



**Conceptos básicos, elementos y
esquemas**

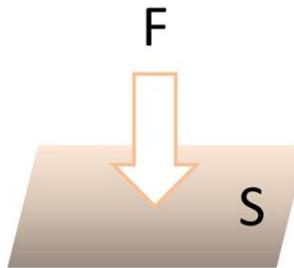
AUTOMATIZACIÓN NEUMÁTICA

Magnitudes y Diferencias

Presión (P)

Representa la fuerza (F) ejercida sobre una superficie (S).

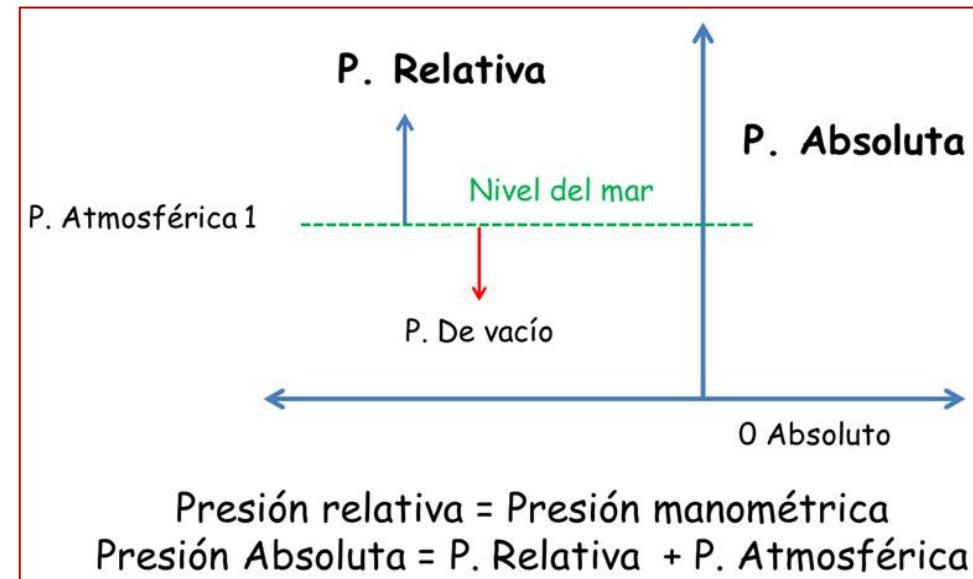
$$P = \frac{F}{S}$$



La unidad internacional: el pascal (Pa)

Es la presión ejercida por una fuerza de **1 newton** sobre una superficie de **1 metro cuadrado**.

Diferencias entre los tipos de presión.



➤ **Presión atmosférica (Patm):** Presión en la superficie de la Tierra.

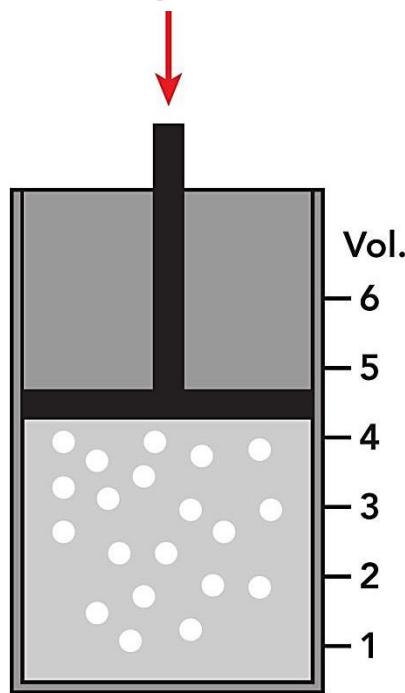
➤ **Presión absoluta (Pa) o (Pabs):** mide la presión por encima de la presión absoluta cero.

➤ **Presión manométrica (Pg) o (Pgauge):** mide la presión por encima de la presión atmosférica.

➤ **Presión de vacío (Pvac):** mide la presión por debajo de la presión atmosférica.

➤ **Presión diferencial (dp):** es la diferencia entre dos mediciones de presión diferentes.

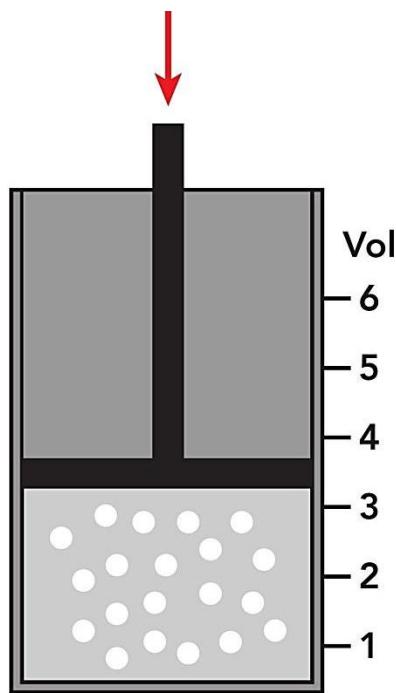
Ley de Boyle - Mariotte



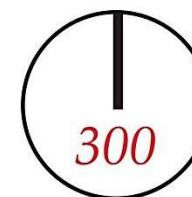
Pressure



Temperature



Pressure



Temperature

El volumen es inversamente proporcional a la presión:

- Si la presión aumenta, el volumen disminuye.
- Si la presión disminuye, el volumen aumenta.

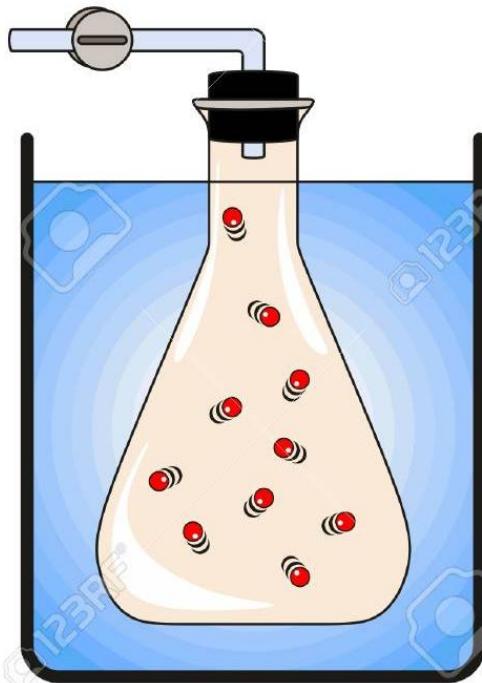
$$P_1 \cdot V_1 = P_2 \cdot V_2; \quad T = \text{Kte}$$

$$pV = k$$

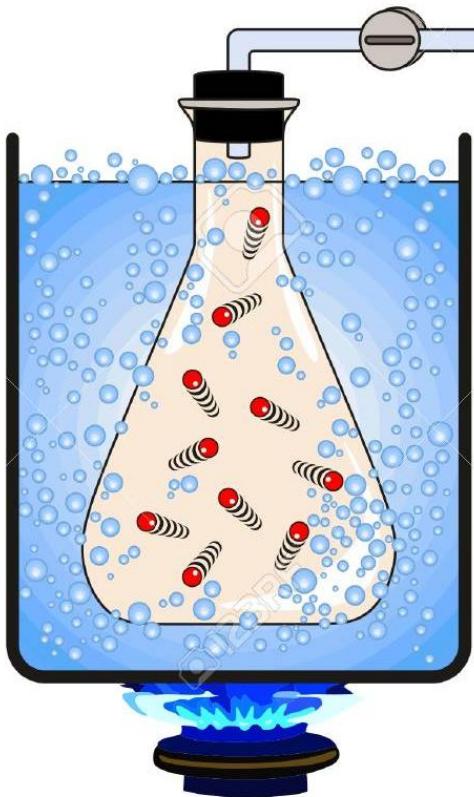
For a given mass, at constant temperature, the pressure times the volume is a constant.

Leyes de Charles - Gay Lussac

It is an ideal gas law where at constant volume, the pressure of an ideal gas is directly proportional to its absolute temperature (Kelvin).



Cold Water



Boiling Water

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

= Constant, when the volume is kept constant.

La presión del gas es directamente proporcional a su temperatura:

- Si aumentamos la temperatura, aumenta la presión.
- Si disminuimos la temperatura, disminuye la presión.

$$P_1 / T_1 = P_2 / T_2; \quad V = Kte$$

Complemento Charles: <https://www.youtube.com/watch?v=1ZduXmVPe1I>

Complemento Gay Lussac: https://www.youtube.com/watch?v=OJ9_mgkwZAk

Ecuación de los gases perfectos

La ecuación de los gases ideales, también conocida como la ley de los gases ideales, relaciona la presión, el volumen, la cantidad en moles y la temperatura de un gas.

$$PV = nRT$$

donde:

P: presión del gas.

V: volumen del gas.

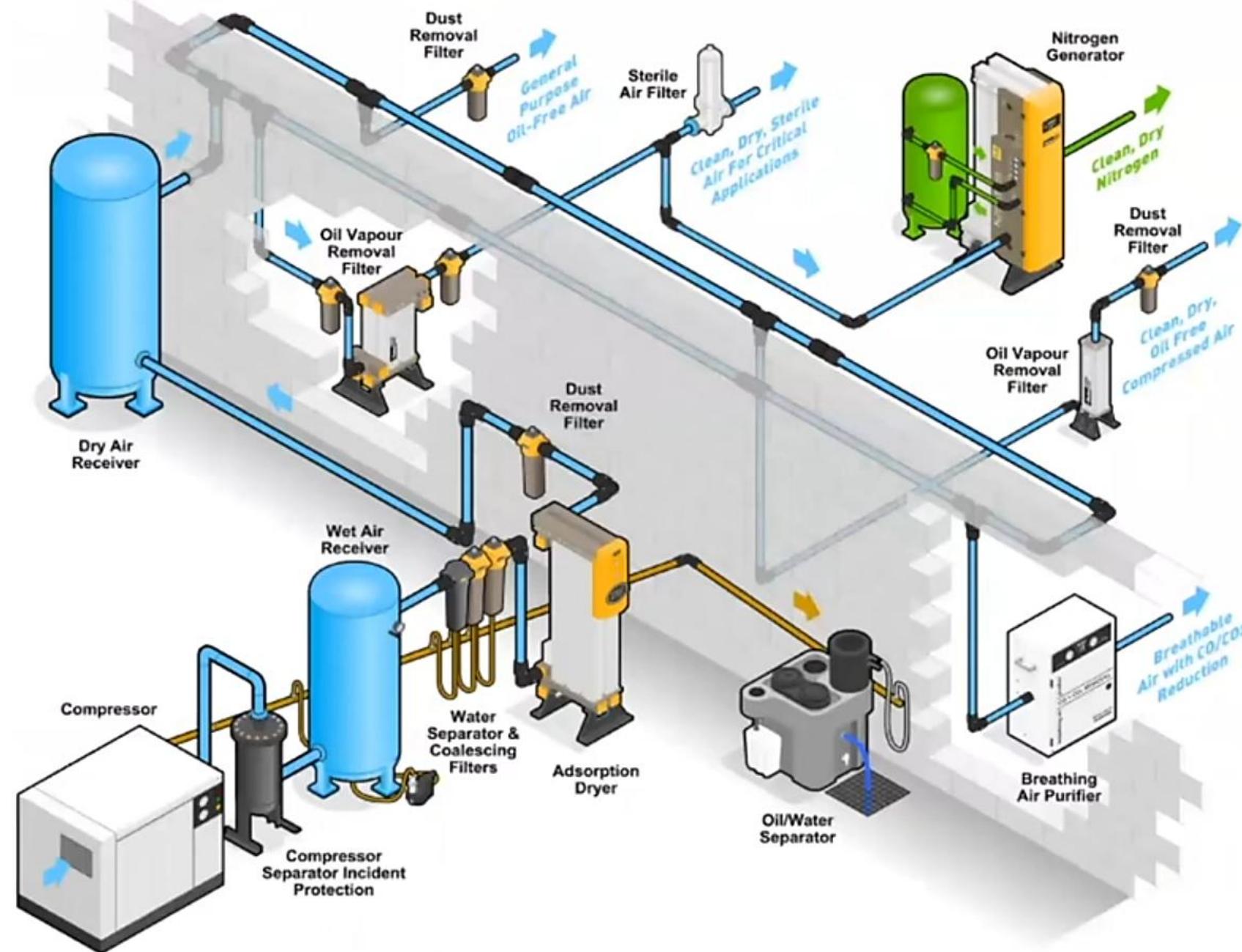
n: cantidad de sustancia del gas en moles.

R: constante universal de los gases ideales.

T: temperatura absoluta del gas.

Esta ecuación es una herramienta fundamental en física y química para describir el comportamiento de los gases en diversas condiciones. Es importante recordar que esta ecuación se aplica a gases ideales, que son modelos teóricos que simplifican el comportamiento de los gases reales, especialmente a bajas presiones y altas temperaturas.

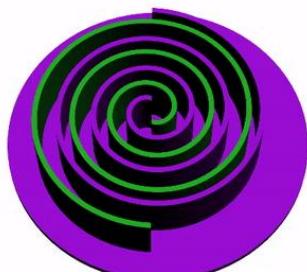
Elementos de una instalación neumática



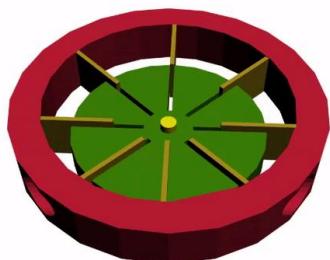
OPTIMIZED SYSTEM DESIGN

THE QUALITY OF AIR REQUIRED THROUGH A TYPICAL COMPRESSED AIR SYSTEM CAN VARY

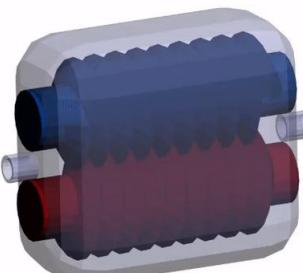
Tipos de Compresores



Scroll



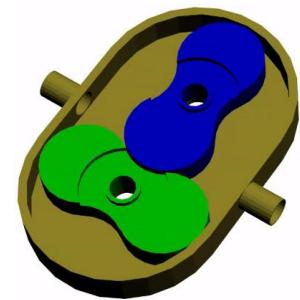
Paletas



Tornillo

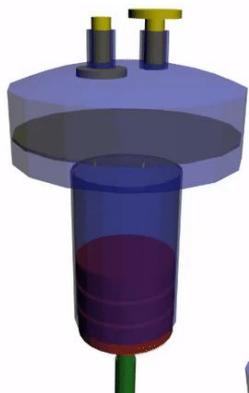


Wankel



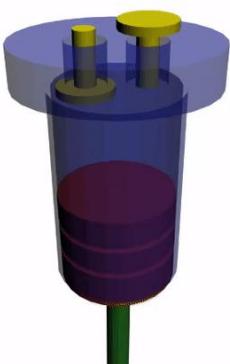
Roots

Membrana

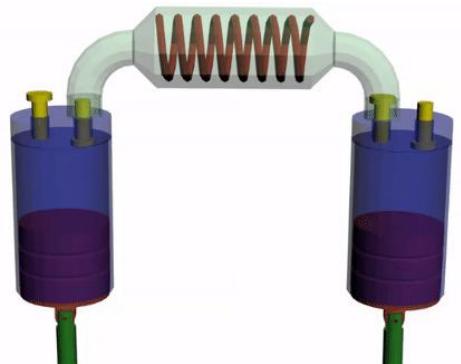


Oscilantes

Pistón



Pistón con Refrigeración



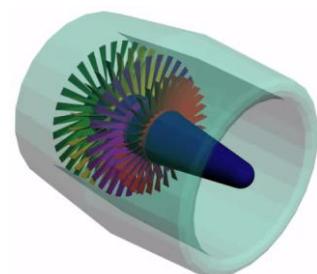
Rotativos

TIPOS DE
COMPRESORES

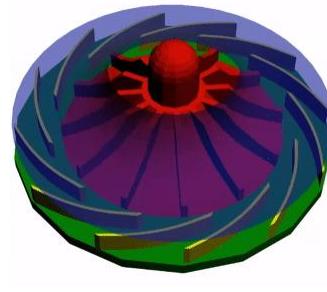
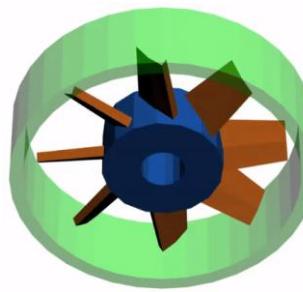
Dinámicos

Axial

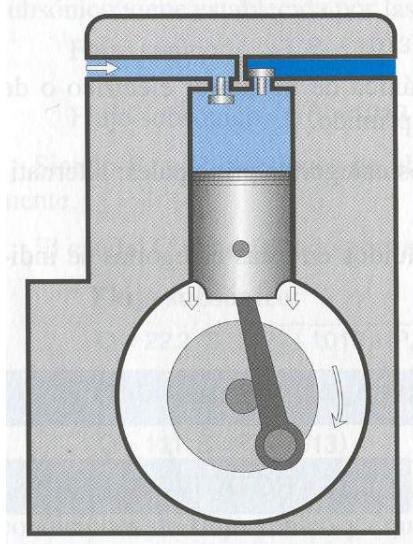
Turbo-compresor



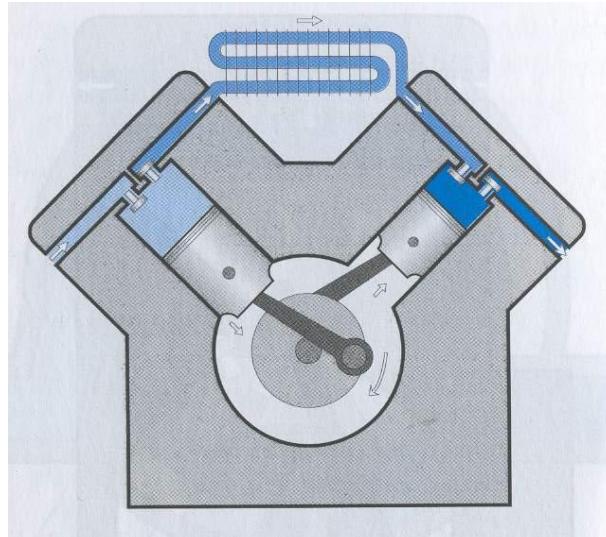
Radial



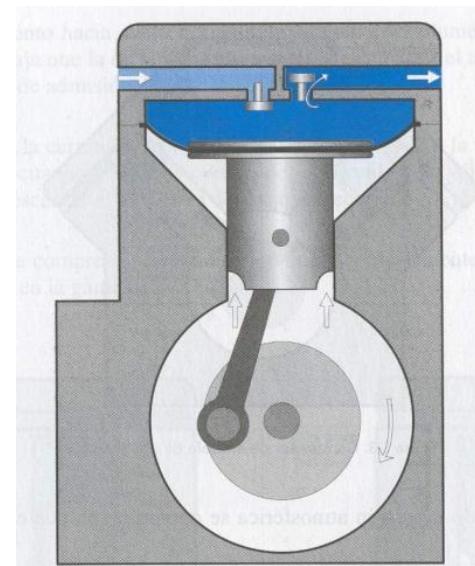
Compresores alternativos



Compresor de pistón de una etapa

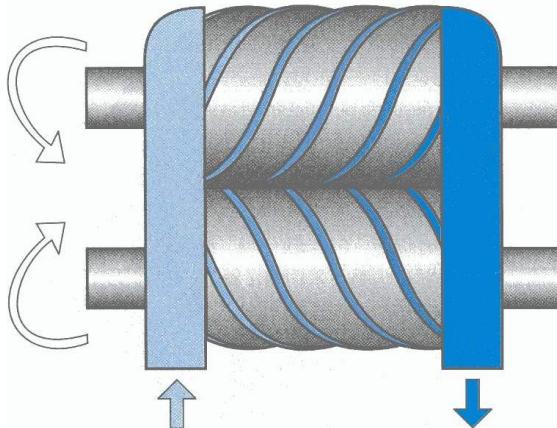
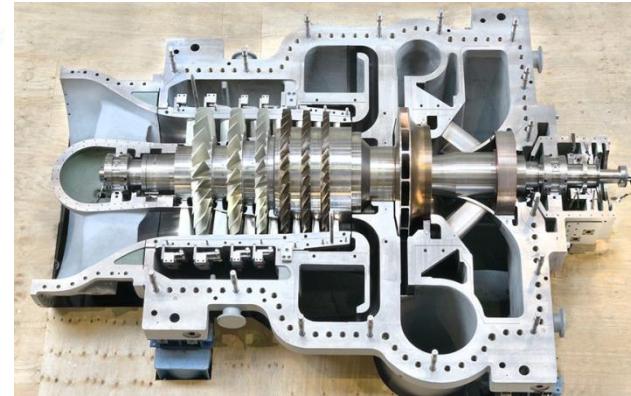
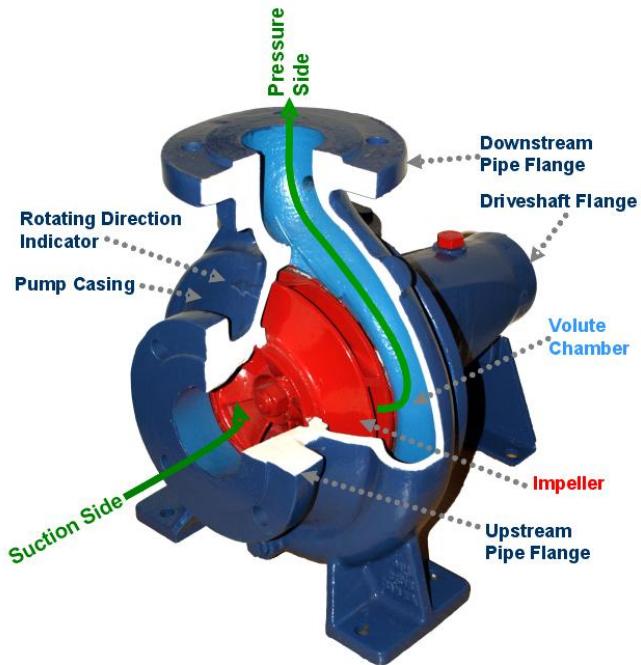


Compresor de pistón de dos etapas

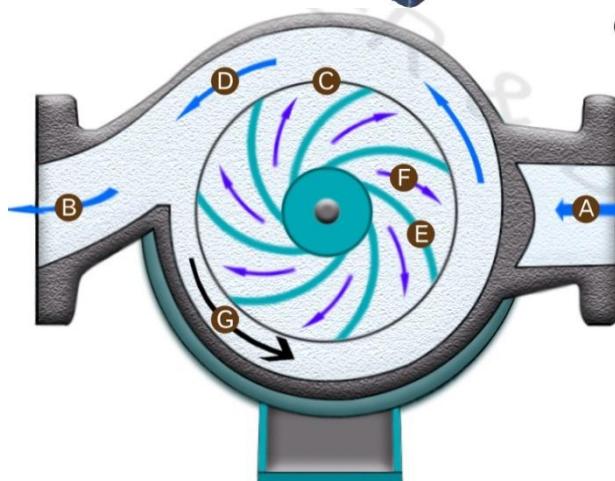


Compresor de diafragma

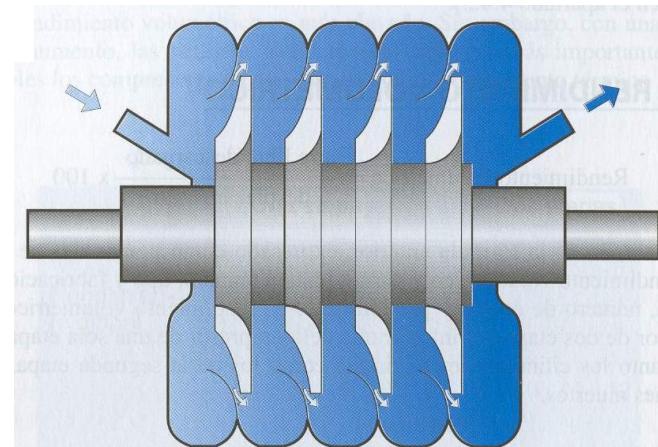
Compresores rotativos



Compresor de tornillo

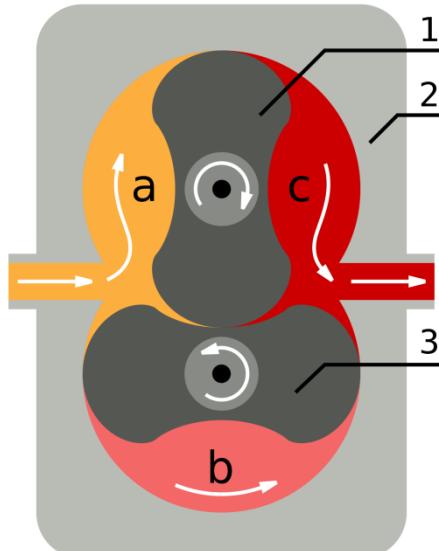
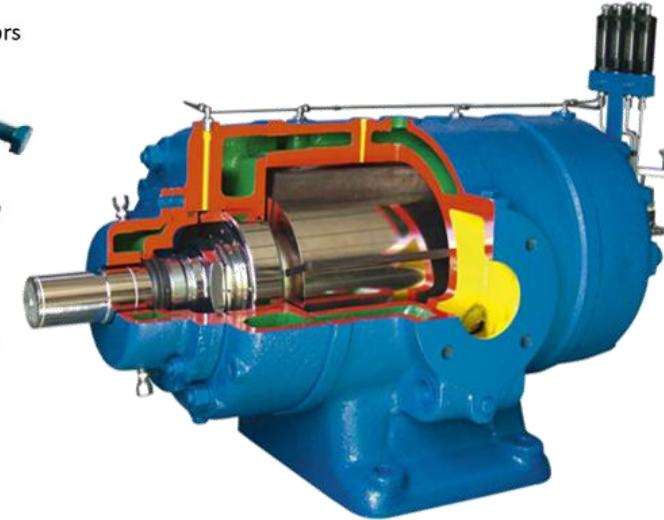
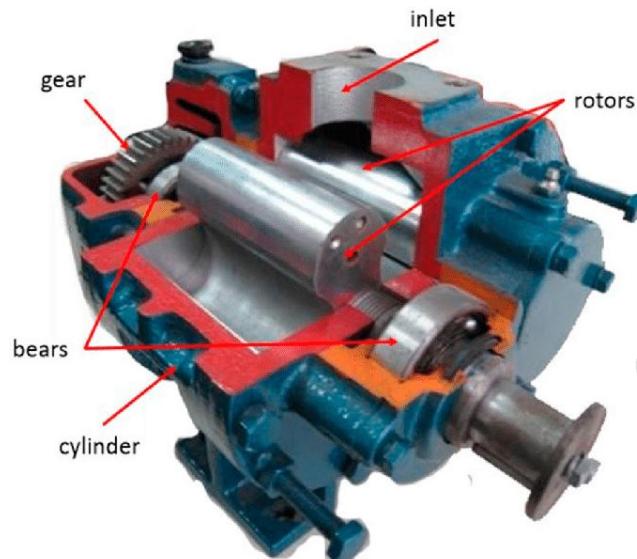


compresor radial



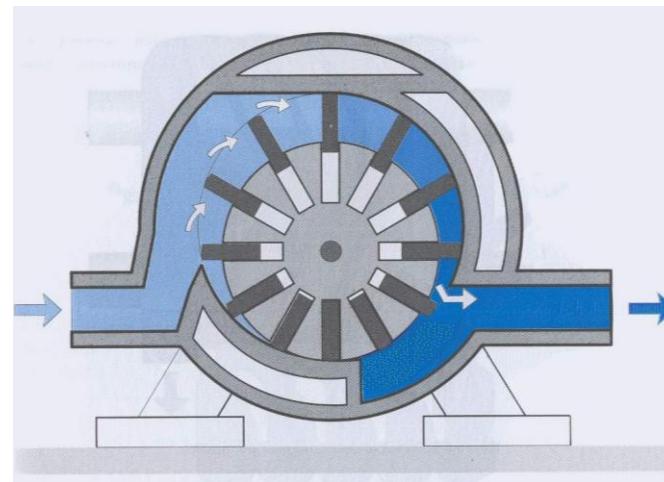
Turbo compresor axial

Compresores rotativos-compuestos



Compresor scroll

Compresor de lóbulos o roots

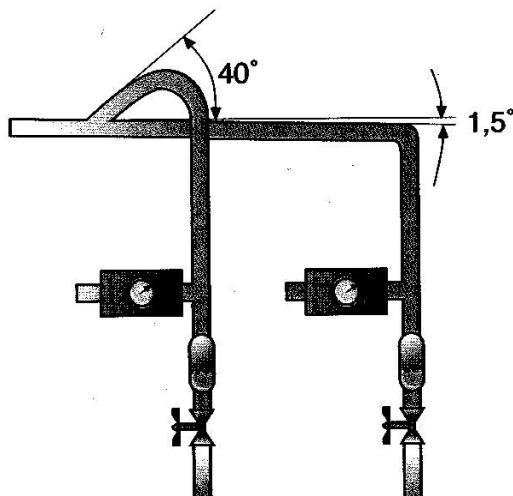
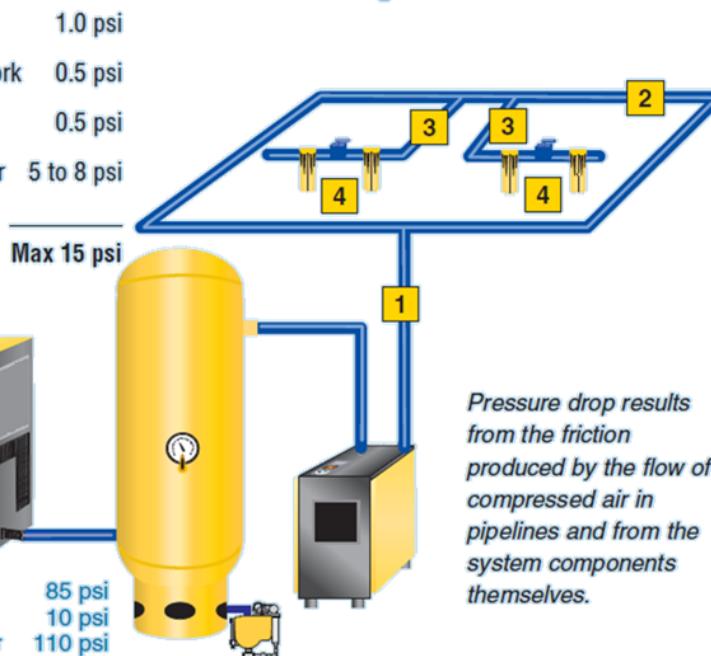


compresor de paletas o vane

Conducto principal en línea abierta

Pressure Drop

1	Main Pipe work	1.0 psi
2	Distribution Pipe work	0.5 psi
3	Connecting Lines	0.5 psi
4	Regulator Lubricator and hose	5 to 8 psi



Red de distribución de aire

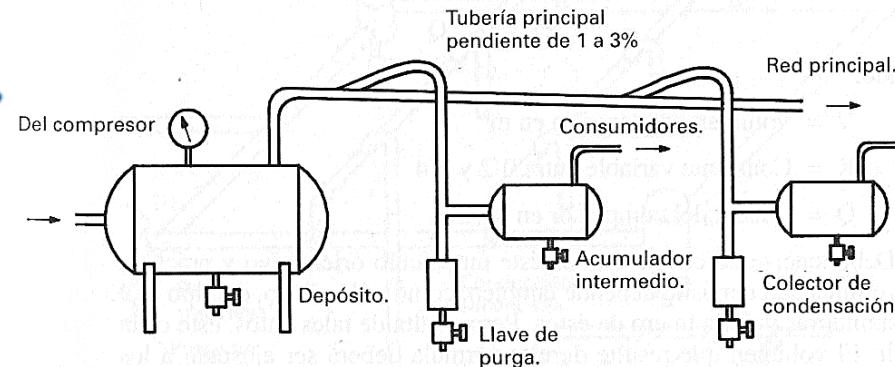
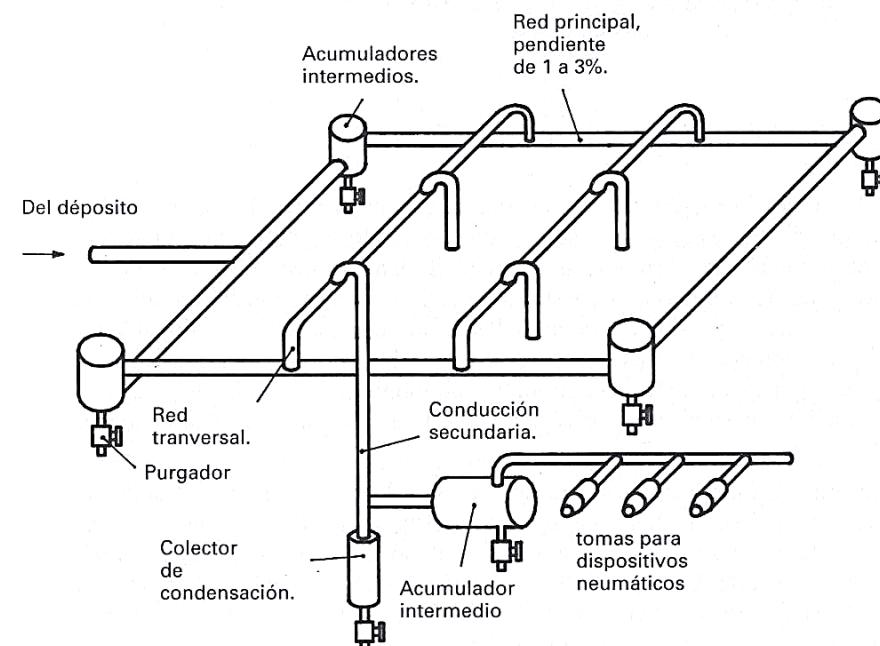


Fig. 3.9. Depósito, acumuladores intermedios y colectores.

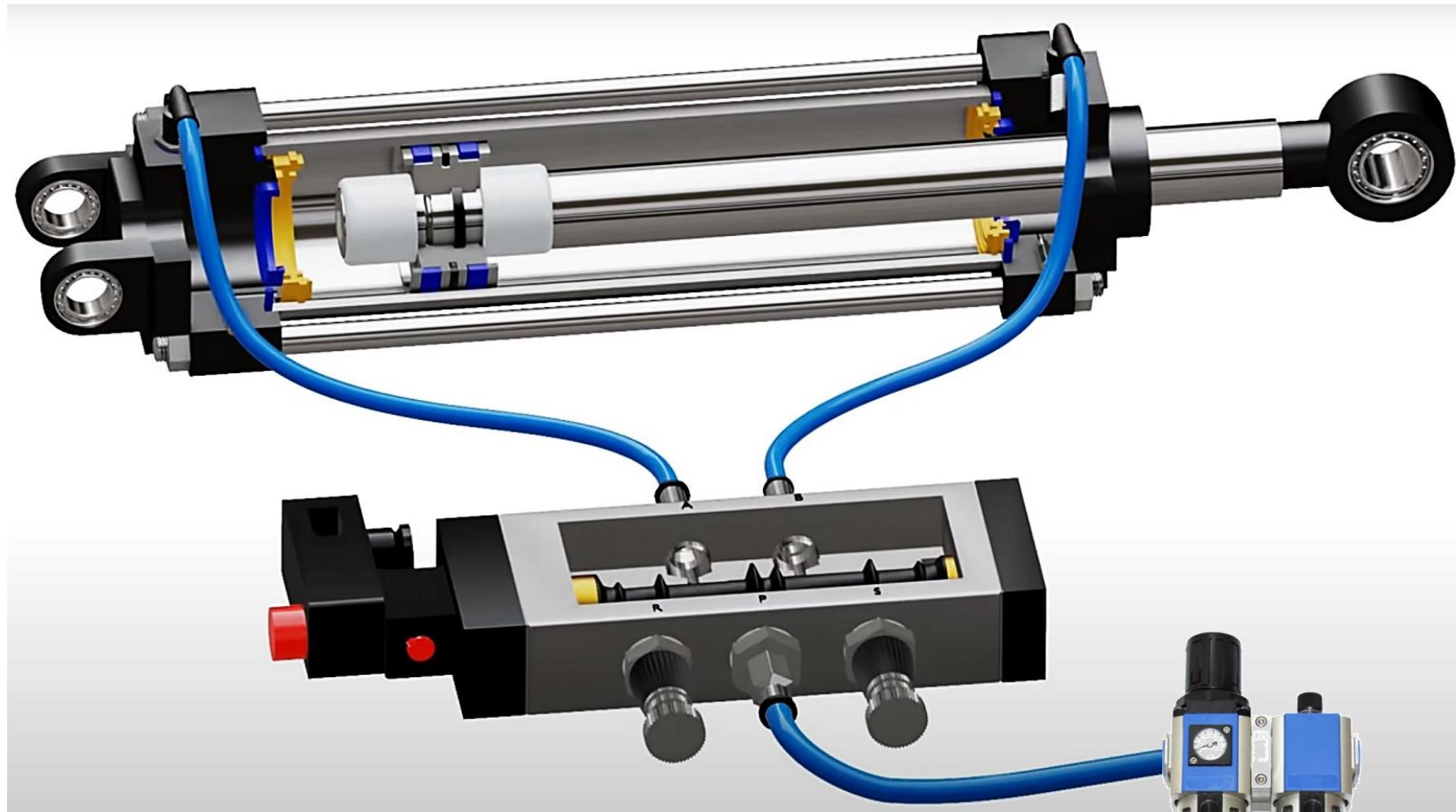


Conducto principal en anillo

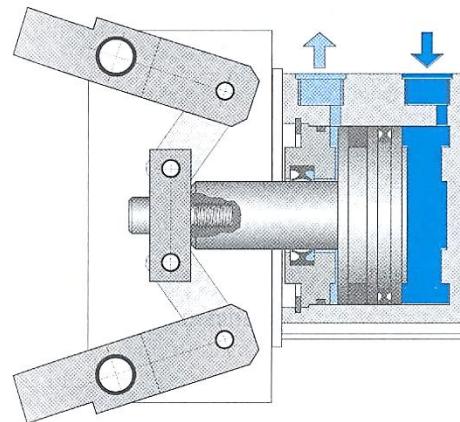
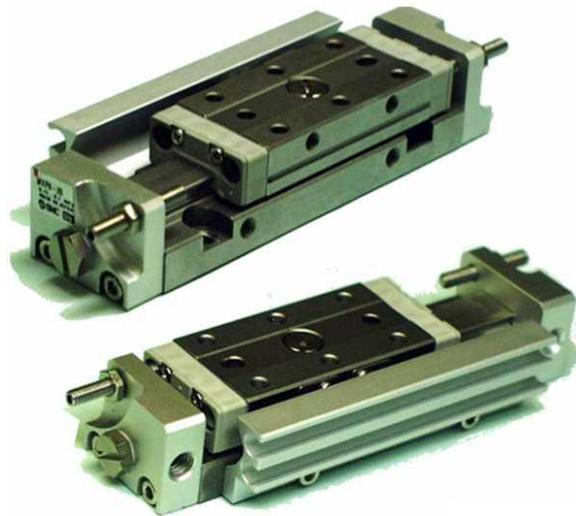
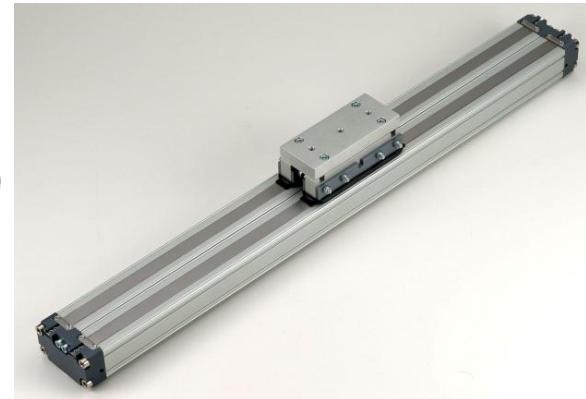


Red de distribución de aire

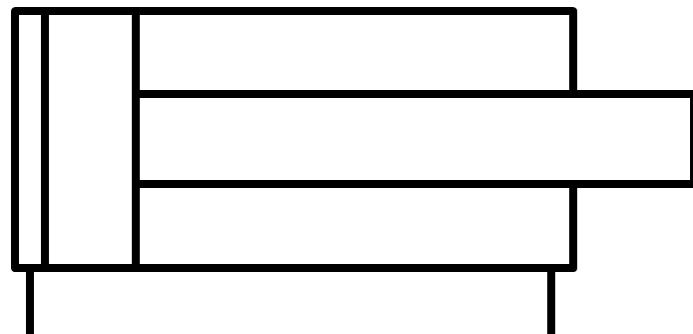
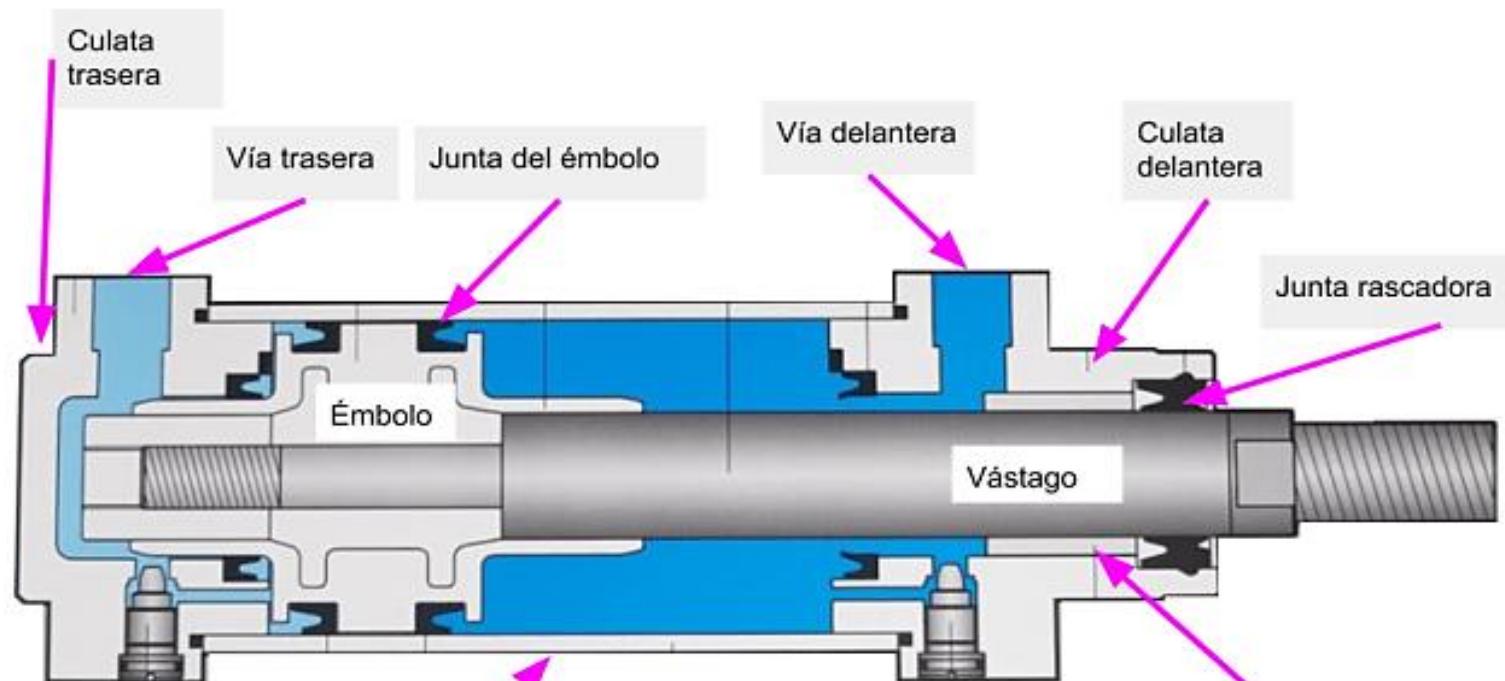
Componentes principales de un circuito neumático



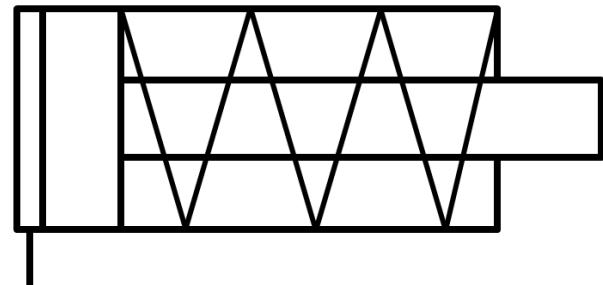
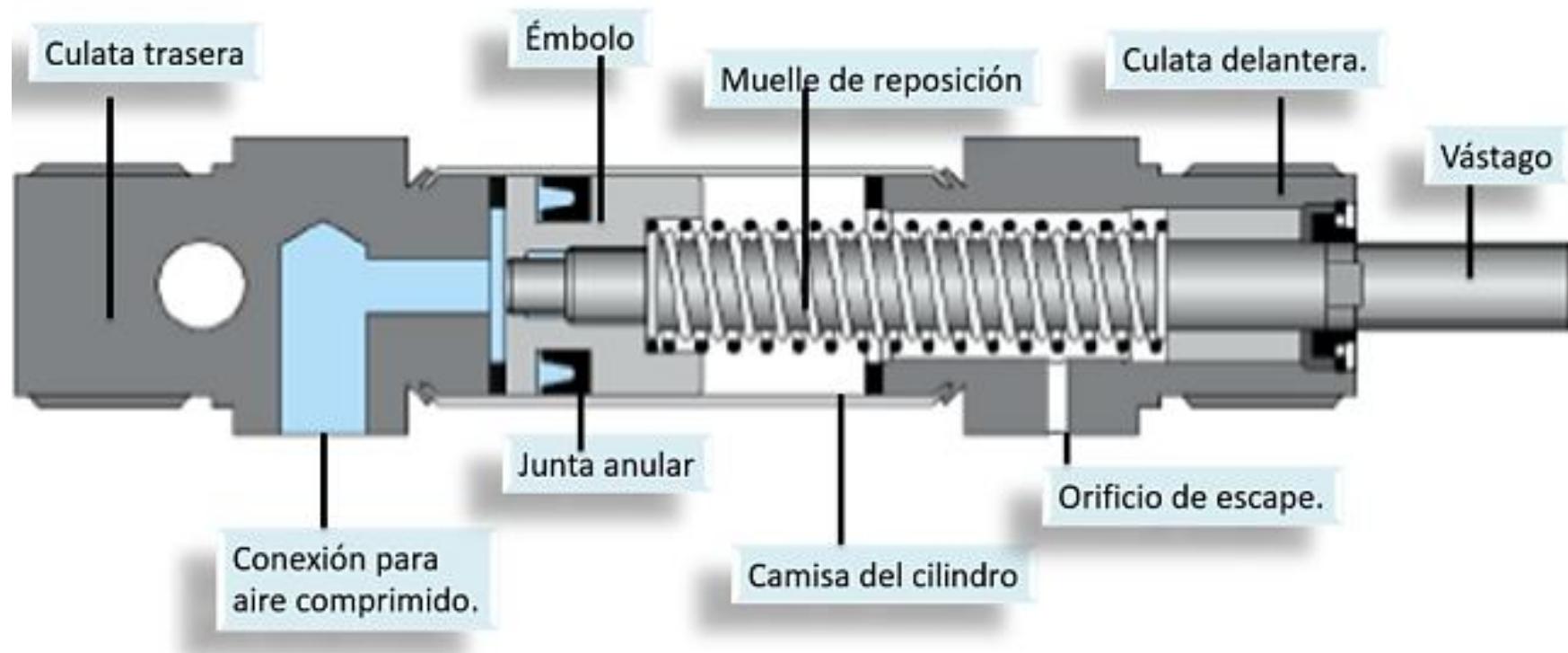
Actuadores



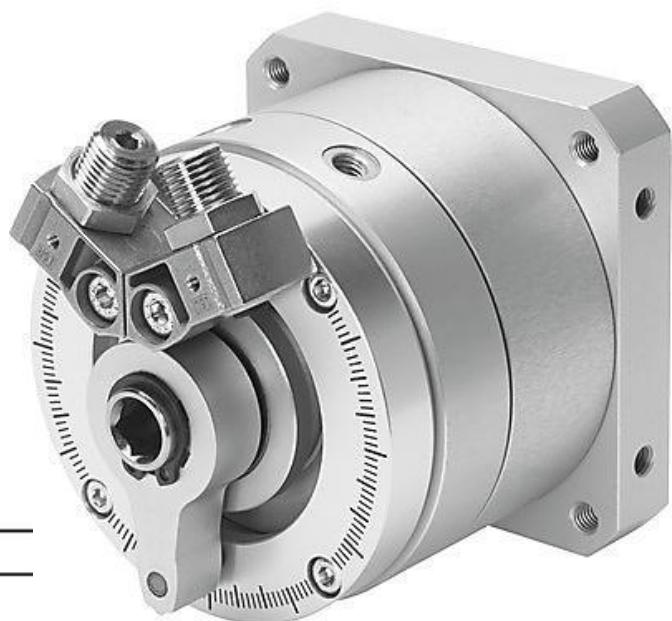
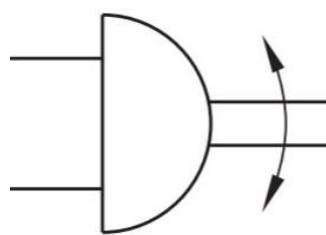
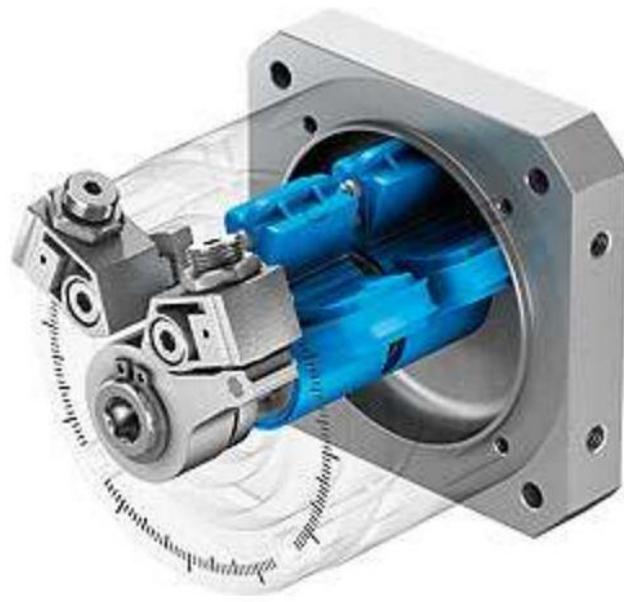
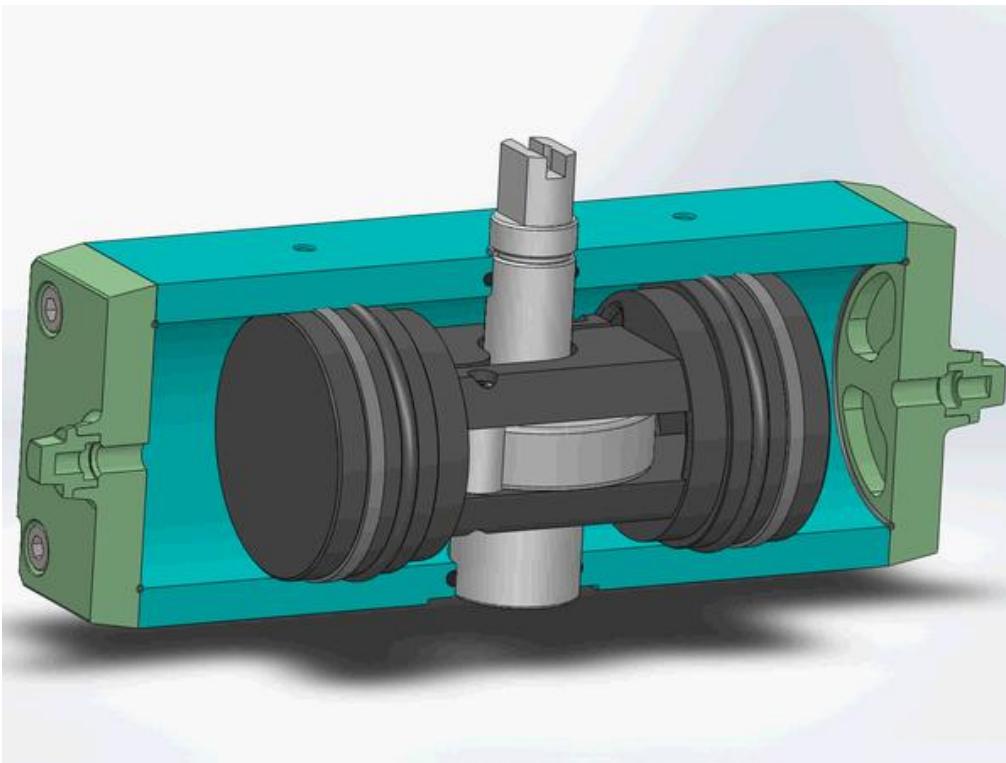
Cilindro de doble efecto



Cilindro de simple efecto



Cilindro rotativo



Fuerza que ejerce el vástagos

Cilindro de simple efecto

Fuerza teórica

$$F = P \cdot S = P \frac{\pi D^2}{4}$$

Fuerza efectiva en el avance

$$F_e = \eta \left(P \frac{\pi D^2}{4} - E \right)$$

P = Presión, N/m².

E = Empuje del muelle, N.

D = Diámetro del émbolo, mm².

D = Diámetro del vástagos, mm².

η = Rendimiento del cilindro.

Cilindro de doble efecto

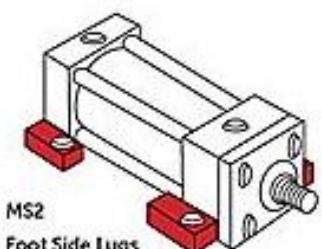
Fuerza efectiva en el avance

$$F_{ea} = \eta P \frac{\pi D^2}{4}$$

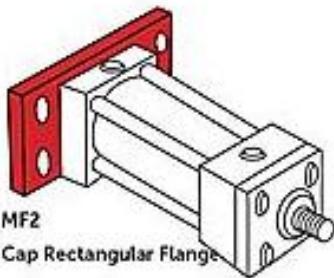
Fuerza efectiva en el retroceso

$$F_{er} = \eta P \frac{\pi (D^2 - d^2)}{4}$$

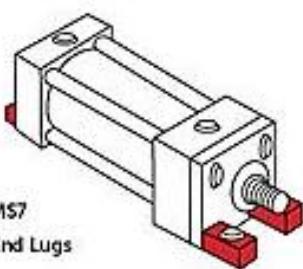
Métodos de fijación de cilindros



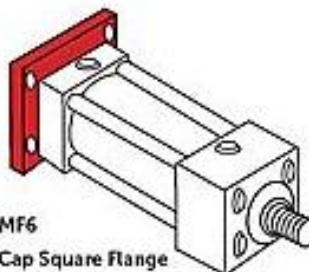
MS2
Foot Side Lugs



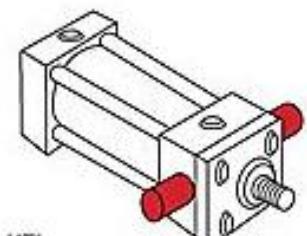
MF2
Cap Rectangular Flange



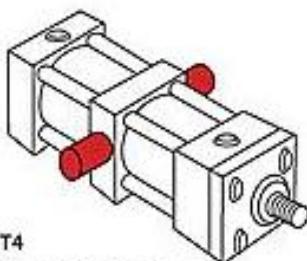
MS7
End Lugs



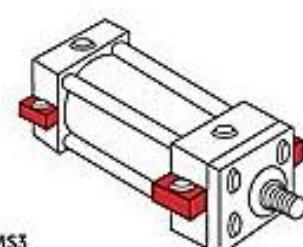
MF6
Cap Square Flange



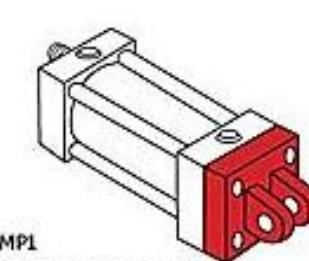
MT1
Head Trunnion



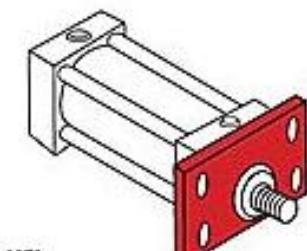
MT4
Intermediate Trunnion



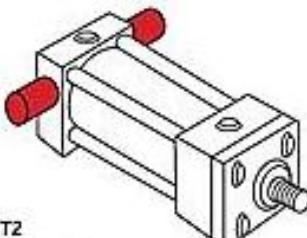
MS3
Centerline Lugs



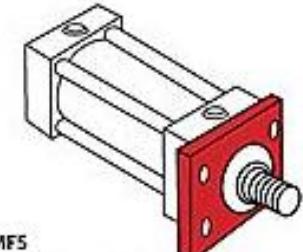
MPI
Cap Detachable Clevis



MF1
Head Rectangular Flange



MT2
Cap Trunnion

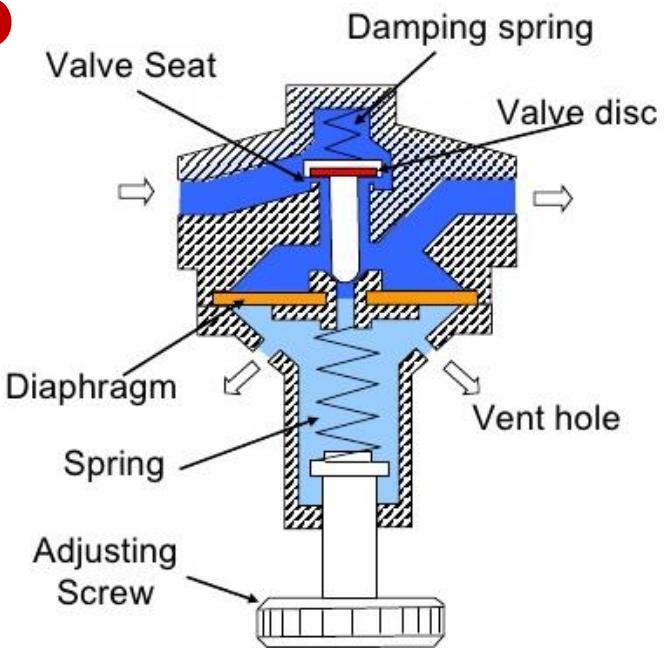
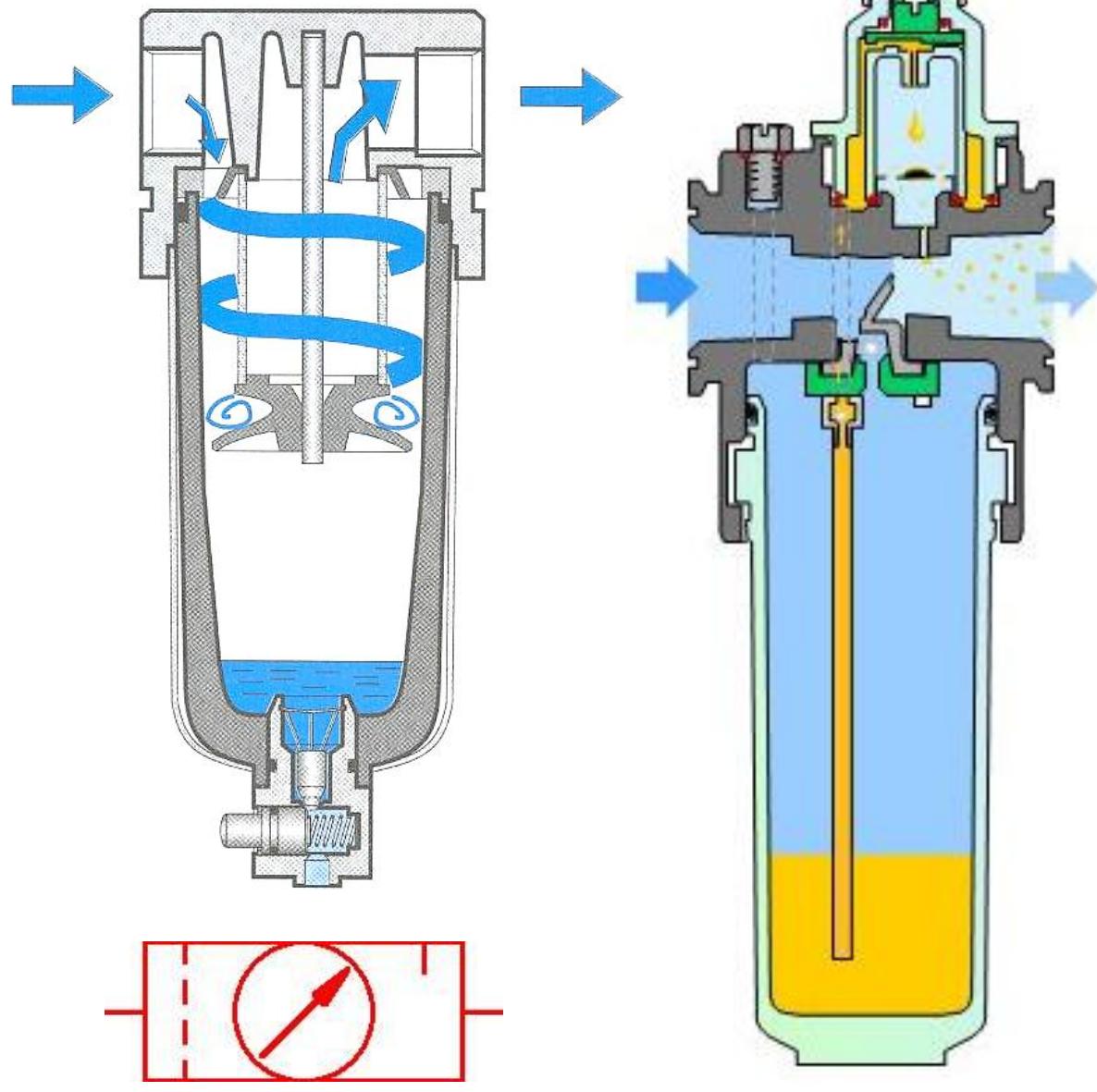


MF5
Head Square Flange

There are a variety of NFPA-approved cylinder mounting styles; pictured here are 11 of the most common designs, used especially on mobile machines.



Unidad de mantenimiento



Válvulas distribuidoras

Válvulas distribuidoras

Válvula 2/2

Válvula 3/2

Válvula 4/2

Válvula 5/2

Válvula 5/3

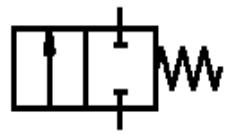
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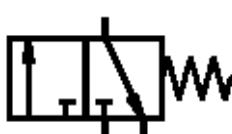
NA



NC



NC



Vías

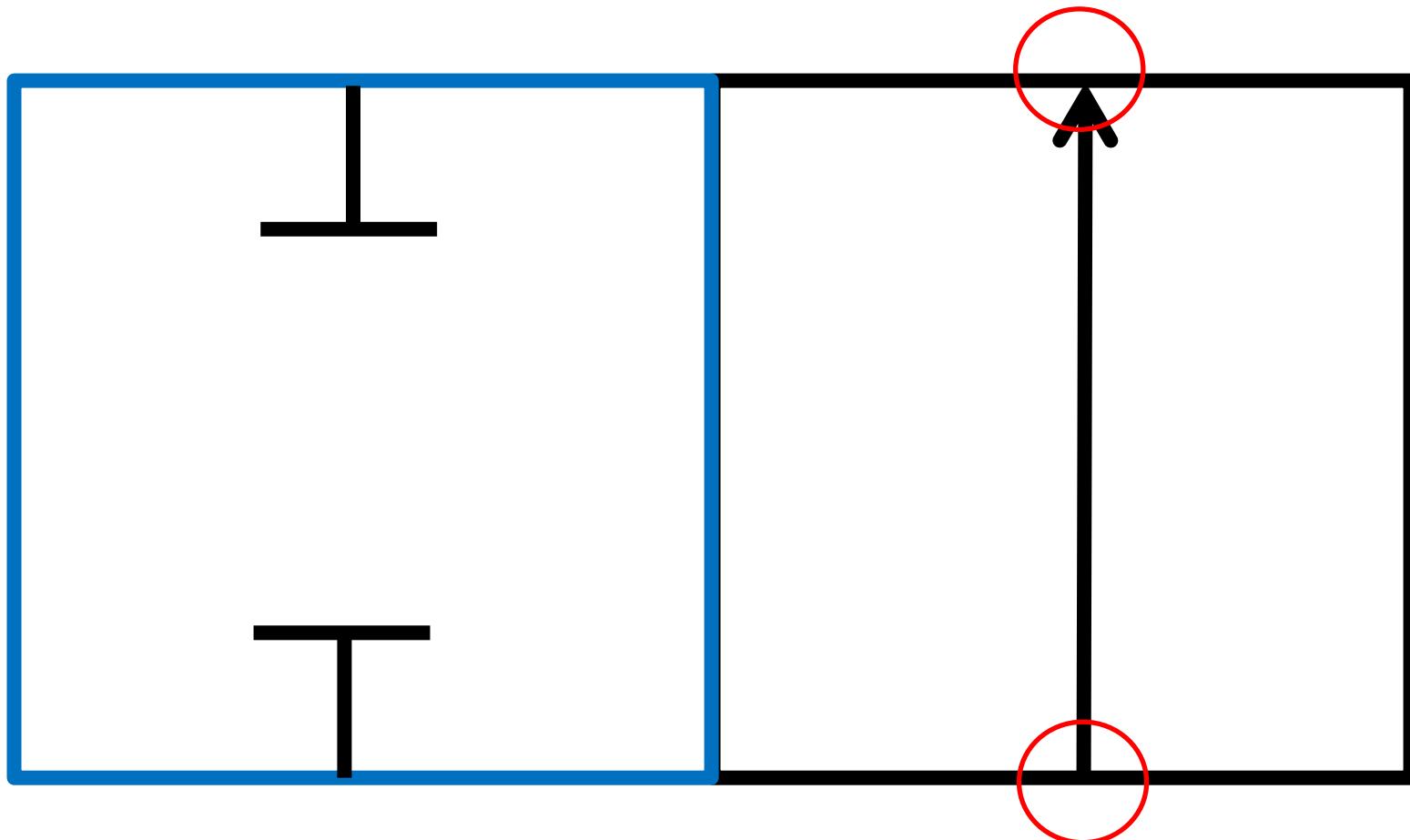
2/2

3/2

4/2

5/2

Posiciones



Válvulas distribuidoras

Vías

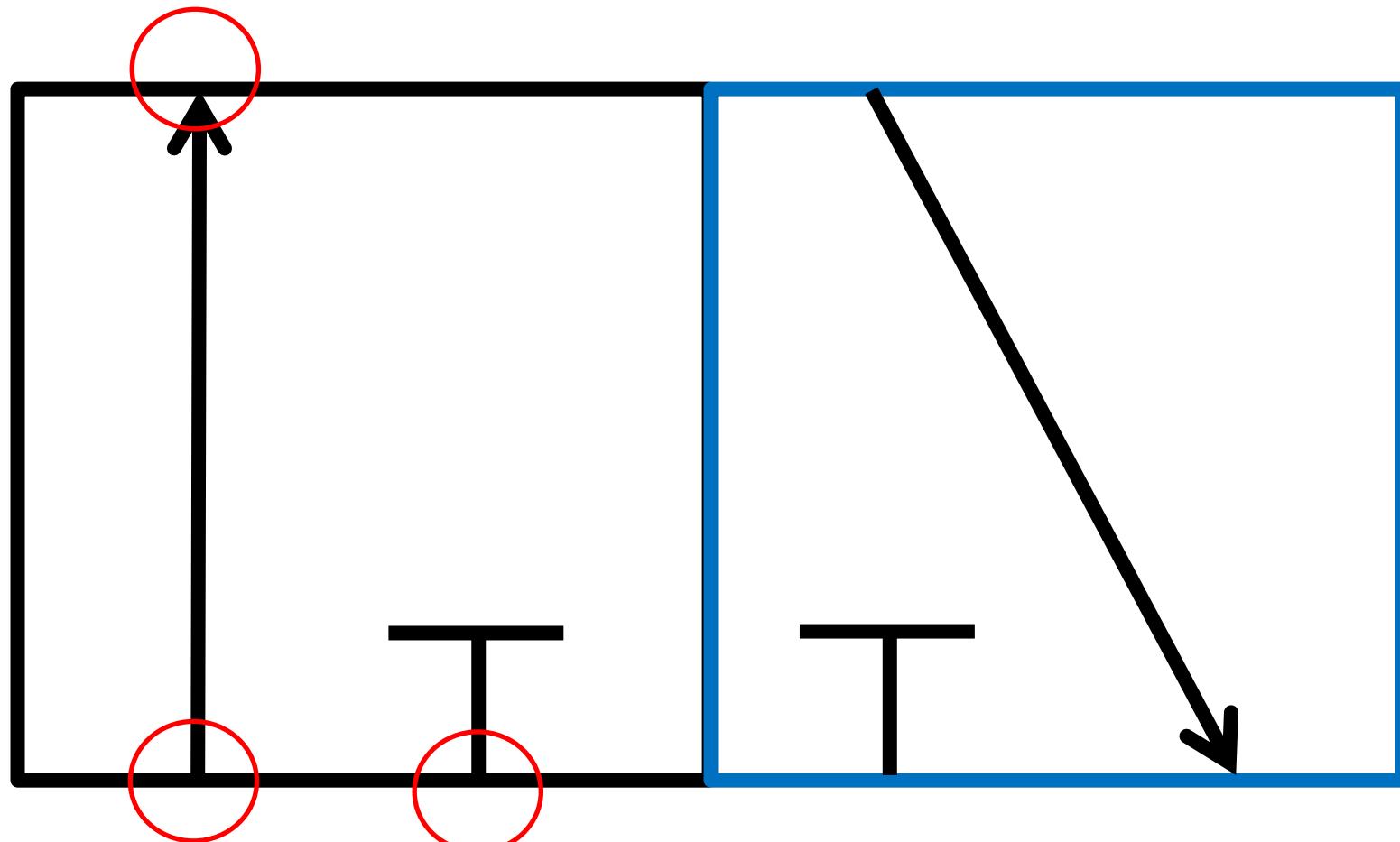
2/2

3/2

4/2

5/2

Posiciones



Válvulas distribuidoras

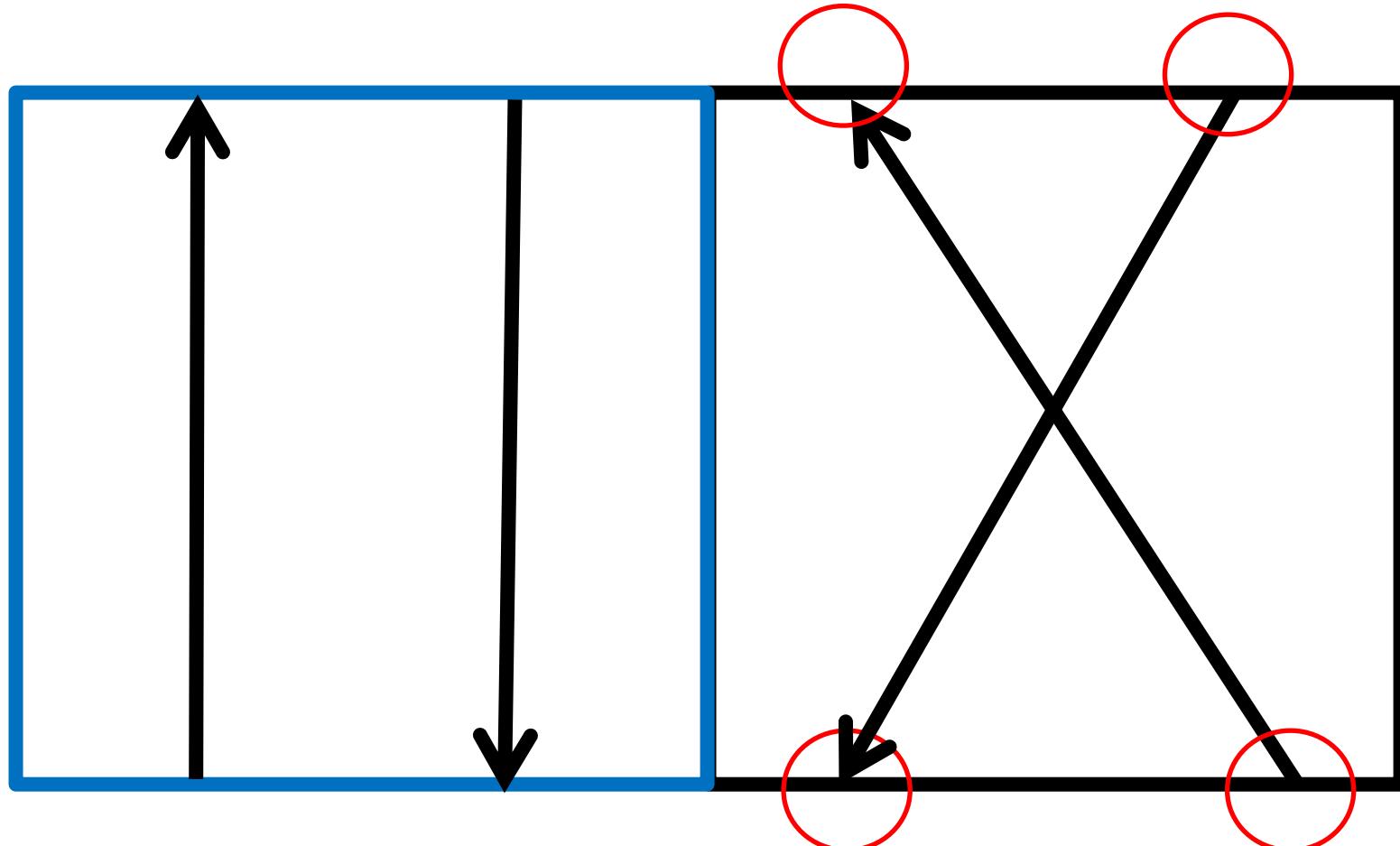
2/2

3/2

Vías

4/2

Posiciones



Válvulas distribuidoras

Vías

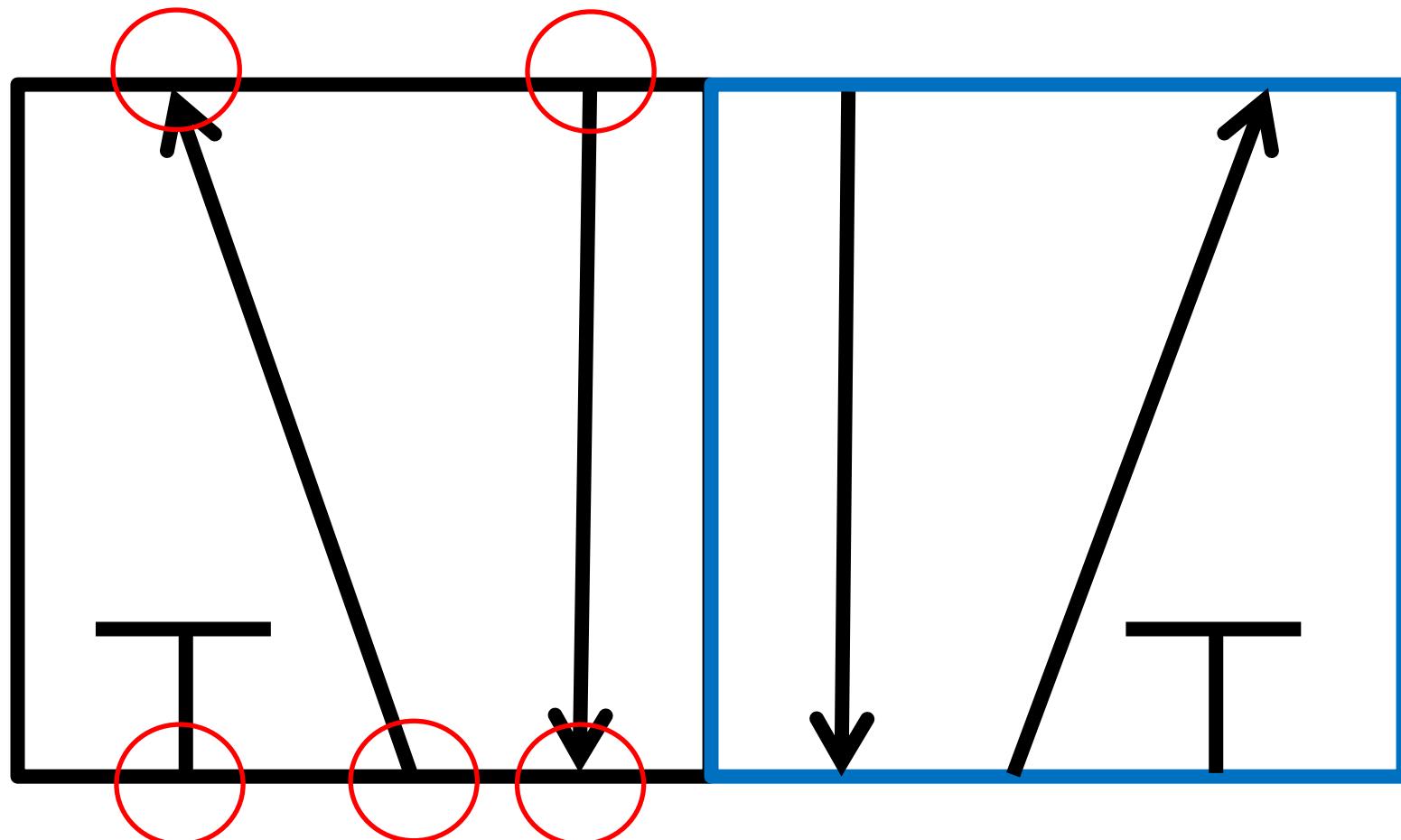
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4/2

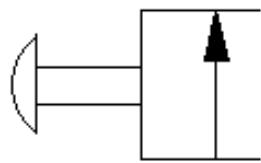
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Posiciones

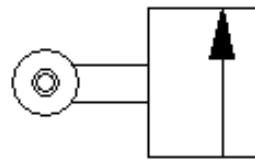


Válvulas distribuidoras

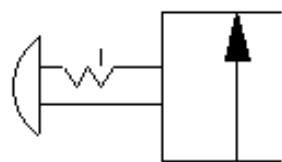
Accionamiento de las válvulas



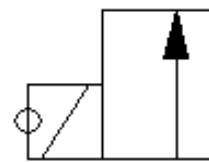
Botón



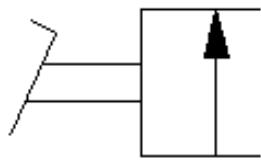
Rodillo



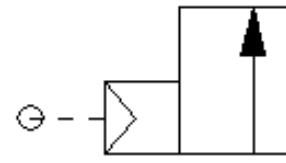
Botón + enganche



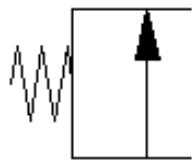
Eléctrico



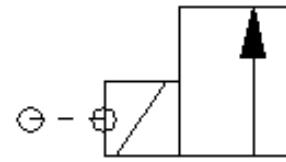
Pedal



Neumático



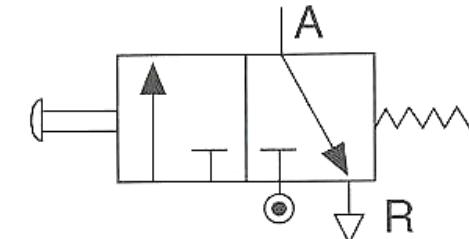
Resorte



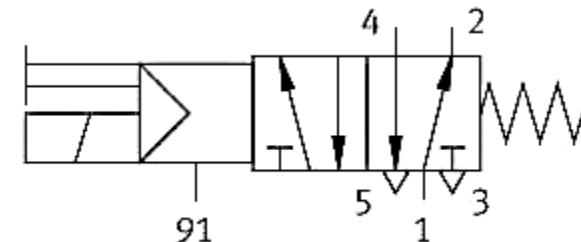
Eléctrico + Neumático

EJEMPLOS

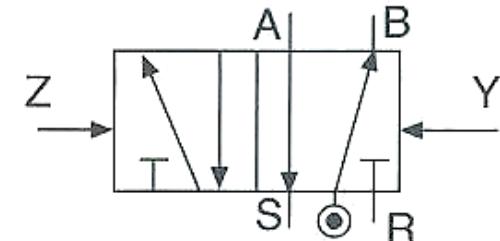
3/2 NC pulsador
retorno muelle



5/2 pulsador
retorno muelle
Electroneumática
Servo pilotada

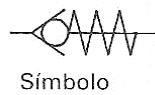
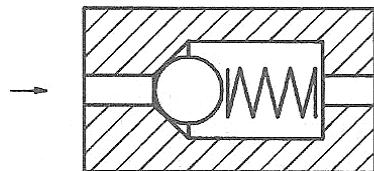


5/2 biestable
doble pilotaje
neumático

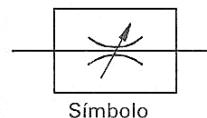
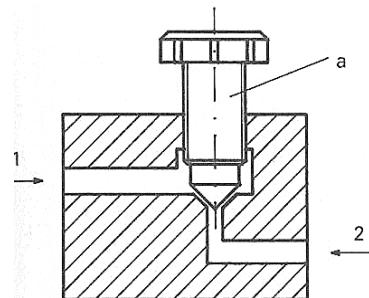


Válvulas reguladoras, de control y bloqueo

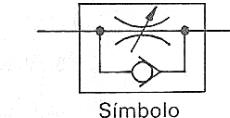
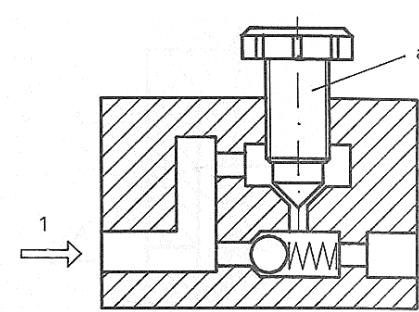
Anti-retorno



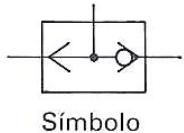
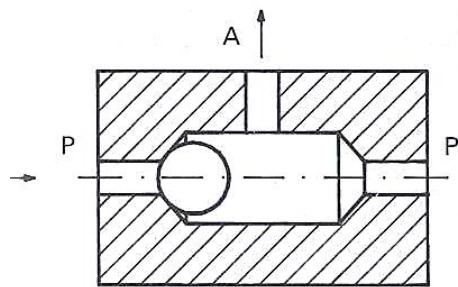
Reguladora de caudal



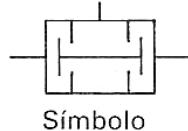
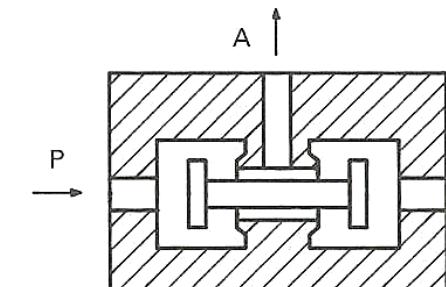
Reguladora de caudal unidireccional



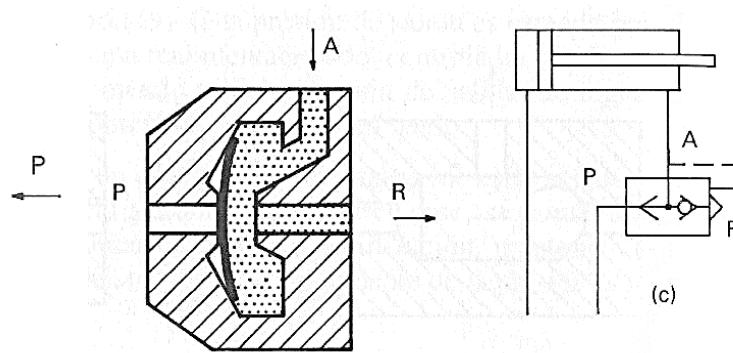
Selectora



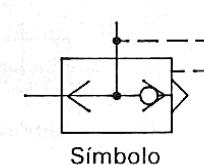
De simultaneidad



Escape rápido



(b)



Símbolo

Código de las vías de una válvula

CONDUCTOS	NORMA ISO	NORMA CETOP
Alimentación de presión	P	1
Conductos de trabajo	A, B, C, ...	2, 4, 6, ...
Escapes	R, S, T, ...	3, 5, 7, ...
Conductos de pilotaje	Z, Y, X, ...	12, 14, 16, ...

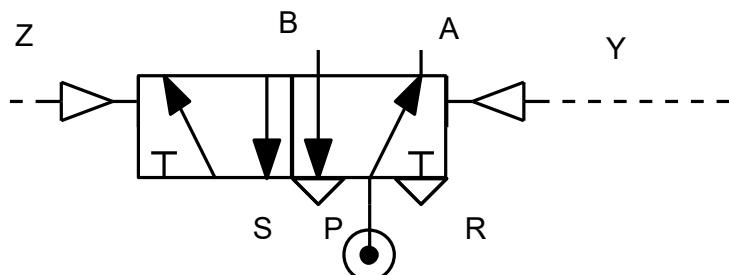
ISO, International Organization Standardization.

CETOP, Comité Europeo de las Transmisiones Óleo-hidráulicas y Neumáticas

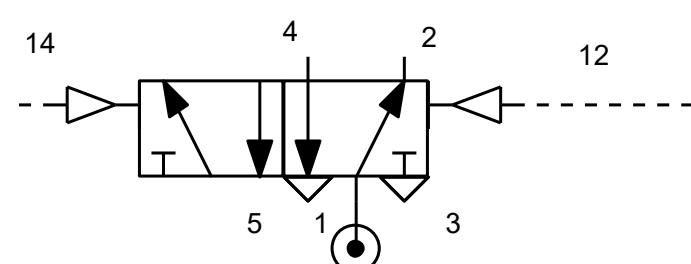
En neumática, la ISO 1219 es equivalente a la UNE 101 149-86.

UNE, Una Norma Española.

ISO

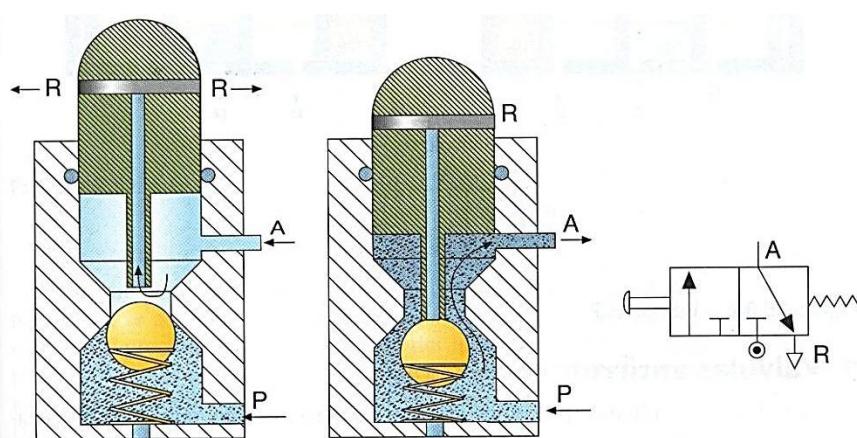


CETOP

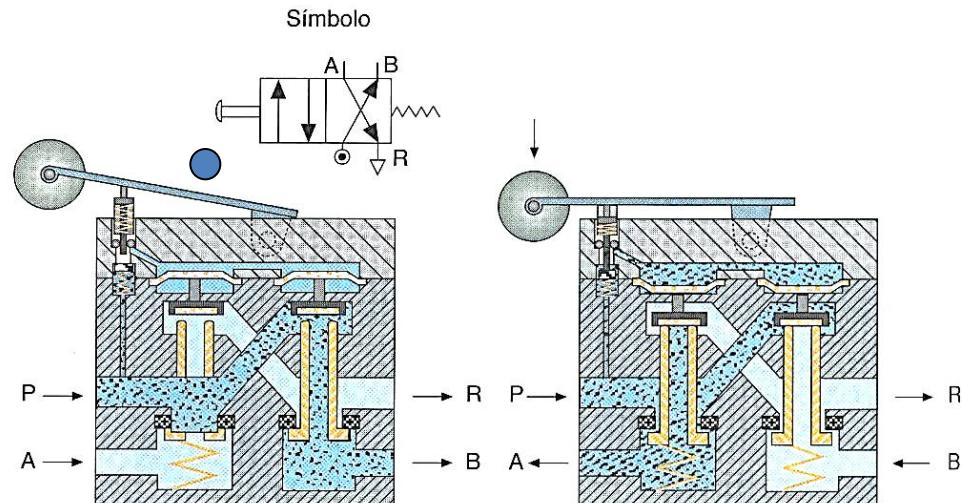


Nomenclatura: Vías y posiciones.

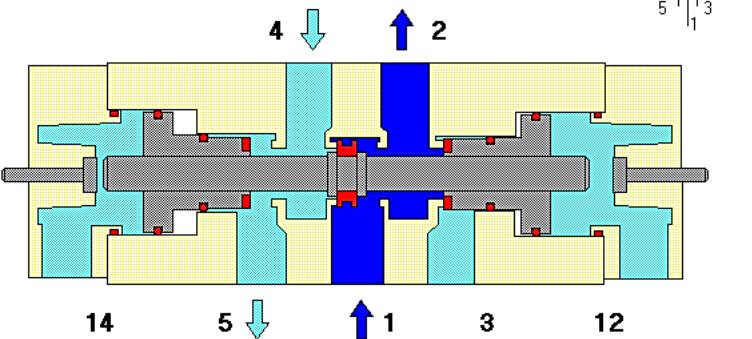
Válvula de 3 vías y 2 posiciones, normalmente cerrada 3/2 con accionamiento por pulsador y retorno por muelle



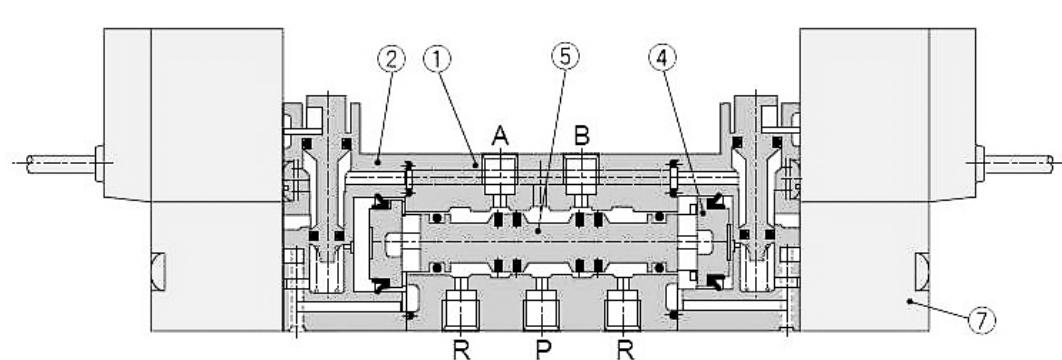
Válvula de 4 vías y 2 posiciones, 4/2 con accionamiento por rodillo y retorno por muelle



Válvula 5/2 biestable accionamiento neumático

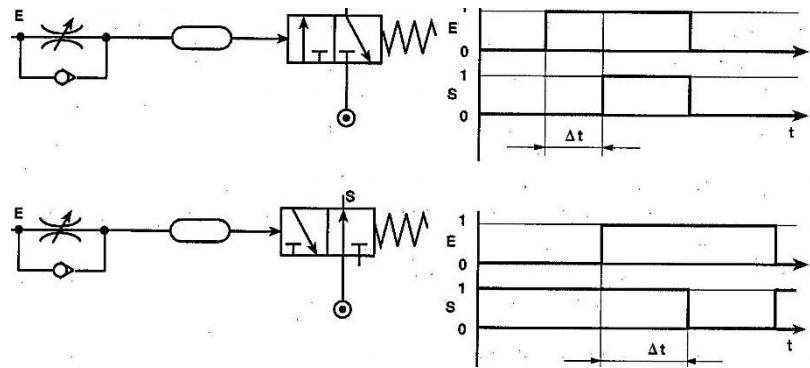


Electroválvula 5/2 biestable

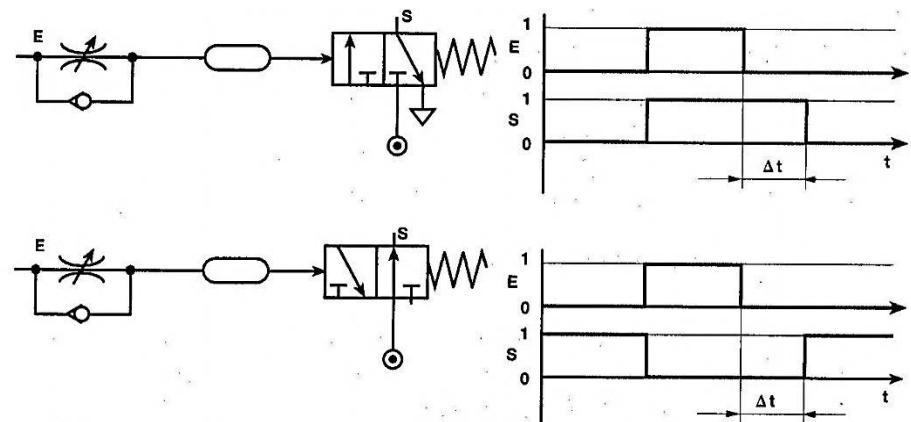


Temporizadores

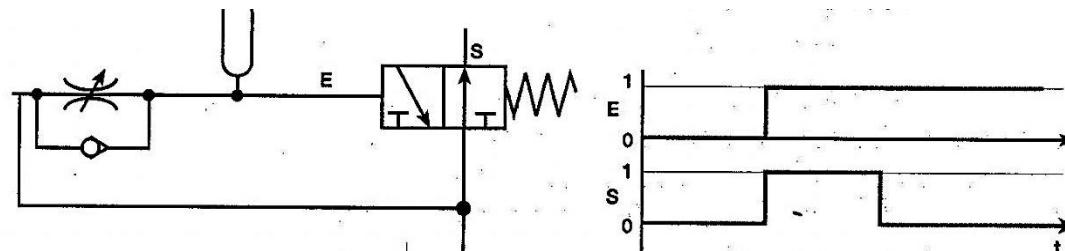
A la conexión



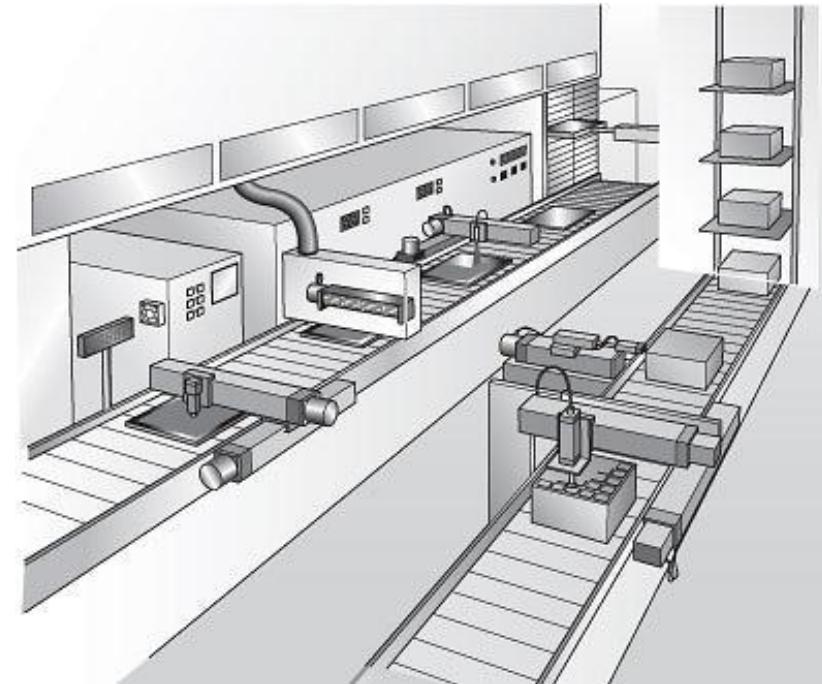
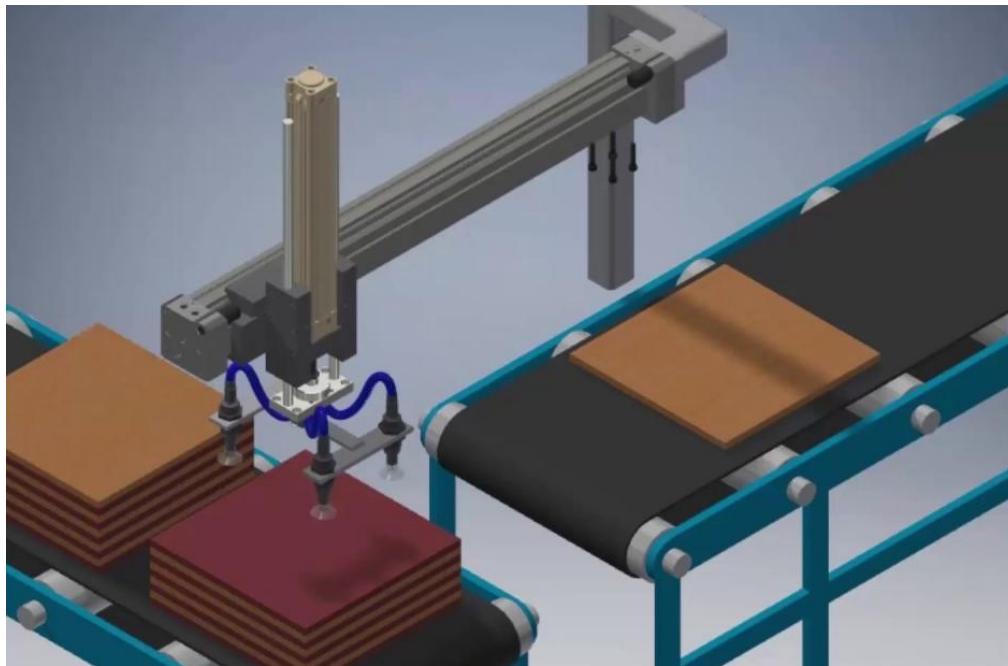
A la desconexión



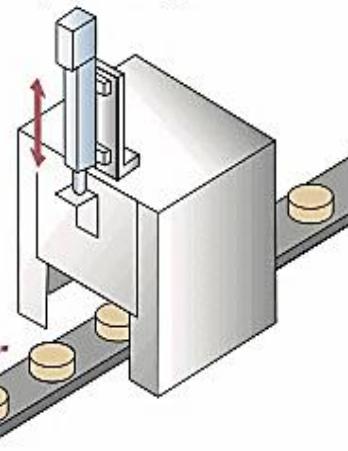
Conversión de una señal permanente en un impulso



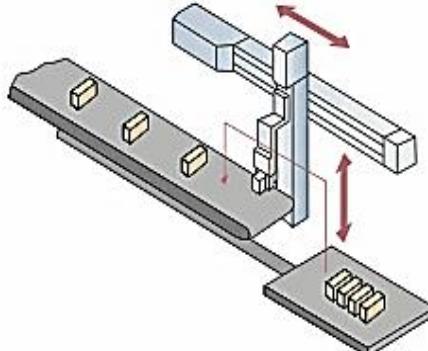
Aplicaciones del Actuador Neumático



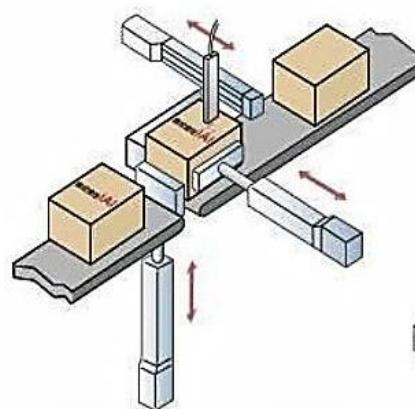
■ Opening and closing doors



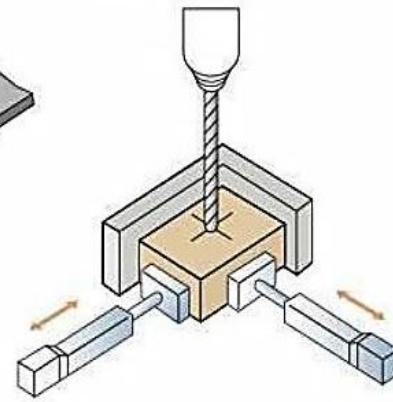
■ Pick and place



■ Push parts



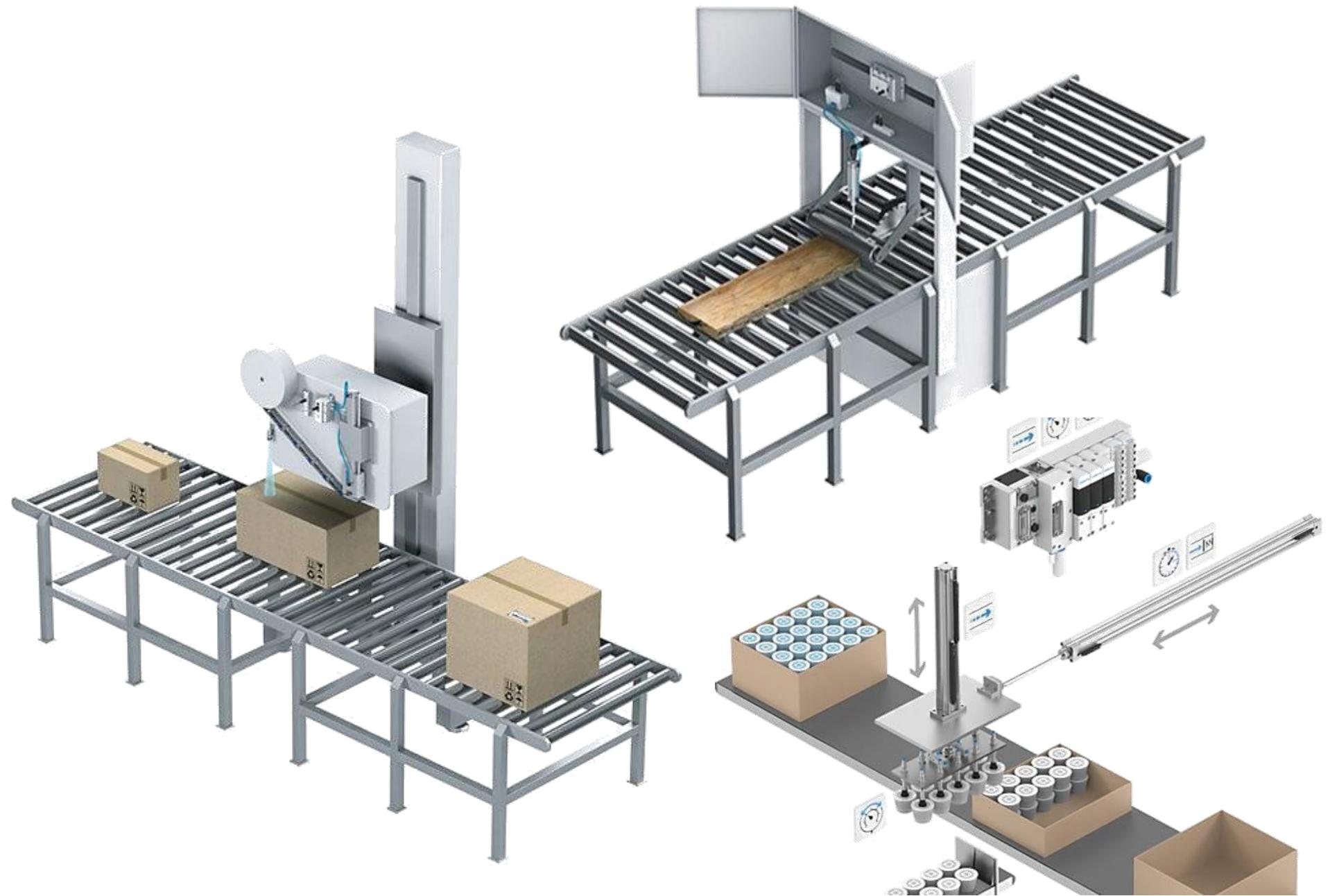
■ Fixturing parts



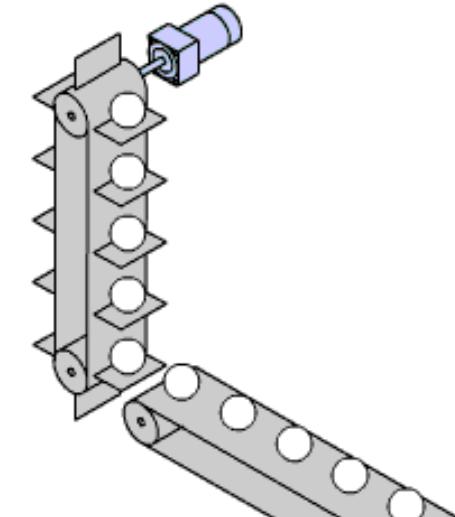
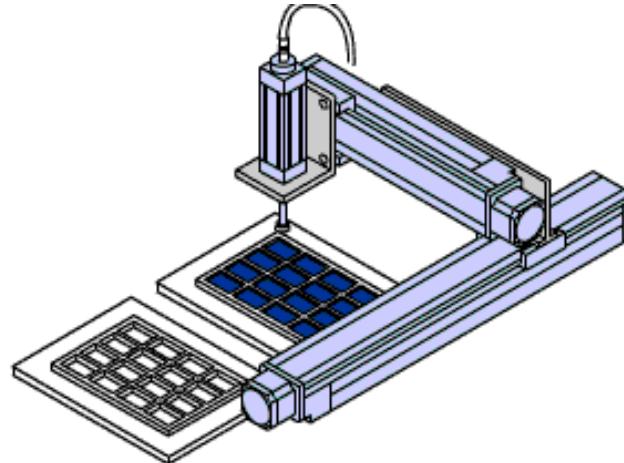
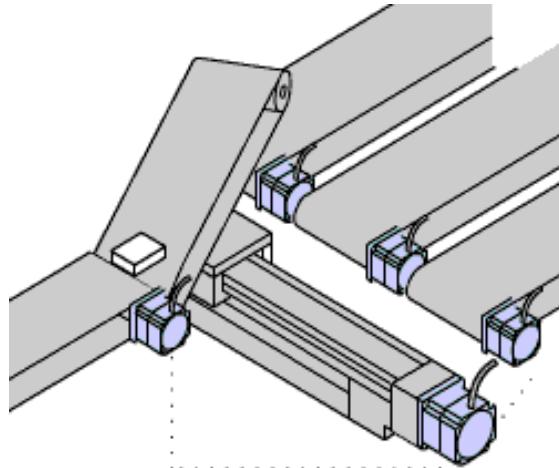
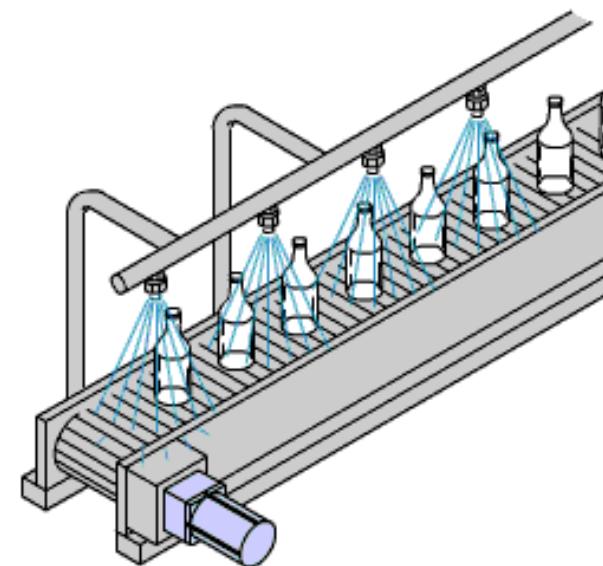
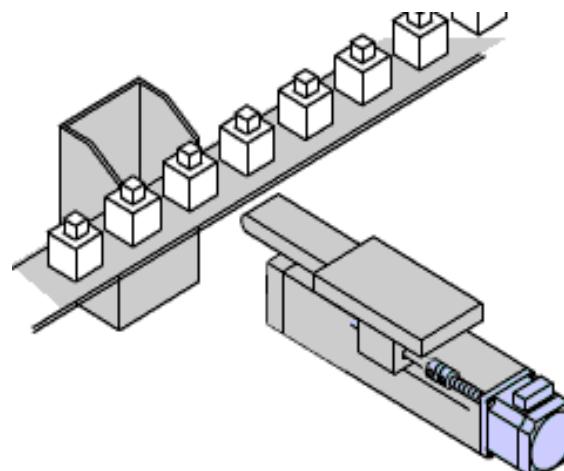
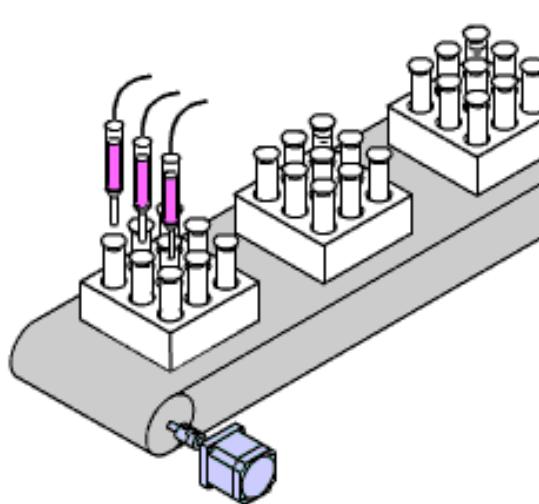
Applications ● Conveyance and movement of part

Applications ● Part detection, press fitting, clamp parts, etc.

Aplicaciones del Actuador Neumático



Aplicación del Actuador Neumático



Realización del esquema

NIVEL	COMPONENTE	EJEMPLOS
6º	Elementos de trabajo	Cilindros, motores neumáticos
5º	Elementos de regulación de velocidad	Reguladores de caudal unidireccional
4º	Elementos de potencia	Válvula distribuidora para el cilindro
3º	Elementos de tratamiento de señal	Selectores de función "O" e "Y"
2º	Elementos de entrada de señal	Microválvulas acc. manual, final de carrera
1º	Fuente de alimentación de energía	Unidad de mantenimiento

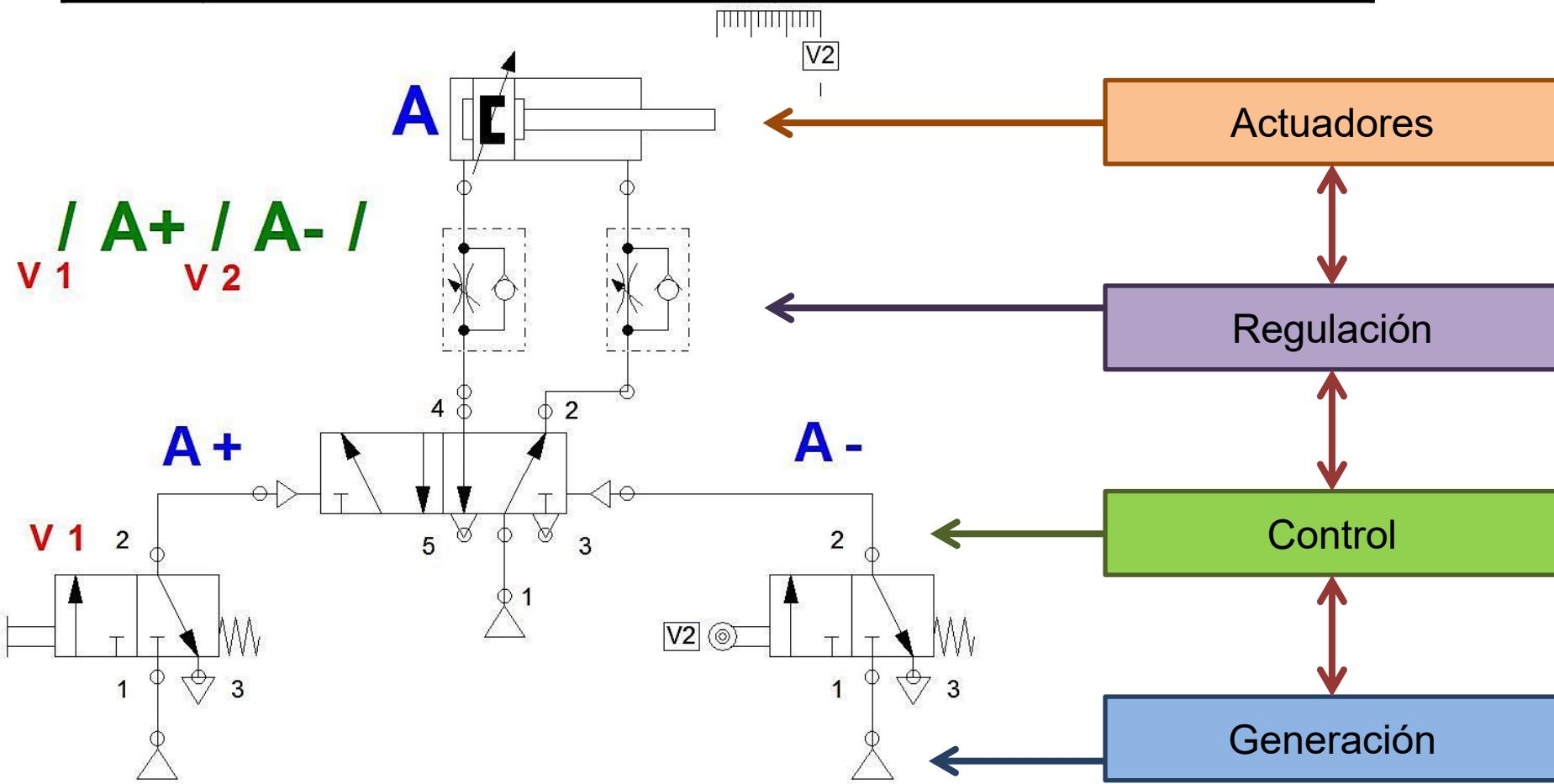


Diagrama de movimientos

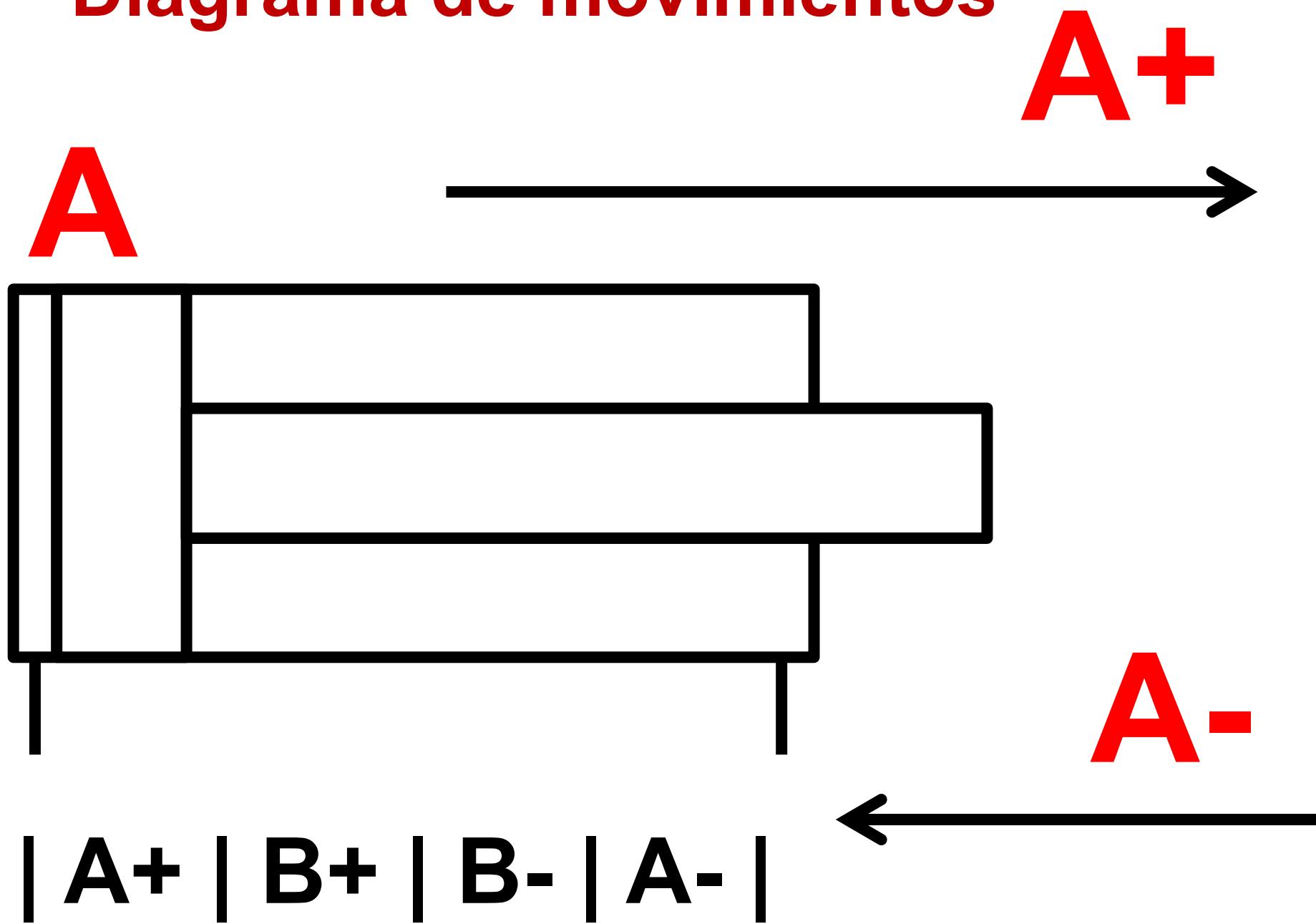


Diagrama de movimientos

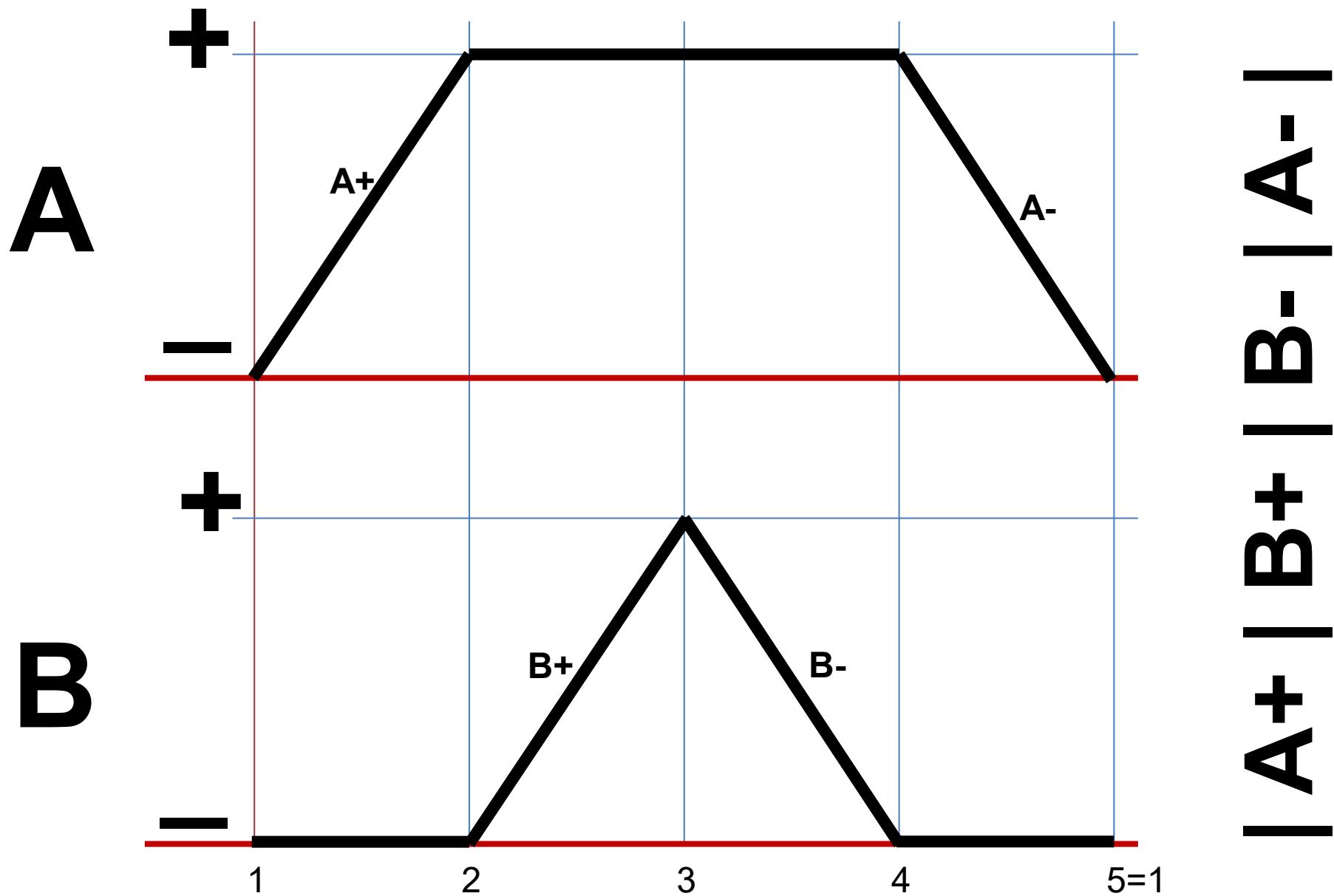


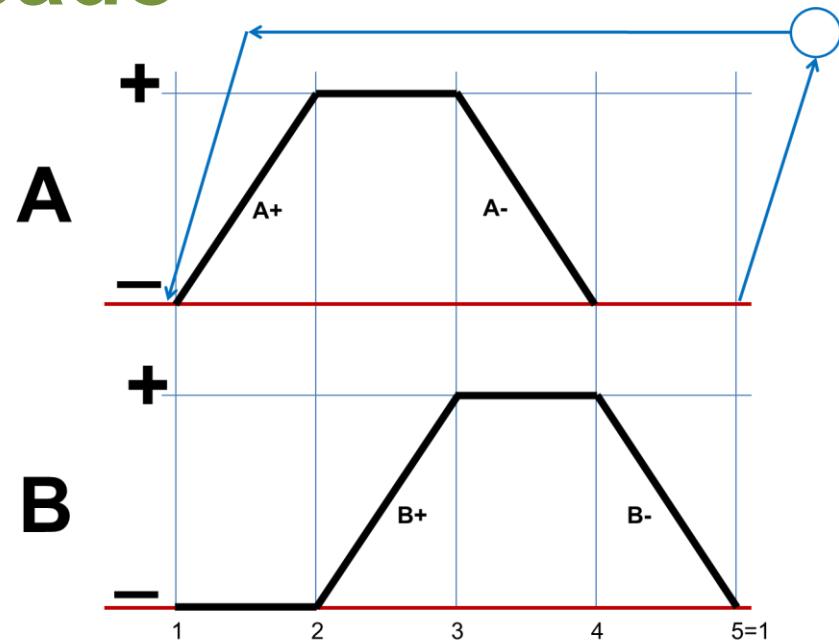
Tabla de movimientos

A+	B+	B-	A-
----	----	----	----

Pasos	Actuadores	
	A	B
1	+	
2		+
3		-
4	-	

Representación de secuencias.

Mecanismo de empacado



| A+ | B+ | A- | B- |

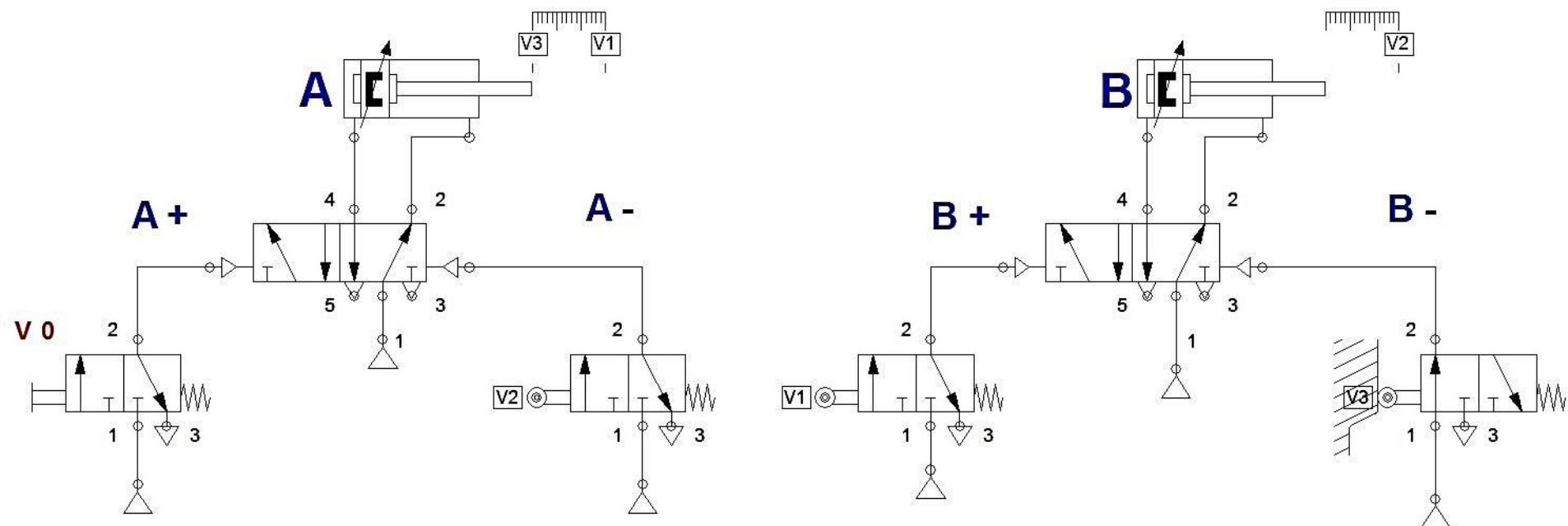
Pasos	Actuadores	
	A	B
1	+	
2		+
3	-	
4		-

Circuito Neumático de la secuencia.

Mecanismo de empacado

| A+ | B+ | A- | B- |

v0 ↑ ↓ v1 ↑ ↓ v2 ↑ ↓ v3 ↑

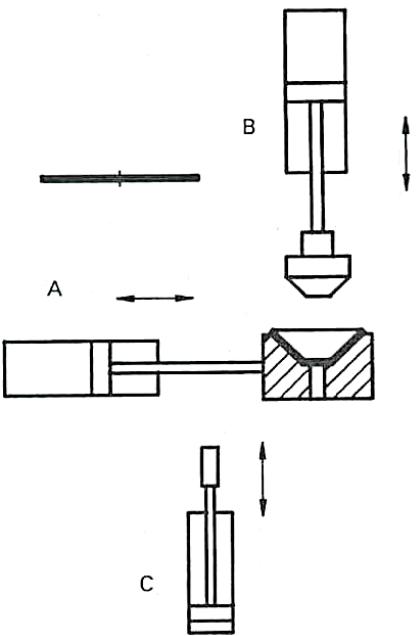


| A+ | B+ | A- |
| B- |

| B- | A+ | B+ | A- |

Representación de secuencias.

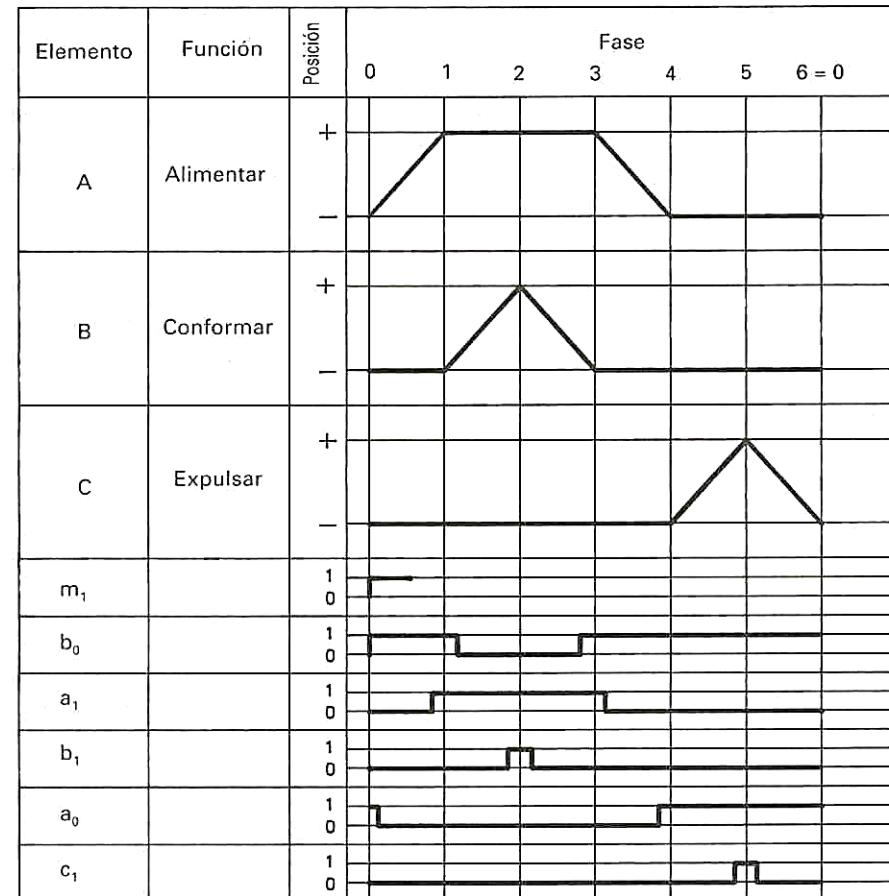
Mecanismo de conformado.



Etapa	Actuador		
	A	B	C
1	+		
2		+	
3		-	
4	-		
5			+
6			-

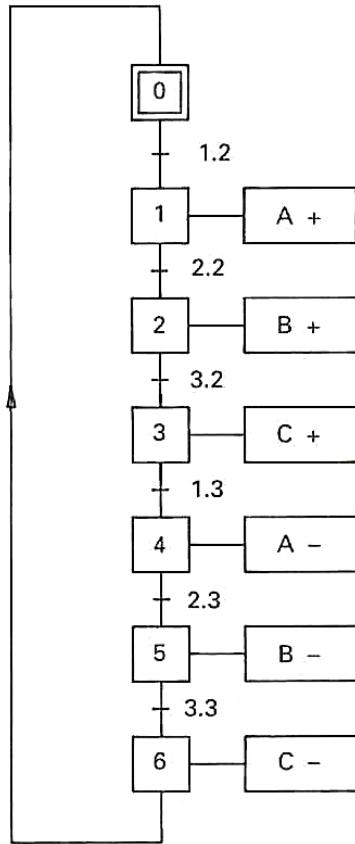
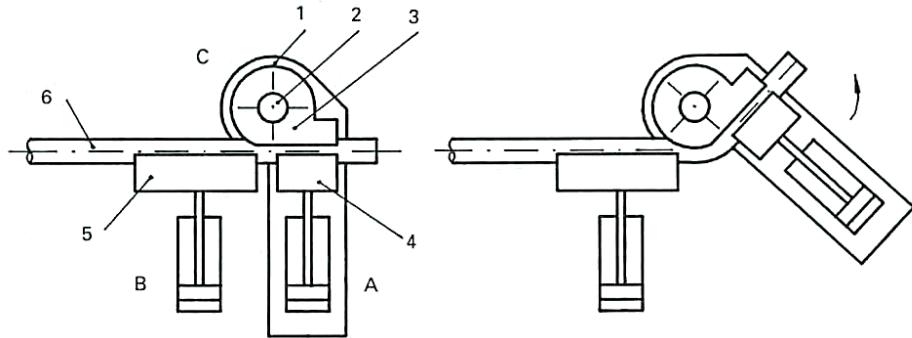
Fig. 14.2. Cuadro de secuencia.

|A+|B+|B-|A-|C+|C-|



Representación de secuencias.

Mecanismo de curvado



Grafct de
la secuencia

Diagrama de Mando y movimiento

Elemento	Función	Posición	Fase						
			0	1	2	3	4	5	6 = 0
A	Amordazar	+							
A	Amordazar	-							
B	Soportar	+							
B	Soportar	-							
C	Curvar	+							
C	Curvar	-							
1.2		1							
1.2		0							
1.3		1							
1.3		0							
2.2		1							
2.2		0							
2.3		1							
2.3		0							
3.2		1							
3.2		0							
3.3		1							
3.3		0							

How Industrial Automation Engineering Empowers Intelligent Manufacturing

