder yang sangat cepat
- Silinder yang berdiameter besar ($> 125\text{mm}$)

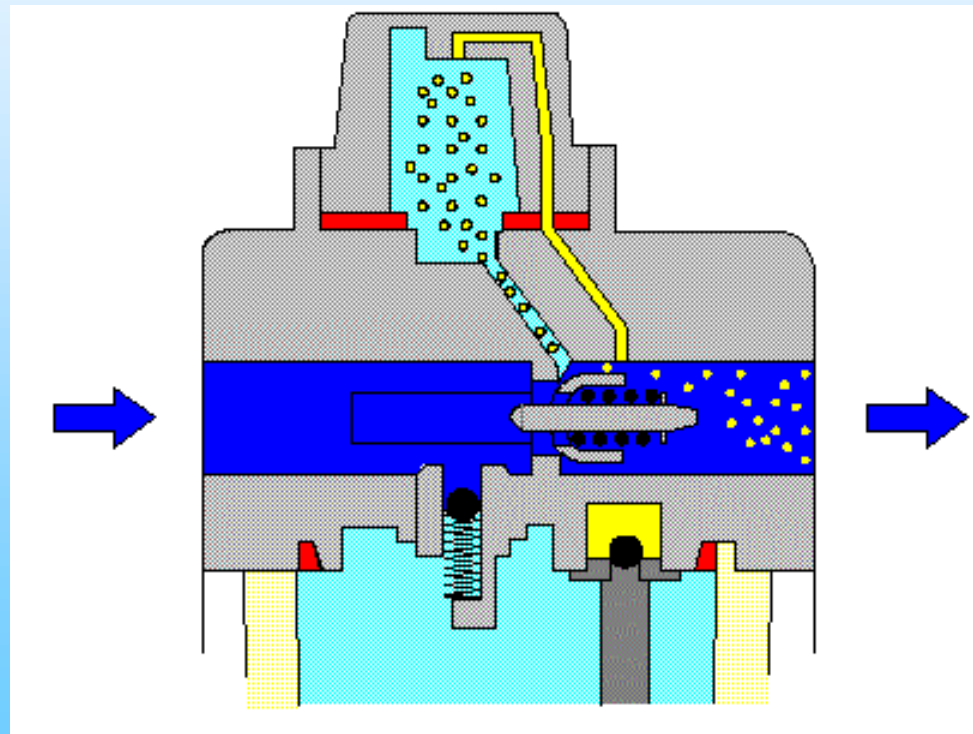
Air Lubricator



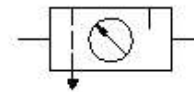
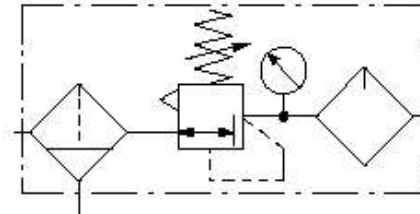
Air Lubricator



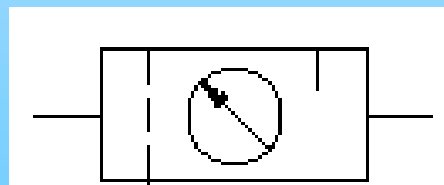
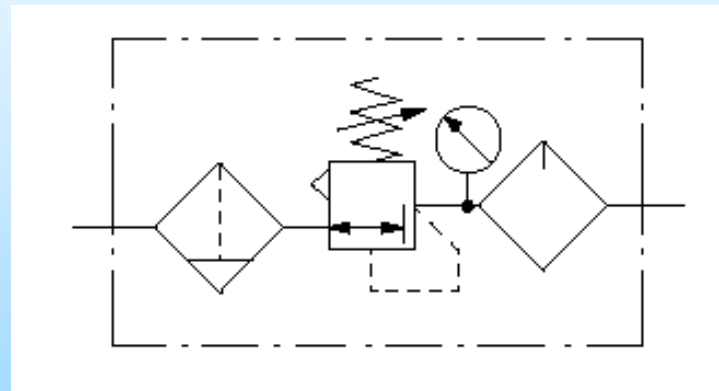
Air Lubricator



Air Service Unit (Unit Pelayanan Udara)



Simbol Unit Pelayanan Udara



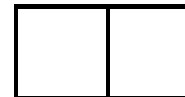
KATUP KONTROL ARAH

Symbol Development

Each valve switching position is represented by a square.



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



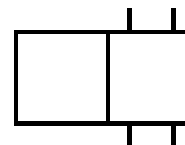
Lines indicate the flow path, arrows show the direction of flow.



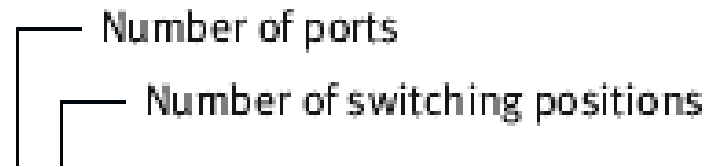
Shut-off positions are identified in the boxes by lines drawn at right angles.



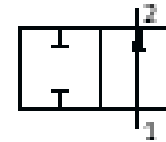
The connections (inlet and outlet ports) are shown by lines on the outside of the box.



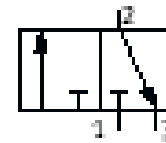
Ports and Positions



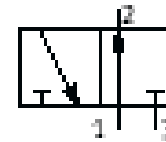
2/2-way valve, normally open position



3/2-way valve, normally closed position

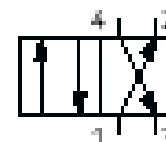


3/2-way valve, normally open position



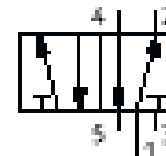
4/2-way valve

flow from 1 → 2 and from 4 → 3

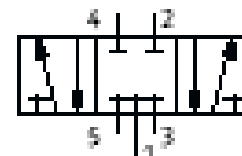


5/2-way valve

flow from 1 → 2 and from 4 → 5



5/3-way valve, mid-position closed



Metoda Aktuasi



MANUAL



General



Push Button



Lever



Pedal



Detent

MECHANICAL



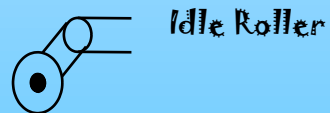
Spring



Button

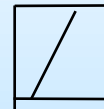


Roller

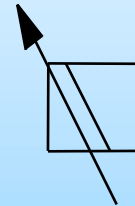


Idle Roller

ELECTRICAL

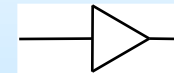


Solenoid



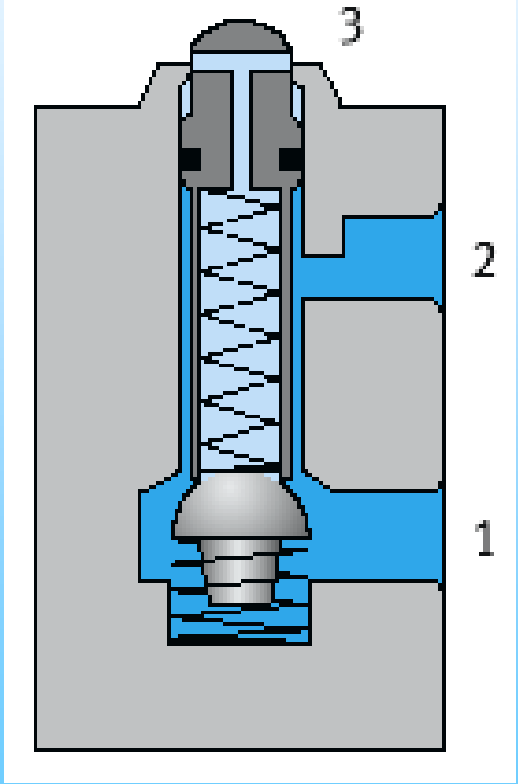
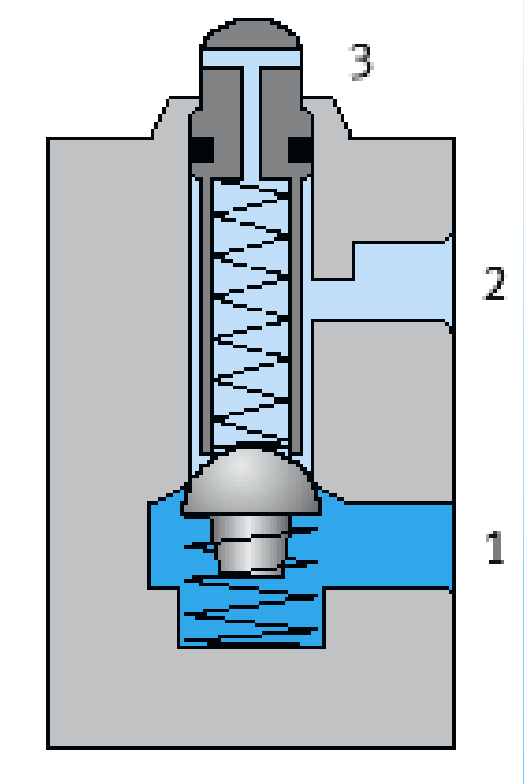
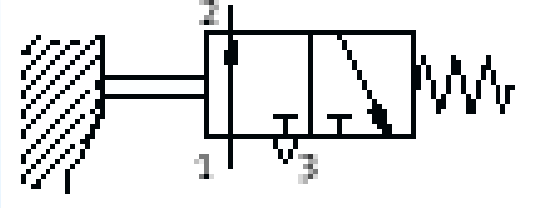
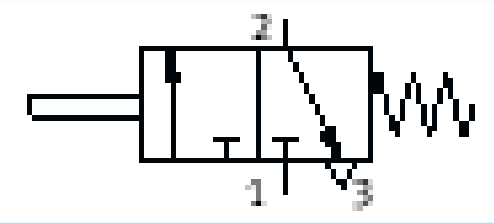
Proportional Solenoid

PNEUMATIC

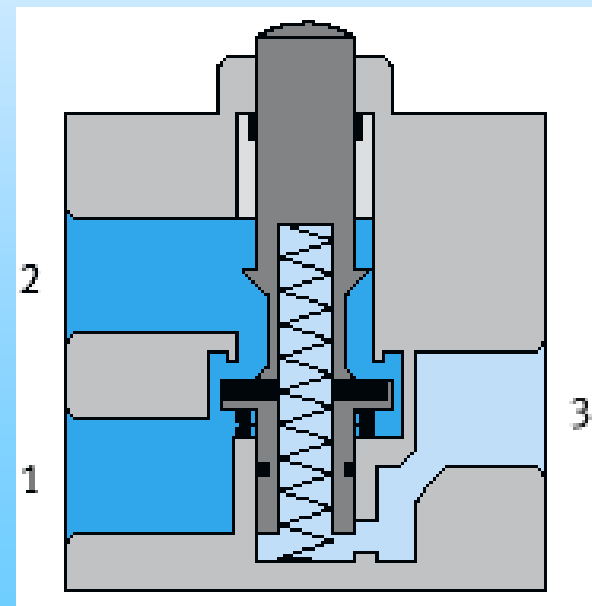
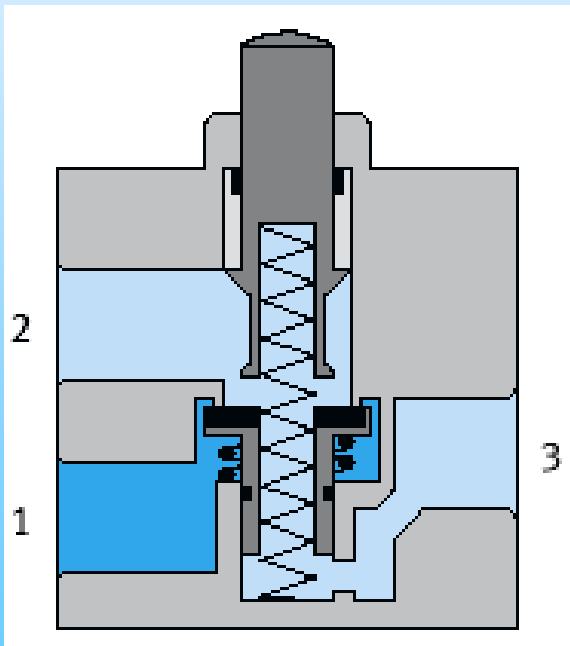
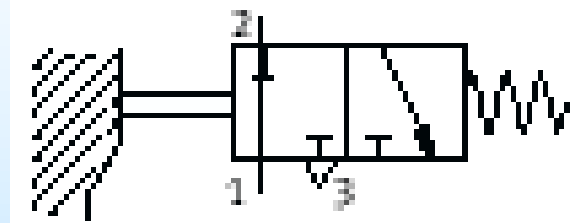
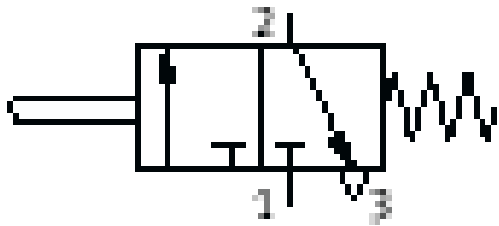


Pneumatic

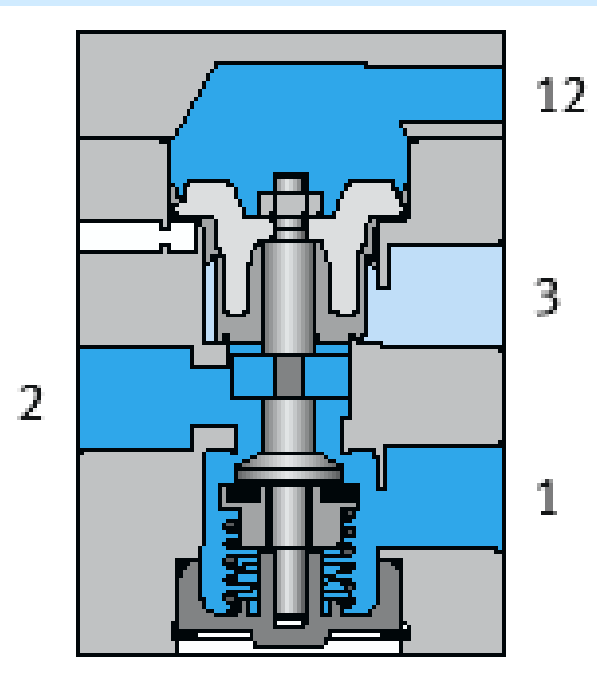
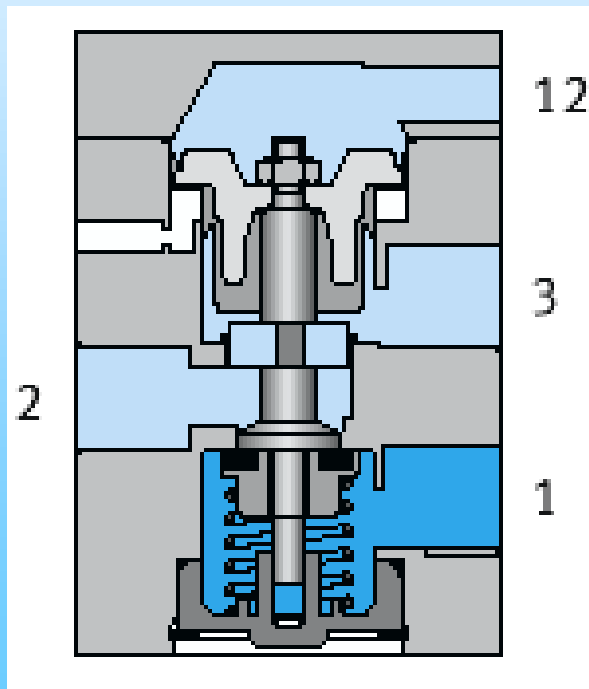
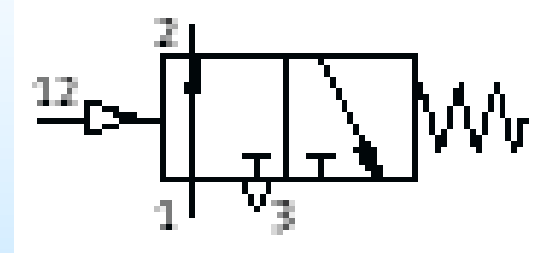
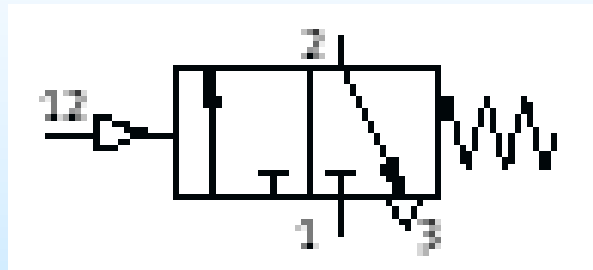
Katup 3/2 normal tertutup „Ball Seat“



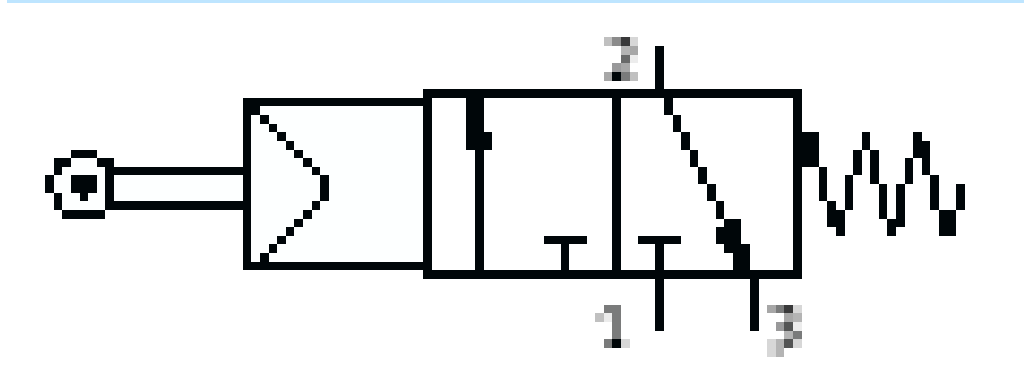
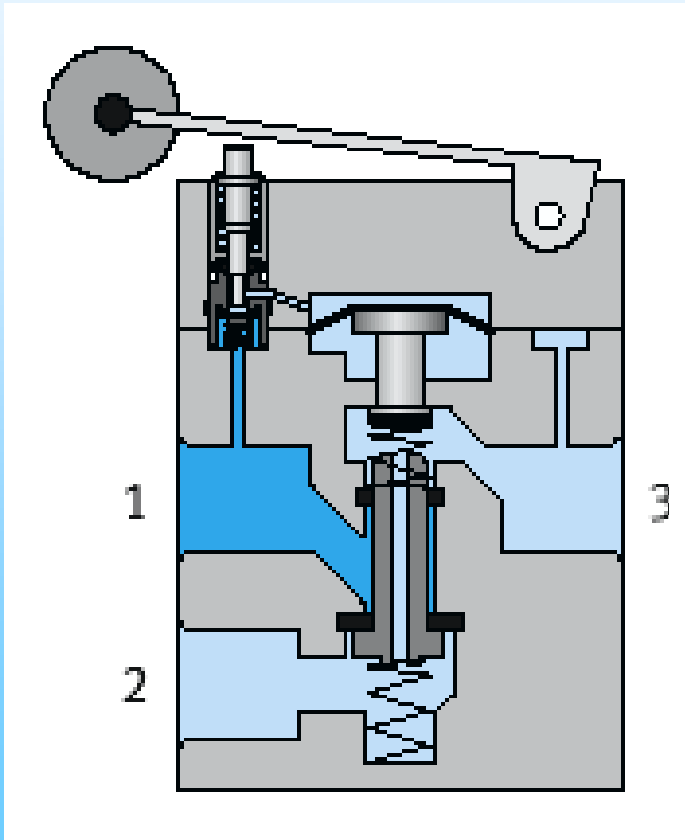
Katup 3/2 normal tertutup „Disk Seat“



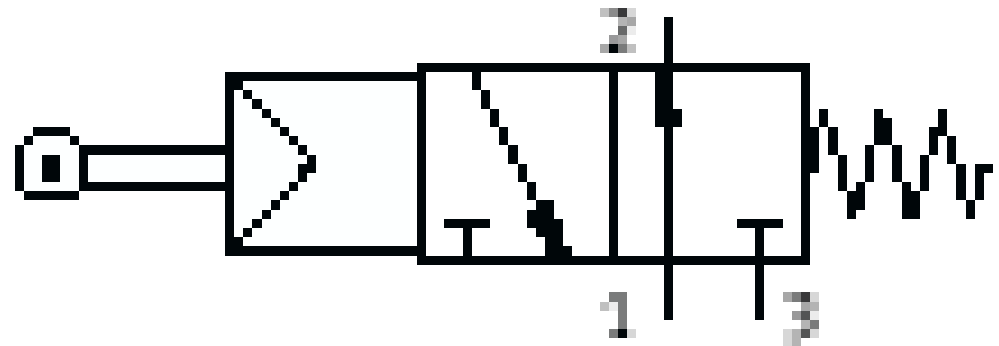
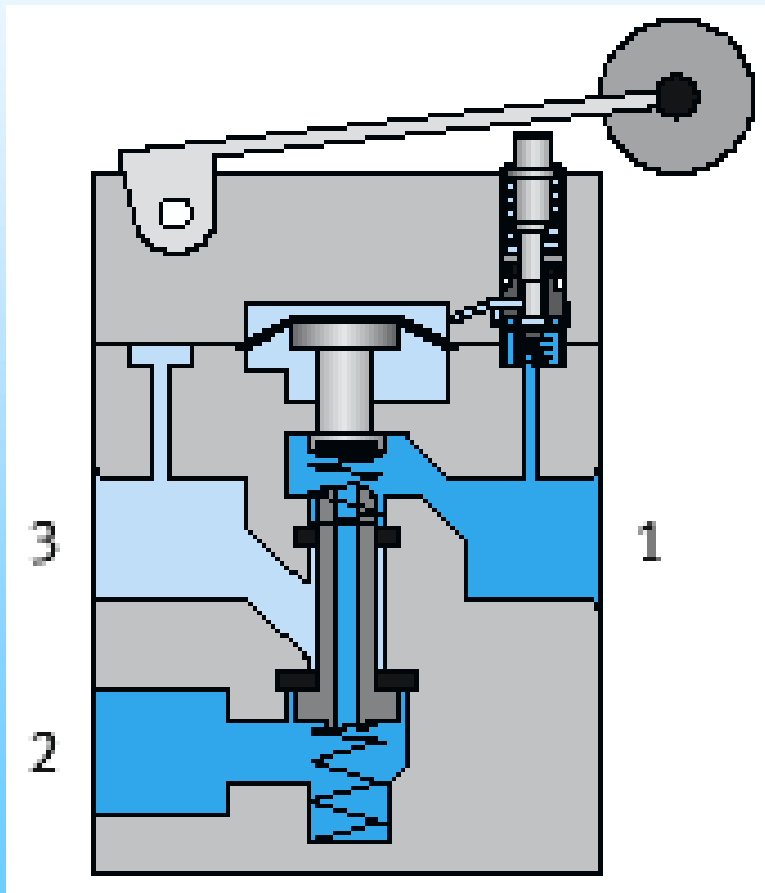
Katup 3/2 normal tertutup „single pilot pneumatic“



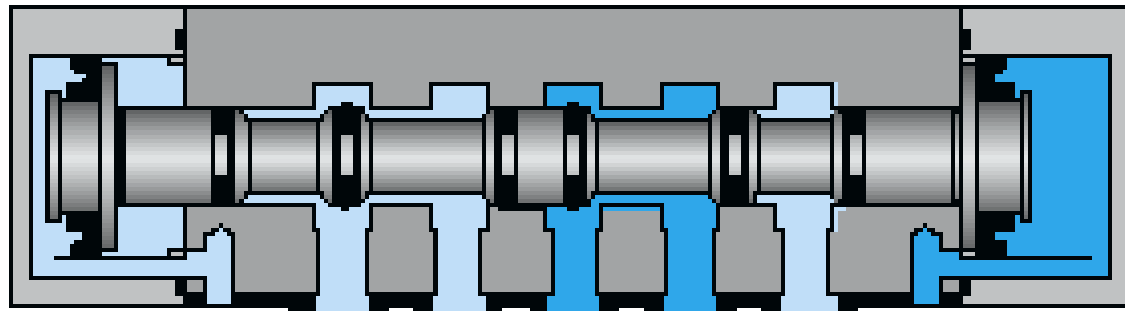
Katup 3/2 normal tertutup aktuator maju dengan roller pilot aktuator mundur dengan pegas



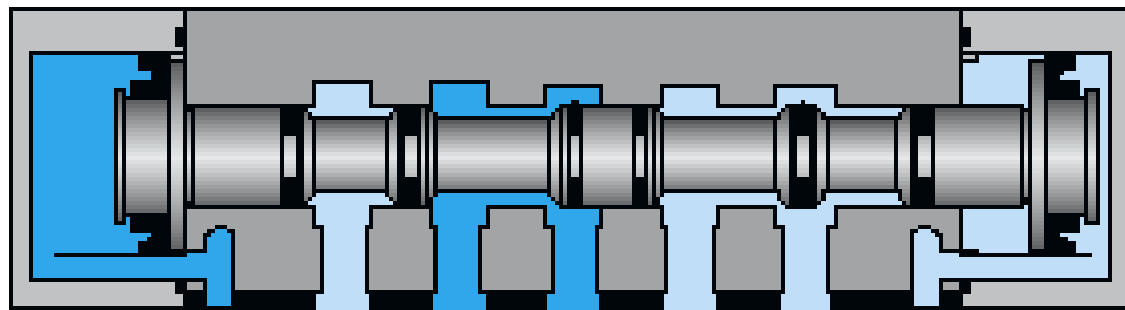
Katup 3/2 normal terbuka aktuator maju dengan roller pilot aktuator mundur dengan pegas



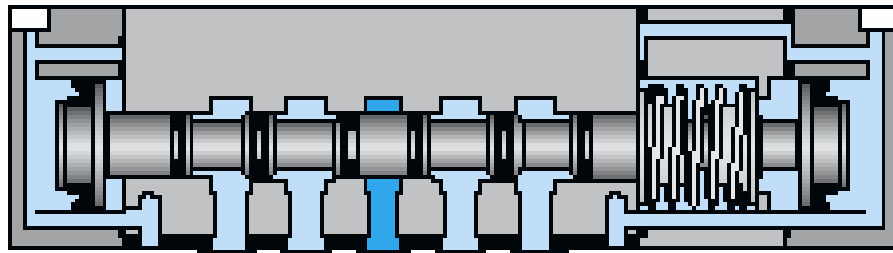
Katup 5/2 „double pilot pneumatic“



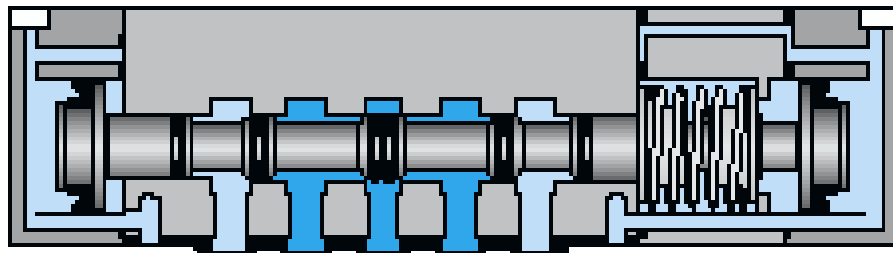
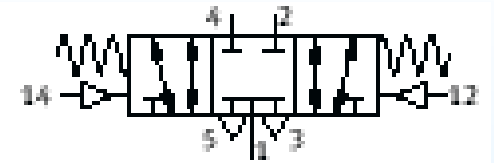
14 5 4 1 2 3 12



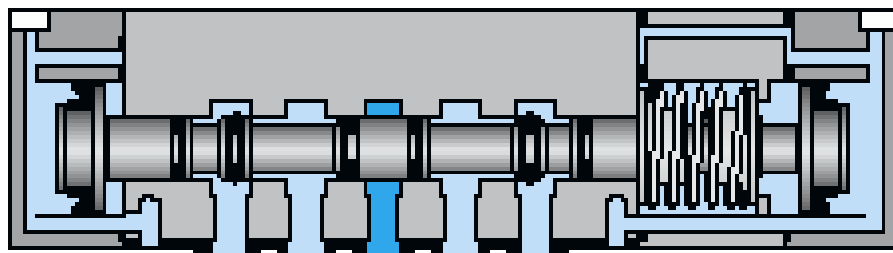
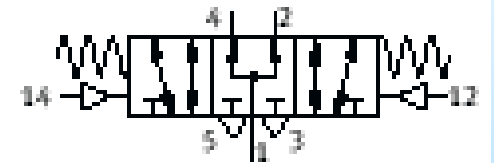
14 5 4 1 2 3 12



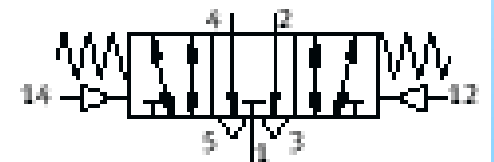
14 5 4 1 2 3 12



14 5 4 1 2 3 12

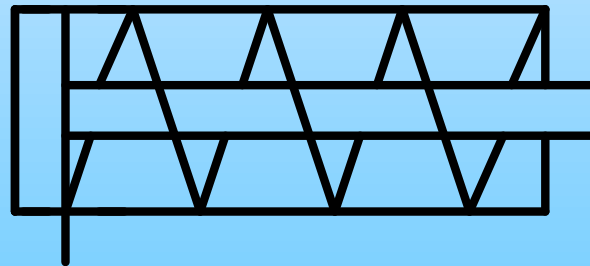
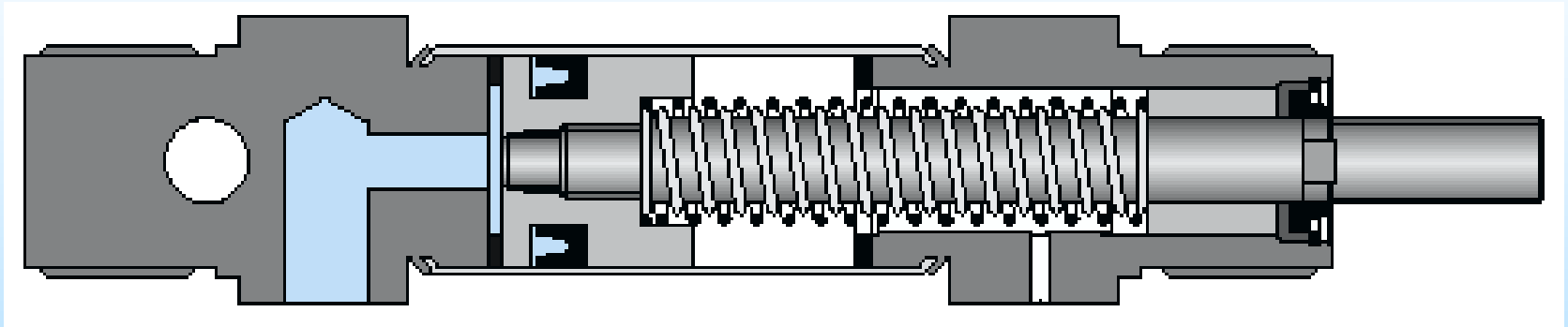


14 5 4 1 2 3 12

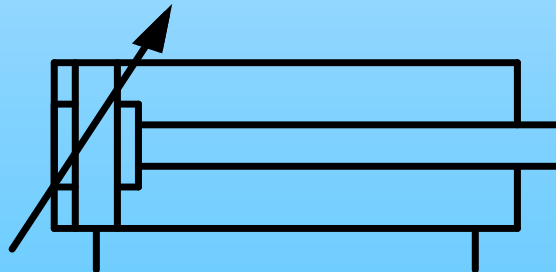
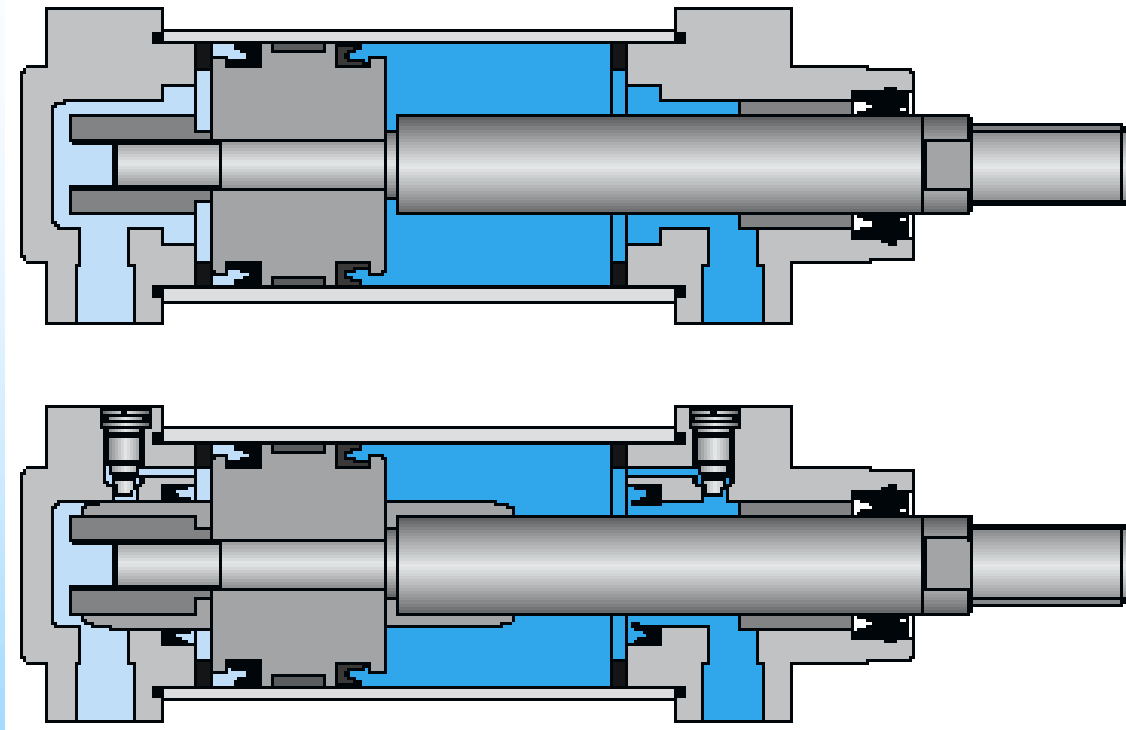


AKTUATOR

Silinder Kerja Tunggal

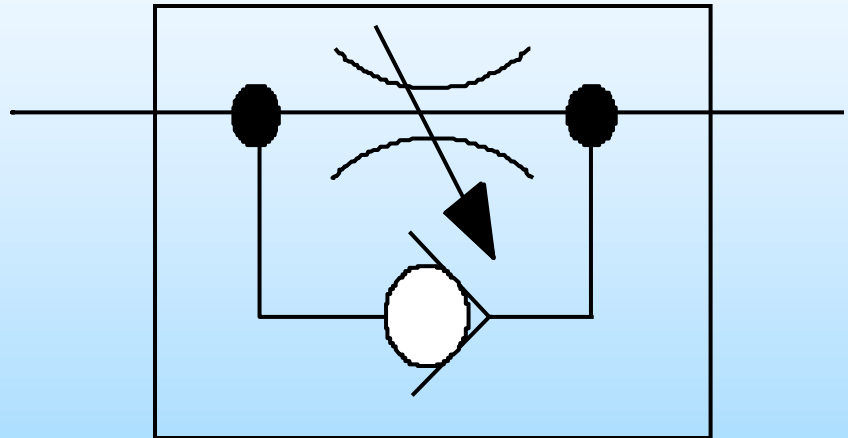
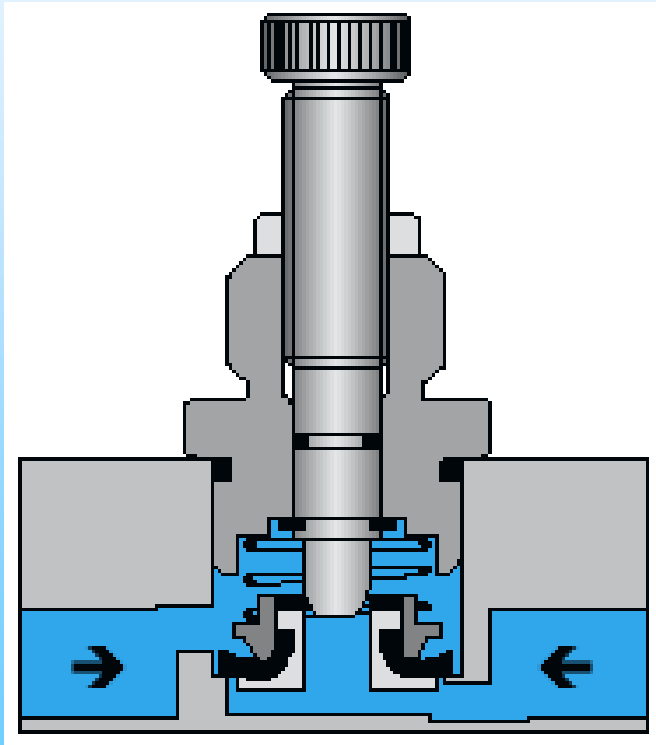


Silinder Kerja Ganda

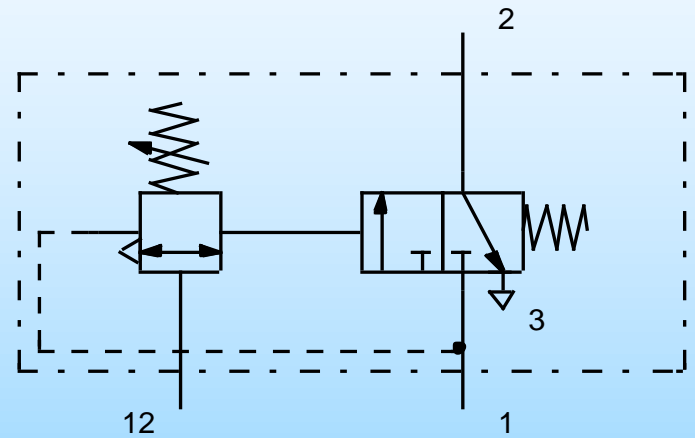
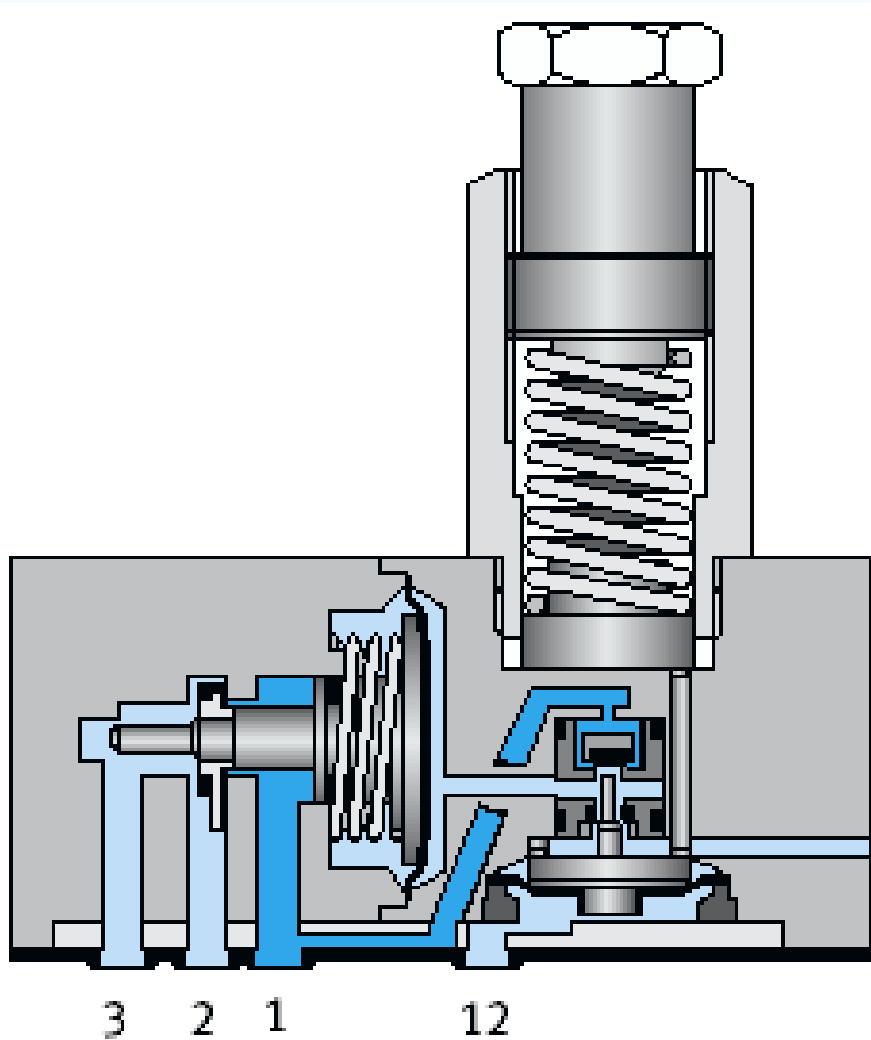


NON-RETURN VALVE

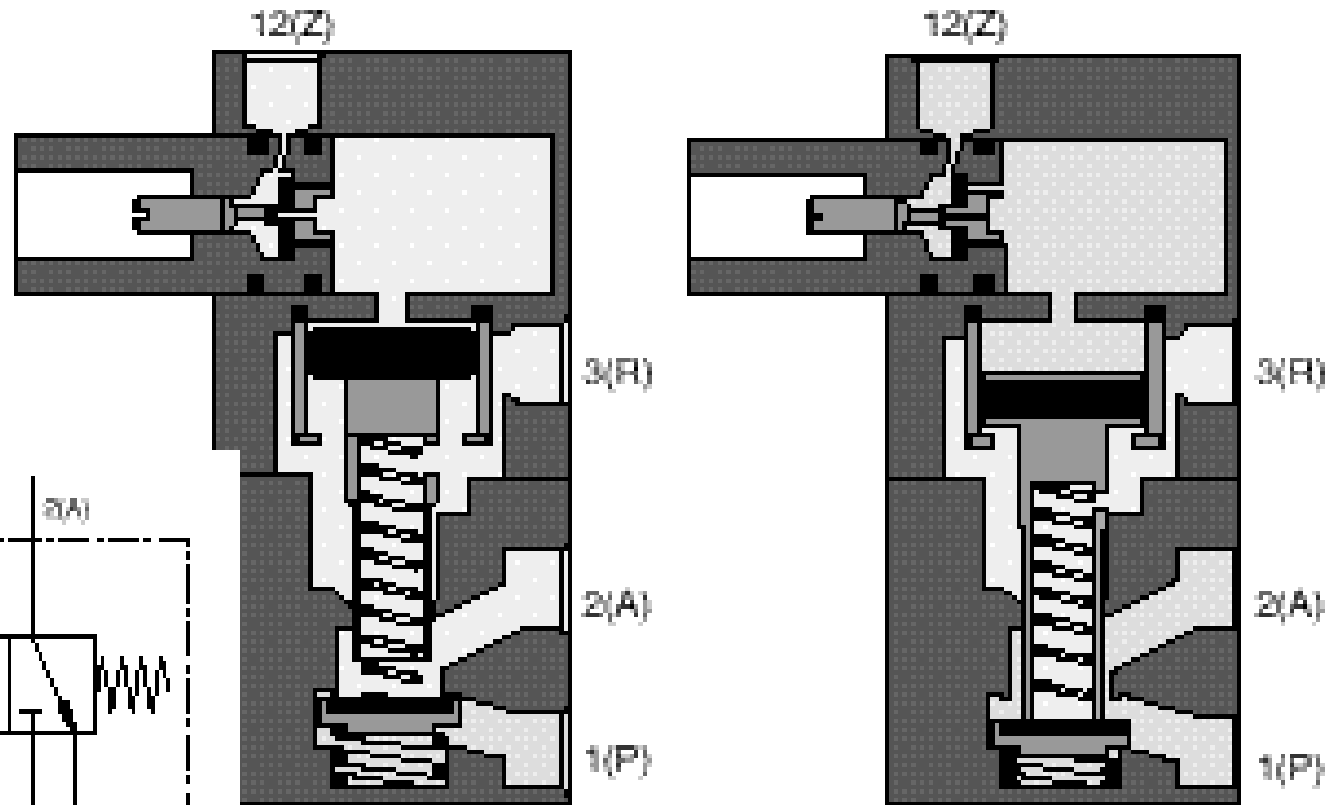
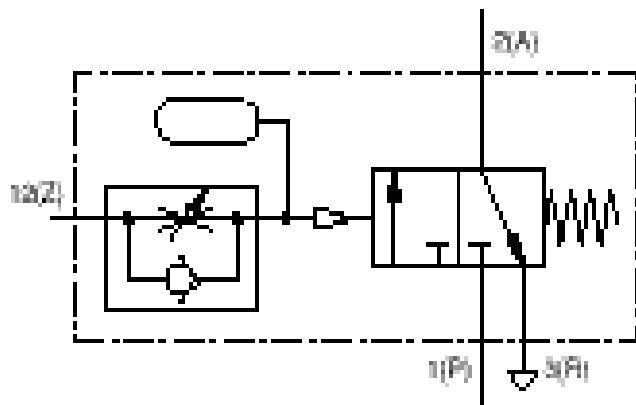
One-Way Flow Control Valve



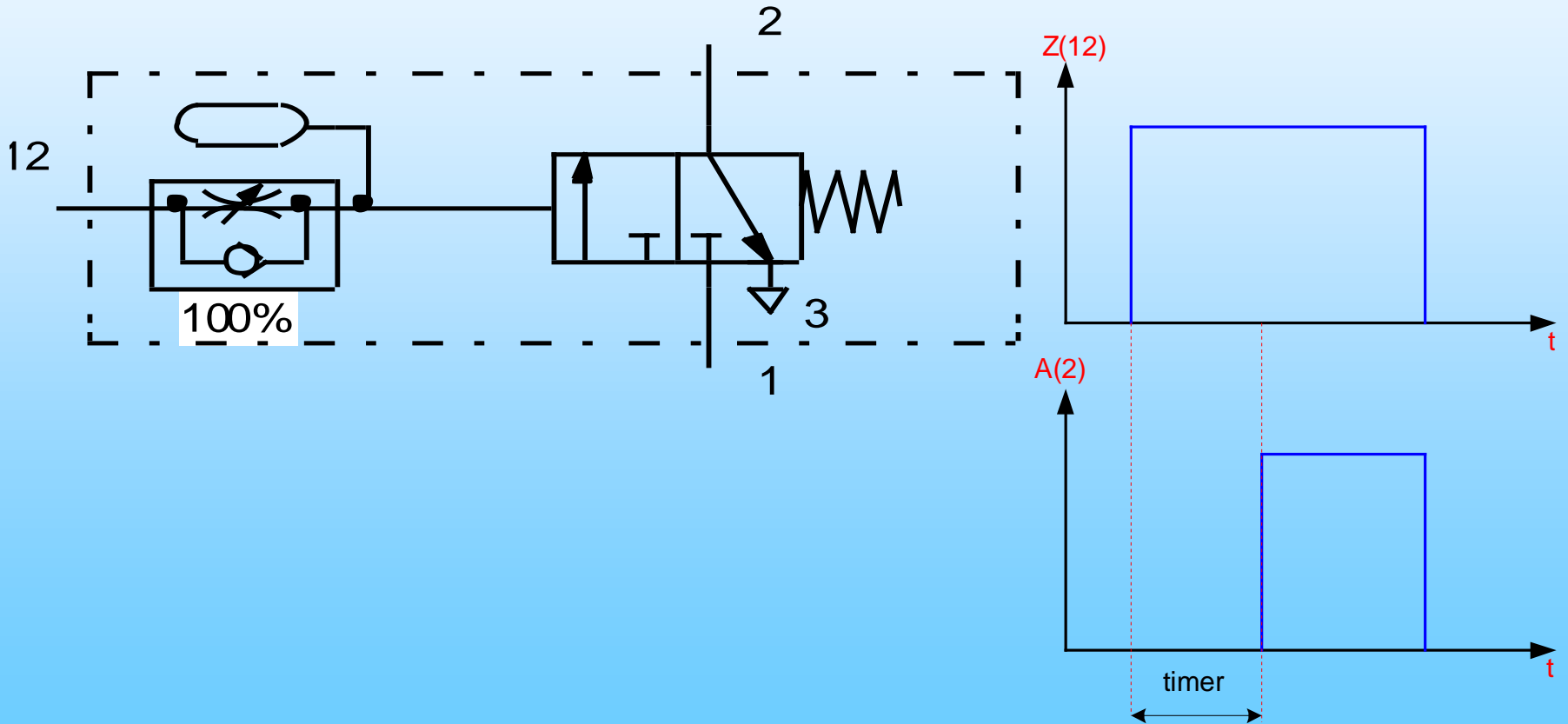
Pressure Sequence Valve



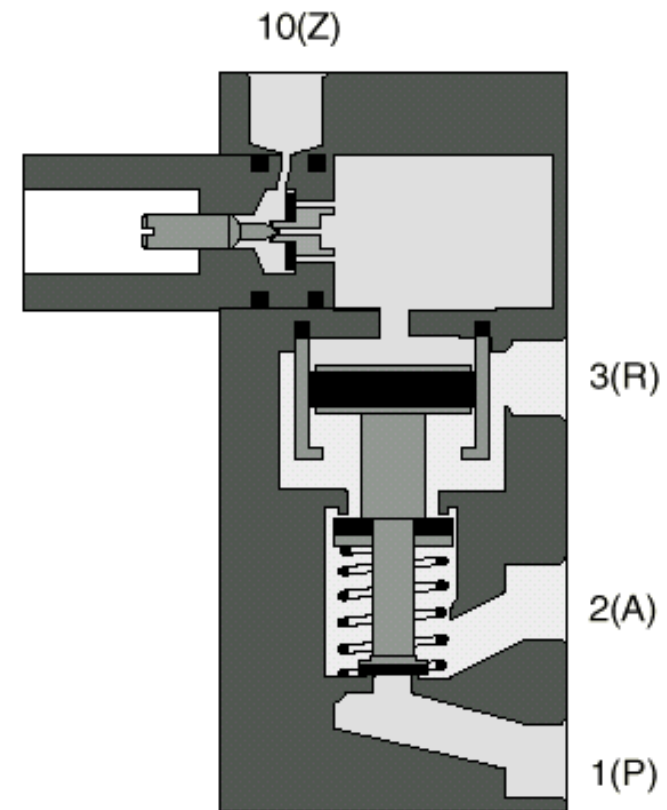
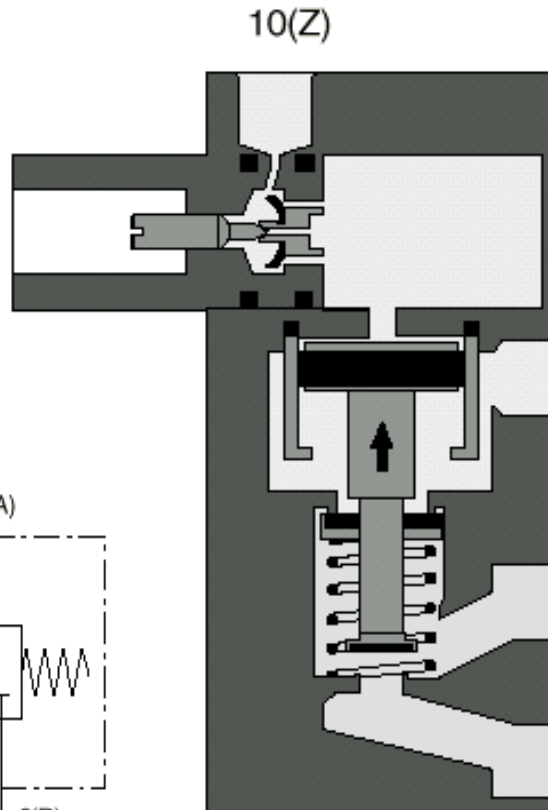
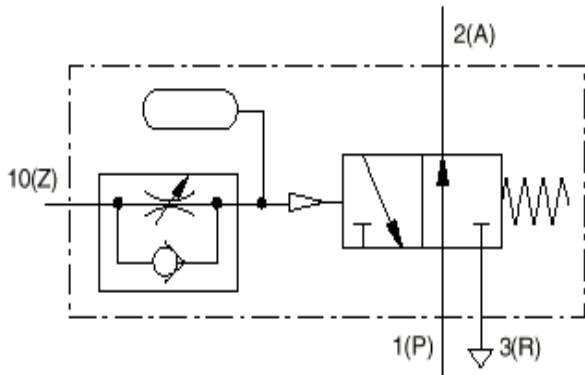
Time Delay Valve Normally Closed



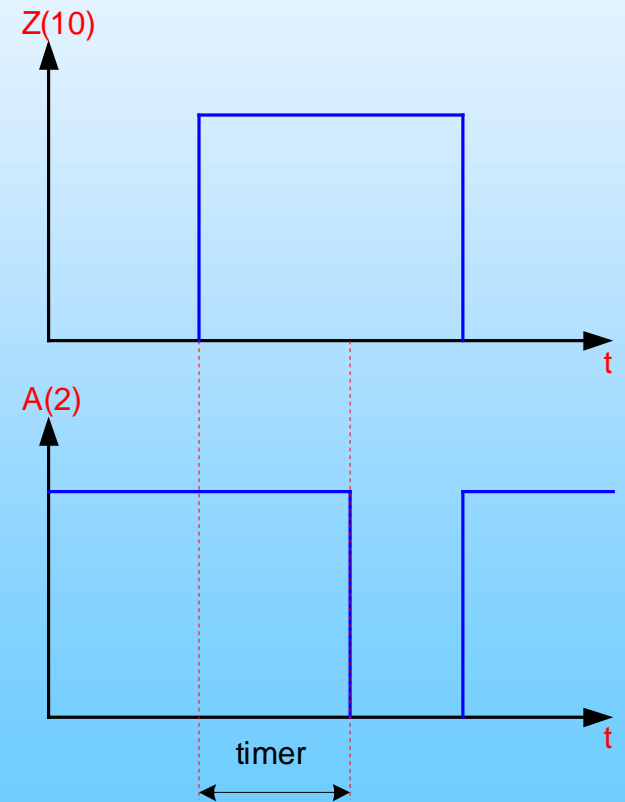
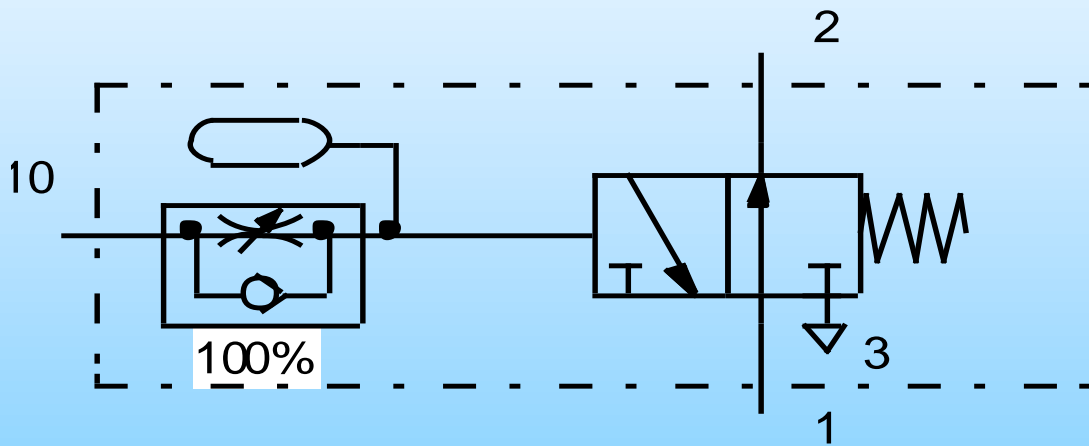
Time Delay Valve Normally Close



Time Delay Valve Normally Open



Time Delay Valve Normally Open



Thankyou!