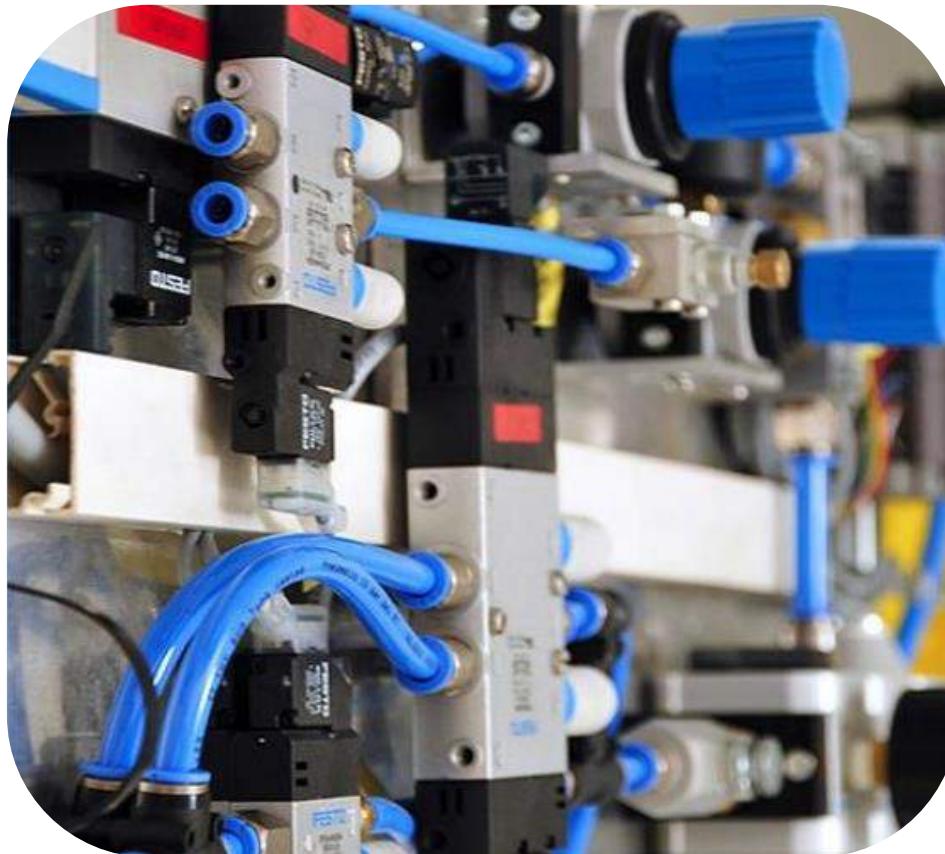


PNEUMATIC SYSTEM



លោនចំណាតេញ

បន្ទាប់ពីបញ្ចប់មេដ្ឋាន សិស្សនិងទួលបានចំណោះដើរដារជាគោរព

- ❖ ចំណោះការដលិតខ្សែលេខ និងវិធីសារស្ថិតិយោគ
- ❖ របៀបតាំងអេក្រង មុខងាររបស់ផ្ទៀកនឹមួយាក្នុងប្រព័ន្ធឌំណោះការទាំងមូល
- ❖ អាណានិងពិនិត្យលើមូលដ្ឋានត្រីវិធីបញ្ចប់
- ❖ វិធីចំណុចសំណើរបព័ន្ធបញ្ហារ

នាគិត្យា

- I. សេចក្តីផ្តើម
- II. ការប្រើប្រាស់ប្រព័ន្ធប្រលៀម
- III. បង្កើសំខាន់របស់ប្រព័ន្ធប្រលៀម
- IV. វិធីសារស្ថុគណនោ
- V. កុប្រស៊ី [Compressor]
- VI. ធ្វើការដំឡើរការរបស់ប្រព័ន្ធប្រលៀម
- VII. សូច្ចិក

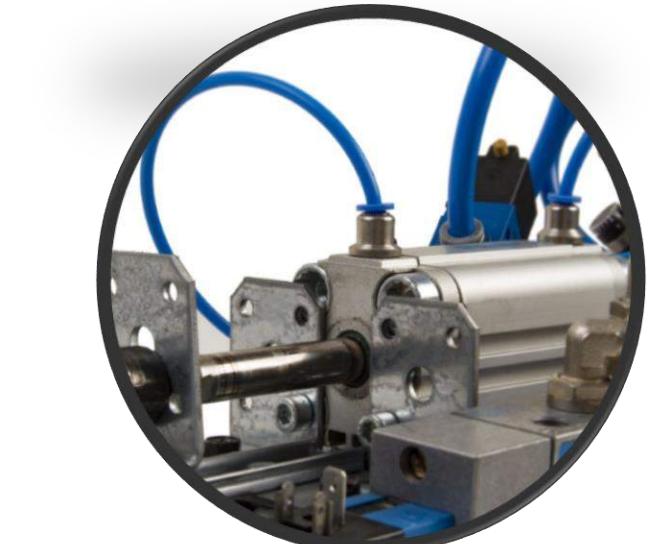
Course Content

- I. សេចក្តីផ្តើម
- II. ការប្រើប្រាស់ប្រព័ន្ធប្រលៀម
- III. បង្គំសំខាន់របស់ប្រព័ន្ធប្រលៀម
- IV. វិធីសារស្នូតណាង
- V. កុំប្រស៊ា [Compressor]
- VI. ធ្វើកដំណើរការរបស់ប្រព័ន្ធប្រលៀម
- VII. សិក្សាប៉ាប់

1.1. សេចក្តីផ្តើម

Power transmission ក្នុងបណ្តាឃ្ម Fluid transmission មានបីប្រភេទគឺ៖

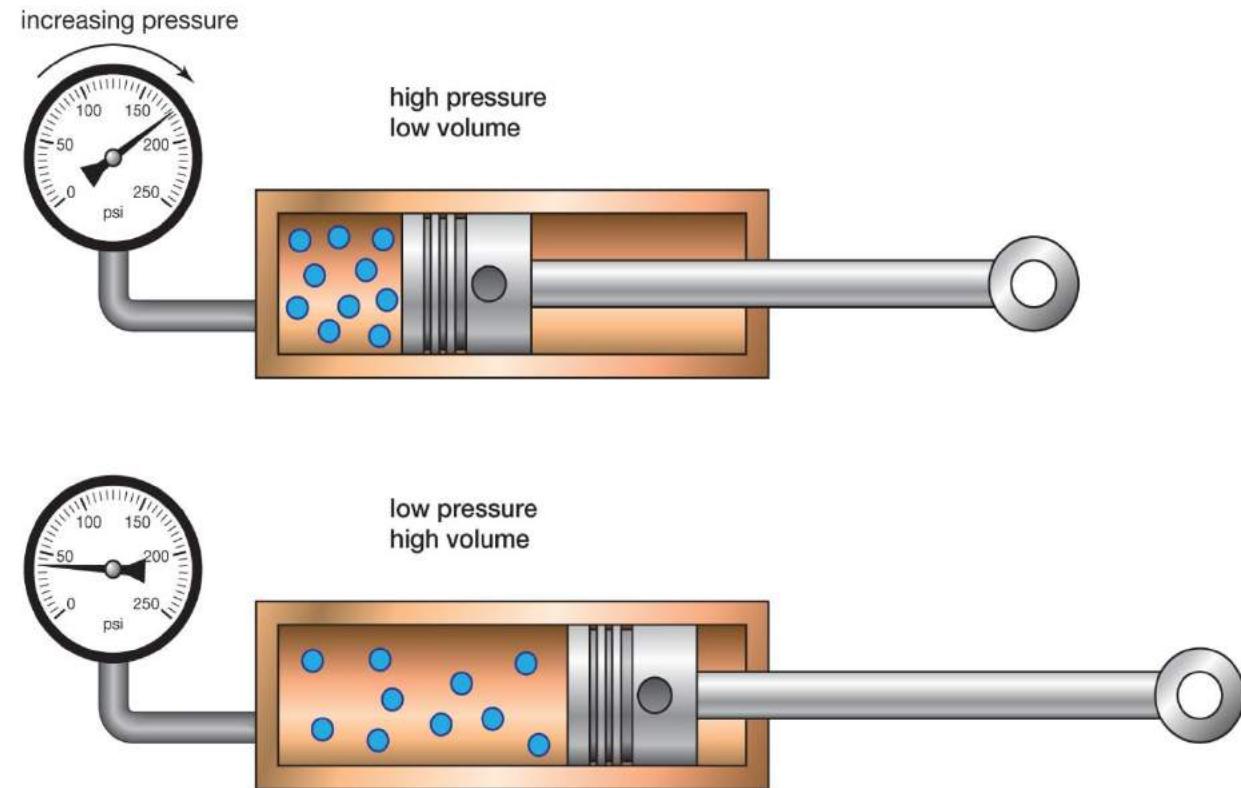
1. Electrical motor
2. Mechanical power transmission elements
3. Fluid power
 - hydraulic (Oil, water, other liquid)
 - Pneumatic (Air, other gases)



1.1. ការប្រើប្រាស់ប្រព័ន្ធមួល

អ្នីទៅធ្វើប្រព័ន្ធមួល? តើជាបច្ចេកវិទ្យាដែលយកសំពាលមួលមកធ្វើការ។

ការបង្កើមមួល ដែលមានភ្លើងបរិយាតាស
ដែលមានមាចម្លោលដែលអោយចូលភ្លើង
ធម្មម្មួយដែលមានមាច (Volume) ត្រូវចាត់
មុន នៅ៖សំពាលនិងកែវនឡើង។ (ប្រើគេ
ហេតាញម្រោងចាមពលបង្កើមត្រូវ)



1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

តើប្រព័ន្ធរុញ្ញូម អាចធ្វើអីបានខ្លះ?

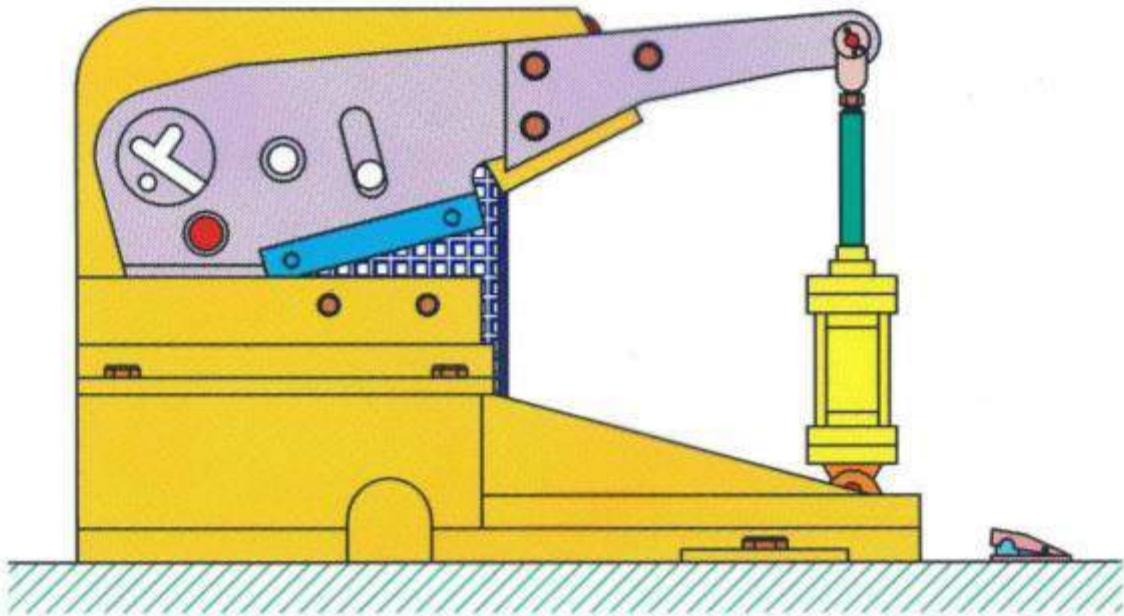
ការប្រើប្រាស់ប្រព័ន្ធខ្សែលគឺជានេដនកំណត់។

ផ្ទៃកការងារដែលប្រើប្រាស់ប្រព័ន្ធខ្សែល:

- ▶ Lifting up, Feeding of objects
- ▶ Clamping, stamping, cutting, forming of components
- ▶ Packaging
- ▶ Transferring of materials (Pick & Place)
- ▶ Sorting of parts
- ▶ Bus door system
- ▶ Spray painting
- ▶ Robots

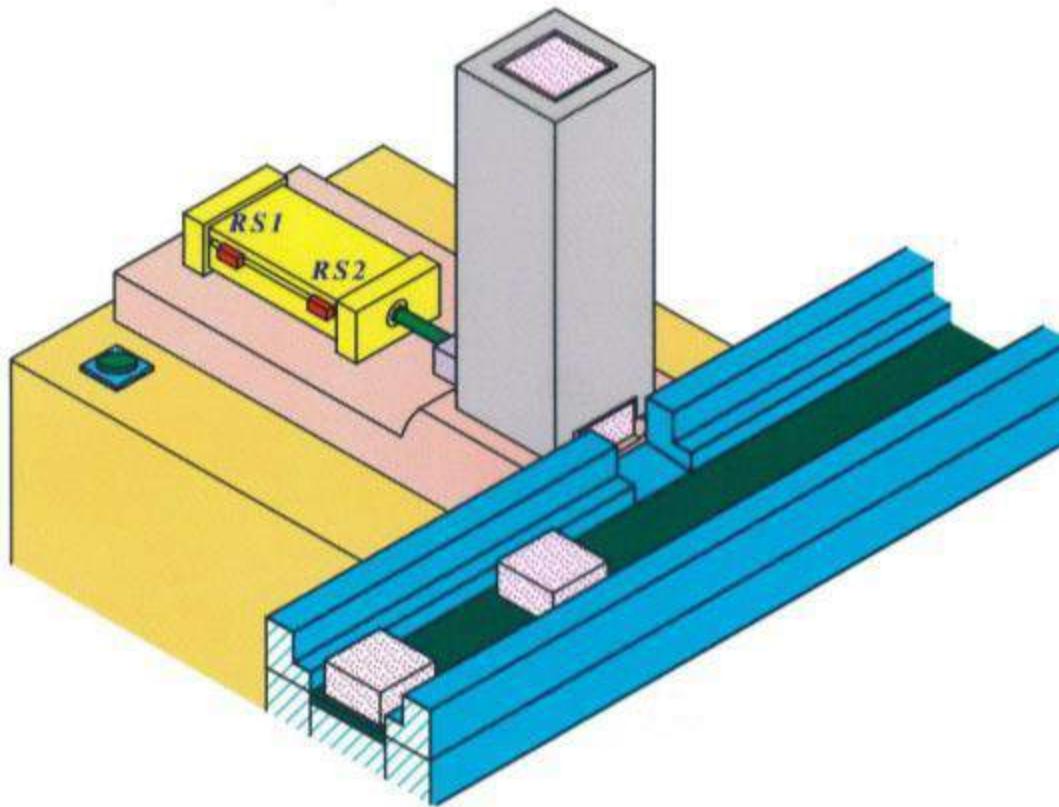
1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Cutting Application



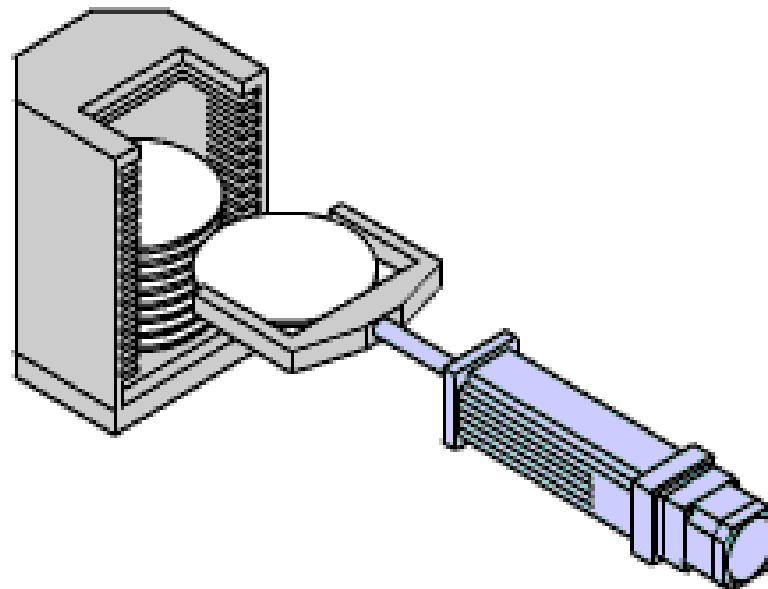
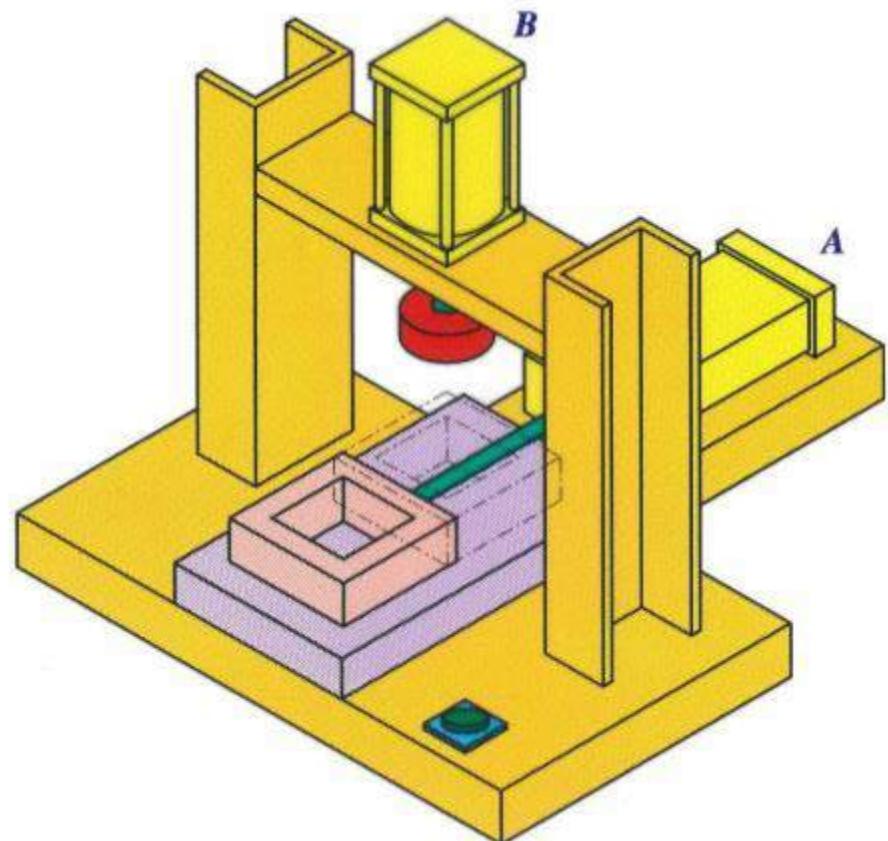
1.1. ការប្រើប្រាស់ប្រព័ន្ធណូល (ក...)

Ejecting Application



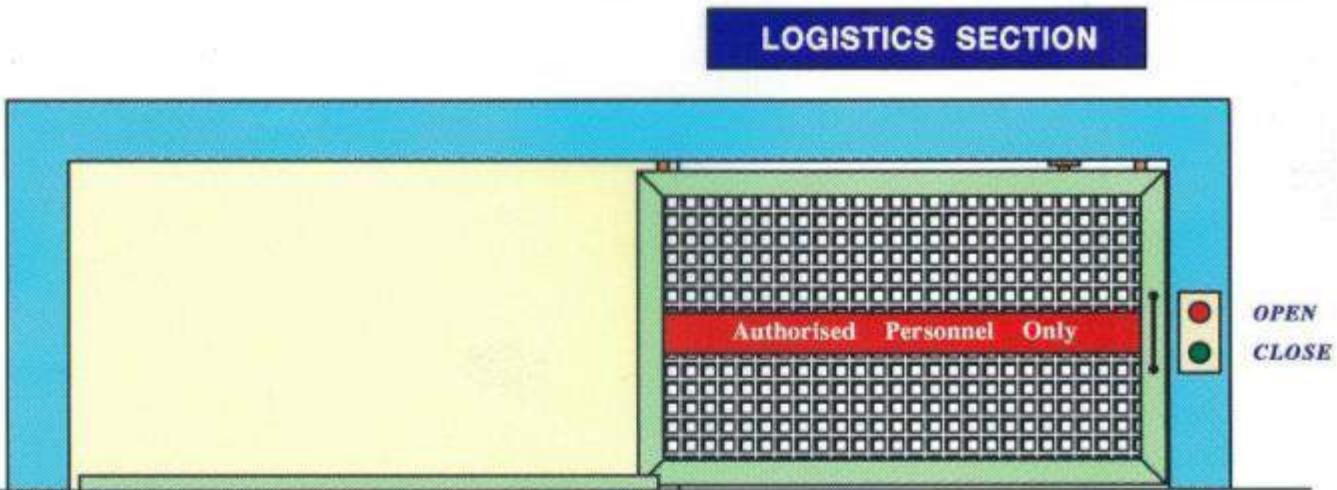
1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Stamping & Transferring Application



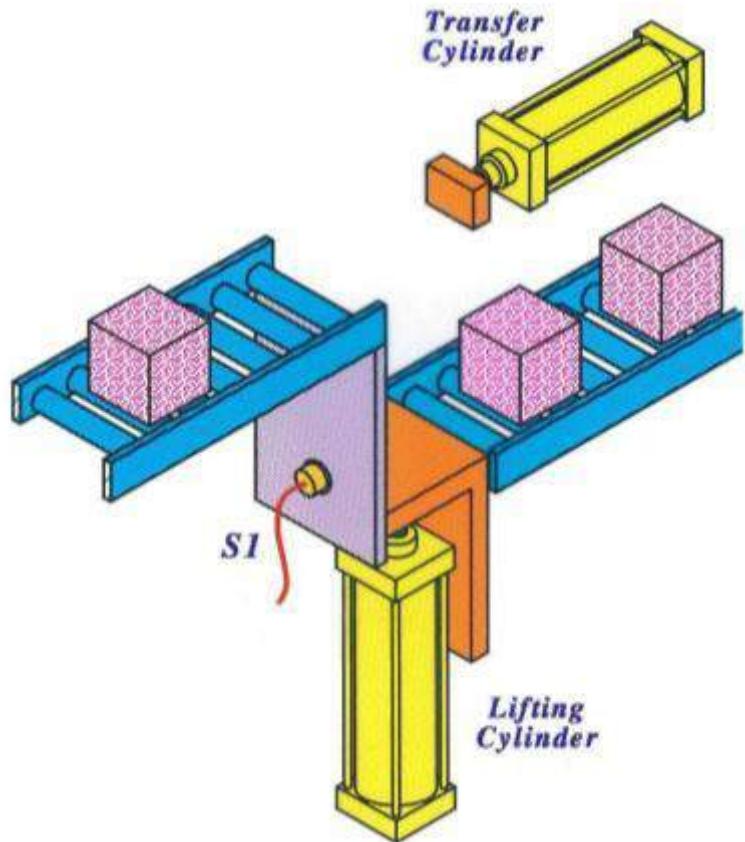
1.1. ការប្រើប្រាស់ប្រព័ន្ធអ្នល់ (ក...)

Door System Application



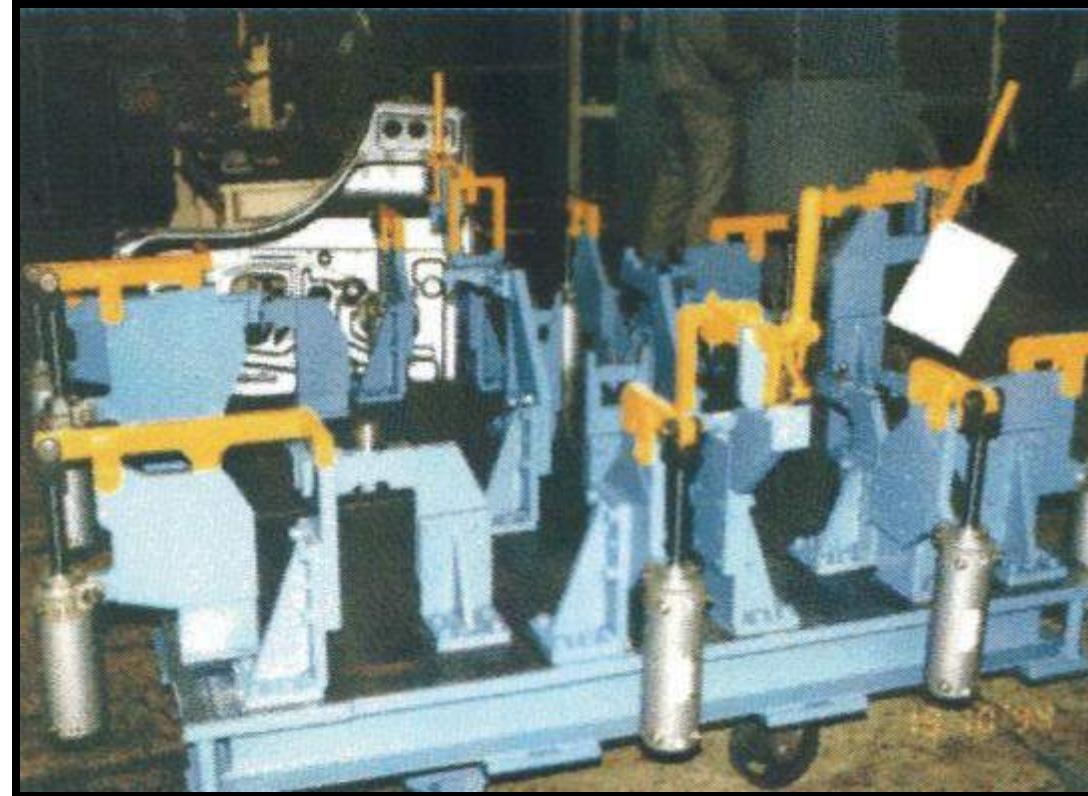
1.1. ការប្រើប្រាស់ប្រព័ន្ធអ្យល (ក...)

Lifting & Transferring Application



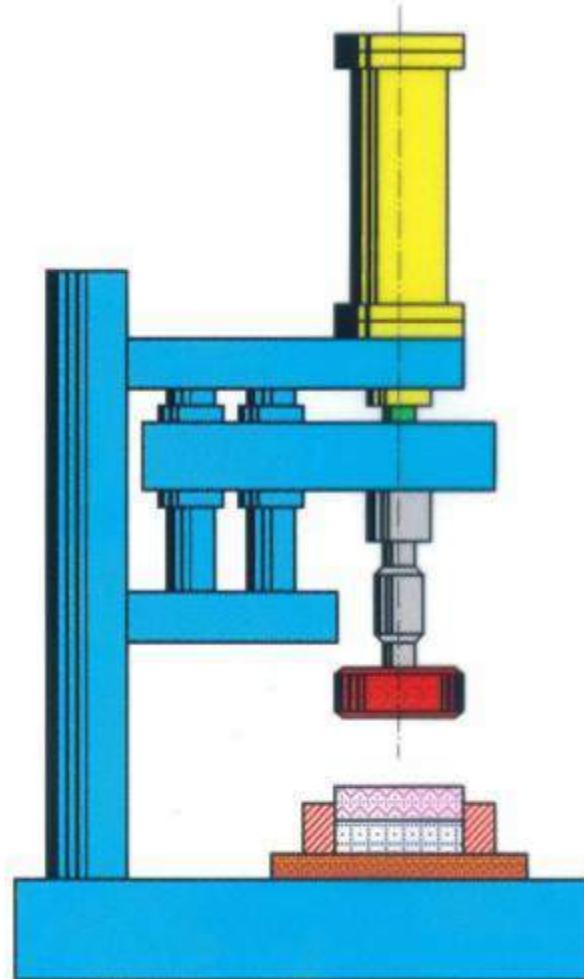
1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Clamping for welding operation



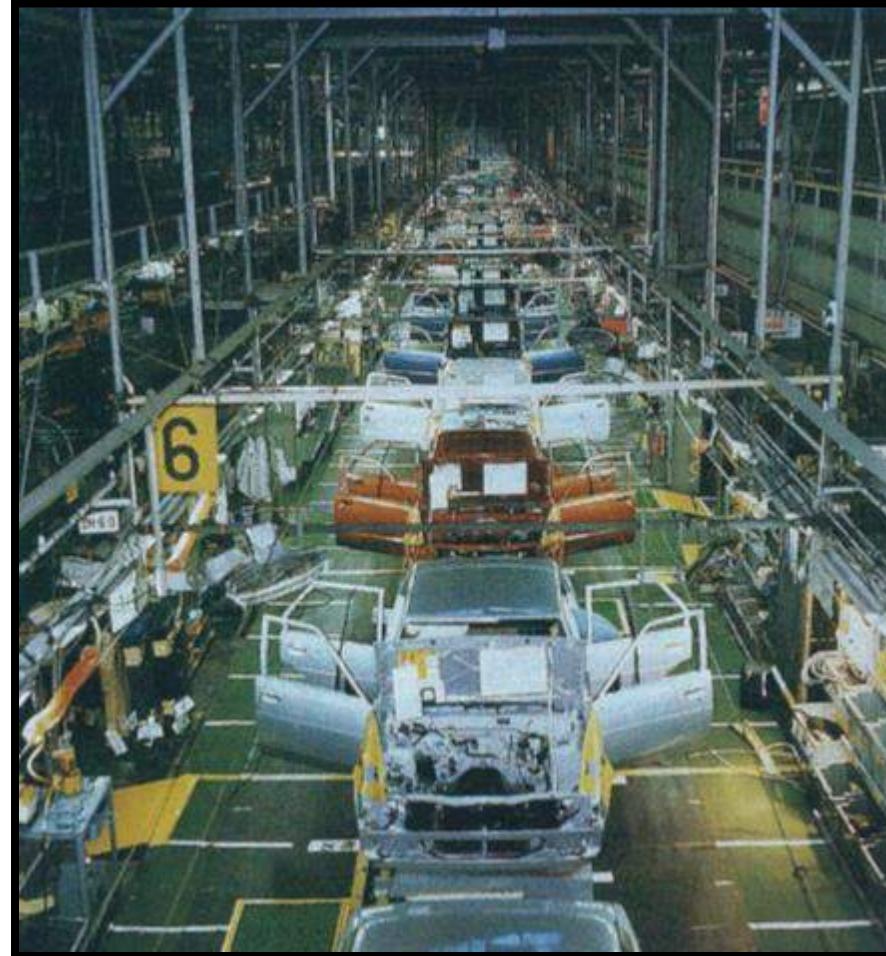
1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Pressing Application



1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Car Assembly Line



1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

Clean Room Application



1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ត...)

ហេតុអ្និយធម៌ប្រើប្រាស់ប្រព័ន្ធខ្សែលសម្រាប់ការងារ?

គុណភាពខ្លួន:

- ▶ **ប្រកាសចុះចុះផ្តាំង**
បរិមាណគ្មានដែលកំណត់និងមិនចំណាយមិនវិភាគ
- ▶ **ការធ្វើកក**
យើងអាចធ្វើកខ្សែលដោត្រឹនក្នុងឯកសារទូទៅមួយ
- ▶ **ការចំណាយគិចសម្រាប់ប្រព័ន្ធស្តីយប្រៀតុ**
អាយស្ថិតម៉ែន ហើយចំណាយគិចនិងអាយក្នុងការបញ្ជាក់
- ▶ **ជំនួយនៃចំណាយបស់គម្រោន**
អាចដានម្រាងលូតបុរិយាទិន្នន័យបុរិយធម៌បាន

1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ក...)

ហេតុអ្និយធម៌ប្រើប្រាស់ប្រព័ន្ធគ្មាល់សម្រាប់ការងារ?

គុណសម្បត្តិ:

► ភាពធននិងទំនុកចិត្ត

អាជធ្មោការកងរយ: ពេលដែននិងមិនដាយវិករិល

► បរិធីនប្រើប្រាស់សាត់

មិនបានលោកយោងមានសារធាតុកង្វេក និងមិនមានករបំពុលដល់ការអារម្មណក់ព័ន្ធ

ମାତ୍ରା ପଦ୍ଧତି

ଅନ୍ତରେ କିମ୍ବା ପାଇଁ ଏହାର ଦେଖିବା ପାଇଁ ଏହାର ଦେଖିବା ପାଇଁ

ଶ୍ରୀ ମହାତ୍ମା ଗାଁନ୍ଦିରା - ପ୍ରକାଶକ ପରିଷଦ

1.1. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល (ត...)

គុណវិប្បត្តិ:

- ▶ ដំណើរការដលិតខ្សែលមានតម្លៃថ្មី
- ▶ ការបន្ទូតខ្សែលត្រូវតែមានជាតាំង
- ▶ ងាយក្នុងការធ្វាបឆ្លាយខ្សែល
- ▶ ប្រភពប្រើប្រាស់ទាប($\leq 10\text{bar}$)
- ▶ បើប្រភពសំពាងឆ្លាក់ចុះនោះដំណើរការ និងកម្បាំងរបស់សូត្រប់អាចចិយចុះខ្សែល
- ▶ ការបញ្ចារលេវ្កិនមានកម្រិតលំអៀងប្រើន
- ▶ ការគំណត់ទីតាំងដំណើរការជាក់លាក់កម្រិងខ្ពស់មានការលំបាតកនិងចំណាយប្រើន

Course Content

- I. សេចក្តីផ្តើម
- II. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល
- III. បង្កុំសំខាន់របស់ប្រព័ន្ធខ្សែល
- IV. វិធីសារស្ថិតិយាង
- V. កុប្រស៊រ [Compressor]
- VI. ផ្ទៃកដំណើរការរបស់ប្រព័ន្ធខ្សែល
- VII. សូច្ចាប់

IV. វិធីសាស្ត្រគណនា

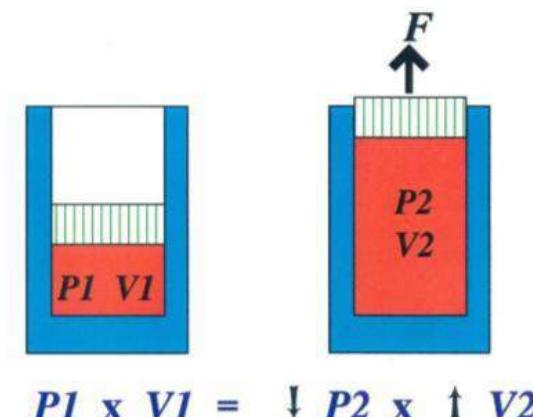
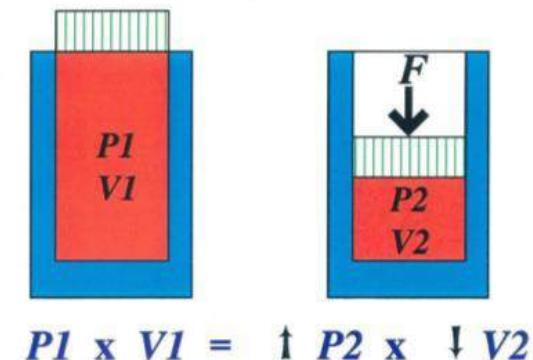
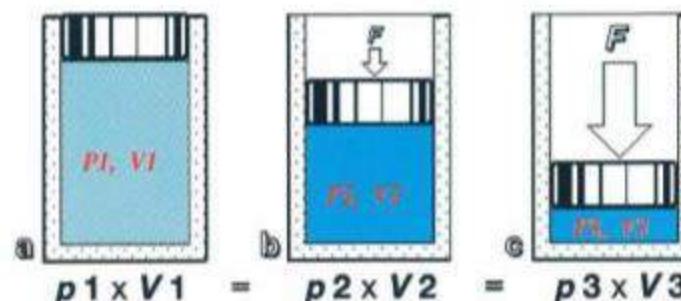
ច្បាប់ BOYLE

ច្បាប់របស់ Boyle រកយើងឱ្យចាត់ផលគុណរវាងសំពាន និងមាមរបស់ខស្តែនមានតម្លៃថ្មីដូចនឹងចុះ ឧណា: សុំតុណ្ឌភាពមិនមានការប្រើប្រាស់។



$$P_1 \times V_1 = P_2 \times V_2 = \text{Constant}$$

Where : P = Pressure (bar)
 V = Volume (m^3)



IV. វិធីសាស្ត្រគណនា

ចុះប៊ែង Charles លើកទូទឹងថាមឈាន៖ សំពាលនៃឧស្សាហម្បយដេរ នៅ៖
មាចនៃឧស្សាហនោះនិងកែនទូទឹងសេវរនៃកំណើនរបស់សិតុណ្ឌភាព។



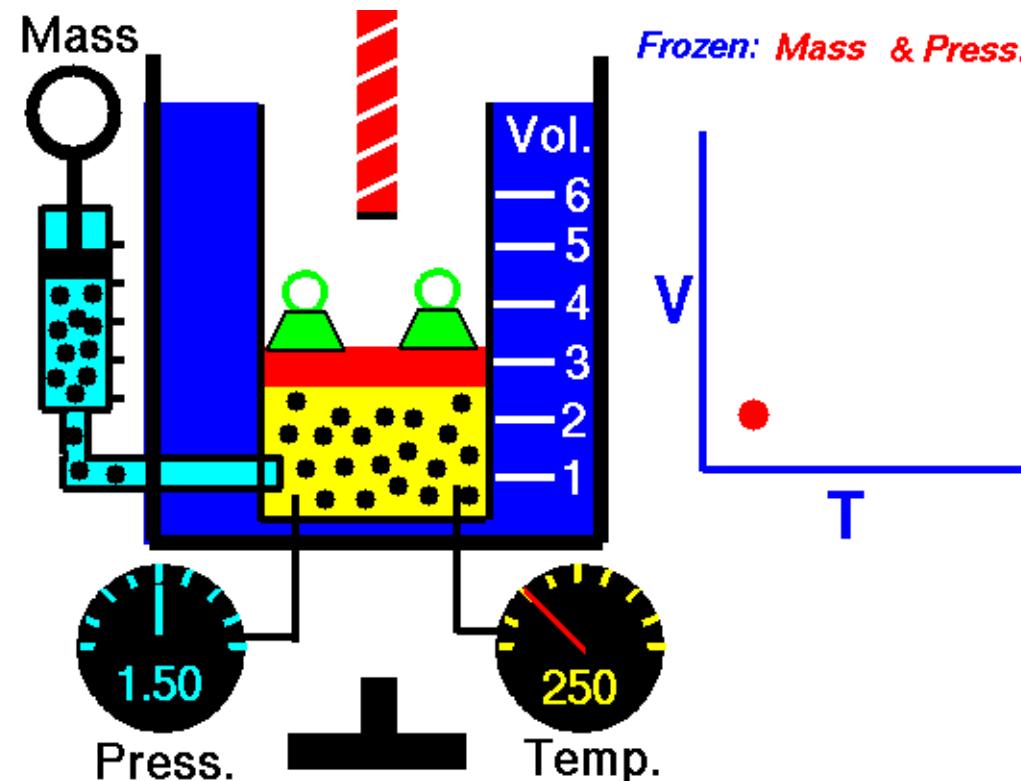
$$\frac{V_1}{V_2} = \frac{T_1}{T_2} = \frac{V_1}{T_1} = \frac{V_2}{T_2} \text{ នៅទី } V_2 = \frac{V_1 \times T_2}{T_1}$$

$$\left. \begin{array}{l} V: ចំណោះឧស្សាហ \\ T,t: \text{សិតុណ្ឌភាព គិតជា (K,C^0)} \\ \text{រក } T = t + 273 \\ \text{រក } t = T - 273 \\ 273 \text{ ជាមេគុណសិតុណ្ឌភាព} \end{array} \right\}$$

IV. វិធីសាស្ត្រគណនា

ចូរប់ Charles

ចូរប់របស់ Charles លើកឡើងថាគារសំពាងនៃឧស្សាហម្បយចេរ នៅមាន
នៃឧស្សាហនោះនិងកែនឡើងស្មើនៃកំណើនរបស់សីតុណ្ឌភាព។



IV. វិធីសាស្ត្រគណនា

ឧ១.

ឧស្សែនមួយបិតនៅចំណុះ 152mL ក្នុងសីតុល្អភាព 18°C តើក្នុងសីតុល្អភាព 32°C រាយចកចាប់បើនោន?

IV. វិធីសាស្ត្រគណនា

ដំណោះស្រាយ ទៅ

គណនា V_2 ?

$$\text{តាមរូបមន្ត្រ } V_2 = \frac{V_1 \times T_2}{T_1}$$

ដោយ $V_1 = 152\text{mL}$, $t_1 = 18^\circ\text{C}$, $t_2 = 32^\circ\text{C}$

$$\rightarrow T_1 = t_1 + 273 = 18 + 273 = 291K$$

$$\rightarrow T_2 = t_2 + 273 = 32 + 273 = 305K$$

$$V_2 = \frac{152 \times 305}{291} = 159.3127 [\text{mL}]$$

$$V_2 = 159.327\text{mL}$$

IV. វិធីសាស្ត្រគណនា

ច្បាប់ Lussac ពេលថាបើមាចន់នឹងស្ថិនមួយមានតម្លៃថែរនោះ
សំពាងនៃនឹងស្ថិននោះនិងសមាមាត្រឡើងសិក្សុណ្ឌភាព។



$$\frac{P_1}{P_2} = \frac{T_1}{T_2} \quad \text{នៅទី } T_2 = \frac{P_2 \times T_1}{P_1}$$

- P1: សម្គាមធម្មល់ គិតជា Kpa
- P2: សម្គាមបរិយាកាស ដែល
1atm=101.325 kpa
- T,t = សិក្សុណ្ឌភាព គិតជា (K, °C)

IV. វិធីសាស្ត្រគណនា

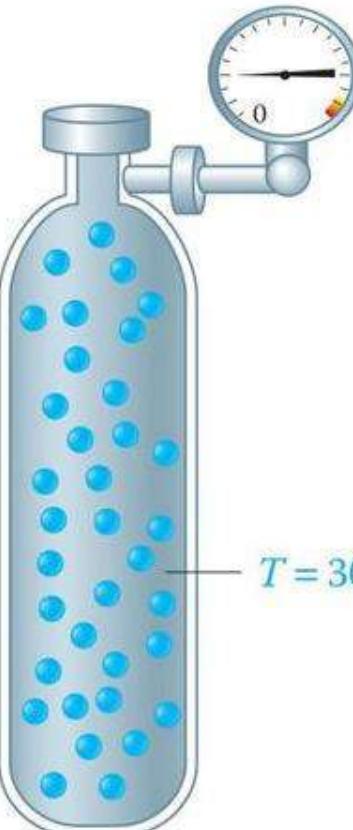
ច្បាប់ Lussac ពោលថាបើមាចនេខស្ថិនមួយមានកម្លែបែរនោះសំពាលនេខស្ថិននោះនឹងសមាមត្រឡប់នឹងសិក្សាពាណិជ្ជការ។

Gay-Lussac's Law

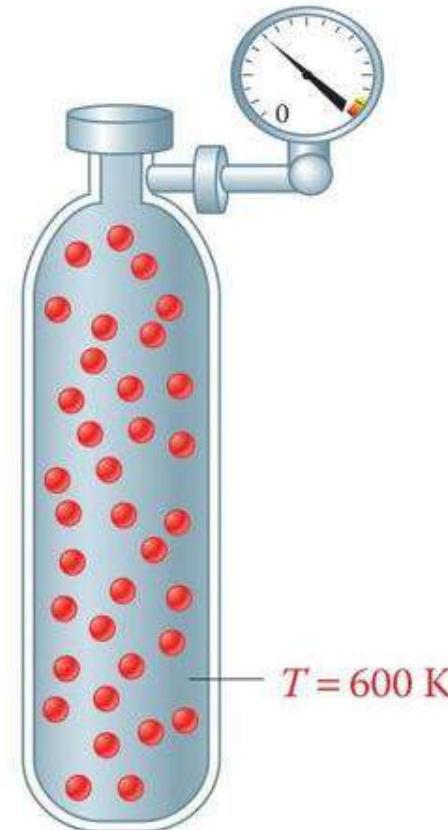
$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

P and T have a direct, linear relationship

$P = 1.00 \text{ atm}$



$P = 2.00 \text{ atm}$



IV. វិធីសាស្ត្រគណនា

សំពាល់: គីបាកម្លោងដែលធ្វើអំពើក្នុងម្នាយ
ខ្លួនផ្លូវ

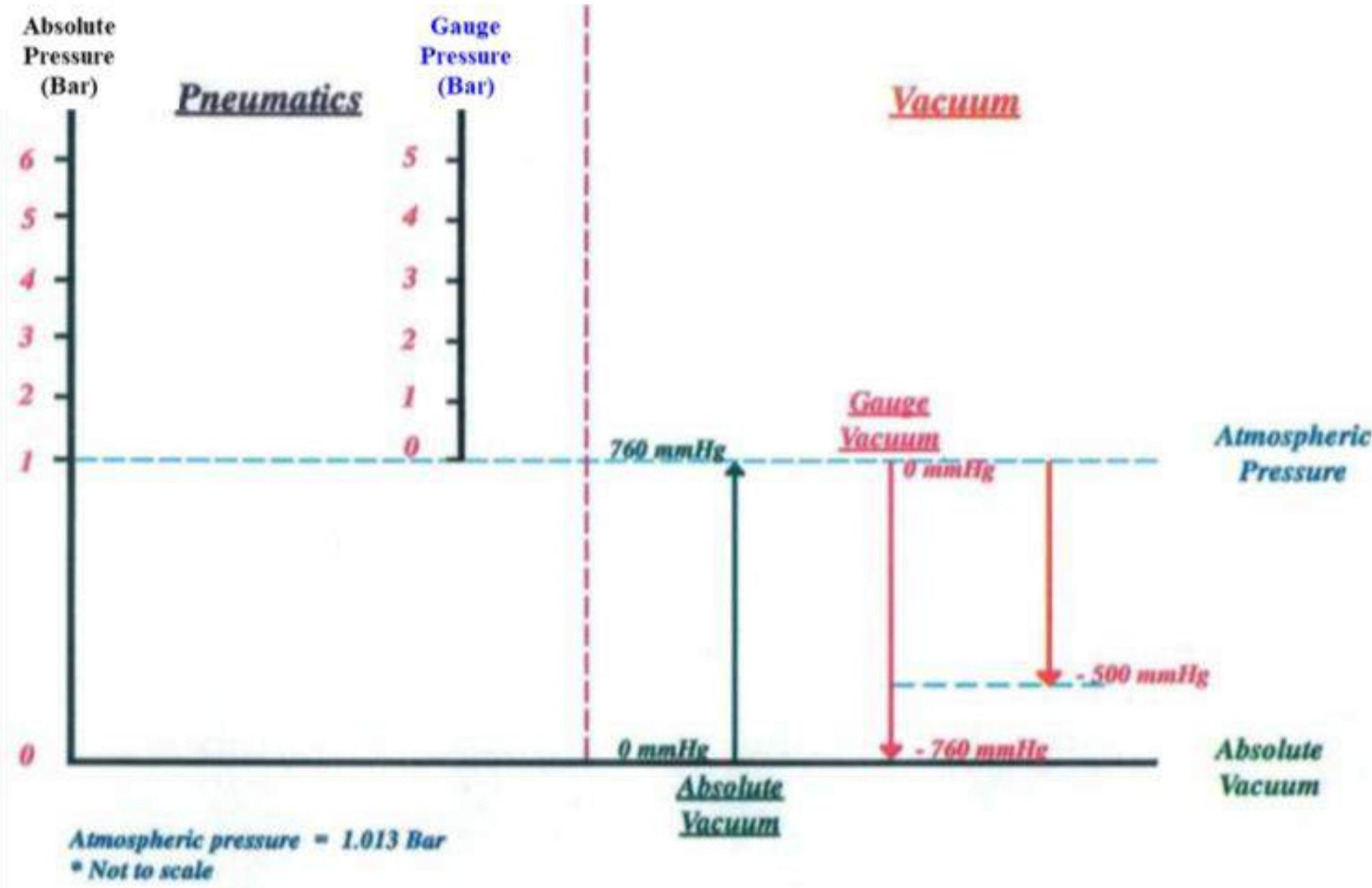
ខ្លួនរបស់ SI គីតិតជាន់
Pascal (Pa) ឬ Bar(bar)

$1 \text{ Pa} = 1 \text{ N/m}^2$ (*Newton per square meter*)

$1 \text{ bar} = 100 \text{ kPa} = 100000 \text{ Pa}$
 $= 100000 \text{ N/m}^2$

$$\text{PRESSURE (P)} = \frac{\text{FORCE (F)}}{\text{AREA (A)}}$$

IV. វិធីសាស្ត្រគណនា



IV. វិធីសាស្ត្រគណនា

គណនាកម្មោងអតិប្បរមា

គេមាន៖

មួយកាត់អតិប្បរមាបស់ស្តីឡើងខ្សែល់ $d = 300\text{mm}$
សំពាលដំណឹករការជាចម្លាតា **6 [bar]**



កម្មោងអតិប្បរមាបស់ប្រព័ន្ធដែលតិចប៉ុណ្ណោះ 42 KN។
ហើយត្រូវការលើសពនៃគោគកមកប្រើ
ប្រព័ន្ធប្រើប្រាយដំនួលសវិញ។

$$\begin{aligned} A &= \frac{\pi d^2}{4} \\ &= \frac{\pi(300)^2}{4} \text{ m}^2 \\ &= 70685.8 \text{ mm}^2 \\ &= 0.071 \text{ m}^2 \end{aligned}$$

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

$$\begin{aligned} F &= P \times A \\ F &= 6 \times 10^5 \text{ N/m}^2 \times 0.071 \text{ m}^2 \\ F &= 42600 \text{ N} \\ F &= 42.6 \text{ KN} \# \end{aligned}$$

$1\text{N}=0.102\text{kg}$

IV. វិធីសាស្ត្រគណនា

ស្តីក្បាន់ម្ខាយដែលមាន $d=20\text{mm}$ ត្រូវបានប្រើសម្រាប់រួចរាល់ម្ខាយដែលមានម៉ាស់ 12kg ។ ហើយសំឡុះទំនាក់ទំនងដី តើ $g = 9.8\text{m/s}^2$ ។

ចូរគណនាកសំពាងទាបបំផុតដែលស្តីក្បាន់អាចលើកវិញនៅបាន។

$$F_{\text{gravity}} = mg$$

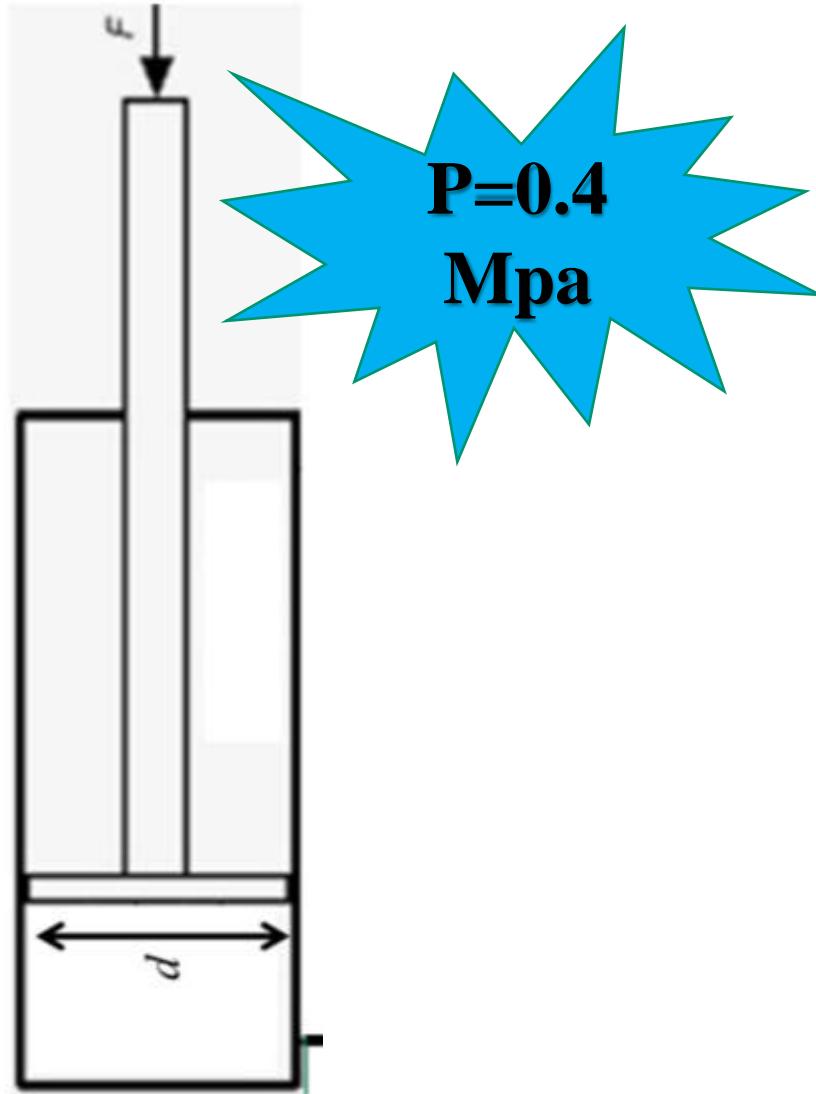
$$F_{\text{gravity}} = (12\text{kg})(9.8 \frac{\text{N}}{\text{kg}})$$

$$F_{\text{gravity}} = 117.6[\text{N}]$$

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

$$P = \frac{F_{\text{gravity}}}{\frac{\pi d^2}{4}}$$

$$P = 0.37 \cong 0.4 \text{ Mpa}$$

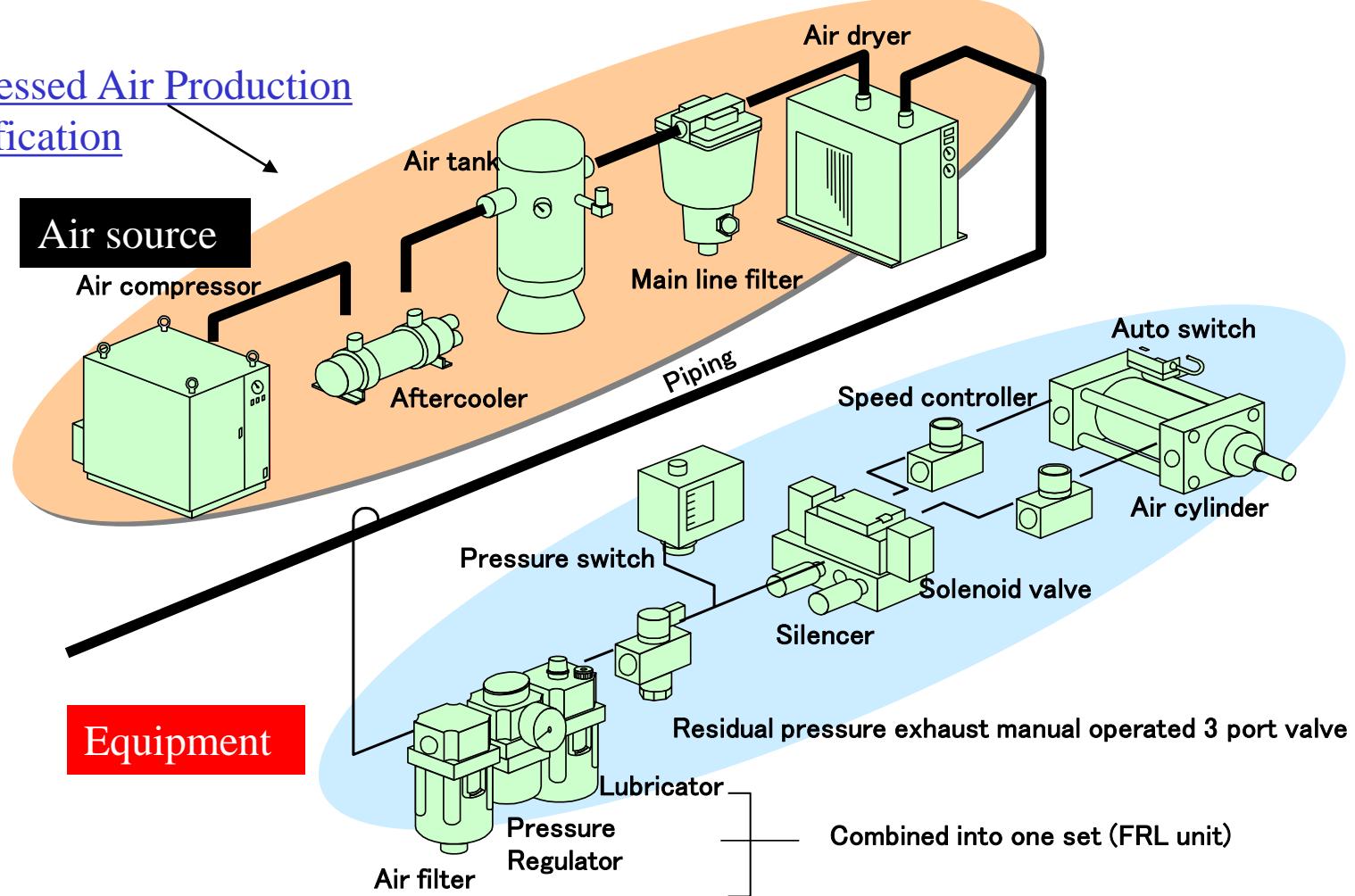


Course Content

- I. សេចក្តីផ្តើម
- II. ការប្រើប្រាស់ប្រព័ន្ធប្រលៀម
- III. បង្កើតរបស់ប្រព័ន្ធប្រលៀម
- IV. វិធីសារស្នូគណៈ
- V. កុំប្រស៊ា [Compressor]
- VI. ធ្វើកដំណើរការប្រស់ប្រព័ន្ធប្រលៀម
- VII. សិក្សាប៉ាប់

The Basic Pneumatic System

Compressed Air Production & Purification



COMPRESSED AIR PRODUCTION

*Compressor
Aftercooler
Main Line Filter
Receiver*

COMPRESSED AIR PURIFICATION

*Air Dryer
Mist Separator
Super Mist Separator*

COMPRESSED AIR DISTRIBUTION

*Air Take-Off (piping layout)
Water Separator (auto drain)
Air Service Unit*

COMPRESSED AIR CONSUMPTION

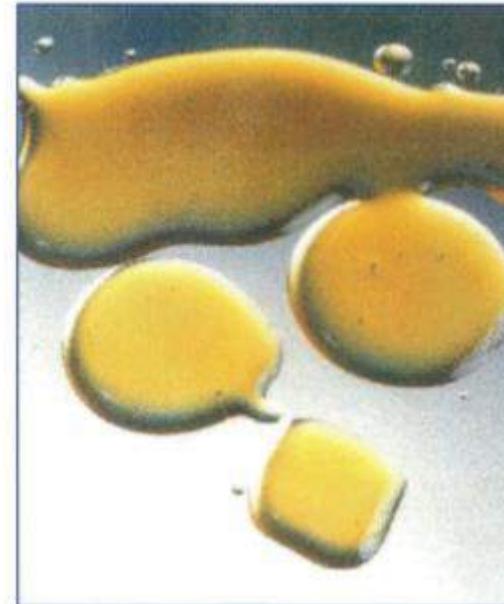
*Directional Control Valve
Non Return Valve
Flow Control Valve
Actuator*

សារធាតុកង្វេកំភុងប្រព័ន្ធមូល

WATER CONDENSATION



OIL CONTAMINATION



DIRT AND RUST



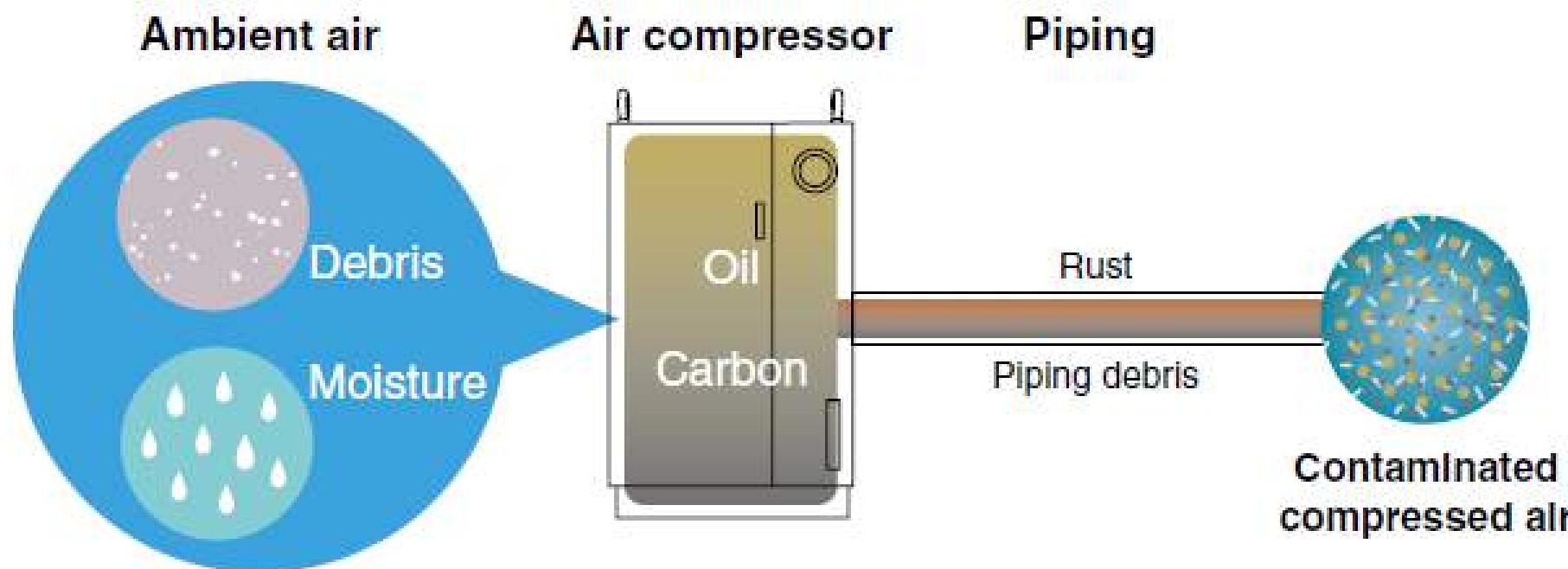
តើសារធាតុទាំងនេះមកពីណា?

សារធាតុកង្វេកក្នុងប្រព័ន្ធប្រល

Problems with compressed air

Compressed air is made by compressing ambient air.

In this process, other substances are taken in with the air.

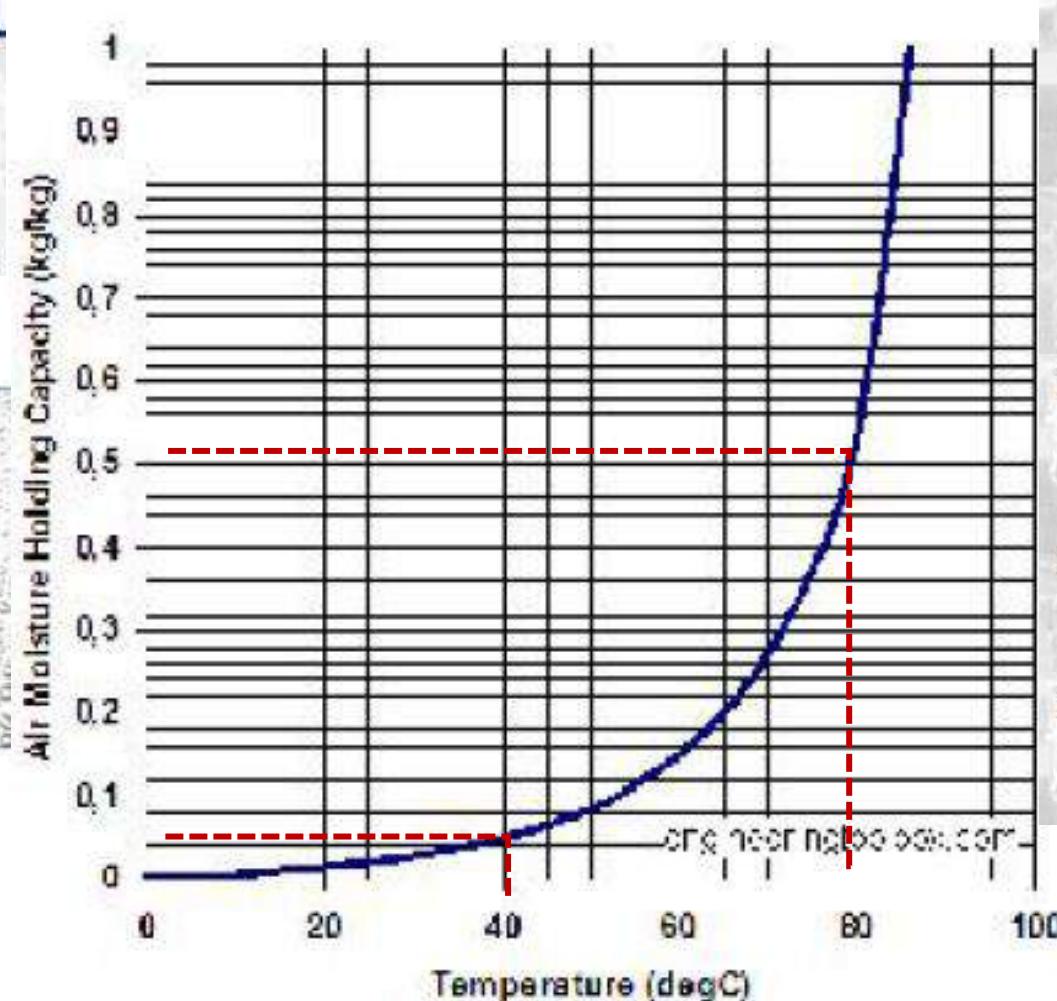


សារធាតុកង្វែកក្នុងប្រព័ន្ធប្រល

The hotter the air, The higher the amount of Moisture.



WATER CONDENSATION

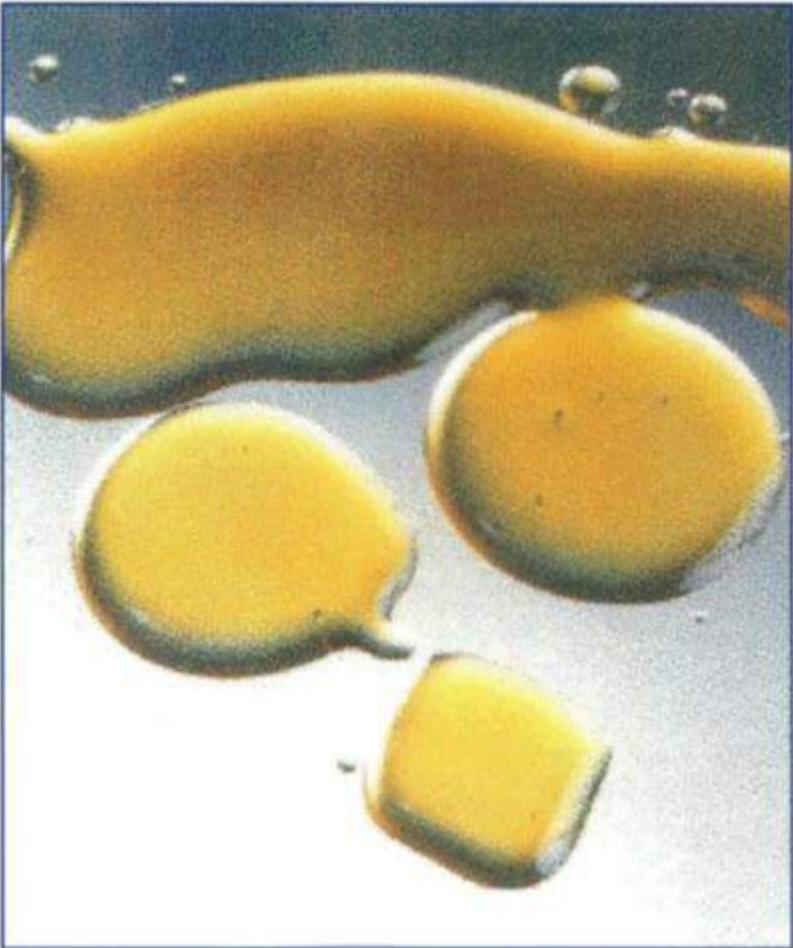


Reasons of water forming in compressed air :

- Air from the environment have a certain amount of moisture.
- During compression, the moisture concentrates to a smaller volume.
- As pressure rises + temperature rises = Air holds more vapor.
- When air temperature drops, air will hold less water vapor resulting in condensation.
- **To remove adverse effect of moisture, cooling down the compressed air is needed.**
- **Cooling down the air condenses the water vapor to liquid form and is drained off.**

សារធាតុកង្វក់ក្នុងប្រព័ន្ធមួល

OIL CONTAMINATION

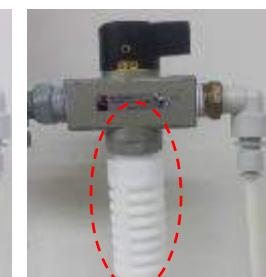


Reasons of oil mist forming in compressed air :

- ***Oil from compressor lubrication turns into mist at high temperature during compression.***
- ***During compression, the oil mist concentrates to a smaller volume.***
- ***As oil mist is almost weightless, it will flow together with the compressed air.***



oil mist



clean

សារធាតុកង្វៀកក្នុងប្រព័ន្ធខ្សែល

DIRT AND RUST

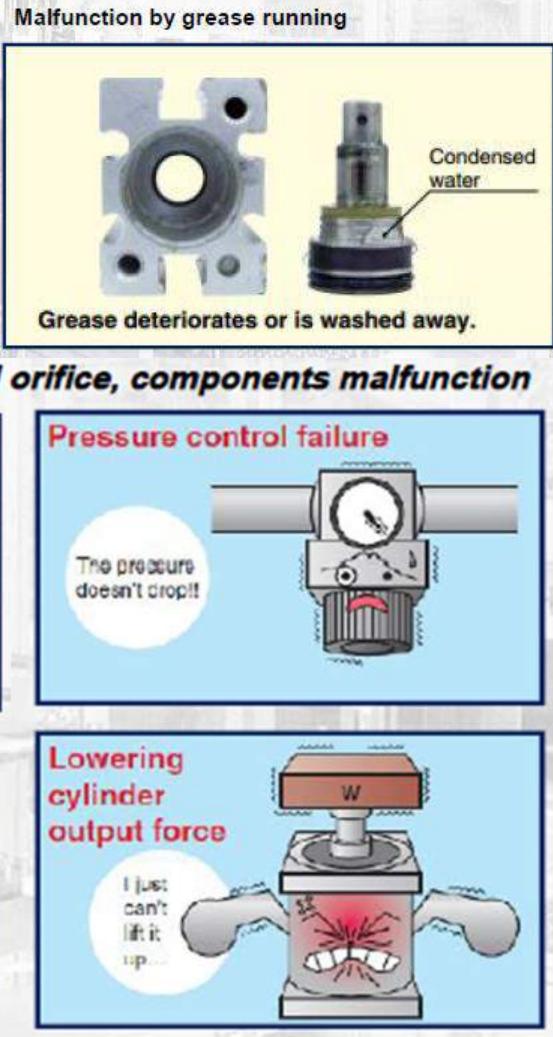
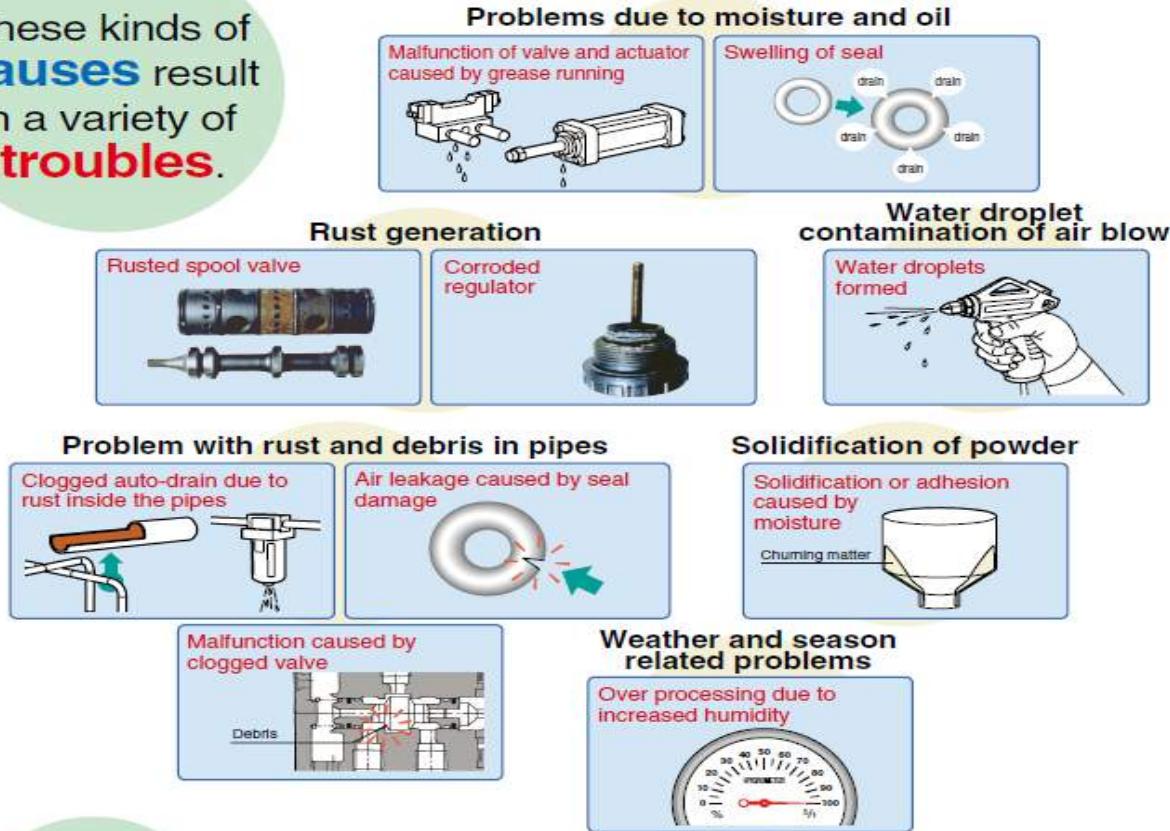


Reasons of dust forming in compressed air :

- ***Air from the environment contains dust.***
- ***During compression, the dust concentrates to a smaller volume.***
- ***As dust is almost weightless, it will flow together with the compressed air.***

សារធាតុកង្វៀកក្នុងប្រព័ន្ធខ្សែល

These kinds of **causes** result in a variety of **troubles**.



→ So The Compressed Air must clean before used.

Course Content

- I. សេចក្តីផ្តើម
- II. ការប្រើប្រាស់ប្រព័ន្ធខ្សែល
- III. បង្កុះសំខាន់របស់ប្រព័ន្ធខ្សែល
- IV. វិធីសារត្រួតពាណា
- V. គ្រឿងបង្កុះរបស់ប្រព័ន្ធខ្សែល [Pneumatic Components]
- VI. ផ្ទៃកដំណើរការរបស់ប្រព័ន្ធខ្សែល
- VII. សូចាប់

ပြန်လည်ပစ္စမာန်

[Pneumatic Components]



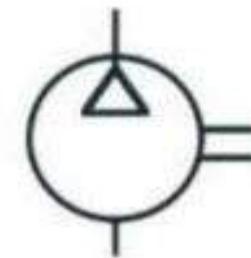
គោលការណ៍របស់គ្រឿងបង្កុនិម្ពយោ

១.៩ ប្រែកធោ Compressors

កំប្រស៊រ គឺជាអ្នកបង្កើតសម្បានឱ្យល់ និងបញ្ចនសម្បានឡើមជ្លាត់ប្រើប្រាស់
ធ្វើង់ តាមរយៈ Pipe ឬ Hoses។

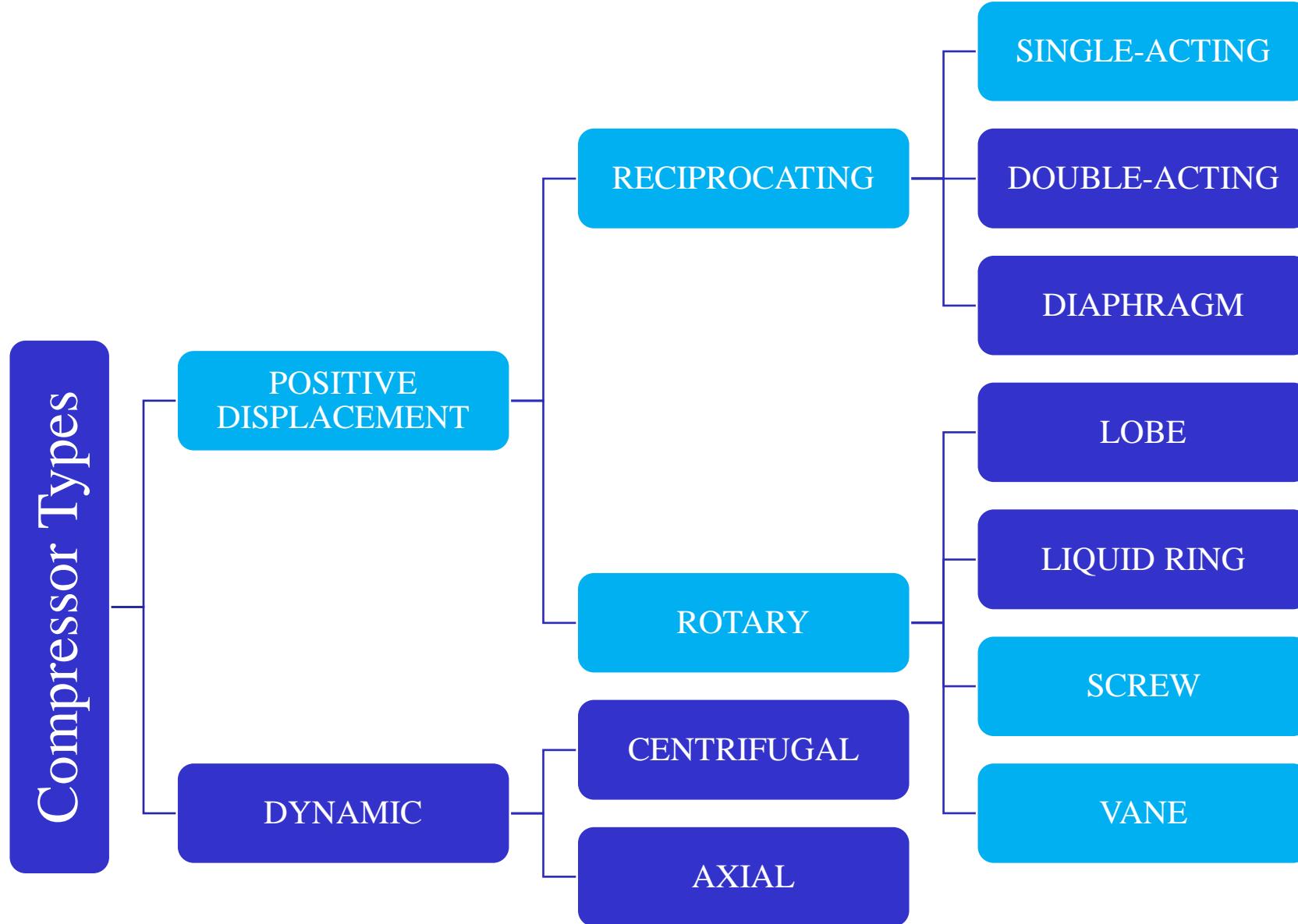


រូបភាព៖ កំប្រស៊រ



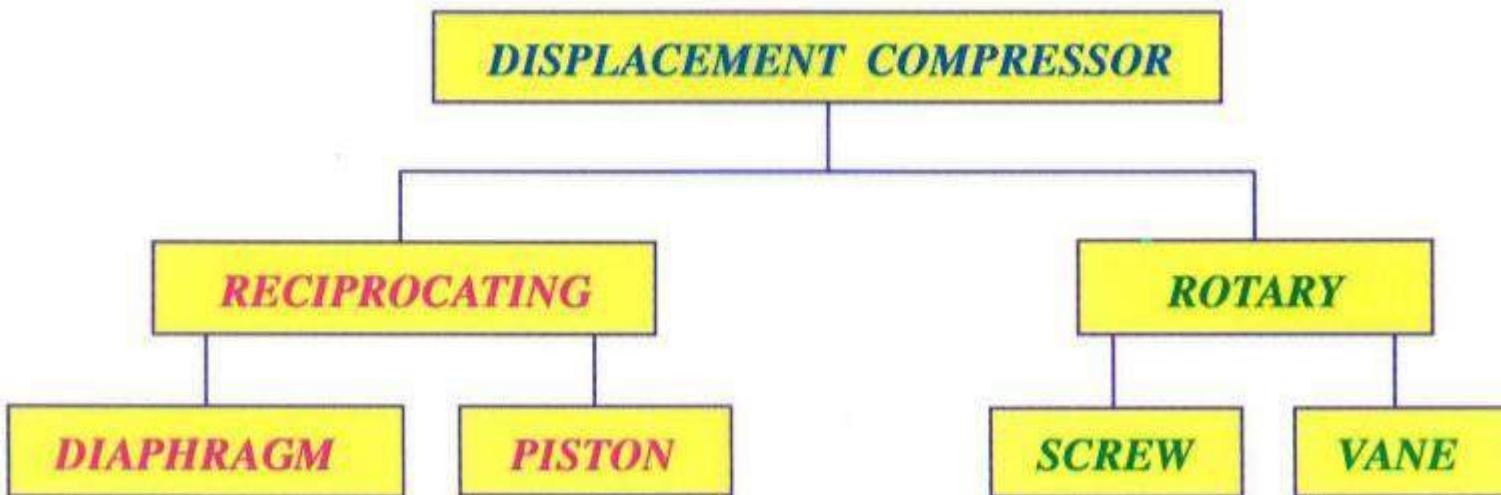
Symbol

៩.៩ ប្រកែវ Compressors



១.៩ ប្រកែទ Compressors

ប្រកែទកំប្រស់រស់នាន់ទាំងម្រាប់ប្រព័ន្ធខ្សែល



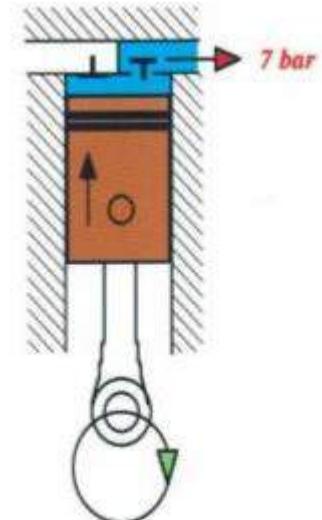
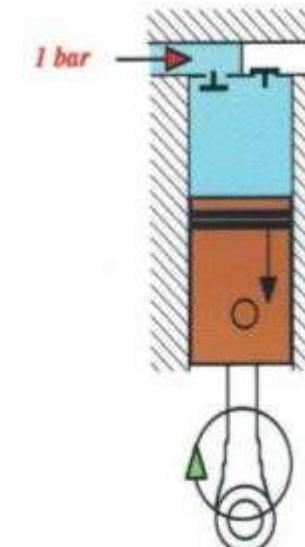
១.១ ប្រកែទេ Compressors

Reciprocating (Piston) Compressor

គីជាប្រកែទេម៉ាសុនខ្សោលដែលធ្វើការបីតបំណែន
ខ្សោលផ្តូរកក្នុងផ្តូងខ្សោលតាមរយៈសិទ្ធិពីស្ថាង ដែលត្រូវបាន
គេនិយមប្រើប្រាស់ជាដំឡើងគេនាទេលបច្ចុប្បន្នចំពោះការងារ
ខ្លាតតុច និងមធ្យម។

Advantage

- *Initial investment is less.*
- *Suitable for high pressure ranges.*



១.១ ប្រកែទេ Compressors

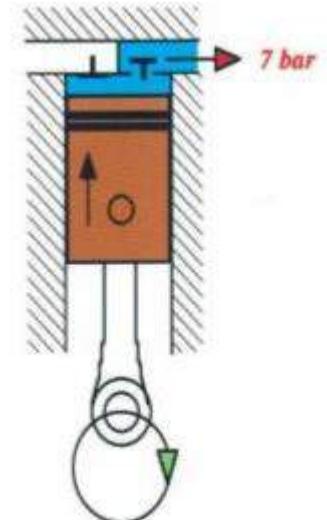
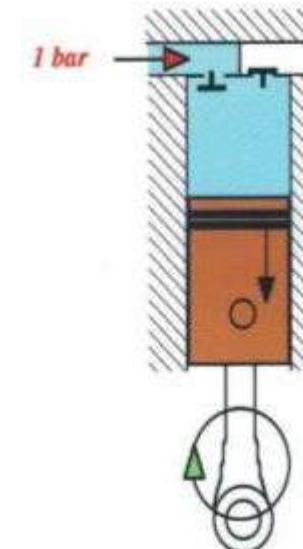
Reciprocating (Piston) Compressor

គីជាប្រកែទេម៉ាសុនខ្សោលដែលធ្វើការបីតបំណែន
ខ្សោលផ្តូរកក្នុងផ្តូងខ្សោលតាមរយៈសិបិតិស្ថាង ដែលត្រូវបាន
គេនិយមប្រើប្រាស់ជាដំឡើងគេនាទេលបច្ចុប្បន្នចំពោះការងារ
ខ្លាតតុច និងមធ្យម។



Disadvantage

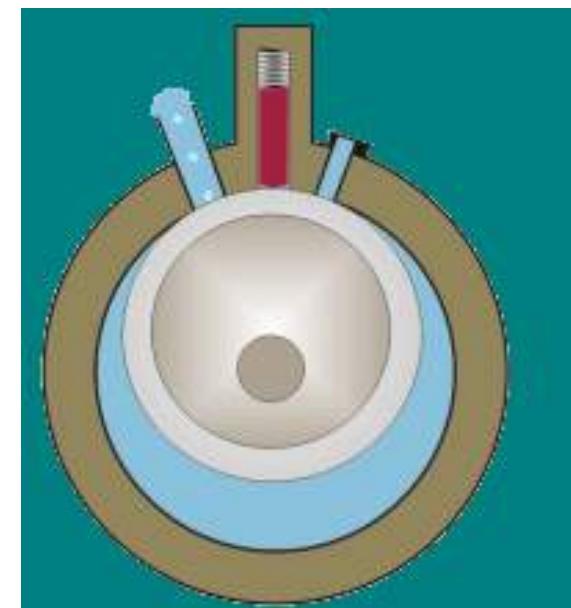
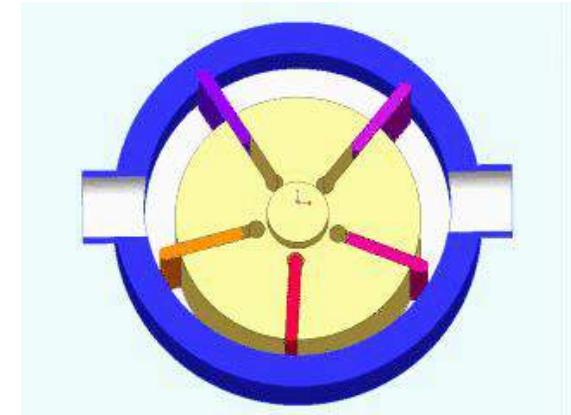
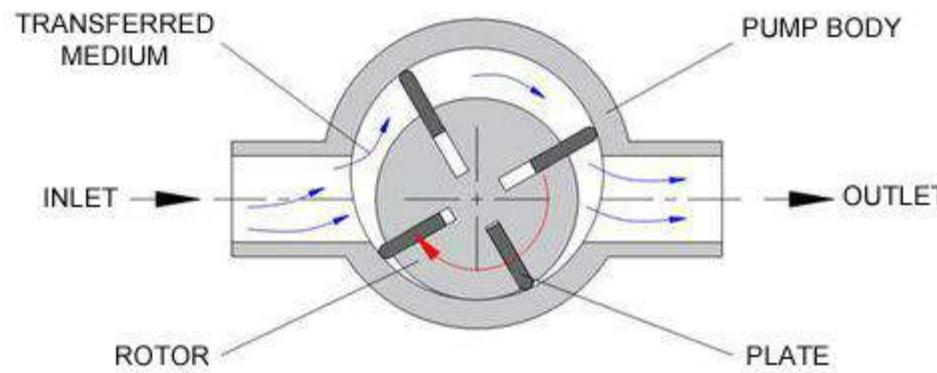
- *Causes vibration.*
- *Pressure output with pulsations.*
- *High maintenance cost due to lots of moving parts.*
- *High output temperature (compressor oil burns easily).*
- *Noisy in operation.*



៩.៩ ប្រកែទេ Compressors

Rotary Compressor

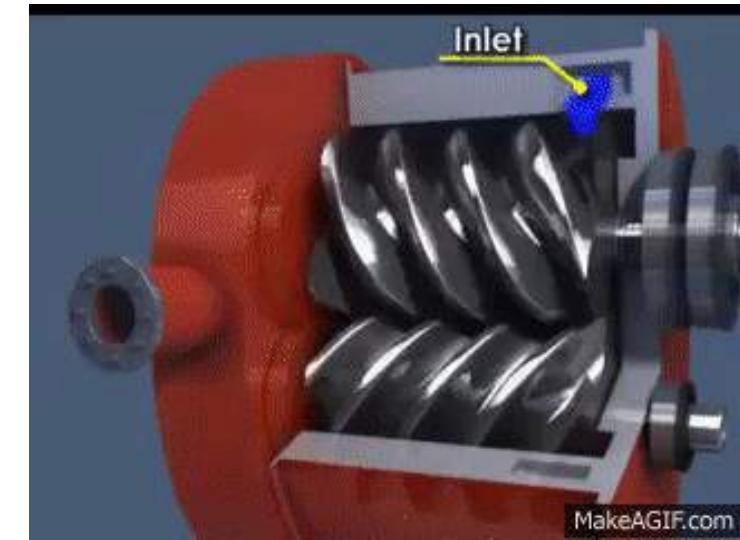
គីជាប្រកែទេម៉ាសុនដែលធ្វើការបើកបំណោនសម្ភារិក្សាន
ធម្មង់ដើម្បីទ្រួមសម្ភារិក្សាល់ ហើយសម្ភារិក្សាដានបង្កើតឡើង
តាមរយៈ**ស្ថាបត្រង់**ដែលចាប់ភ្លាប់ជាមួយនឹងក្រោ Compressor
ដែលត្រួមតែនិយមប្រើជាមួយឧបករណ៍បរិភាគរត្តជាក់។



១.៩ ប្រកែទេ Compressors

Rotary Screw Compressor

គីជាប្រកែទេម៉ាសុនដែលធ្វើការបឹតបំណោន
សម្ងាត់ក្នុងធ្វើធម្មីទ្វូរមានសម្ងាត់ខ្ពស់ ហើយសម្ងាត់
ត្រូវបានបង្កើតឡើងតាមរយៈ Rotor Screw ពីរ រម្លៃ
បញ្ញាស់ទិសត្វាបើម្បីបង្កើតសំពាន។



Advantage

- Vibrations are very less.
- Lower output temperature.
- Quiet.
- Compact.

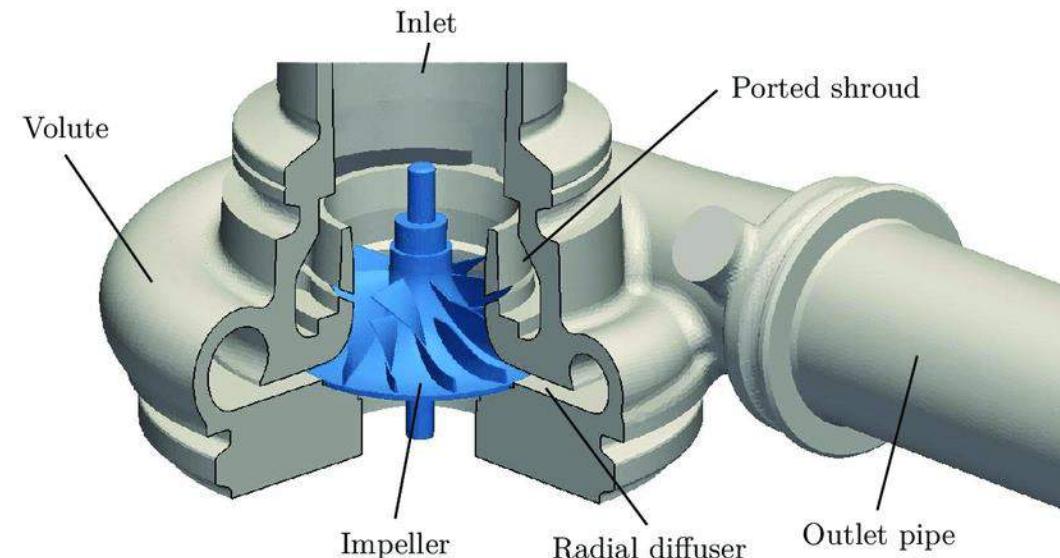
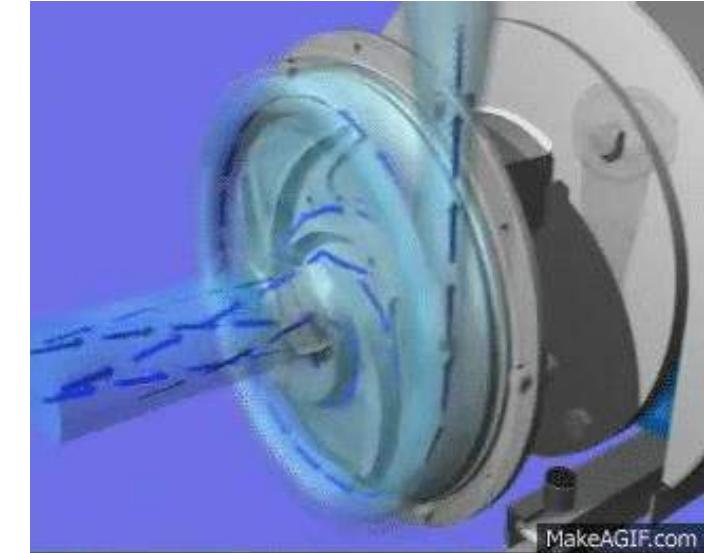
Disadvantage

- Lower pressure range.

១.៩ ប្រកែទេ Compressors

Centrifugal Compressor

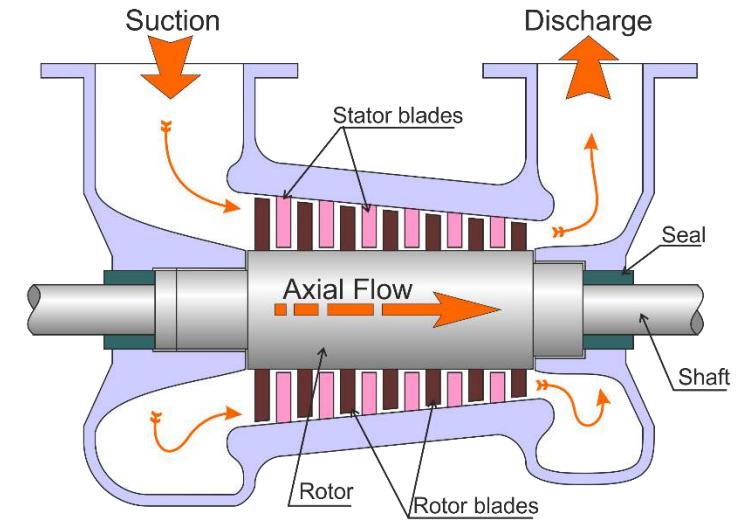
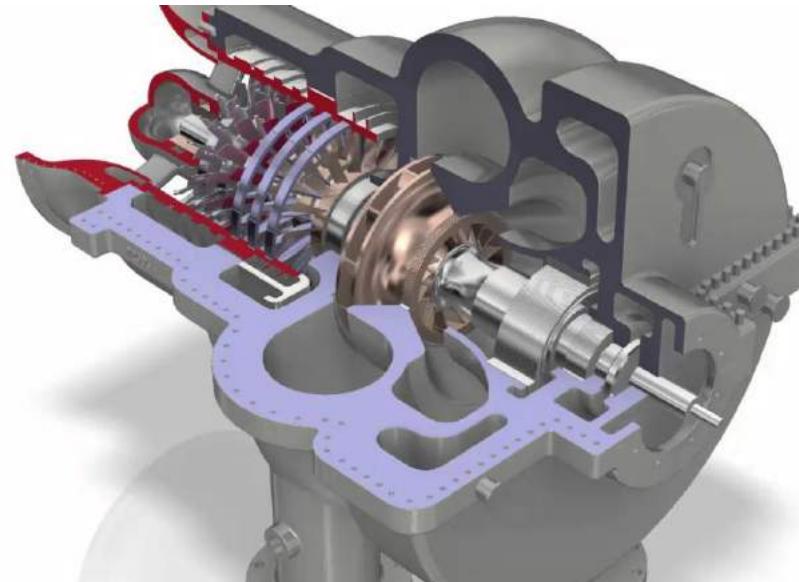
គីជាប្រកែទេម៉ាសុនខ្សោលដែលធ្វើការបីតបំណែន
សម្ងាត់ខ្សោលដូចក្នុងផុងខ្សោលតាមរយៈស្ថាបច្ចេក ដែលមាន
កម្លាំងខ្សោន និងបង្កើតសម្ងាត់ខ្សោលបានតាមរបៀប ដែល
ត្រូវបានគេនិយមប្រើនៅក្នុងរោងច្រែ សហគ្រាល់ជំងឺ។



១.៩ ប្រកែទ Compressors

Axial Compressor

គីជាប្រកែទម៉ាសីនខ្សោយល់ដែលធ្វើការបើតបំណែន
សម្ងាត់ខ្សោយល់ដូរកកុងធុងខ្សោយល់តាមរយៈ**ស្ថាបថាស** ដែល
មានកម្លាំងខ្ពស់ និង**បង្កើតសម្ងាត់ខ្សោយល់**បានភាប់រហ័ស
ដែលត្រូវបានគិនឃើមប្រើនៅក្នុង**ហេងចក្រ** សហគ្រាស
ផំព័រ





ក្របកាត់ បន្ទូប់ Compressors



Compressor room (outdoor)

ក្របកាត់ បន្ទូប់ Compressors

អនុកាតសម្រាប់បង្កើល Compressor

Type	Flow Q, m ³ /min	Compression ratio	Speed n, rpm
Displacement	Reciprocating	0-500	2.5-1000 100-3000
	Rotary	0-500	3-12 300-15000
Dynamic	Radial(Centrifugal)	60-3000	3-20 1500-60000
	Axial	100-9000	2-25 500-20000

ပြန်လည်ပစ္စမာန်

[Pneumatic Components]



គោលការណ៍របស់គ្រឿងបង្កុនិម្នយោ

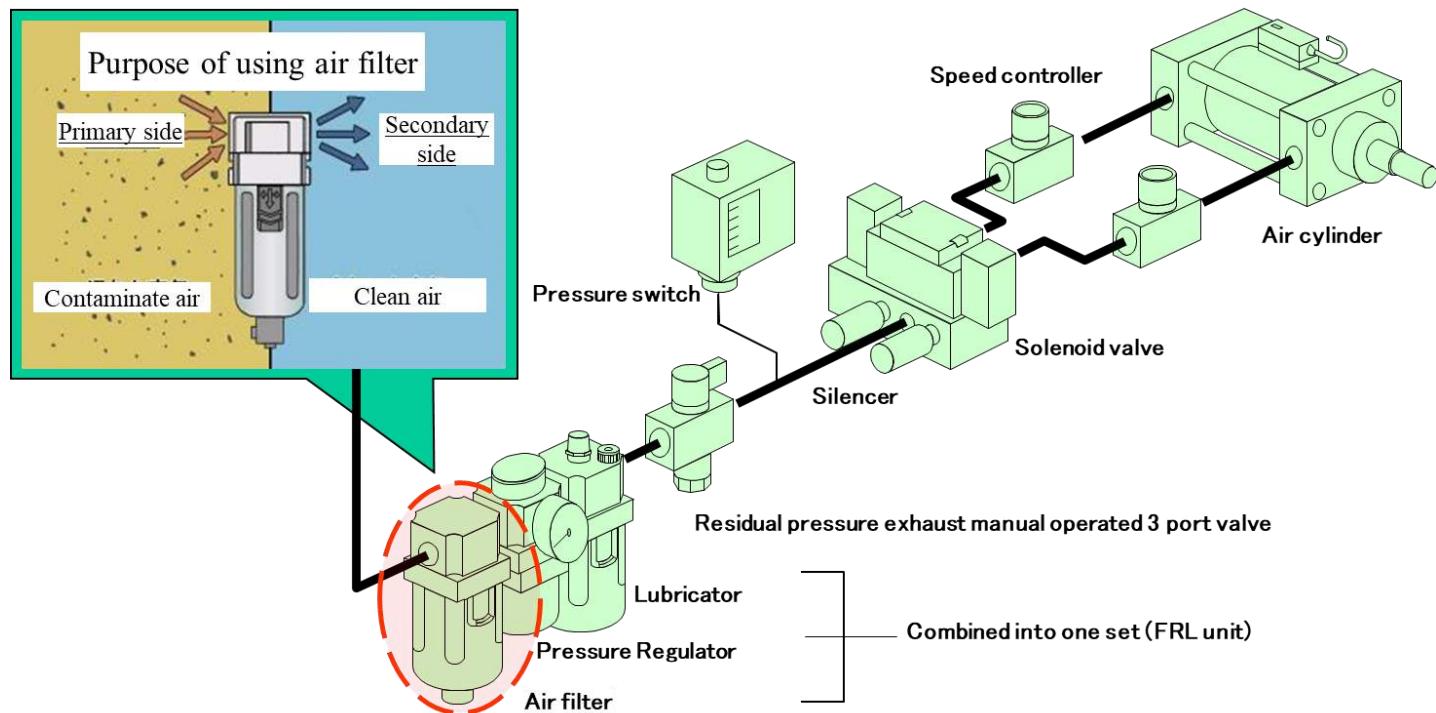
១.២ តម្រងចម្លោះខ្សោល (Air Filter)

តម្រងចម្លោះខ្សោល គឺជាបករណ៍ម្នាយប្រភេទដែលធ្វើ
អំពី Fibrous material សម្រាប់គ្រឿងយកកម្មិចកម្មិ
លម្នានធ្វូលី និងបាក់តេវីតីខ្សោល។ តម្រងនេះកំមានត្បៃ
នាទីសម្រាប់បំបែកទីកញ្ចប់ចេញពីក្នុងខ្សោលដើរ
ហើយរាល់កម្មិចដែលធ្វូលក្នុងបាក់តេវីតីក្នុងបង្កុរ
ចេញមកខាងក្រោមនេះដើរក្នុងបាក់តេវីតីក្នុងបង្កុរ។

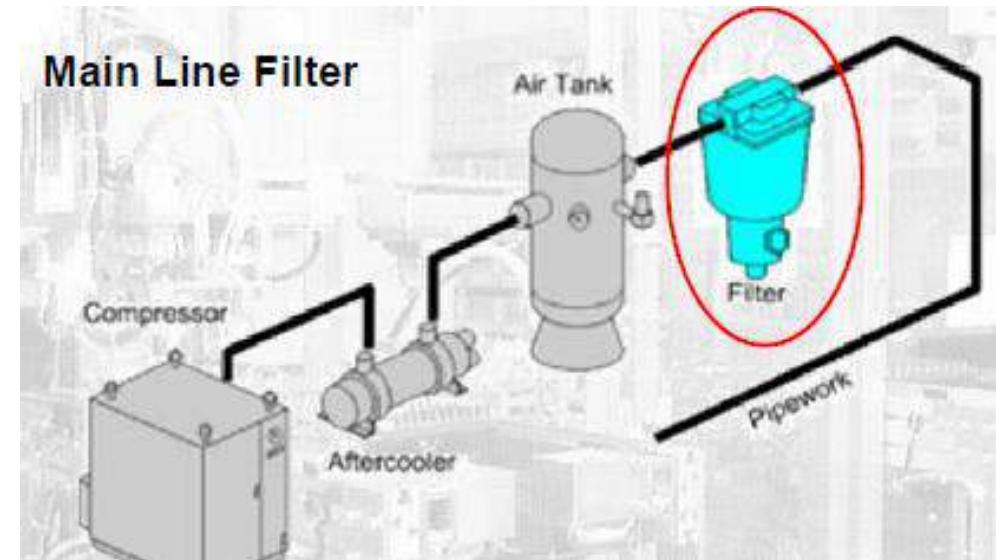


របៀបការណ៍ Air Filter

១.២ តម្រងចរោះខ្សែ (Air Filter)

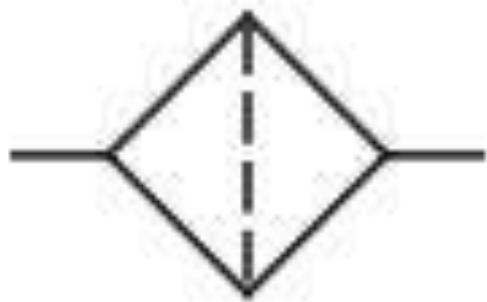


របៀប ១.២ Air Filter

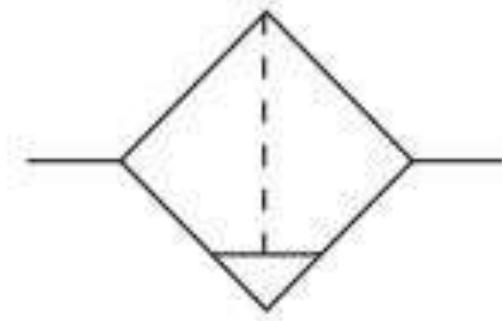


របៀប ១.៣ Main Drain Air Filter

១.២ តម្រងចម្លោះខ្សែ (Air Filter)



រូបភាព៖ Air Filter Symbol



រូបភាព៖ Main Drain Air Filter Symbol

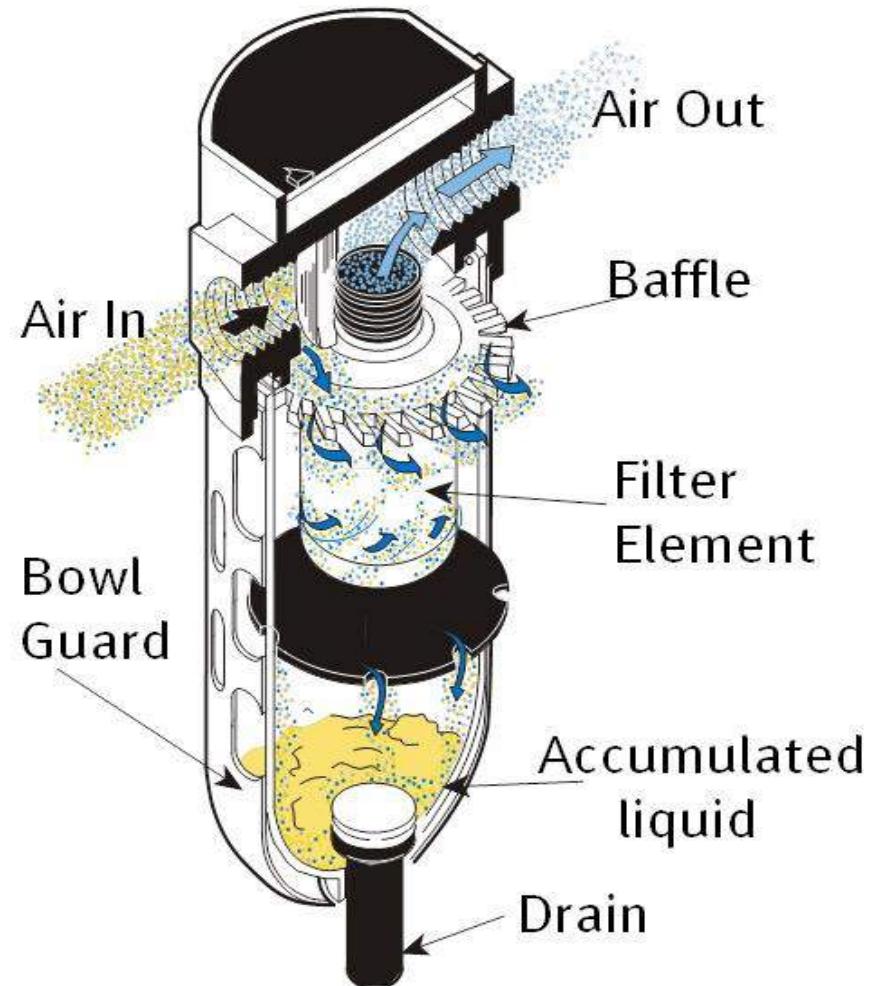
១.២ តម្រងចរោះខ្សោំ (Air Filter)



Flow rate: 0.1-5000 L/min
Standard rate: 1000 L/min

រូបភាព៖ Air Filter

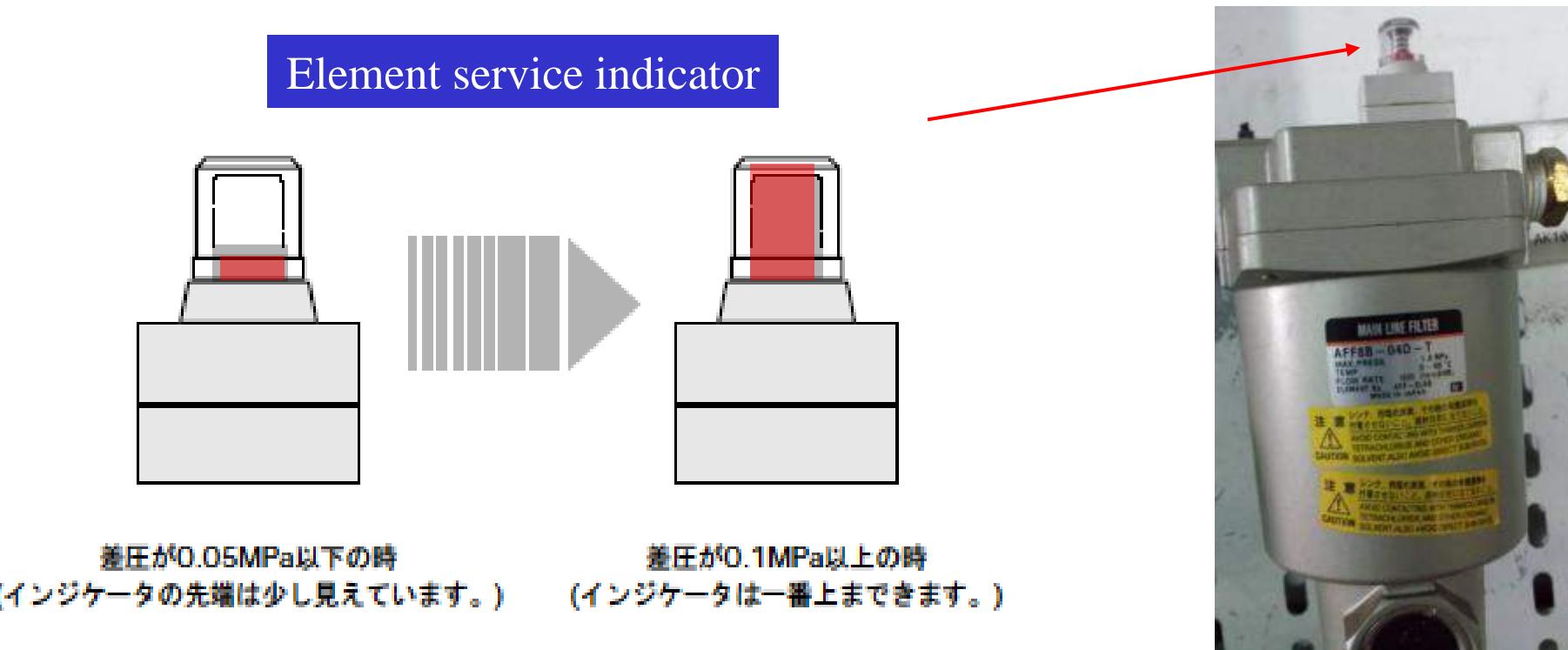
១.២ តម្រងចម្លោះខ្សែ (Air Filter)



រូបភាព៖ ផ្តើកខាងក្រុងរបស់ Air Filter

១.២ តម្រងចម្លោះខ្សែ (Air Filter)

*សំពាល់ផ្តល់ខ្សែ និងខ្សែចេញមានសំពាល់ខ្សែ។



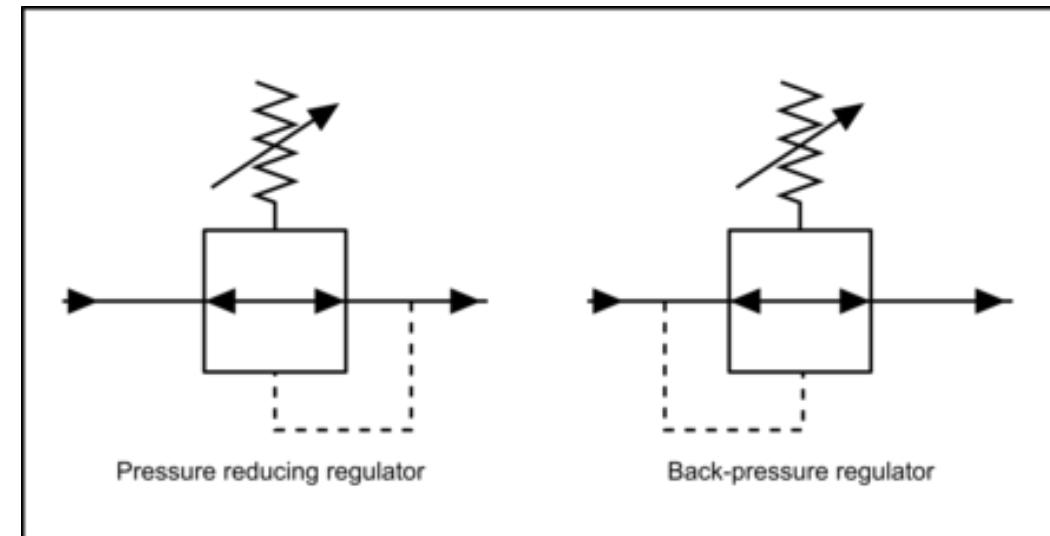
គោលការណ៍របស់គ្រឿងបង្កើនិមួយៗ

១.៣ វ៉ានលេតប្រុសម្អាច (Air Regulator)

គោលការណ៍នៃវ៉ានលេតប្រុសម្អាចគឺរក្សាសម្អាចឡើងមានលំនីងនៅពេលប្រើប្រាស់។



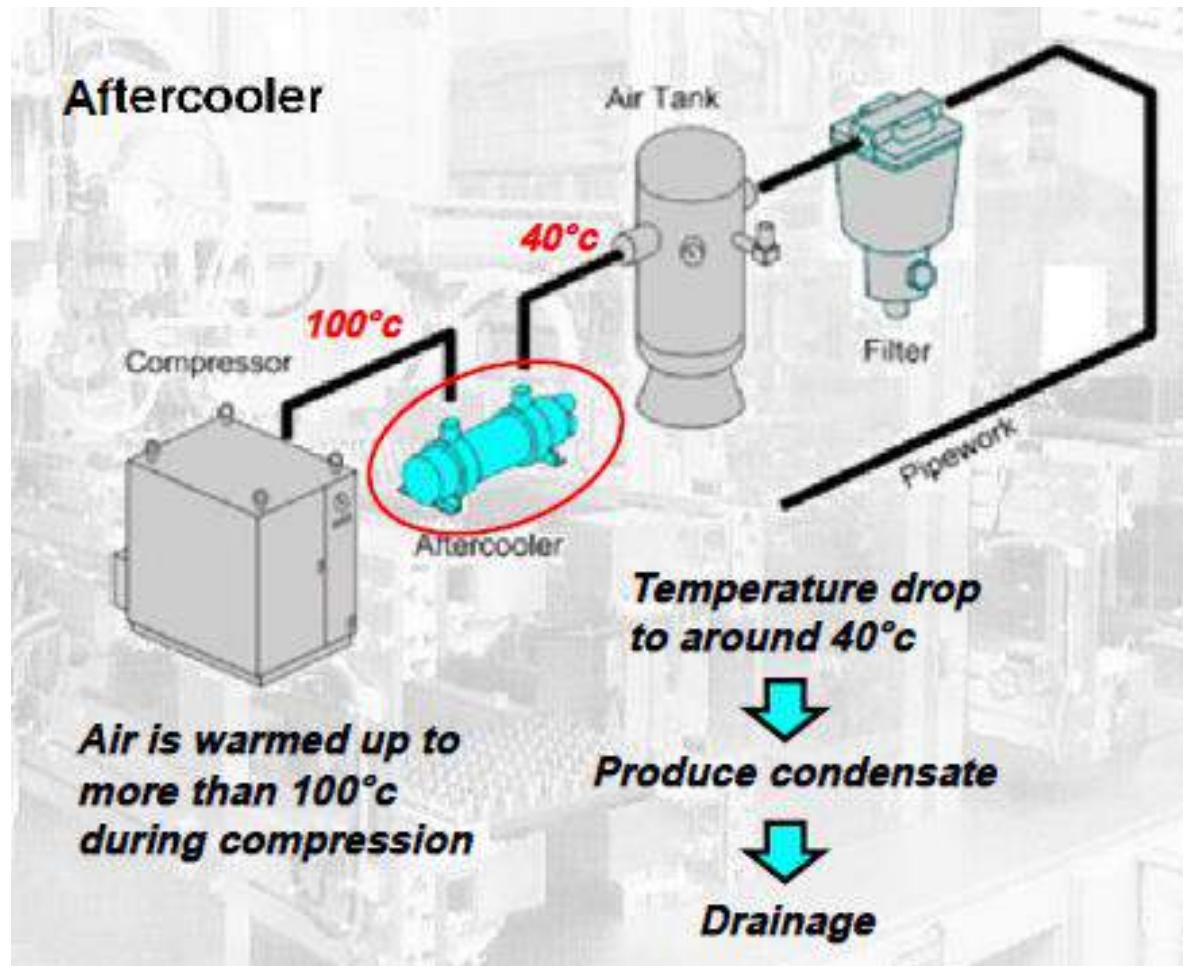
រូបភាព៖ Regulator



រូបភាព៖ Symbol

គោលការណ៍របស់គ្រឿងបង្កុនិម្នយោ

១.៥ បំពុងបញ្ញេះកម្លាំង (After Cool)

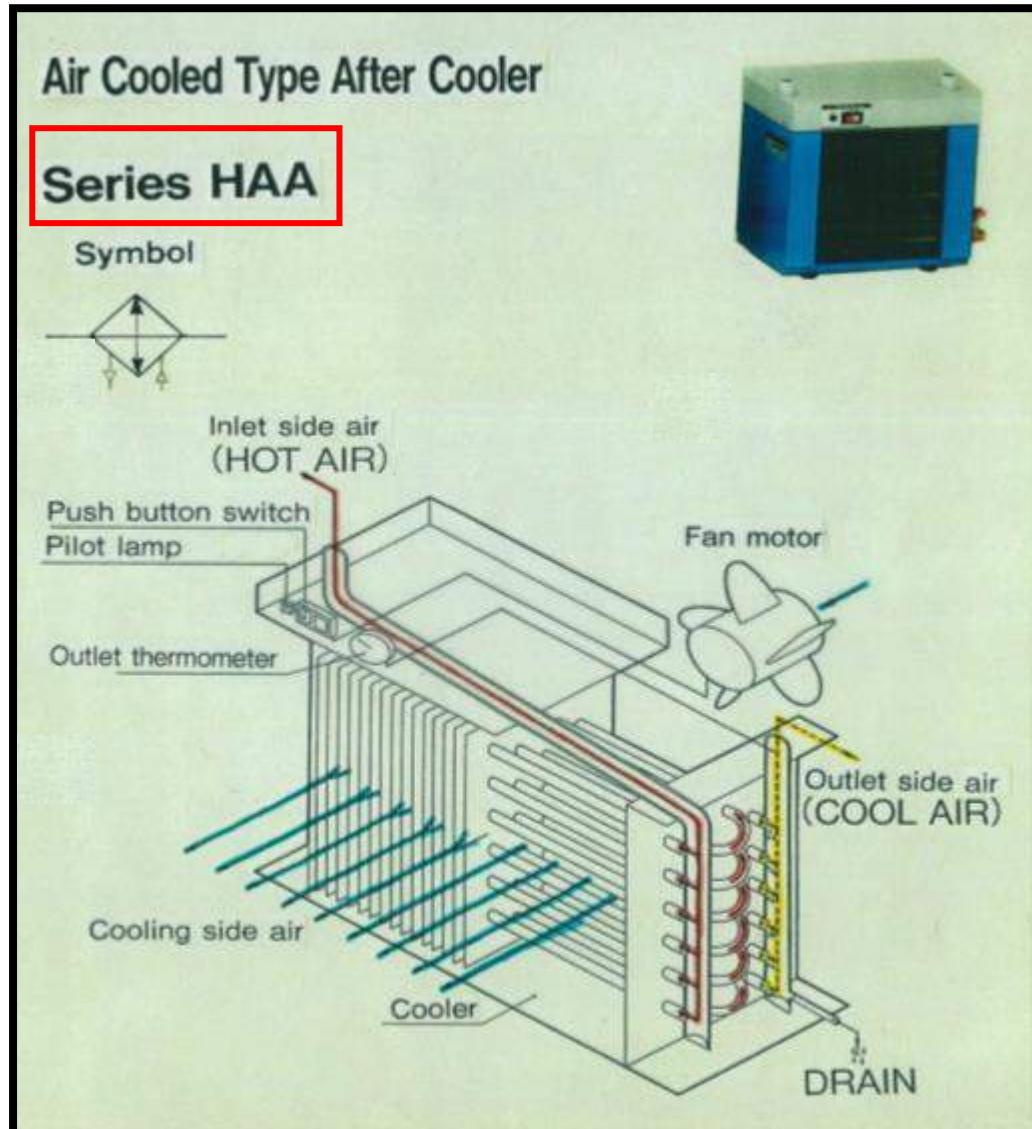


មាននាទីបញ្ញេះកម្លាំង បំបាត់ដំណក់ទឹង និងបំបាត់ជាតិប្រហែល។

Aftercooler មានព្រមទេះ

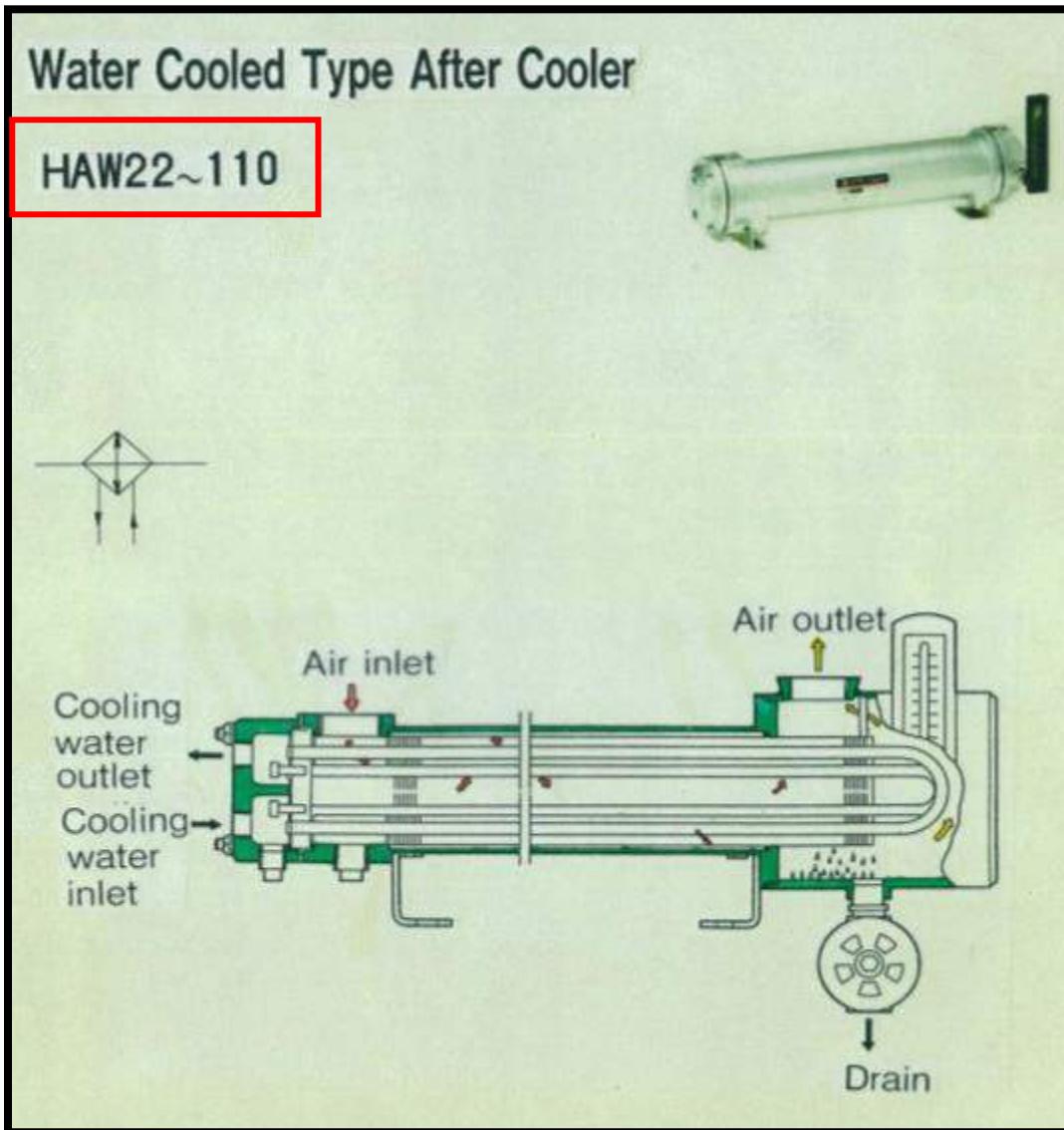
- Air-Cooled
- Water-Cooled

Compressed Air Purification



- ប្រើប្រាស់ខ្សែដើម្បីបញ្ចូនការងារ
- មិនត្រូវការឧបករណ៍បញ្ចូនការងារ
- ងាយស្រួលចំនាំ

Compressed Air Purification



- ប្រើប្រាស់ទឹកដើម្បីបញ្ចុះត្រជាក់
- អាចប្រើប្រាស់ជាមួយសុំតណ្ហភាពក្នុងខ្លួន
- អាចប្រើជាមួយសុំតណ្ហភាពចាប់ពី 5°C to 200°C

គោលការណ៍របស់គ្រឿងបង្កុនិម្នយោ

១.៥ បំពុនសម្បតខ្សោល (Air Dryer)

- Refrigerated Air Dryer



- Desiccant/Heatless Air Dryer



- Membrane Air Dryer



ပြန်လည်ပစ္စမာန်

[Pneumatic Components]



គោលការណ៍របស់គ្រឿងបង្កុនិម្នយោ

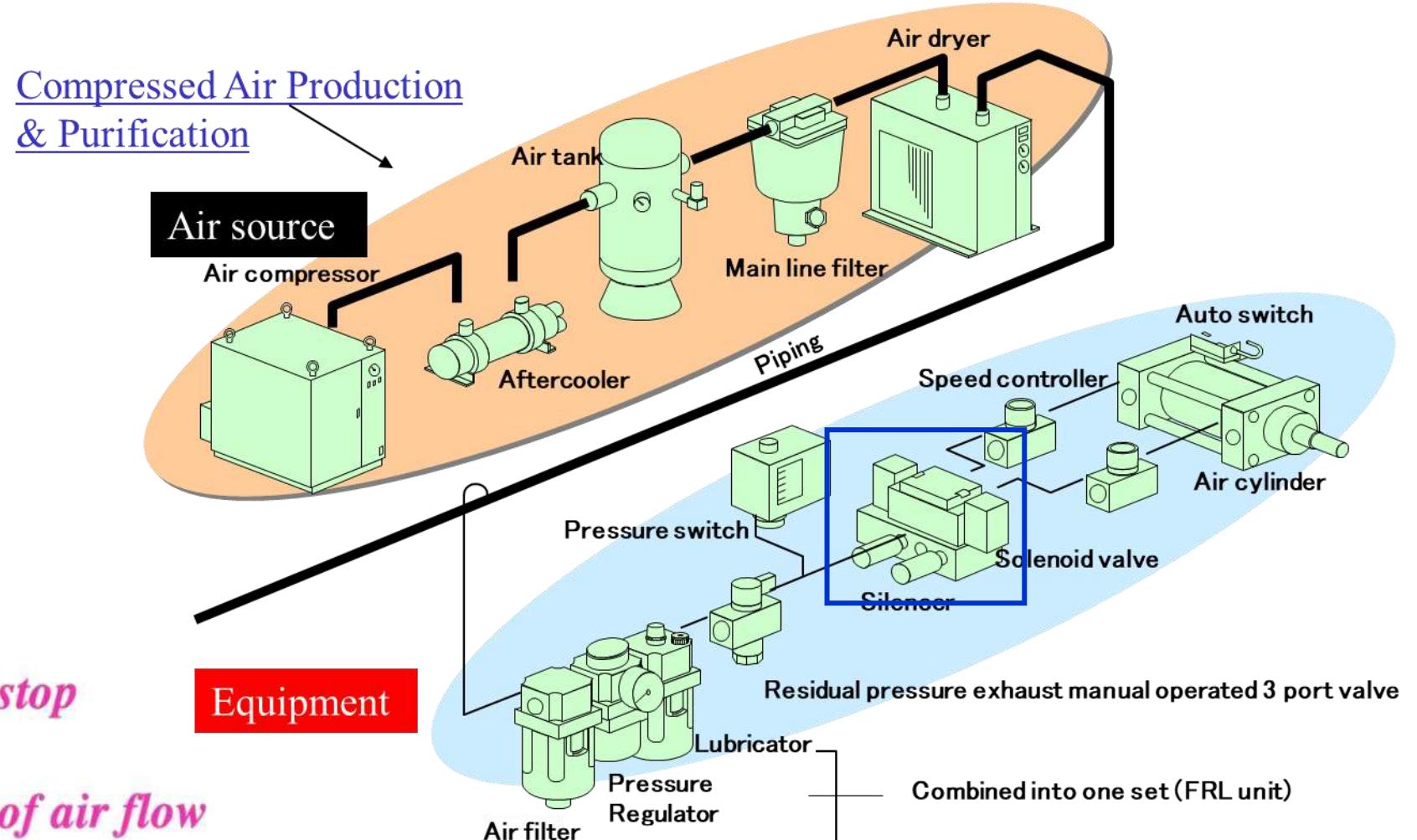
១.៥ សូតាប័ខ្សោល (Valve)

សូតាប័ខ្សោល មានមុខងារត្រួតពិនិត្យសម្គាល់ លំហេរបស់ខ្សោល ដោយអាស្រែយទៅលើប្រភេទរបស់សូតាប័ខ្សោលនិម្នយោ ហើយសូតាប័ខ្សោលមានប្រើប្រាស់ប្រភេទដូចខាងក្រោម



រូបភាព៖ សូតាប័ខ្សោល

១.៤ សូតាប់ខ្សោល (Valve)



FUNCTION :

- *To control the start and stop*
- *To control the direction of air flow in a system*

Directional Control Valves

DESIGNATION OF PORTS / CONNECTIONS

<i>CONNECTION</i>	<i>ISO 1219</i>	<i>ISO 5599</i>	<i>JIS</i>
<i>Supply Port</i>	<i>P</i>	<i>1</i>	<i>P</i>
<i>Outlet Ports</i>	<i>A, B</i>	<i>2, 4</i>	<i>A, B</i>
<i>Exhaust Ports</i>	<i>R, S</i>	<i>3, 5</i>	<i>EA, EB</i>
<i>Control Ports</i>	<i>Y, Z</i>	<i>12, 14</i>	

Directional Control Valves

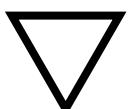
ISO



Air Supply

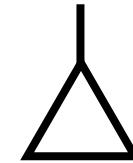


Silencer



Exhaust

JIS



Directional Control Valves

DIRECTIONAL CONTROL VALVES

SYMBOL (ISO 1219)	DESCRIPTION
	2/2 Normally closed
	2/2 Normally open
	3/2 Normally closed
	3/2 Normally open
	3/3 Closed centre
	4/2
	4/3 Closed centre
	4/3 Open centre
	5/2
	5/3 Closed centre
	5/3 Open centre
	5/3 Pressurised centre

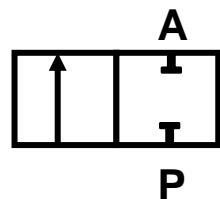
DIRECTIONAL CONTROL VALVES

SYMBOL (ISO 5599)	DESCRIPTION
	2/2 Normally closed
	2/2 Normally open
	3/2 Normally closed
	3/2 Normally open
	3/3 Closed centre
	4/2
	4/3 Closed centre
	4/3 Open centre
	5/2
	5/3 Closed centre
	5/3 Open centre
	5/3 Pressurised centre

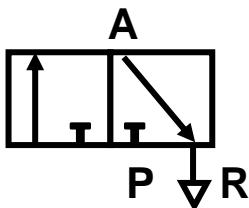
Directional Control Valves

Description of Valves

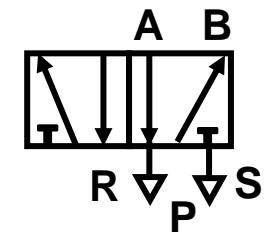
1) Number of ports / connections



2 Ports



3 Ports

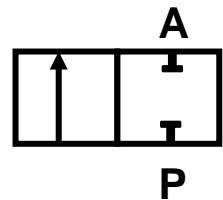


5 Ports

Directional Control Valves

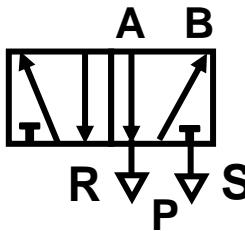
Description of Valves

2) Number of switching positions



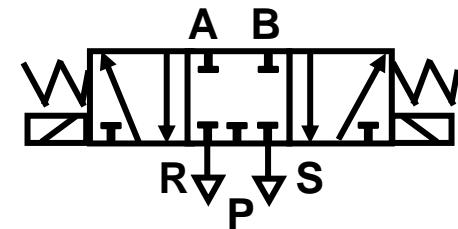
2 Ports
2 Positions

2/2 way



5 Ports
2 Positions

5/2 way



5 Ports
3 Positions

5/3 way

Directional Control Valves

Description of Valves

3) Normal position

ie : Normally Closed (NC) or Normally Open (NO)

NORMALLY CLOSED

At normal (not operated) position, air passage between inlet and outlet is closed



NORMALLY OPEN

At normal (not operated) position, air passage between inlet and outlet is open

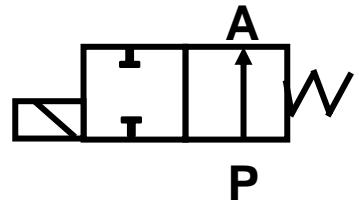


Directional Control Valves

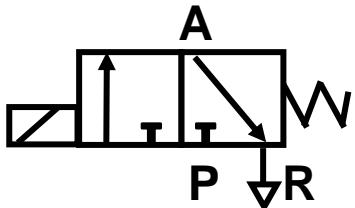
Description of Valves

3) Normal position

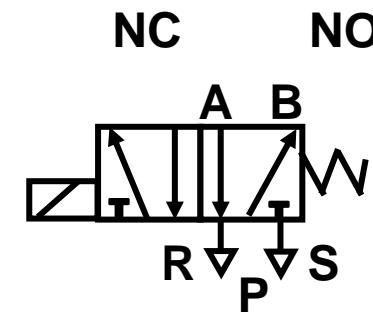
ie : Normally Closed (NC) or Normally Open (NO)



NO



NC



Change-over

វេរចកល្អាកដ្ឋាន

[Directional Control Valves]

Description of Valves

4) Method of actuation

- i) Manual
- ii) Mechanical
- iii) Air
- iv) Solenoid.

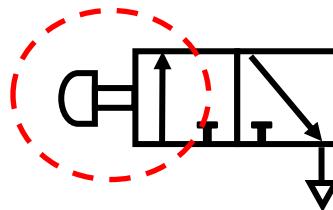
Directional Control Valves

Description of Valves

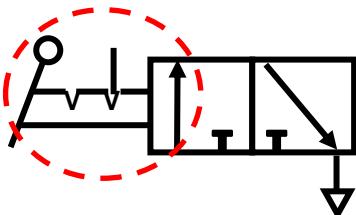
4) Method of actuation

i) Manual

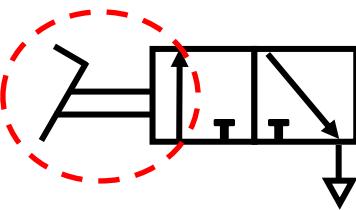
Push Button



Toggle Lever



Foot Pedal



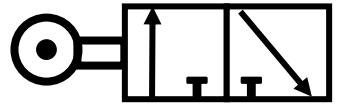
Directional Control Valves

Description of Valves

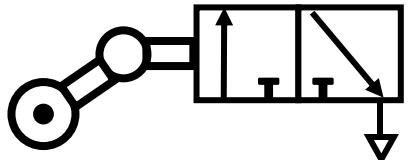
4) Method of actuation

- i) Manual
- ii) Mechanical

Roller Lever



Idle Return Roller



IDLE RETURN ROLLER

The idle return roller will only operate when the control cam strikes the actuator when moving in one direction

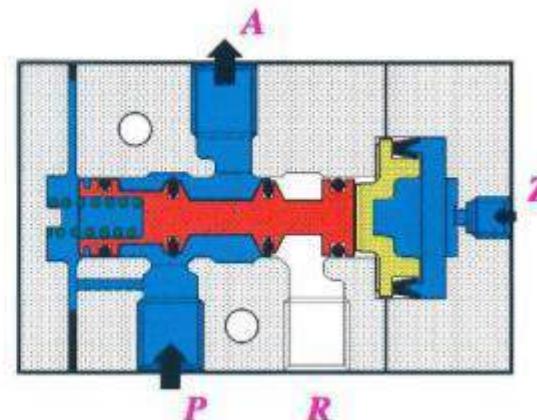
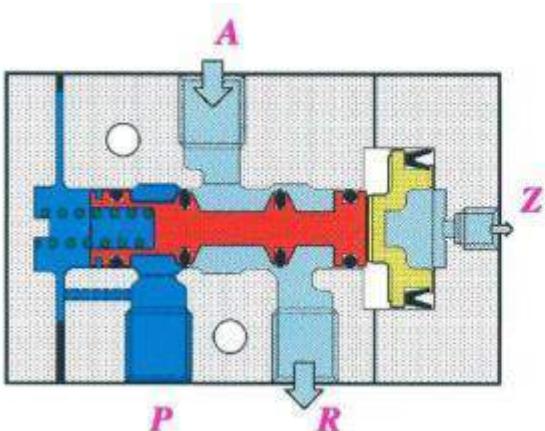
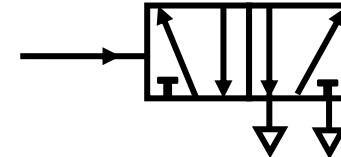
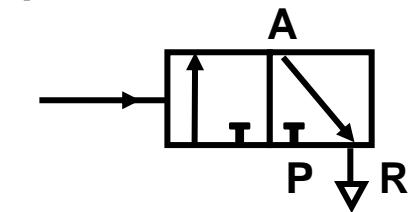
In the reverse direction the roller collapses without operating the valve

Directional Control Valves

Description of Valves

4) Method of actuation

- i) Manual
- ii) Mechanical
- iii) Air

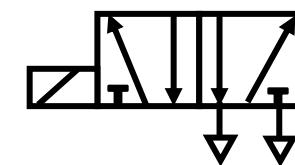
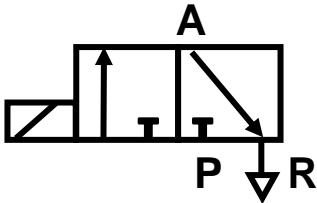
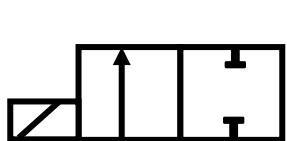


Directional Control Valves

Description of Valves

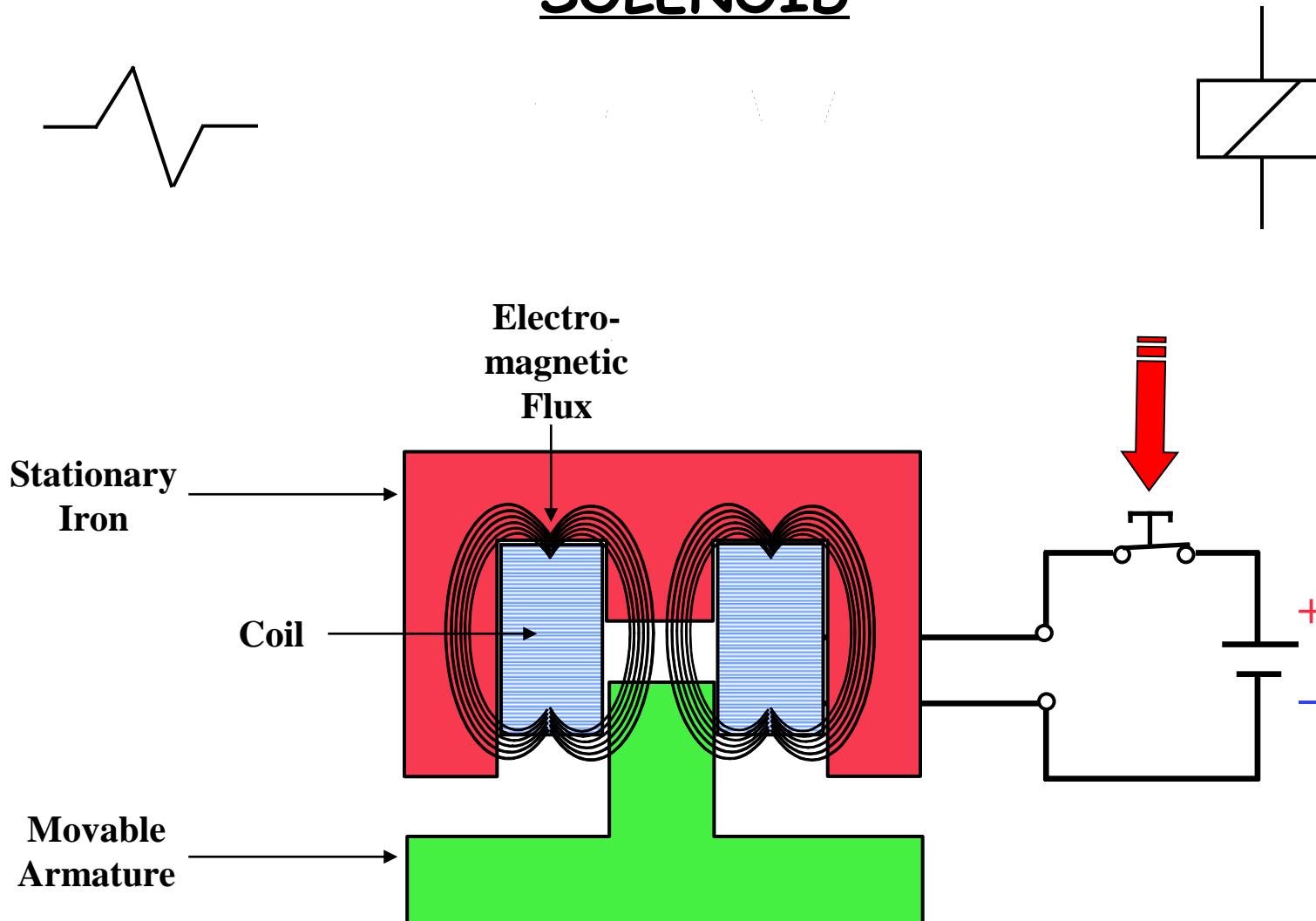
4) Method of actuation

- i) Manual
- ii) Mechanical
- iii) Air
- iv) Solenoid



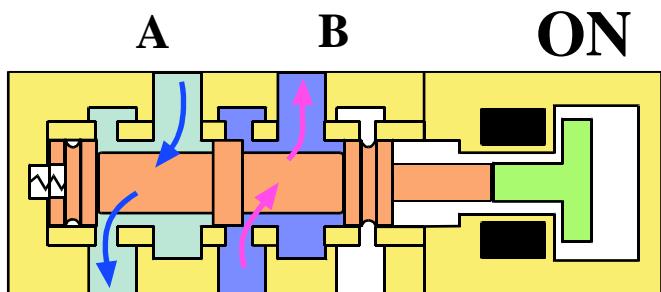
Directional Control Valves

SOLENOID

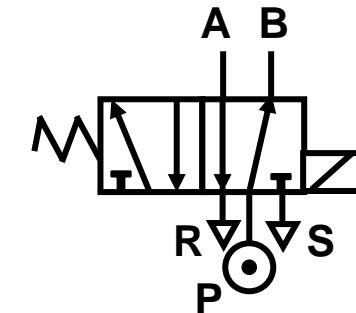
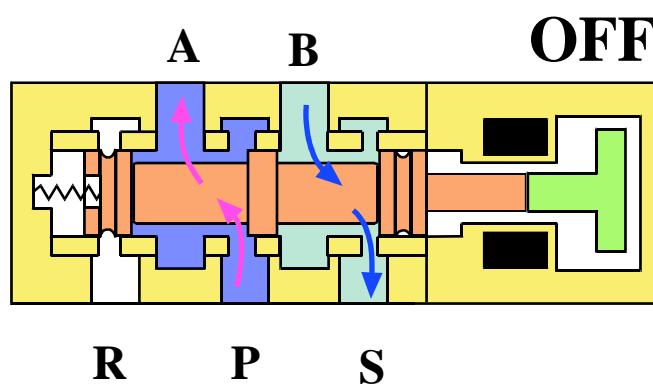


Directional Control Valves

SOLENOID VALVE



R P S



VIDEO

AUDIO

Directional Control Valves

Description of Valves

5) Method of reset

- i) Spring**
- ii) Air**
- iii) Solenoid.**

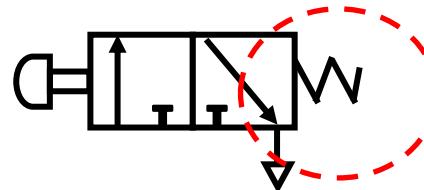
Directional Control Valves

Description of Valves

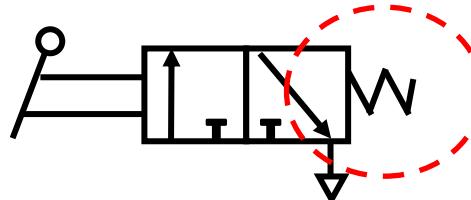
5) Method of reset

i) Spring

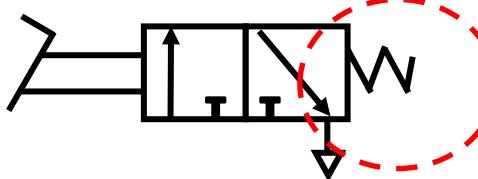
Push Button



Toggle Lever



Foot Pedal

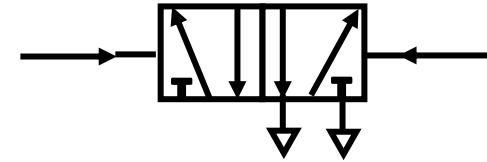
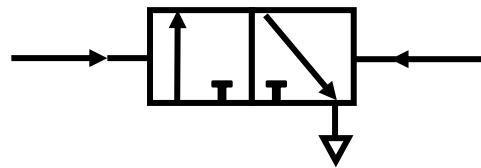


Directional Control Valves

Description of Valves

5) Method of reset

- i) Spring
- ii) Air

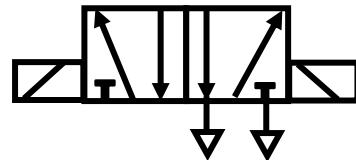


Directional Control Valves

Description of Valves

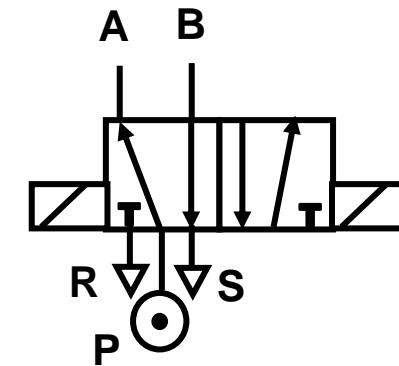
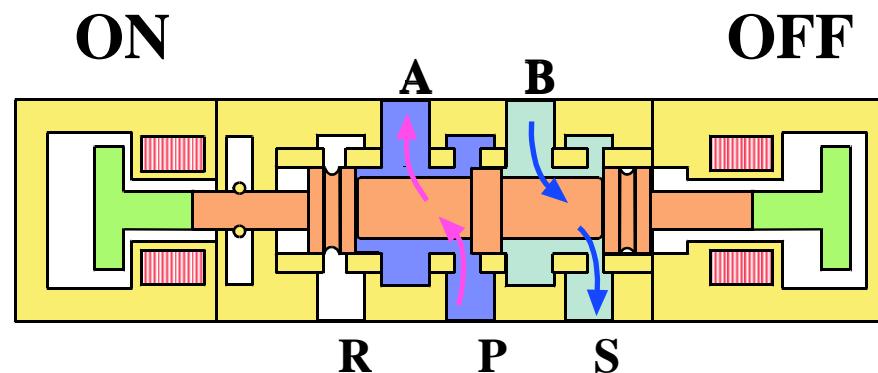
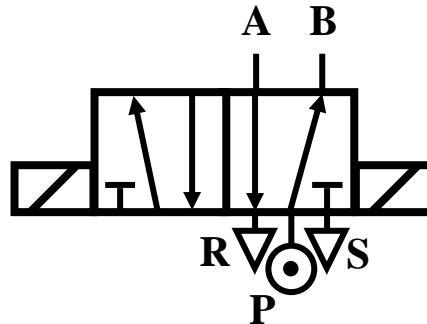
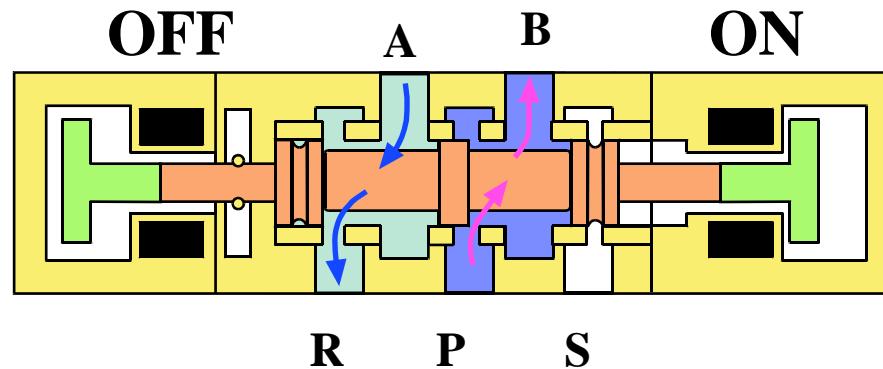
5) Method of reset

- i) Spring
- ii) Air
- iii) Solenoid



Directional Control Valves

SOLENOID VALVE

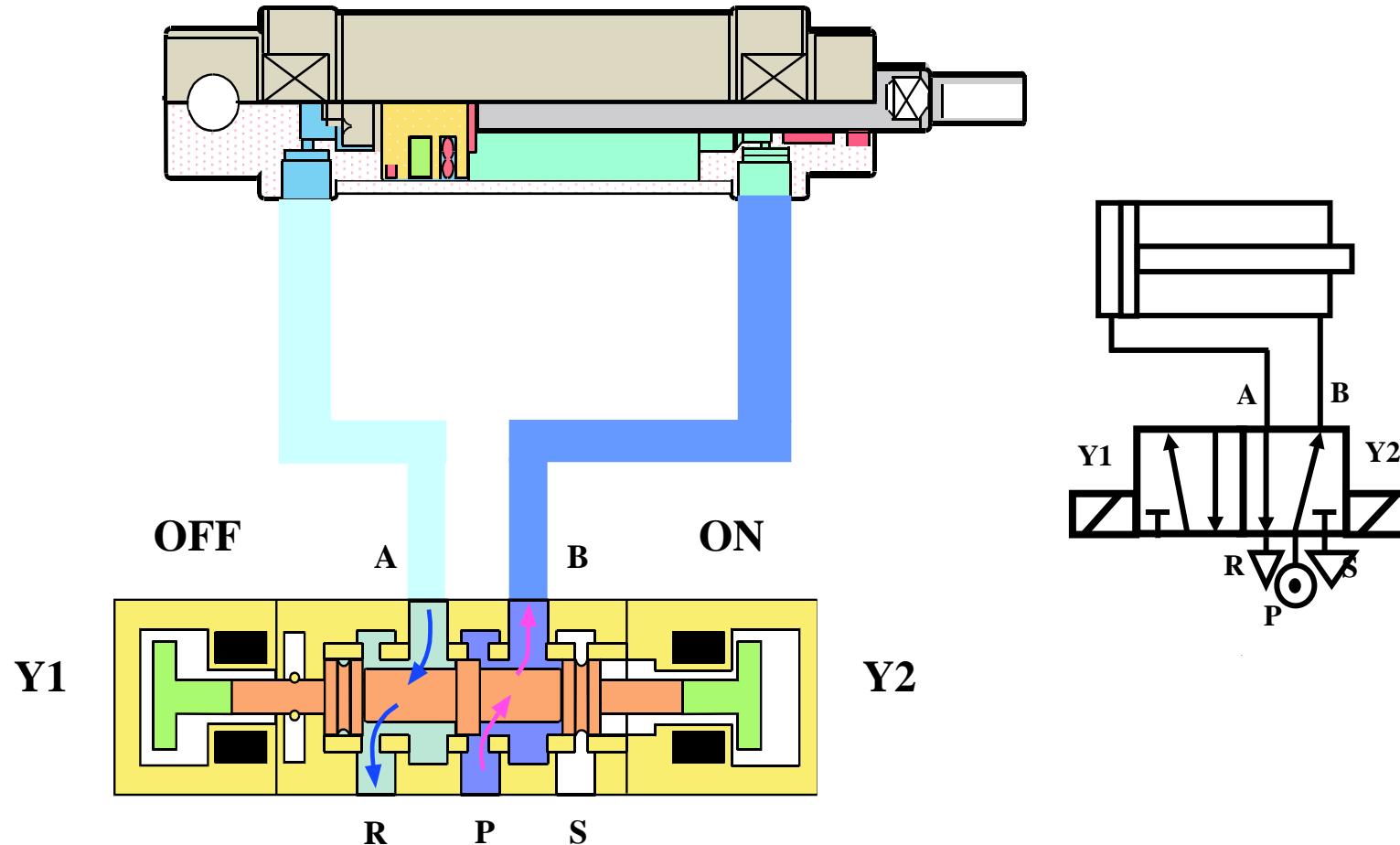


VIDEO

AUDIO

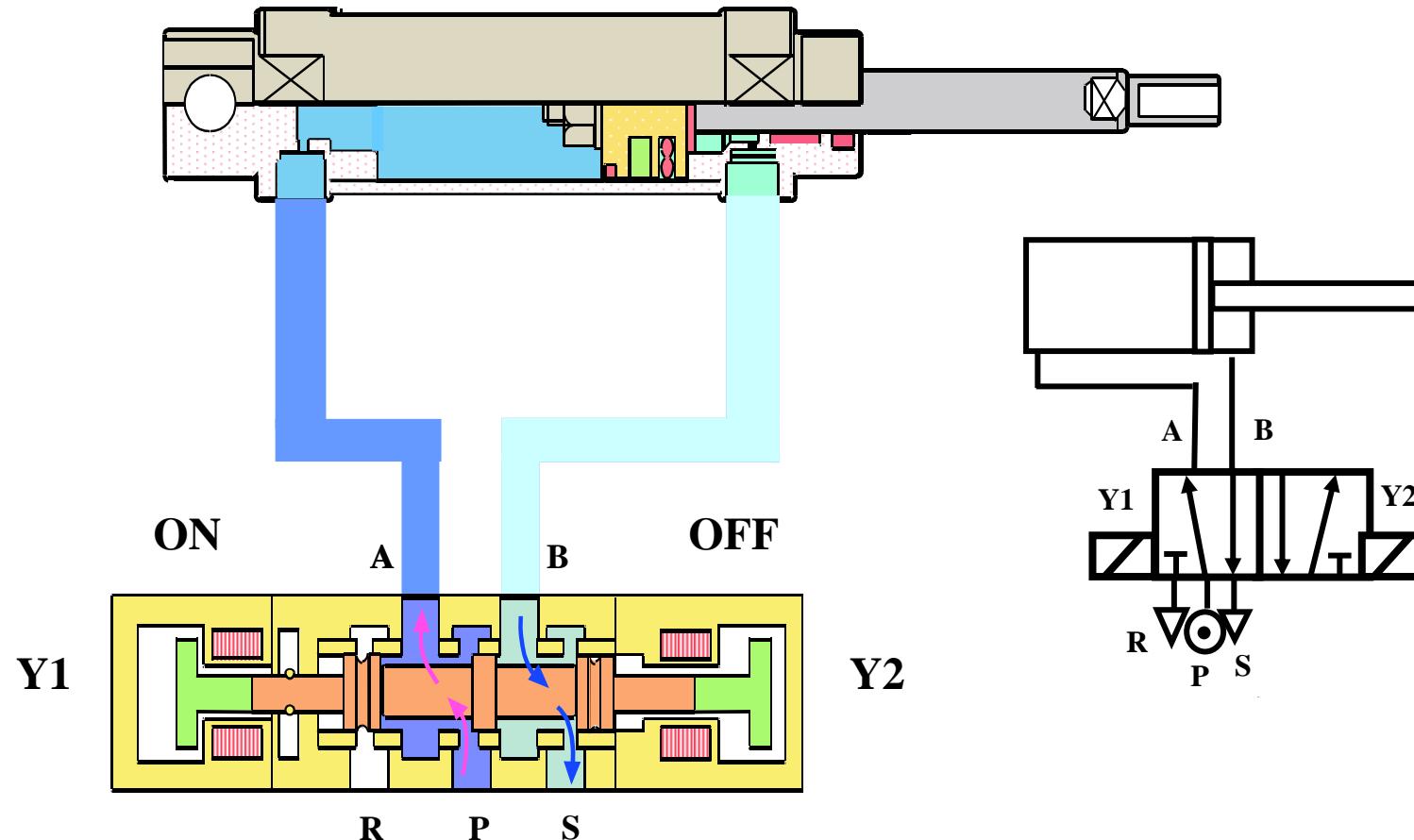
Directional Control Valves

SOLENOID VALVE

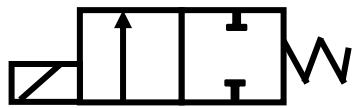


Directional Control Valves

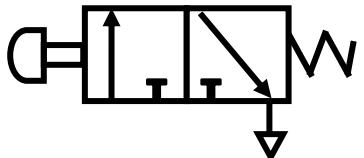
SOLENOID VALVE



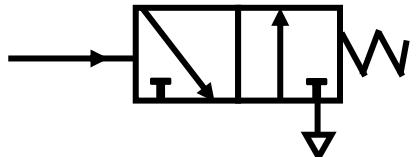
Directional Control Valves



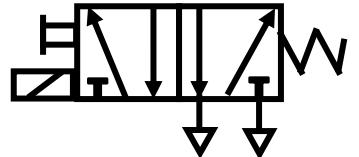
2/2 way, NC, Single solenoid, spring return valve



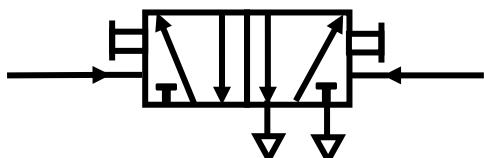
3/2 way, NC, Push button, spring return valve



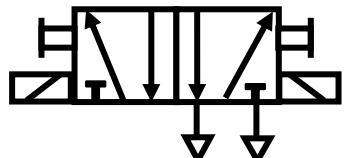
3/2 way, NO, Single air piloted, spring return valve



5/2 way, Single solenoid, spring return valve

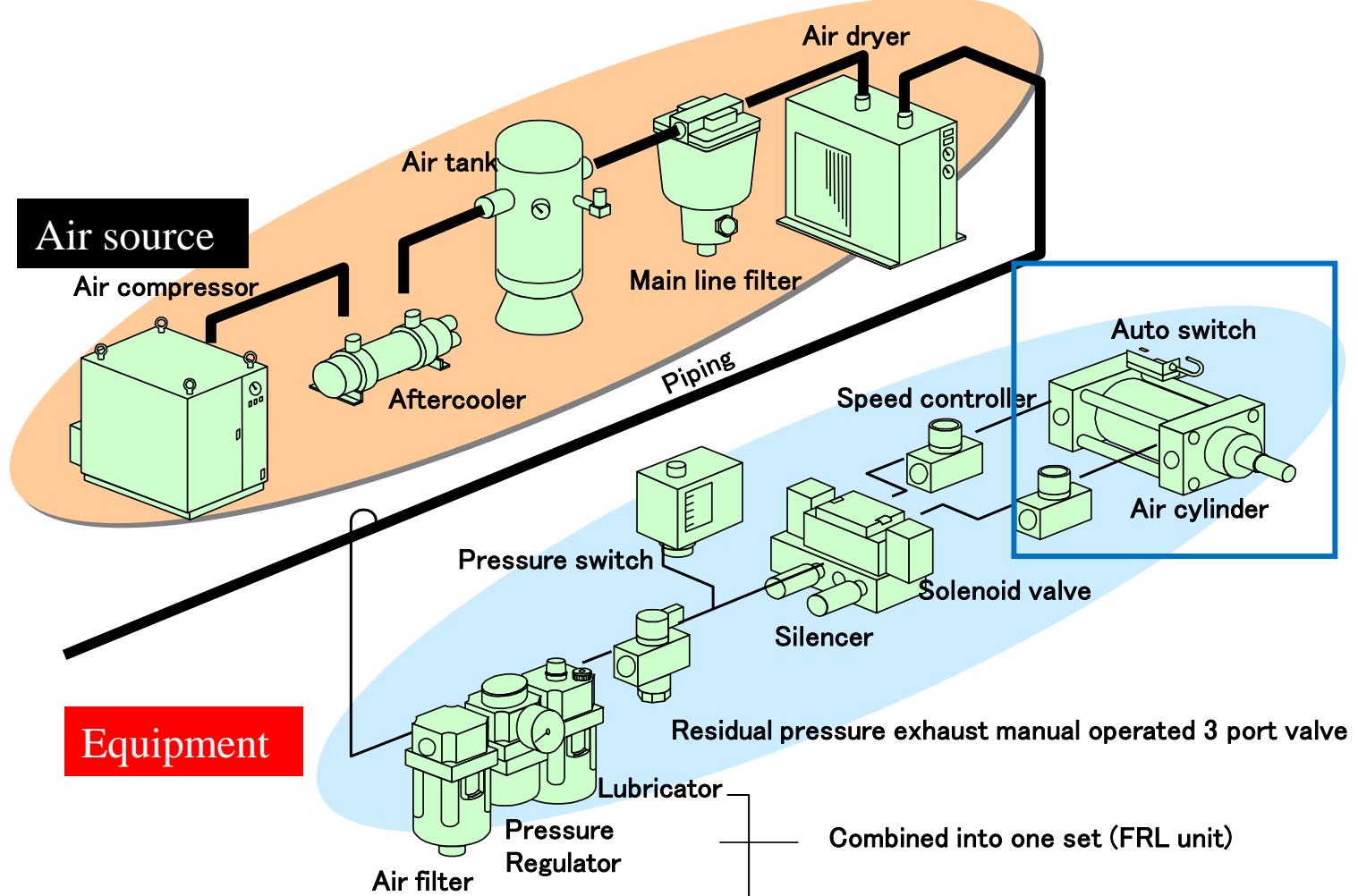


5/2 way, Double air piloted valve



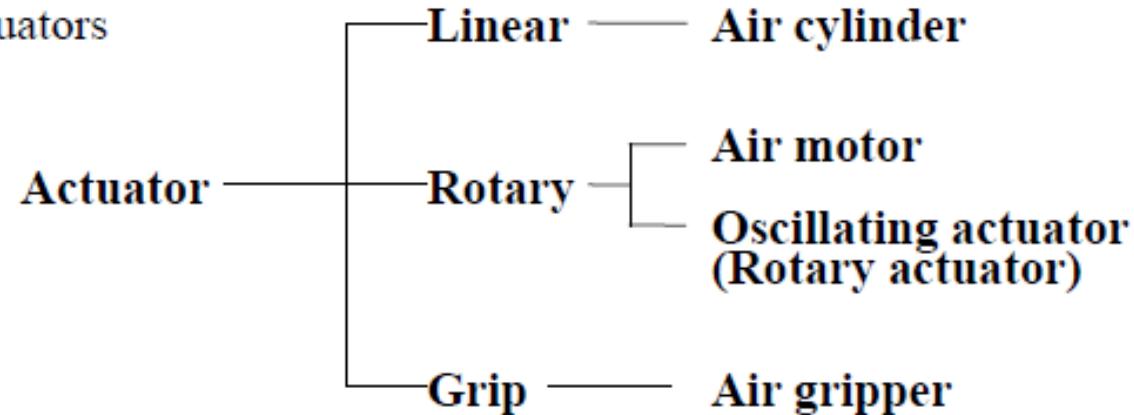
5/2 way, Double Solenoid operated valve

Actuators

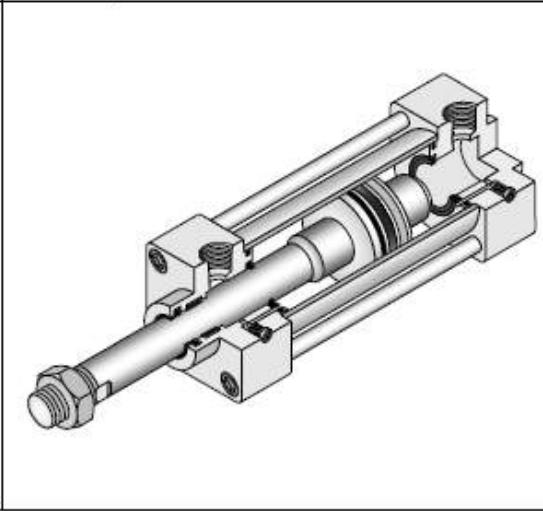


Actuators

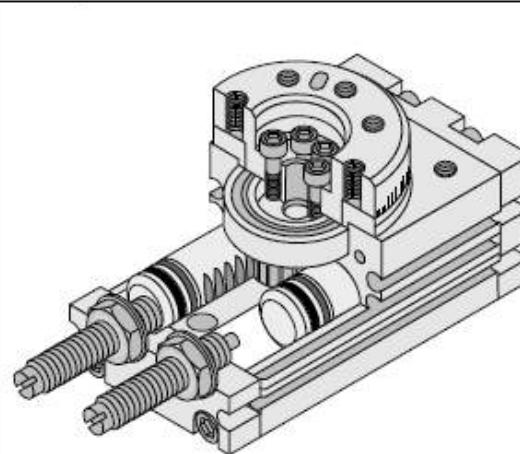
Classification of actuators



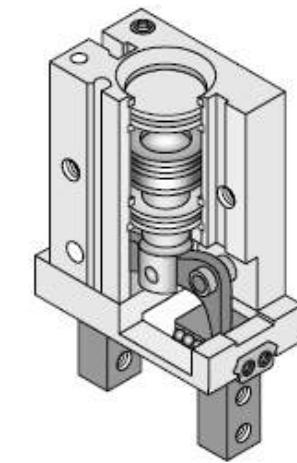
Air cylinder



Rotary actuator



Air gripper



Actuators

*To perform works in linear movement
or rotary in action*

LINEAR ACTUATOR

- ie : - Single acting cylinder
- Double acting cylinder
- Rodless cylinder
- Slide unit*

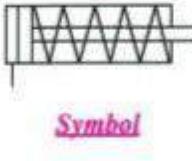
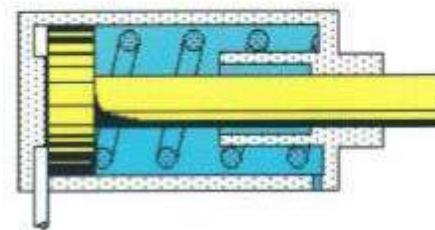
ROTARY ACTUATOR

- ie : - Vane or Rack and pinion type
rotary actuator*

Single Acting Cylinder

- PUSH TYPE

Single acting cylinder with one air inlet to produce a power stroke in one direction. The piston rod is returned with a high speed by a fitted spring or some other external means such as load, mechanical movement etc

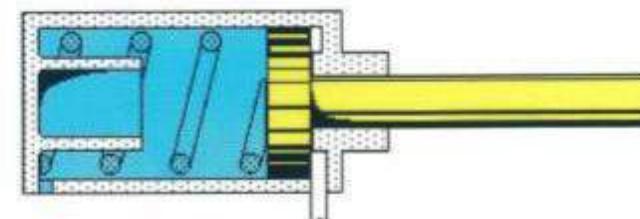


Symbol



VIDEO

- PULL TYPE



Symbol



VIDEO

VIDEO

Single Acting Cylinder

ADVANTAGE :

- *They have a somewhat lower air consumption compared with the equivalent size of Double acting cylinder*

DISADVANTAGES :

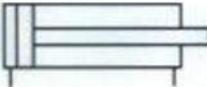
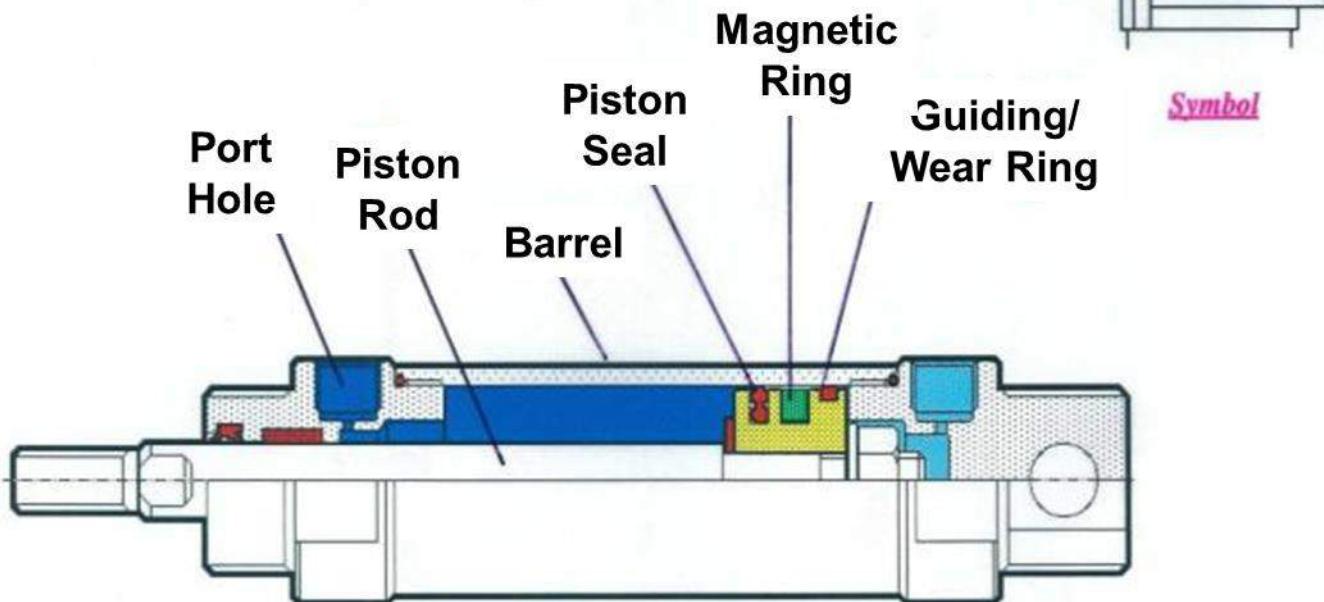
- *Single acting cylinder develops thrust in one direction only*
- *There is a reduction in thrust due to the opposing spring force, and so a larger bore may be required*
- *Accommodating the spring results in a longer overall length and limited stroke length*

Double Acting Cylinder

Double acting cylinder with two air inlets to produce extending and retracting power (thrust) strokes

The thrust available on the retracting stroke is reduced due to the smaller effective piston area, but is only a consideration if the cylinder is to pull the same load in both directions

In principle, the stroke length of the double acting cylinder is unlimited, but bending and buckling of the piston rod must be avoided



Symbol

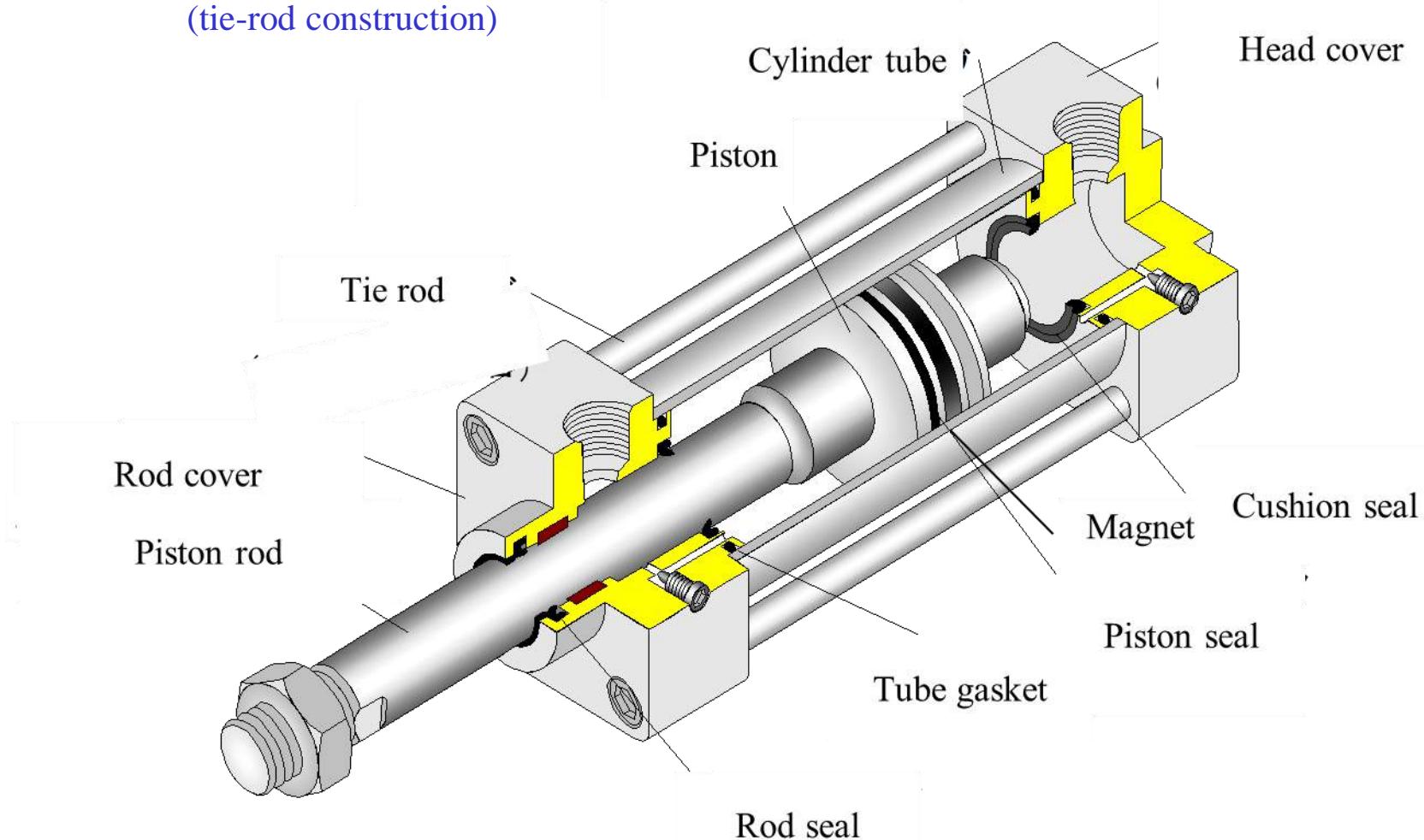


VIDEO

VIDEO

Construction of Air Cylinder

Double-acting Cylinder with air cushion
(tie-rod construction)



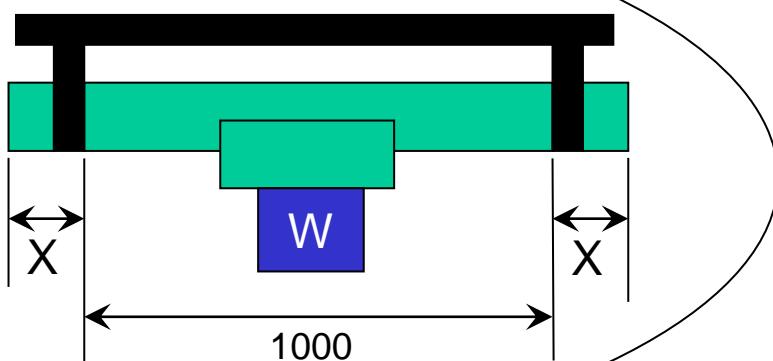
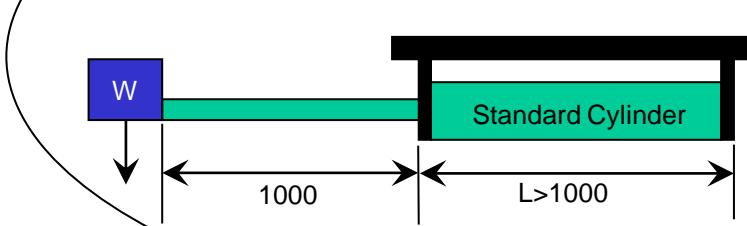
Rodless Cylinder

- During transfers load, **short distance** are usually done by a **Single/Double acting cylinder**. But using a Single/Double acting cylinder for long distance transfers are not recommended, due to **space constrains**.
- Therefore **Rodless cylinder** are used to replace the conventional cylinders for **long distance transfer**. Rodless Cylinders are able to produce the same amount of stroke length while having the mounting length shorten.
- Rodless cylinder are classified into 2 major types:
 - Magnetically Coupled Rodless Cylinder**
 - Mechanically Coupled Rodless Cylinder**

Rodless Cylinder

Rodless Cylinder Can Transfer Load 1m with TTL length about 1m.

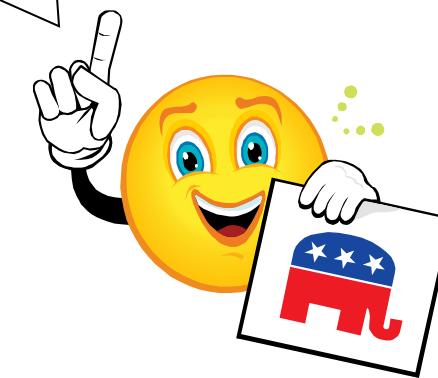
Single/Double Cylinder Can Transfer Load 1m with TTL length 2m.



Happy Designer

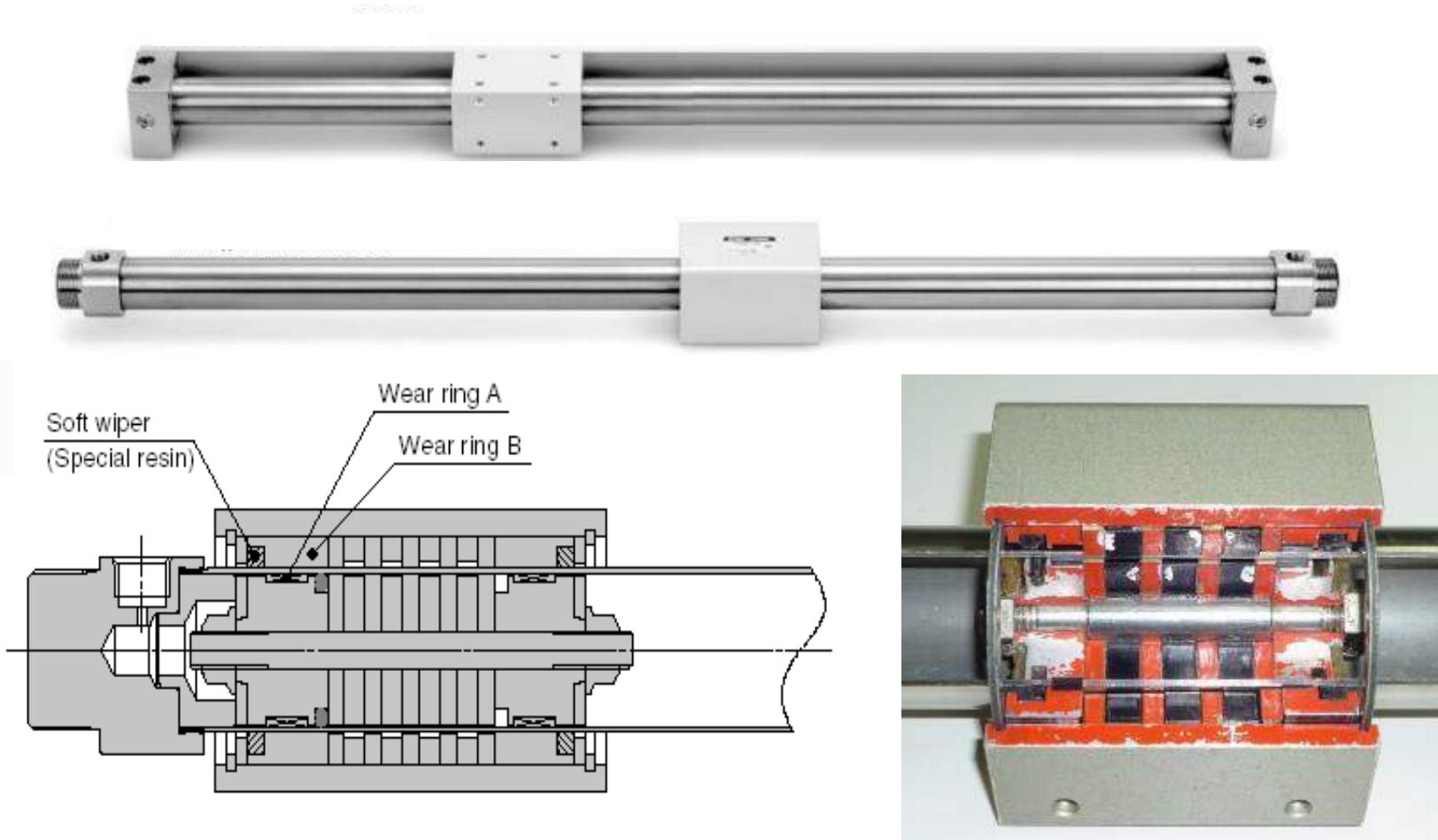


Actual Application

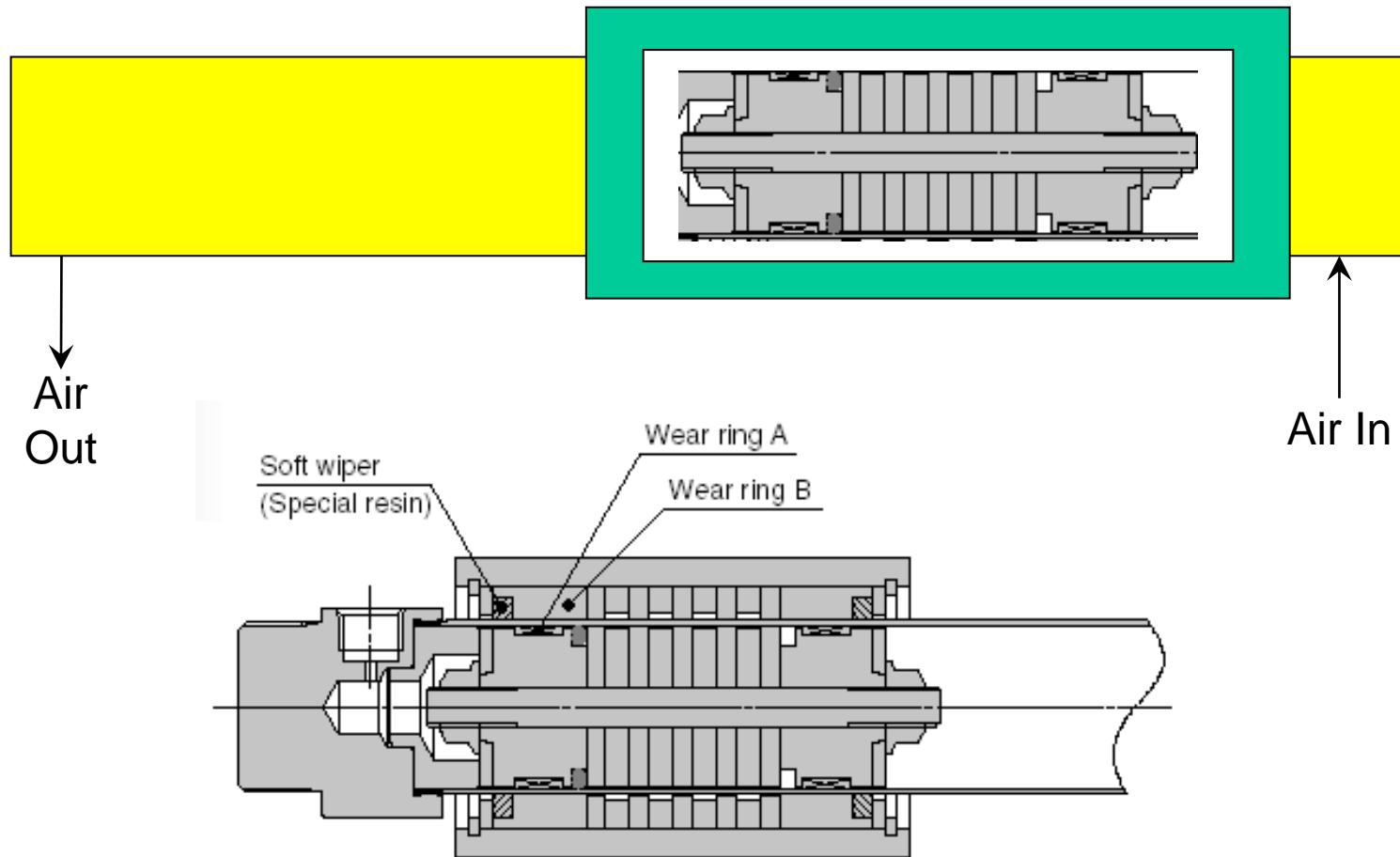


SMC Sales Engineer

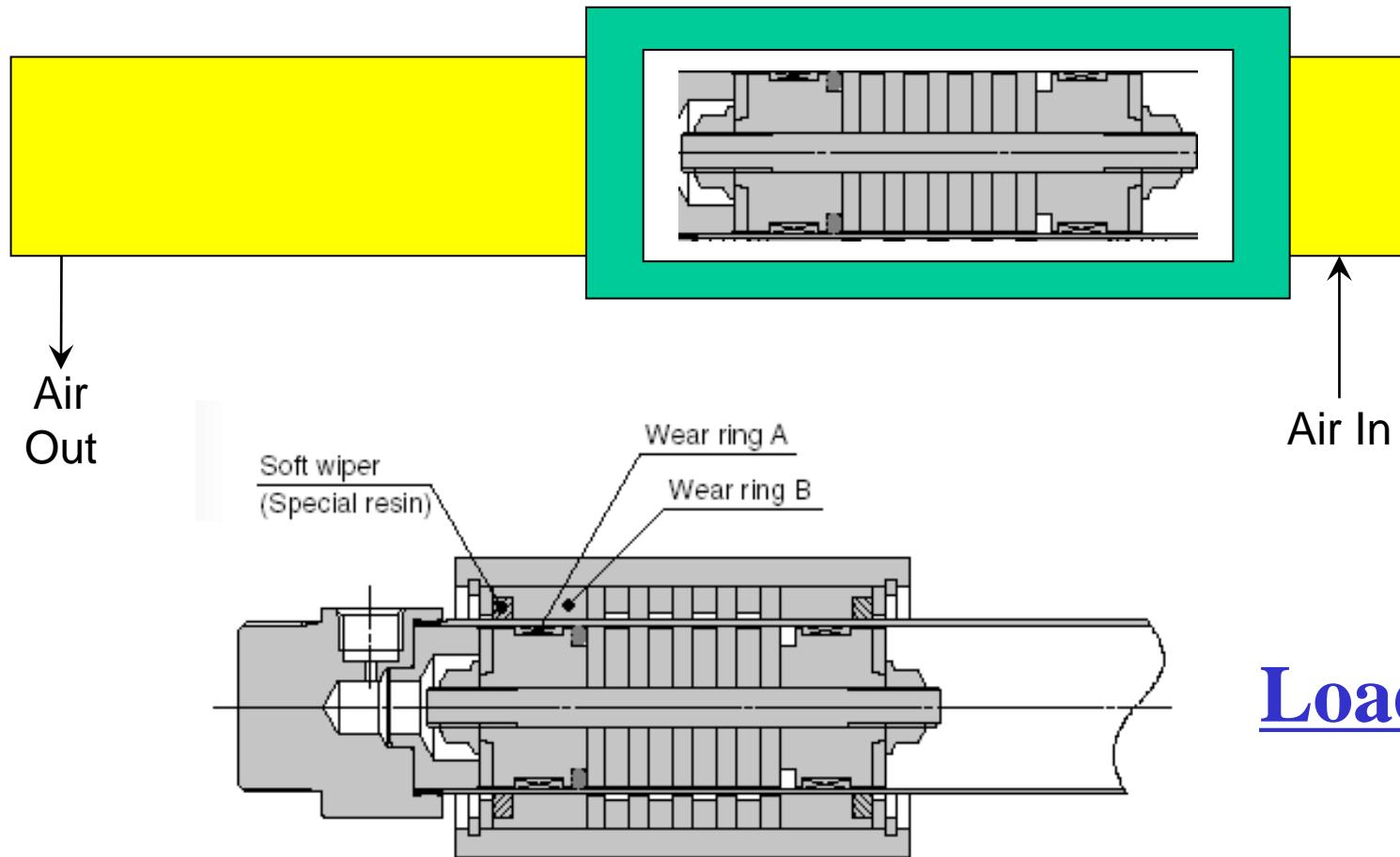
Magnetically Coupled Rodless Cylinder



Magnetically Coupled Rodless Cylinder

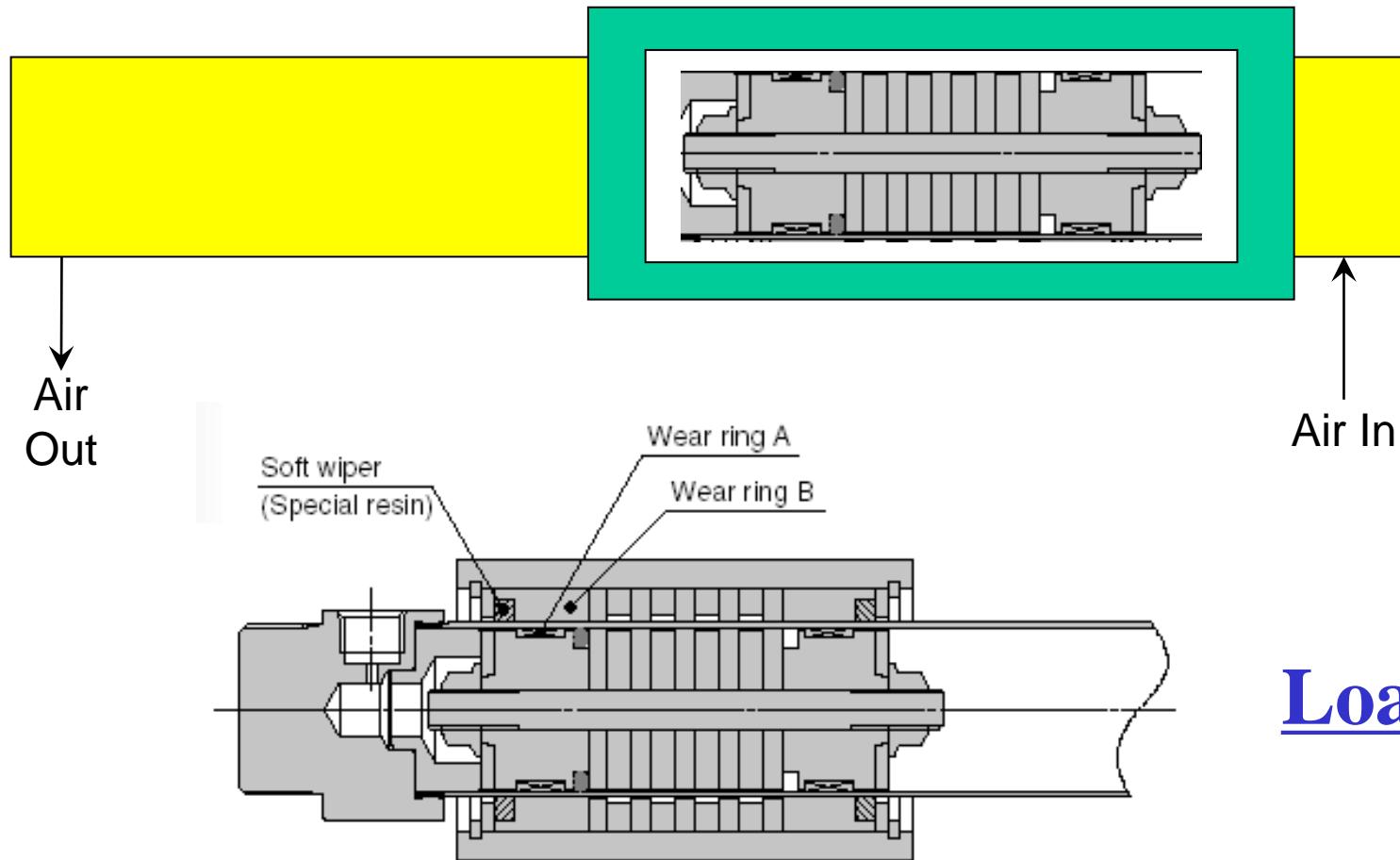


When Load is too heavy!!!



Load not Move

When Load is just nice and intermediate stop!!

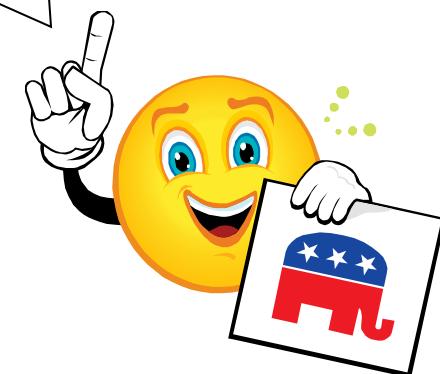


Load not Stop

Actuators

SMC Mechanical Rodless Cylinder:
**Mechanical can cater for
higher Work load.**

U sure??



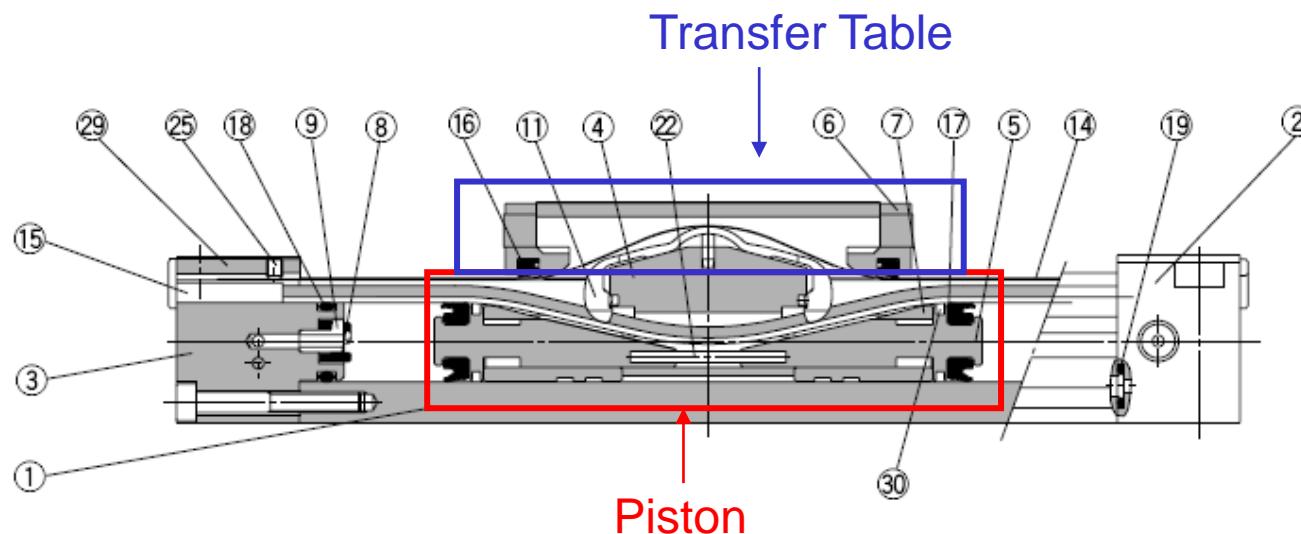
SMC Sales Engineer

Actuators

Magnetic type held the piston and slide table together by magnetic force.

Mechanical Type Piston and Transfer are made as a whole.

The only way to separate the piston and transfer table is breaking them apart

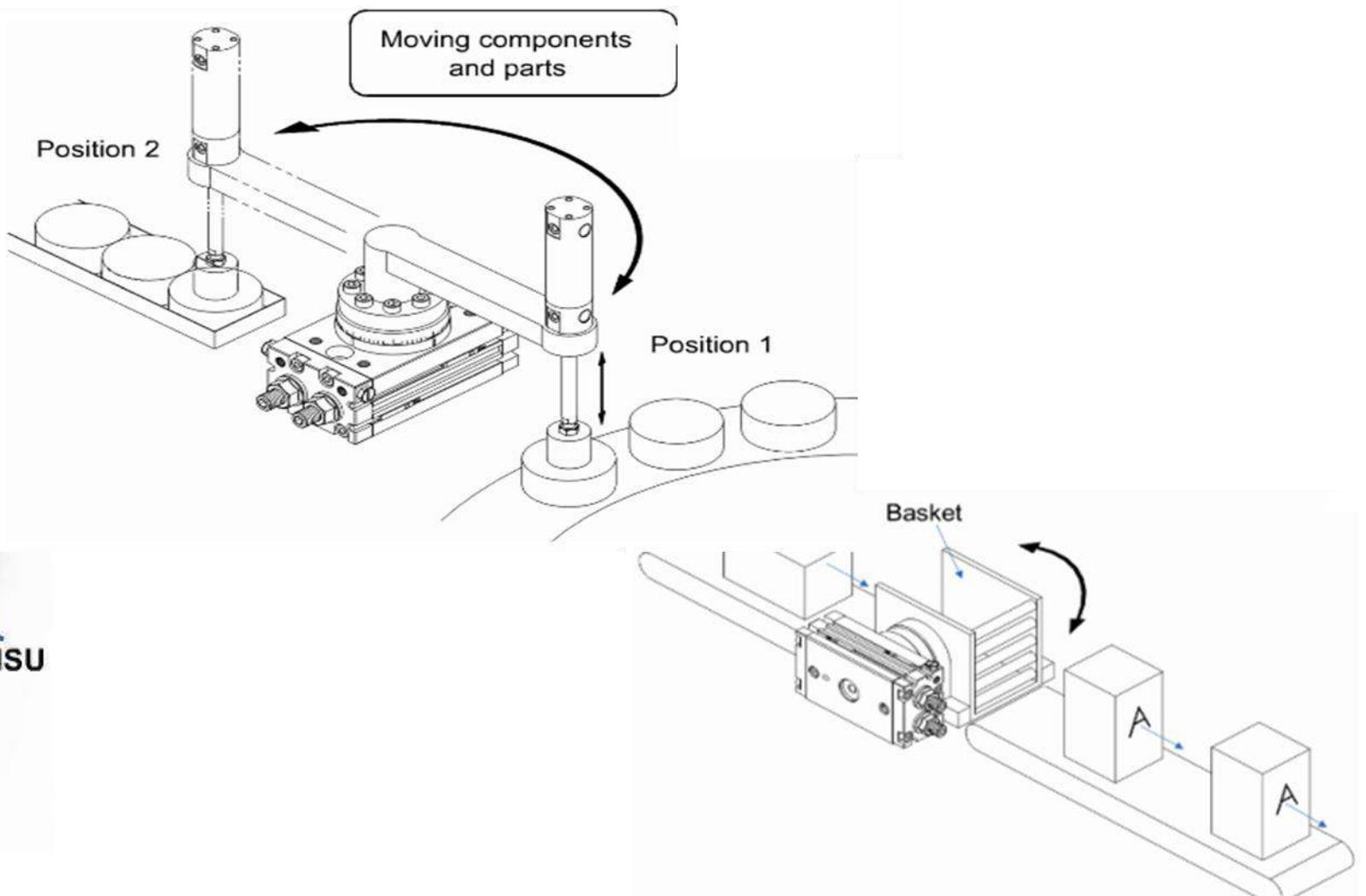
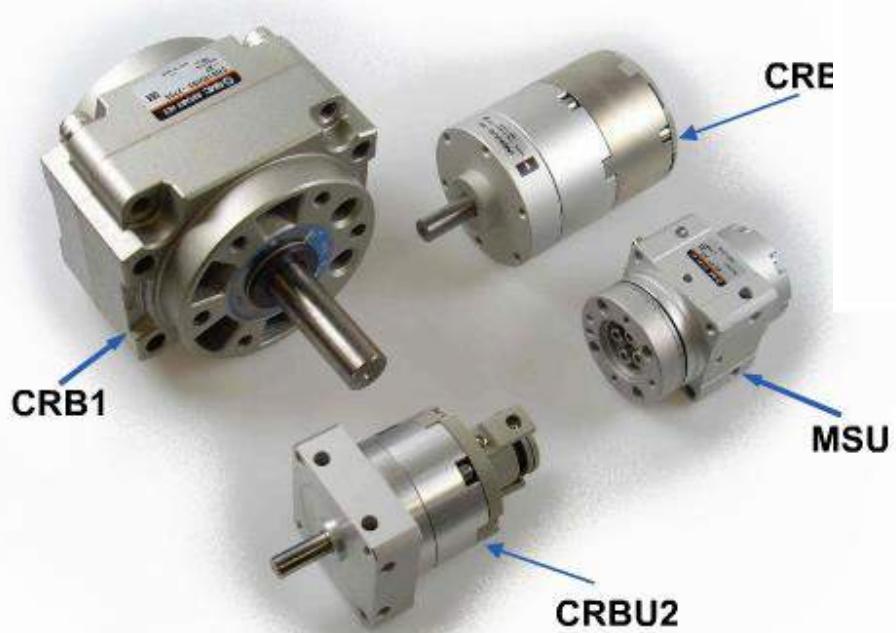


VIDEO

VIDEO

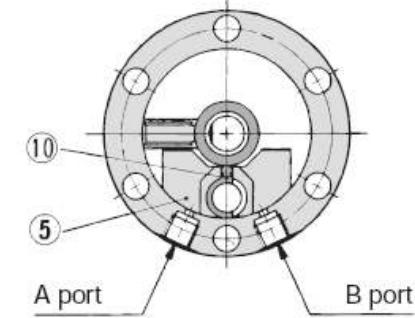
Actuators

Rotary Actuator

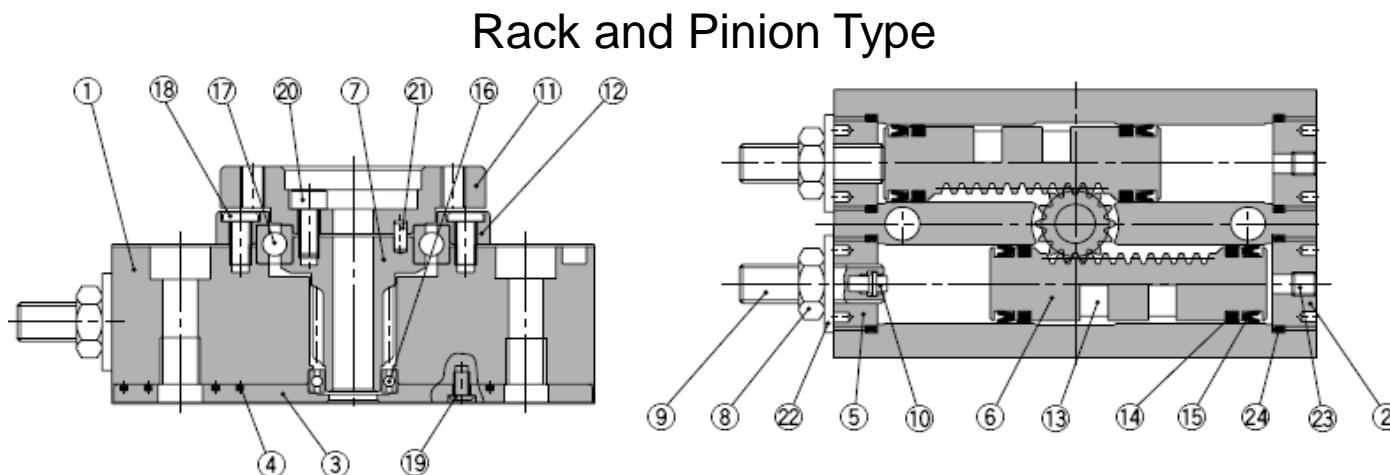


Rotary Actuator

- Rotary Actuator 2 types:
 - Vane Type
 - Rack and Pinion type

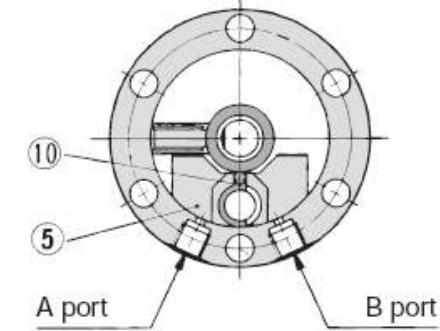


Vane
Type

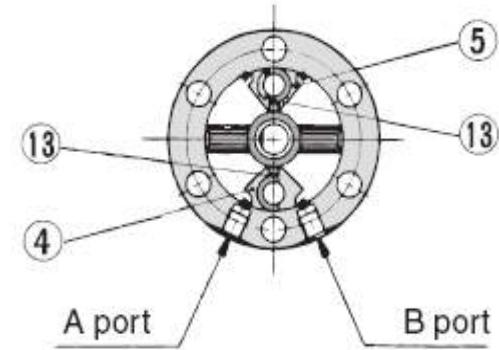


Rotary Actuator

- Rotary Actuator 2 types:
 - Vane Type
 - Single Vane
 - Single vane provide **wider angle of rotation**
 - Double Vane
 - Double vane provide **higher torque** as compare to single for the same bore size



Vane Type, Single Vane

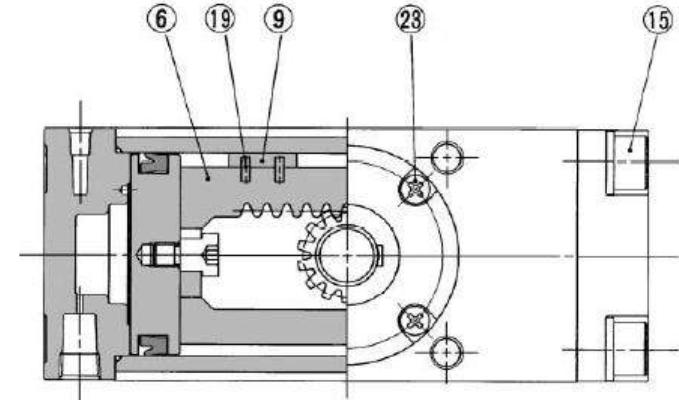
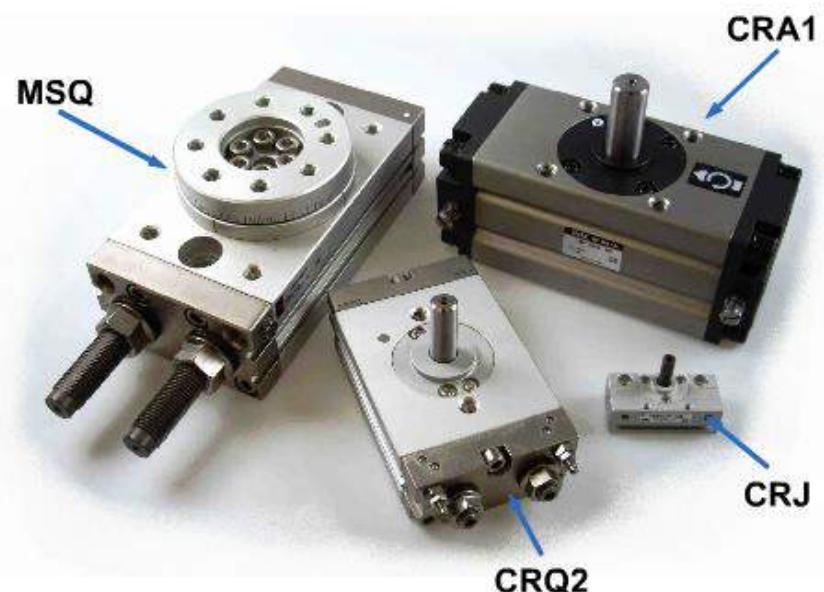


Vane Type, Double Vane



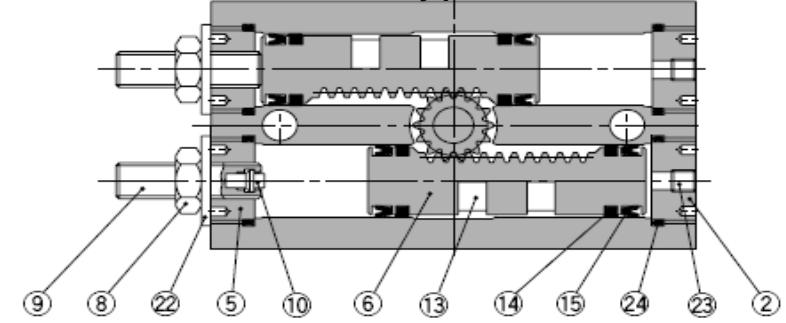
Rotary Actuator

- Rotary Actuator 2 types:
 - Vane Type
 - Rack and Pinion type
 - Single Rack
 - Higher Trust loading than vane type
 - Double Rack
 - Double Rack has no backlash compared to Single Rack



Rack and Pinion Type, Single Rack

Rack and Pinion Type, Double Rack



VIDEO



VIDEO



VIDEO

Vane type vs Rack & Pinion Type

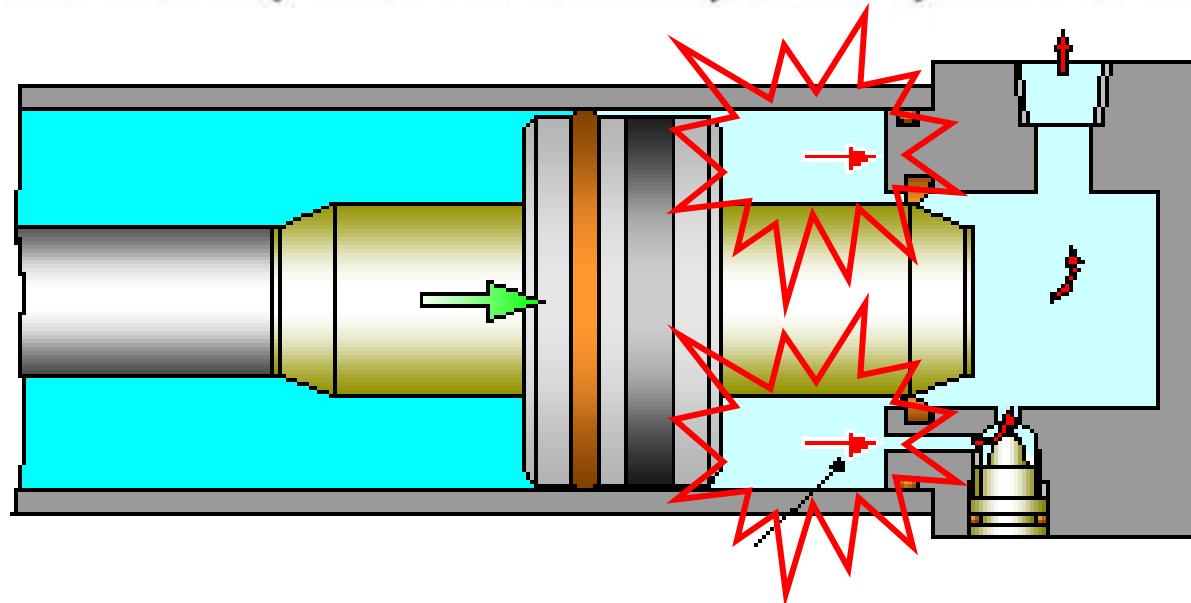
Customer request	Vane type	Rack & Pinion type
High speed	○	
Compactness: Width / Length	○	
Compactness: Height		○
No backlash ?	○	*

○ BEST

* Double rack and CRJ models have no backlash

Cushioning

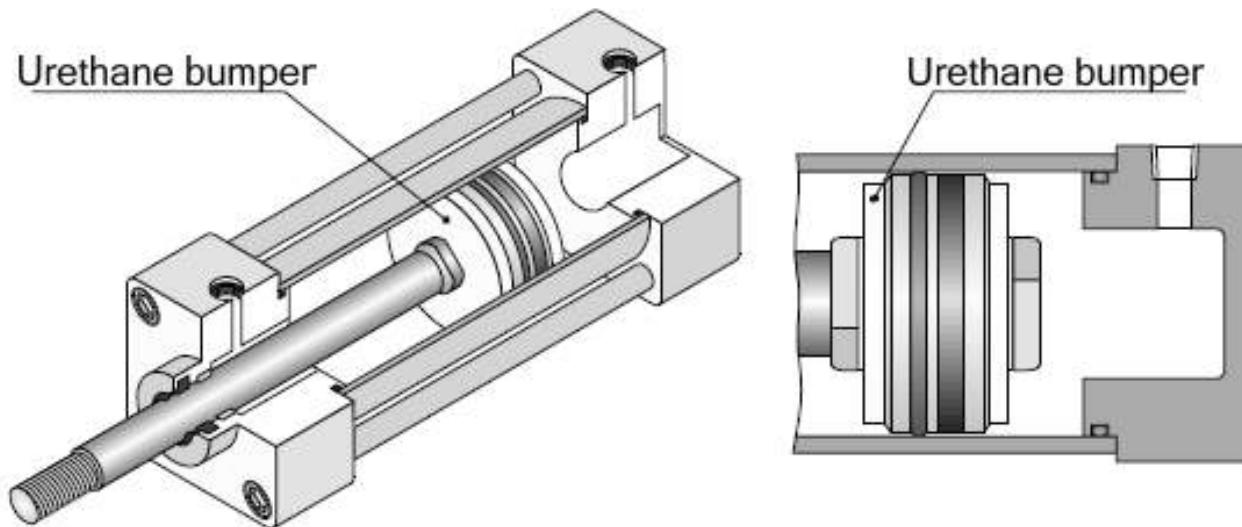
If the piston hits the cover at the end of its stroke with excessive kinetic energy, the impact may cause vibration or a hitting noise or it may affect the durability of the cylinder or the system.



An air cylinder is provided with one of two types of cushioning mechanism suitable for absorbing the impact occurring at the end of the piston stroke. **Rubber Bumper and Air-Cushion**

Rubber Bumper

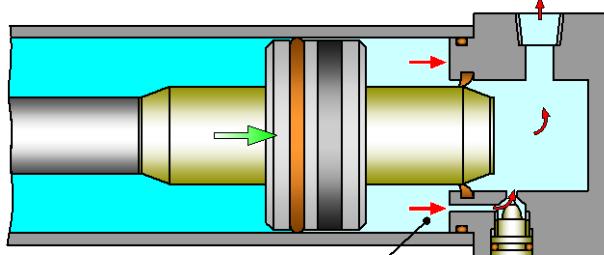
A rubber bumper (urethane rubber) is attached to the piston or the cover to absorb the impact. As the impact is absorbed by displacement of the rubber, the absorbed impact energy is small, so the main purpose of the rubber bumper is to reduce the impact noise.



Urethane rubber

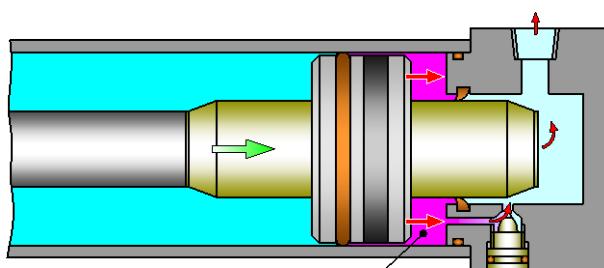
Cushioning

Air Cushion



Cushion ring and cushion packing come in contact with each other

Cushion chamber is formed



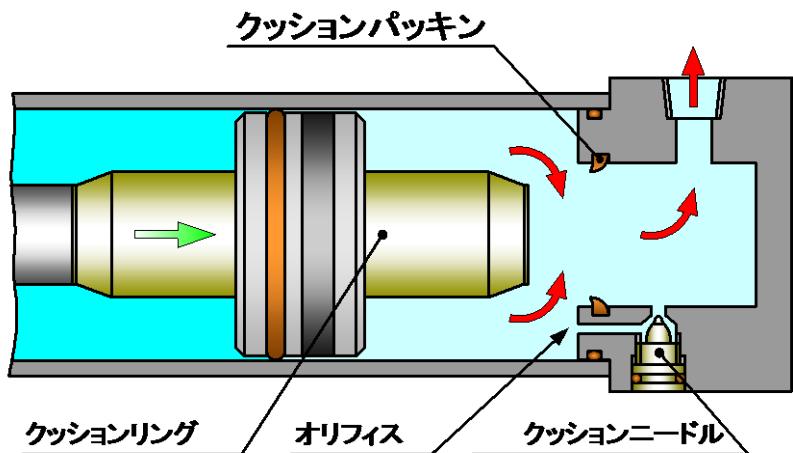
Back pressure in cushion chamber increases

(Exhaust air is adjusted by the cushion needle)



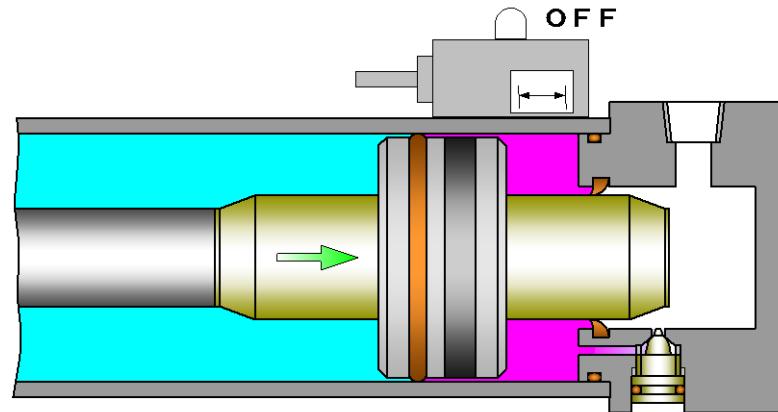
VIDEO

Precaution on adjustment



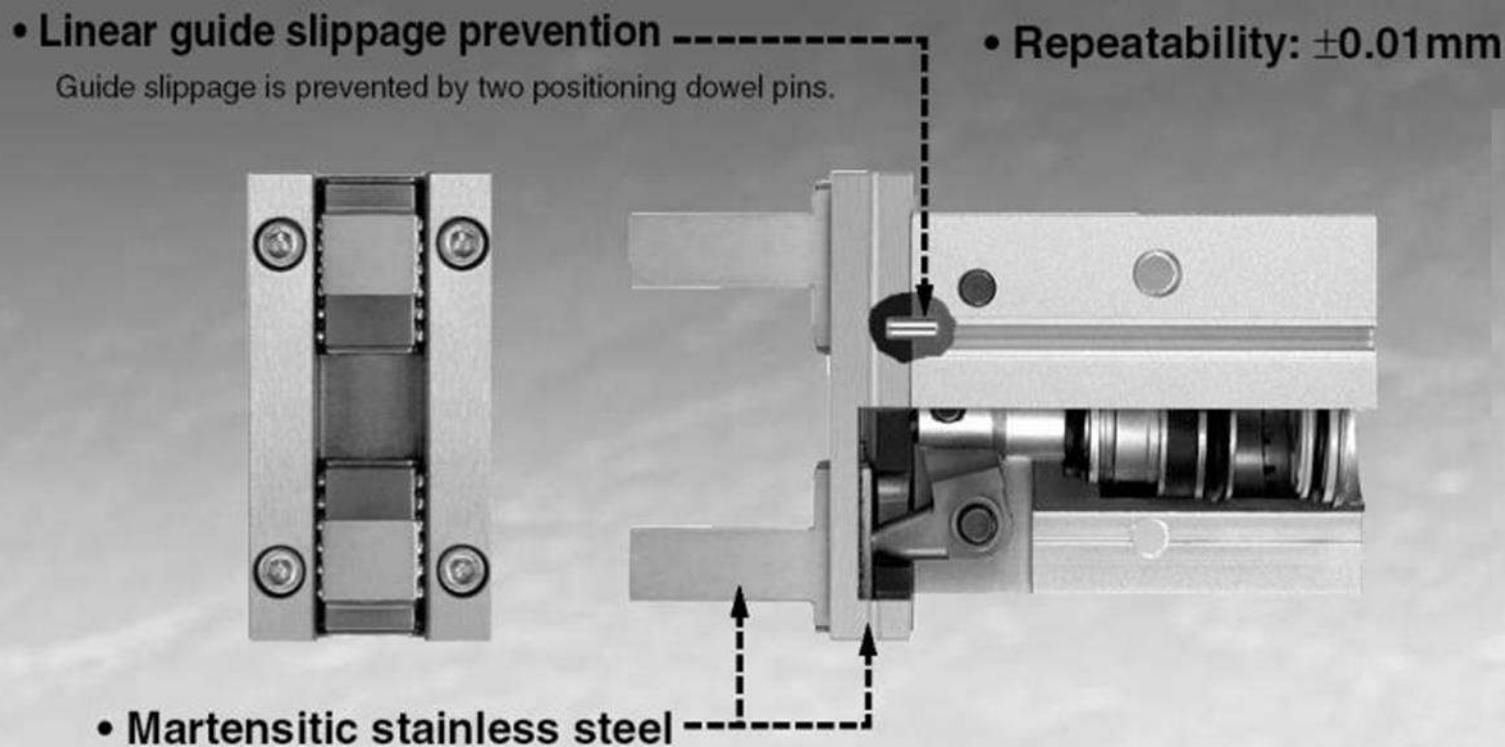
To adjust cushioning, gradually open the needle which is almost fully closed. It is dangerous to make adjustments with the needle opened. Impact may not be absorbed.

If needle is fully closed···



Exhausted air is trapped and can't move to the stroke end. Autoswitch does not work, and the device stops its operation.

Parallel Style Air Gripper



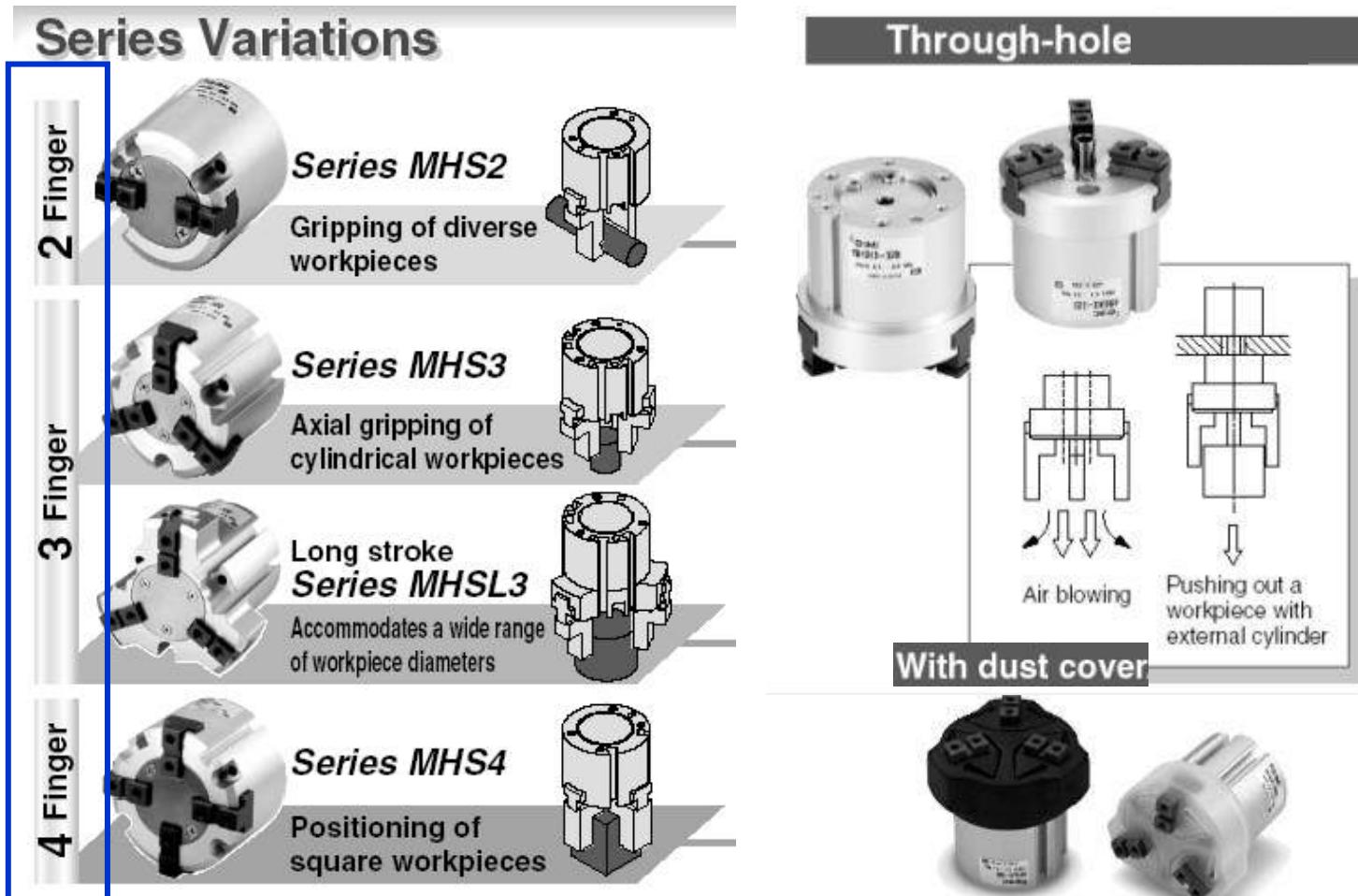
Actuators

Gripper



Actuators

Gripper 2 Finger, 3 Finger, 4 Finger Parallel Type Air Gripper



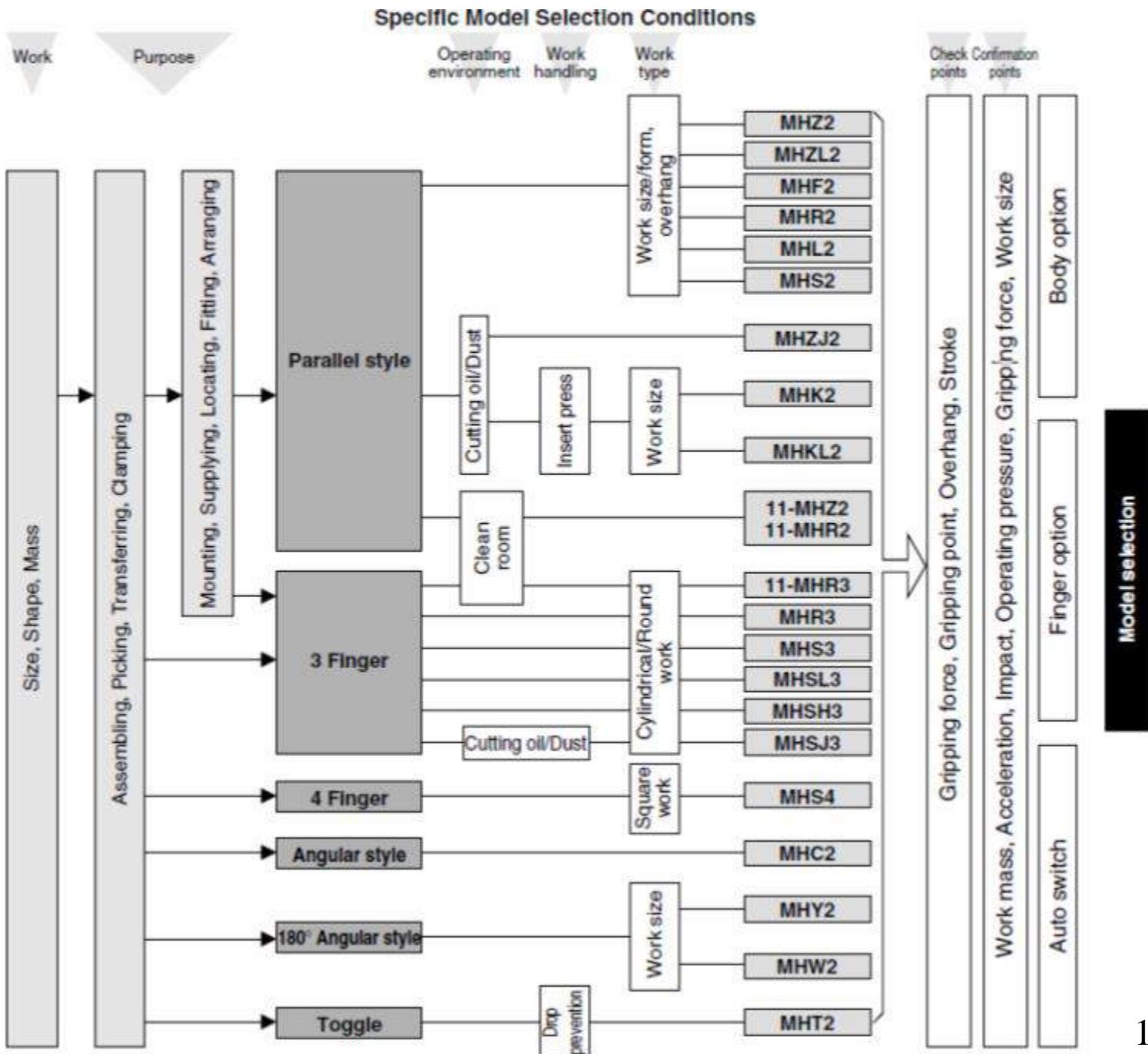
MHS2/MHS3/MHSL3/MHS4 Series

Actuators

Gripper

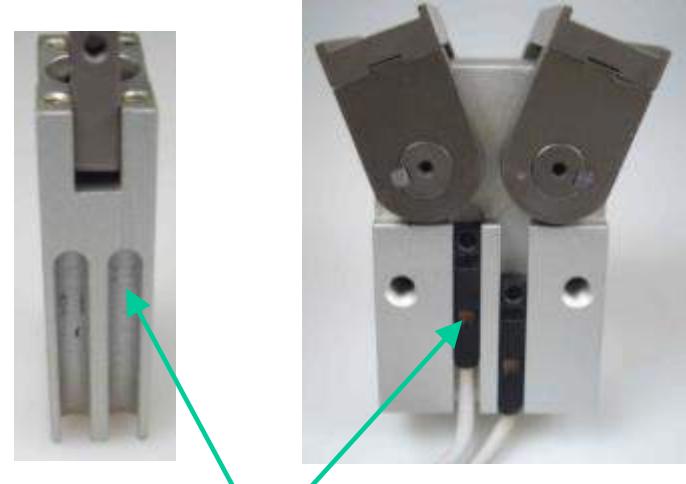
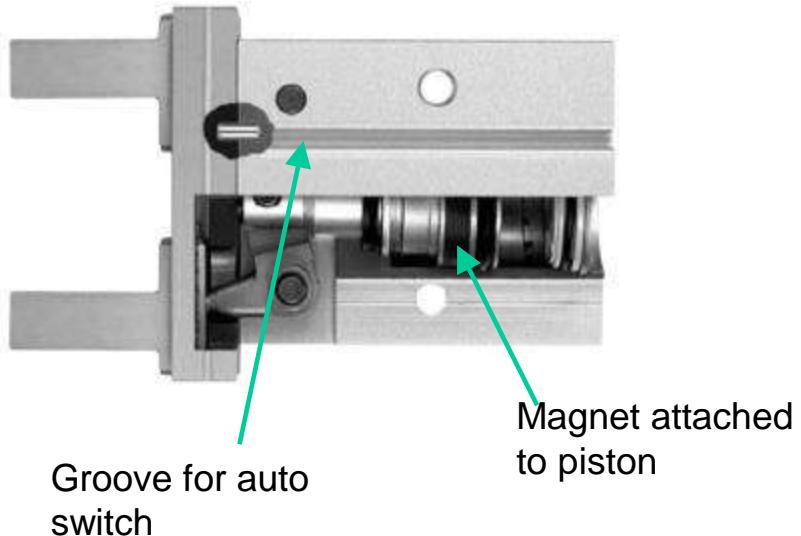
When sizing a gripper:

- Determine the Mass and physical size of the object to be handled.
- determine the purpose of the gripper; for assembly, picking, transferring or clamping?
- specific model selection conditions should be considered, for instance, the working conditions (dusty or oily environment) or the requirement to ensure the load/mass is not dropped when the supply air pressure is lost.



How is Stroke position detected ?

- Most SMC grippers feature grooves for mounting auto switches.
- A Magnet on the piston is detected by auto switches mounted on the actuator body.



Auto switches can be mounted on large as well as small grippers

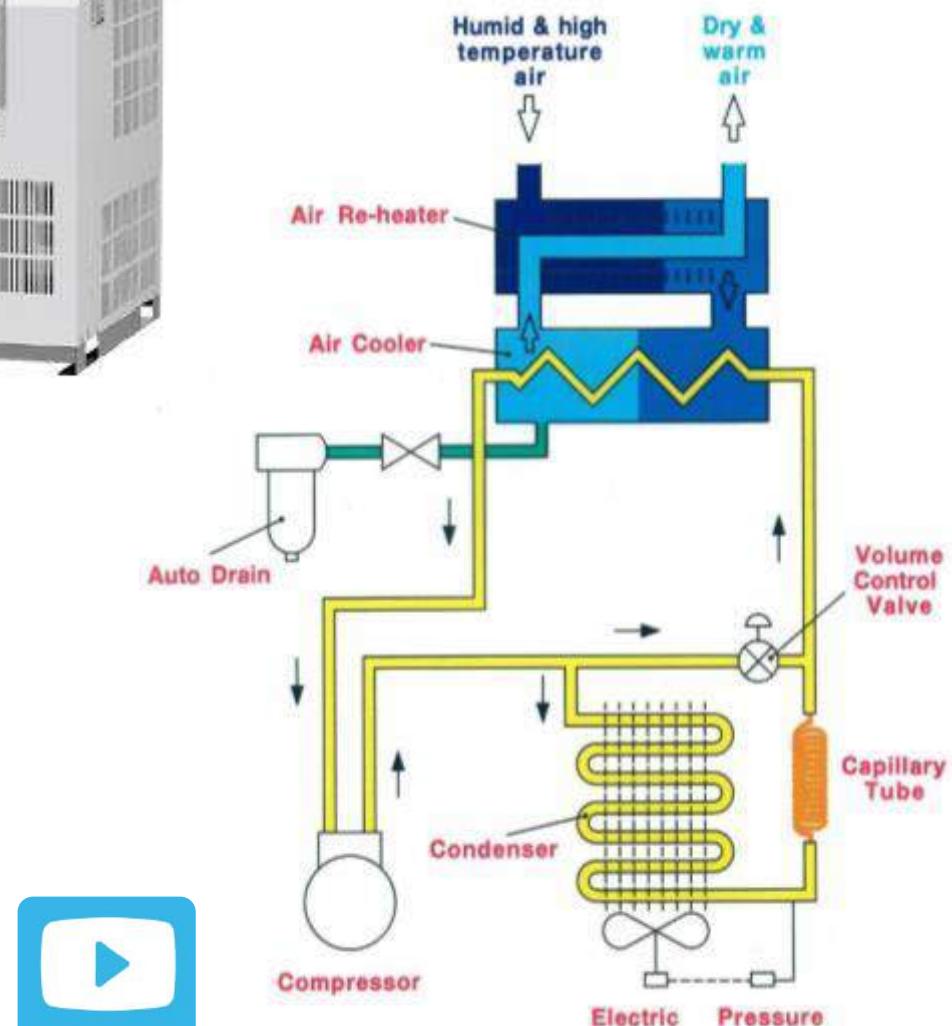
Compressed Air Purification

REFRIGERATED AIR DRYER



PRINCIPLE

Refrigerated air dryers put the wet compressed air temperature (dew point) close to freezing point. The aim is to ensure that the water in the wet air condense and drops out in a spot where it can be easily drained off



Outlet Dew Point : ~10 °C

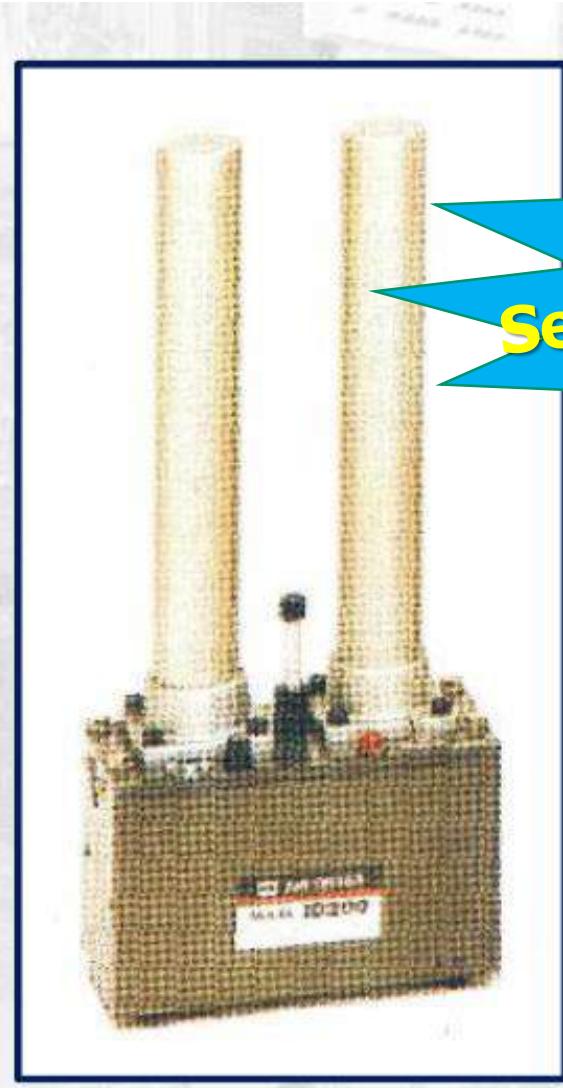
Compressed Air Purification

Desiccant/Heatless Dryer

Dew point (ADP) : -30°C to -50°C

- Desiccant dryers work by feeding compressed air through an alternating duty section while a non-duty section is used for regeneration.
- These units are designed to remove moisture in vapor form.

Point Of Use Only

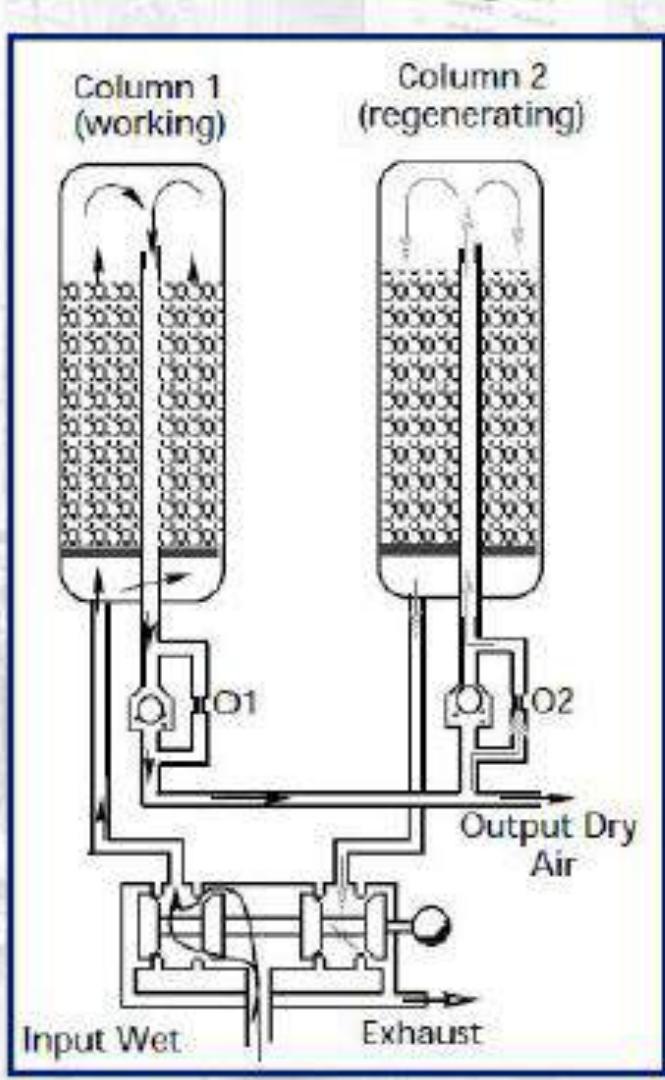


Need mist
Separator before dryer

Compressed Air Purification

Desiccant/Heatless Dryer

- ***Chemical such as silica gel or activated alumina in granular form***
- ***Chamber 1 : dry the wet compressed air by physically absorb moisture***
- ***Chamber 2 : 10 - 20% of dry air passes through orifice O2 in reverse direction to re-absorb moisture from the desiccant to regenerate it.***
- ***Directional control valve to switch the working and regenerating chamber.***



VIDEO



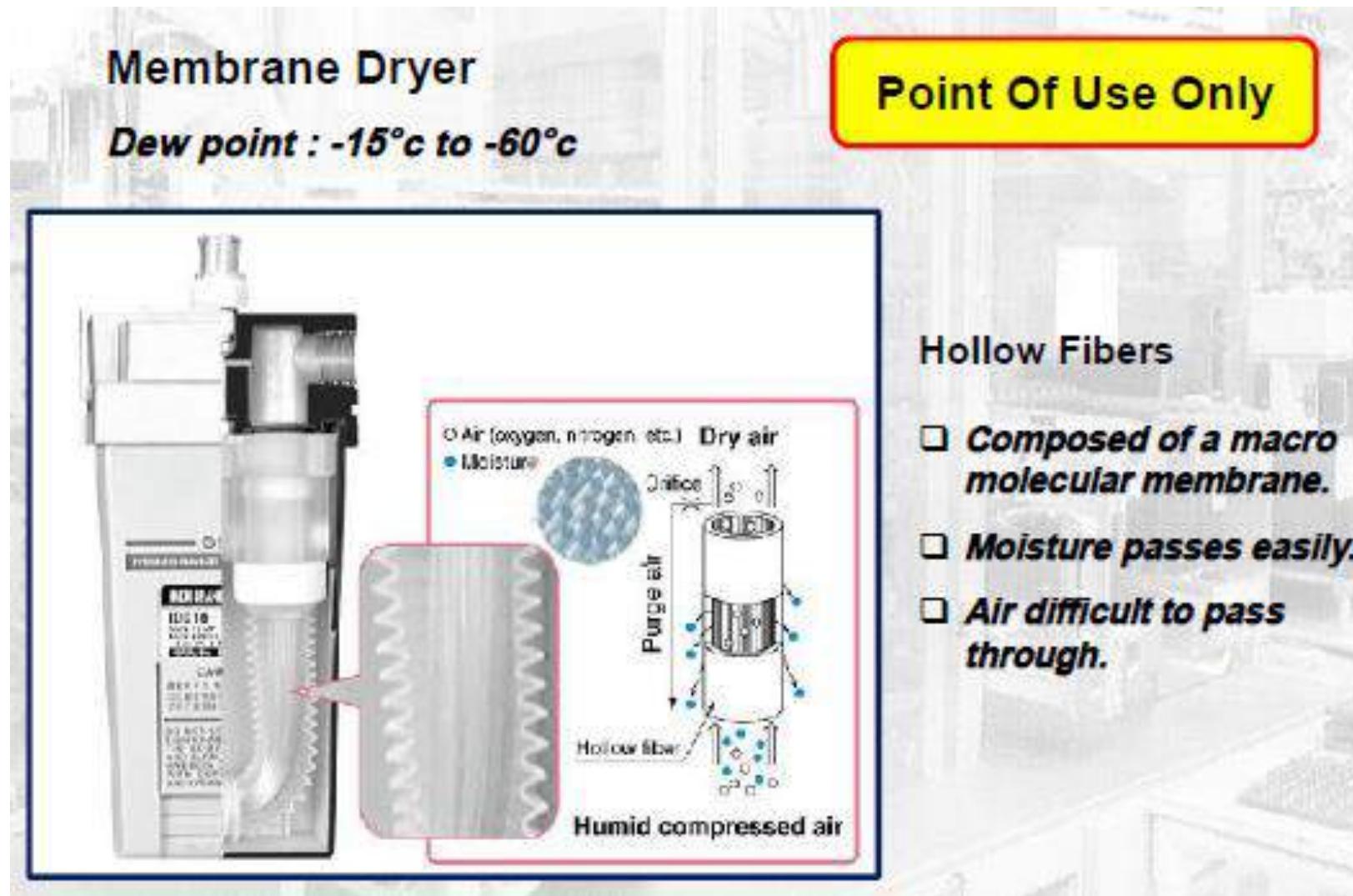
VIDEO

Compressed Air Purification

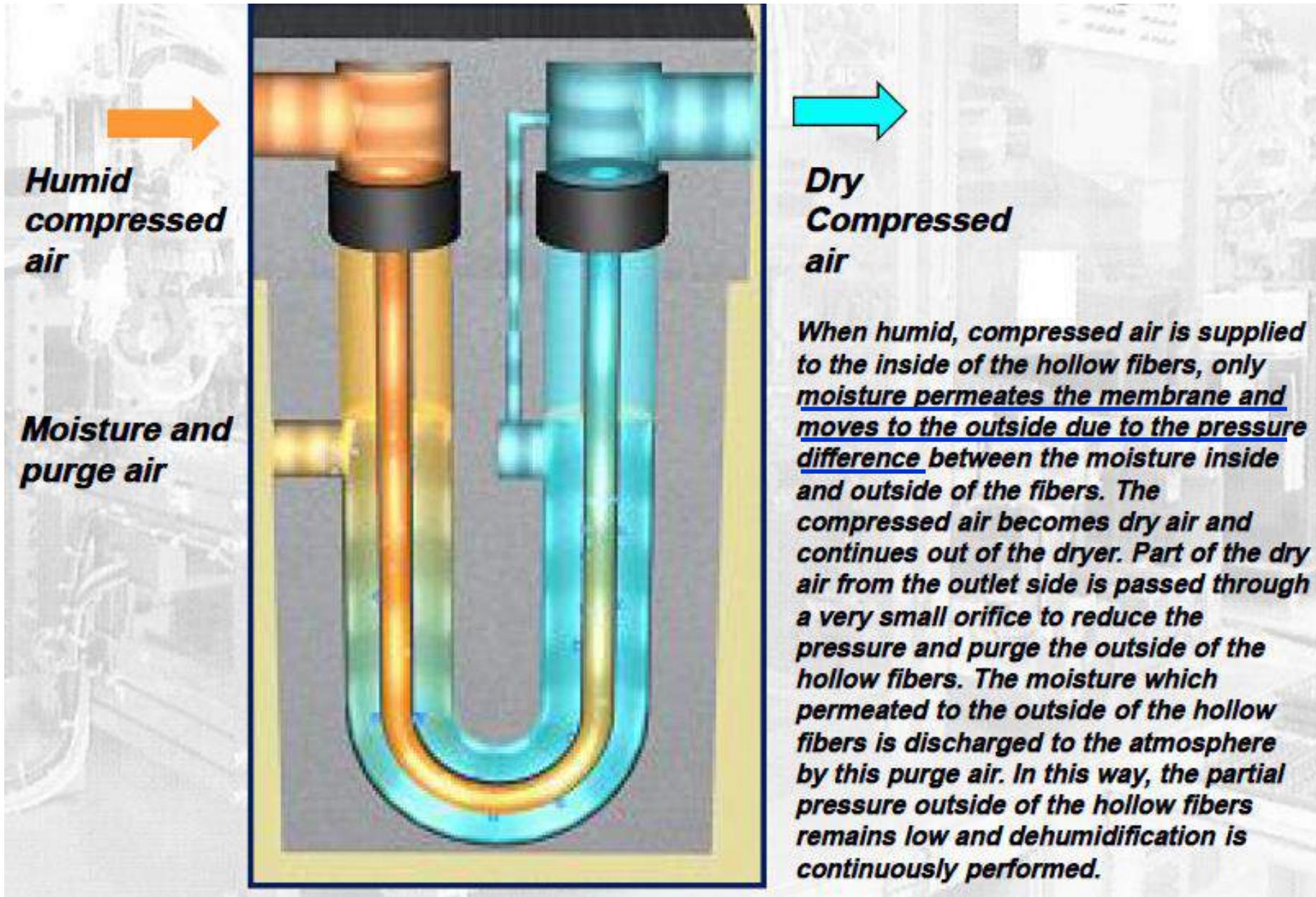
- * *Refrigerated air dryers are used in the industries where the dew point is above 0 °c*
ie : Paint sprayer, Sand blasting, Packaging, Engineering shop, Plastic industry, Pneumatic tools etc

- * *Adsorption (dessicant) air dryers are used in the industries where the dew point is below 0 °c*
ie : Semiconductor (wafer), Chemical, Pharmaceutical, Petroleum industry

Compressed Air Purification



Compressed Air Purification



VIDEO

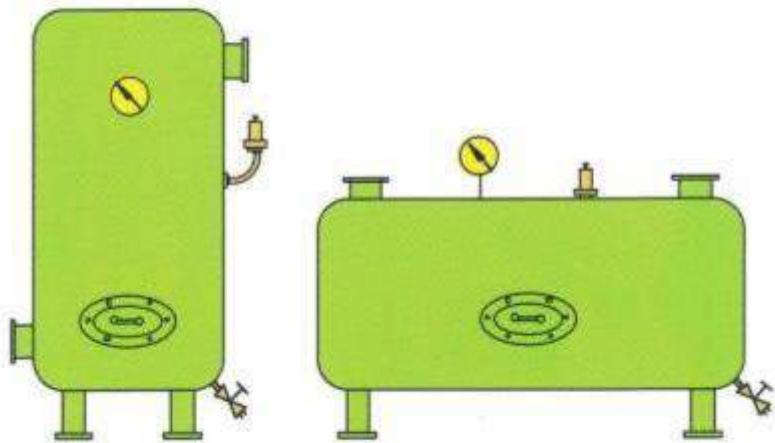


VIDEO

Compressed Air Purification



Symbol

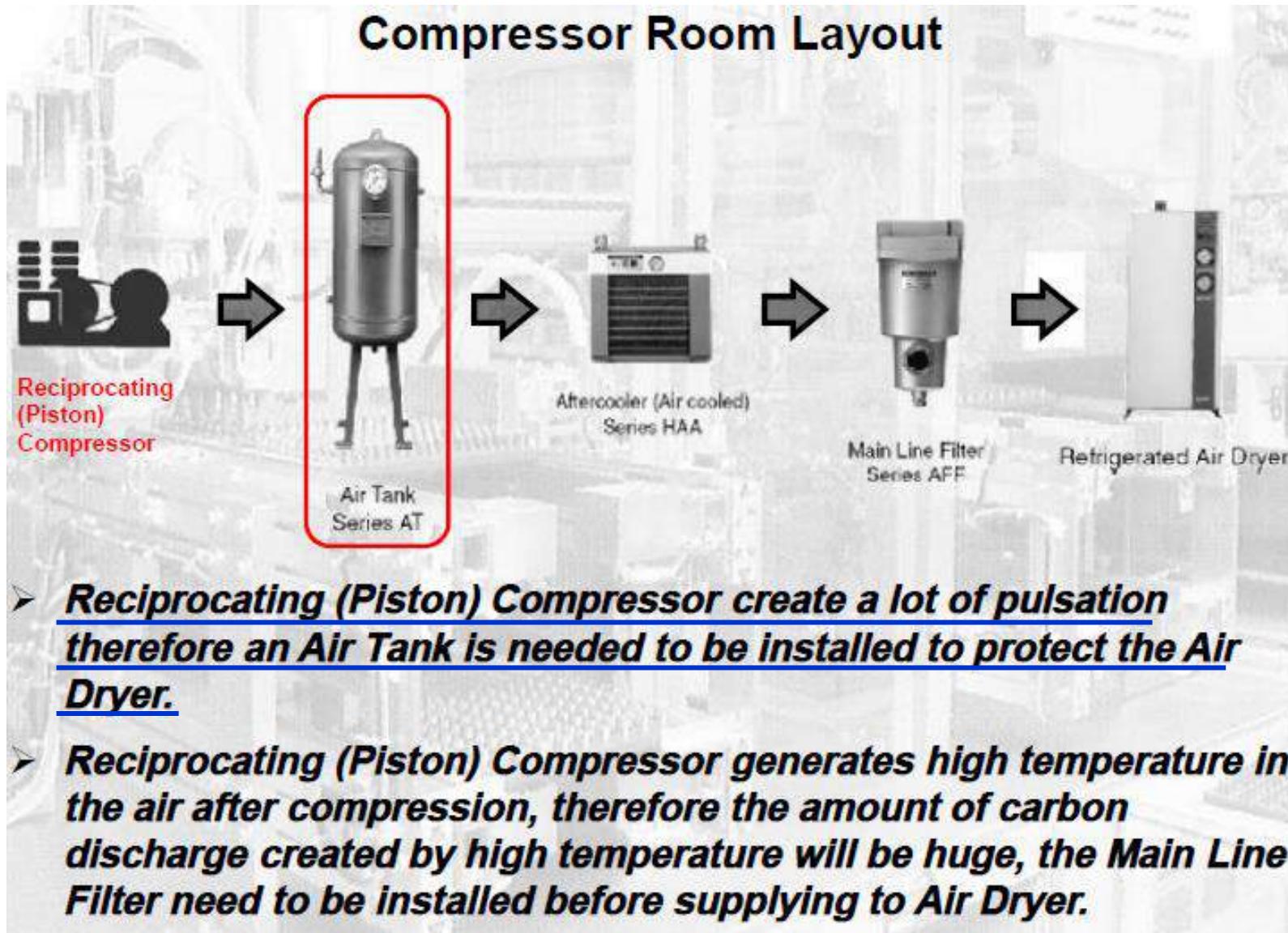


An air receiver is a pressure vessel of welded steel construction, installed horizontally or vertically directly downstream from the aftercooler to receive the compressed air

FUNCTION

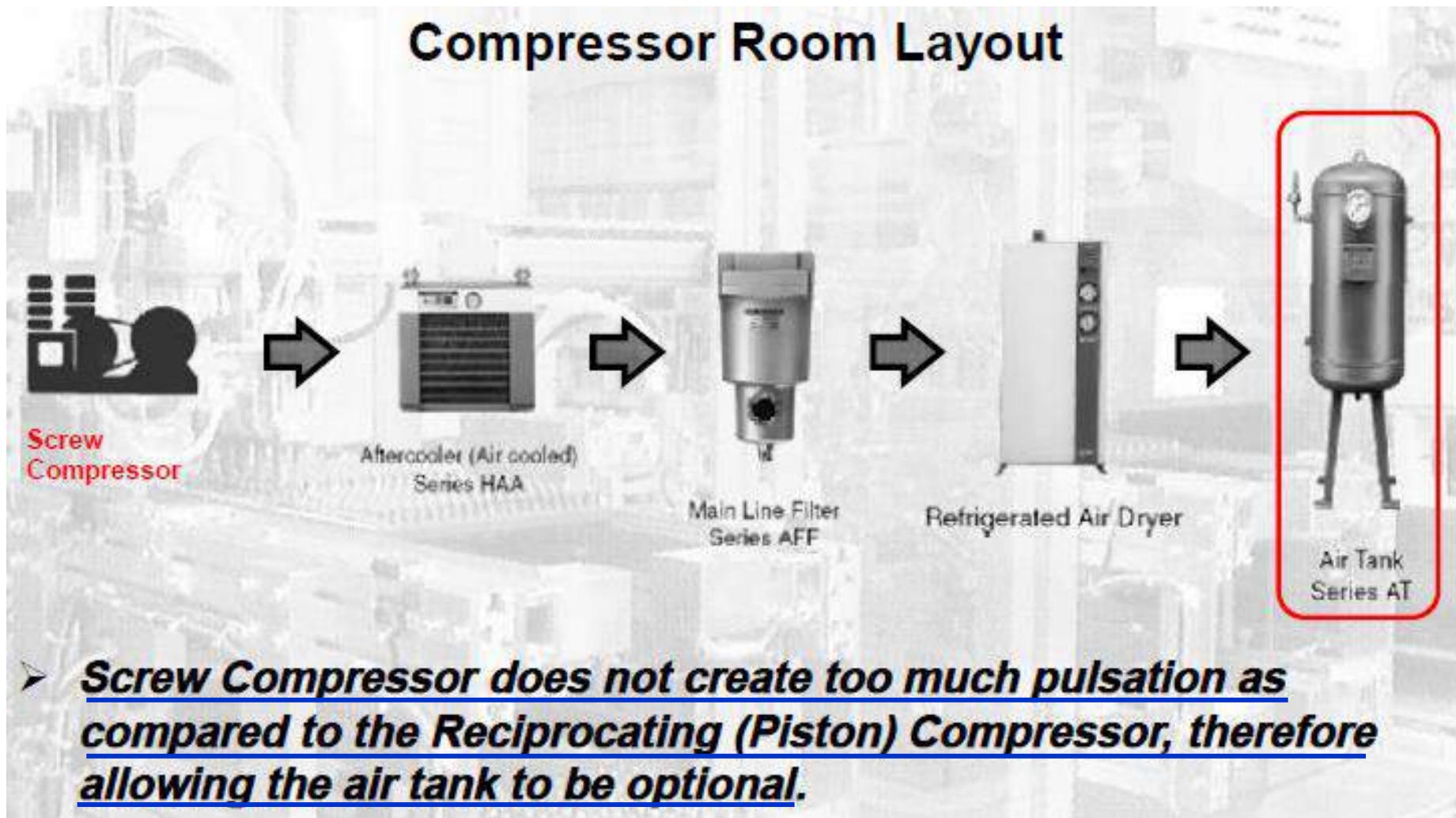
- *To store sufficient compressed air to meet heavy demands in excess of compressor capacity*
- *To dampen the initial pulsations in the air flow*
- *To minimise frequent "loading" and "unloading" of the compressor*

Compressed Air Purification



- **Reciprocating (Piston) Compressor create a lot of pulsation therefore an Air Tank is needed to be installed to protect the Air Dryer.**
- **Reciprocating (Piston) Compressor generates high temperature in the air after compression, therefore the amount of carbon discharge created by high temperature will be huge, the Main Line Filter need to be installed before supplying to Air Dryer.**

Compressed Air Purification



Compressed Air Purification

**Water Separator
Series AMG**

99% water removal rate has been achieved

SMC Water Separator series AMG



Features :

Adoption of an element that is exclusively used for removing water droplets when RH = 100%.

- ✓ *Can remove water droplets in compressed air but not water vapour (moisture) & compressed air leaving AMG will be 100% saturated.*
- ✓ *Use this product in cases where “water must be avoided, but not so dry as when an air dryer is used”.*

Compressed Air Purification

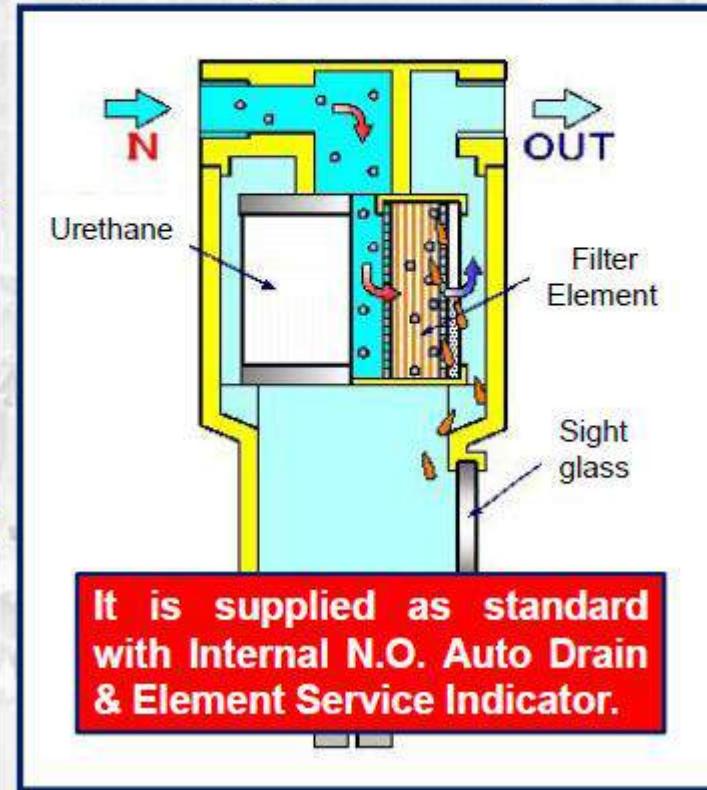
Mist Separator (Series AM)

Remove small dust particles, liquid, oil mist (oil aerosol) and carbon which cannot be removed with a Main Line Filter.

It is ideal for oil filtration following a Reciprocating Piston Compressor.



Mist Separator	Filtration	Max. secondary side oil mist concentration
	0.3µm	1mg/m ³ (ANR) [0.8ppm]



Compressed Air Purification

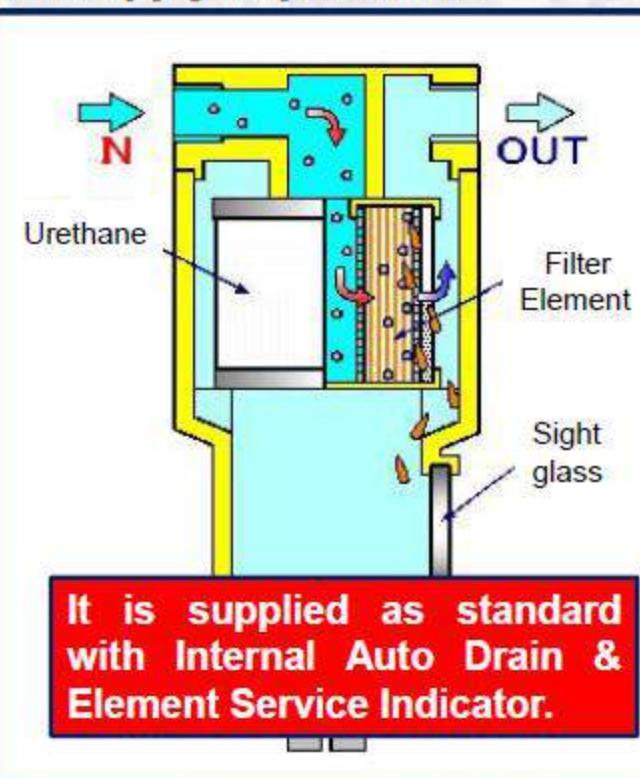
Micro Mist Separator (*Series AMD*)

Remove small dust particles, liquid, and oil mist (oil aerosol) which cannot be removed with a Mist Separator.

It is recommended as a prefilter of the air supply to precision instruments or for clean room applications.



	Filtration	Max. secondary side oil mist concentration
Micro Mist Separator	0.01µm	0.1mg/m ³ (ANR) [0.08ppm]



Compressed Air Purification

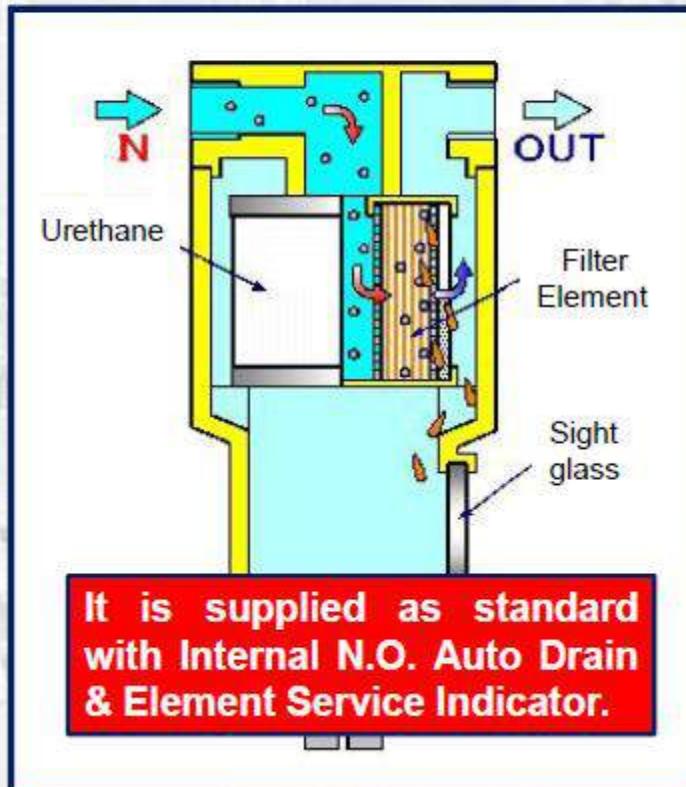
Micro Mist Separator With Prefilter (Series AMH)

Integration of Mist Separator as a prefilter to a Micro Mist Separator (AMH = AM + AMD).

- ❖ *Easier installation.*
- ❖ *Fewer replacement of filter elements.*
- ❖ *Reduced total pressure drop.*



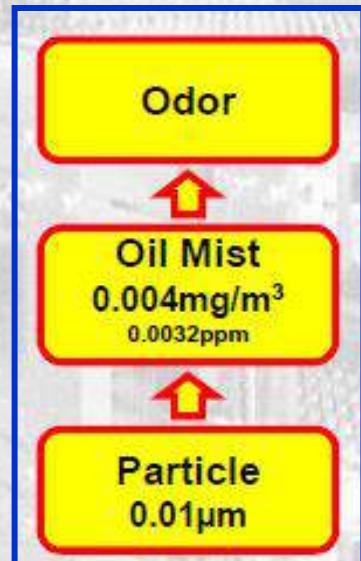
	Filtration	Max. secondary side oil mist concentration
Micro Mist Separator With Prefilter	0.01µm	0.1mg/m ³ (ANR) [0.08ppm]



Compressed Air Purification

Odor Removal Filter (**Series AMF**)

- **Efficiently removes odor (Hydrocarbon & Organic Vapours) from compressed air with an Activated Carbon Filter Element.**
- **The unit is designed for clean room where odors must be avoided. It can be used in breathing air systems to remove odor & taste.**
- **Activated carbon filter will not remove Carbon Monoxide or Carbon Dioxide from compressed air.**



Activated carbon filter must not operate in oil or water saturated conditions.



Compressed Air Purification

Types of filtration system

Filter Model	AMG	AFF	AM	AMD	AMH	AMF
Filter Type	Water Coalescer	Coarse Filtration	Coalescing pre filter	Coalescing Micromist Filter	Coalescing Micromist with Prefilter	Odour Removal
Element Type	Resin Mesh	Cotton/Paper	Micro Fibreglass	Micro Fibreglass	Micro Fibreglass	Adsorbent Activated Carbon



Coarse Filtration



Series AFF

Coalescing



Series AM, AMD, AMH & AME

Absorption



Series AMF

Compressed Air Purification

ISO Standard for Compressed Air Quality

The grade of compressed air purity with “Solid Particles”, “Water” & “Oil” as defined by ISO 8573-1:2010.

ISO 8573-1: 2010 Compressed Air Contaminants and Purity Classes							
Class	Particles			Water		Oil	
	By Particle Size, d (Maximum number of particles per m ³)			By Mass, C _p	Pressure dewpoint	Concentration of liquid water, C _w	Concentration of total oil (liquid, aerosol and vapour)
	0.1μm < d ≤ 0.5μm	0.5μm < d ≤ 1.0μm	1.0μm < d ≤ 5.0μm	mg/m ³	°c	g/m ³	mg/m ³
0	As specified by the equipment user or supplier and more stringent than class 1.						
1	≤ 20 000	≤ 400	≤ 10	-	≤ -70	-	≤ 0.01
2	≤ 400 000	≤ 6 000	≤ 100	-	≤ -40	-	≤ 0.1
3	-	≤ 90 000	≤ 1 000	-	≤ -20	-	≤ 1
4	-	-	≤ 10 000	-	≤ +3	-	≤ 5
5	-	-	≤ 100 000	-	≤ +7	-	-
6	-	-	-	0 < C _p ≤ 5	≤ +10	-	-
7	-	-	-	5 < C _p ≤ 10	-	C _w ≤ 0.5	-
8	-	-	-	-	-	0.5 < C _w ≤ 5	-
9	-	-	-	-	-	5 < C _w ≤ 10	-
x	-	-	-	C _p > 10	-	C _w > 10	> 5

(Source: International Standard ISO 8573-1 Third Edition 2010-04-15)

Reproduced from ISO 8573-1 : 2010 with permission from the International Organization for Standardization (ISO). All rights reserved by ISO.

Compressed Air Purification

Usage of ISO Standard Table

Example : ISO8573-1:2010 Class 1.2.1

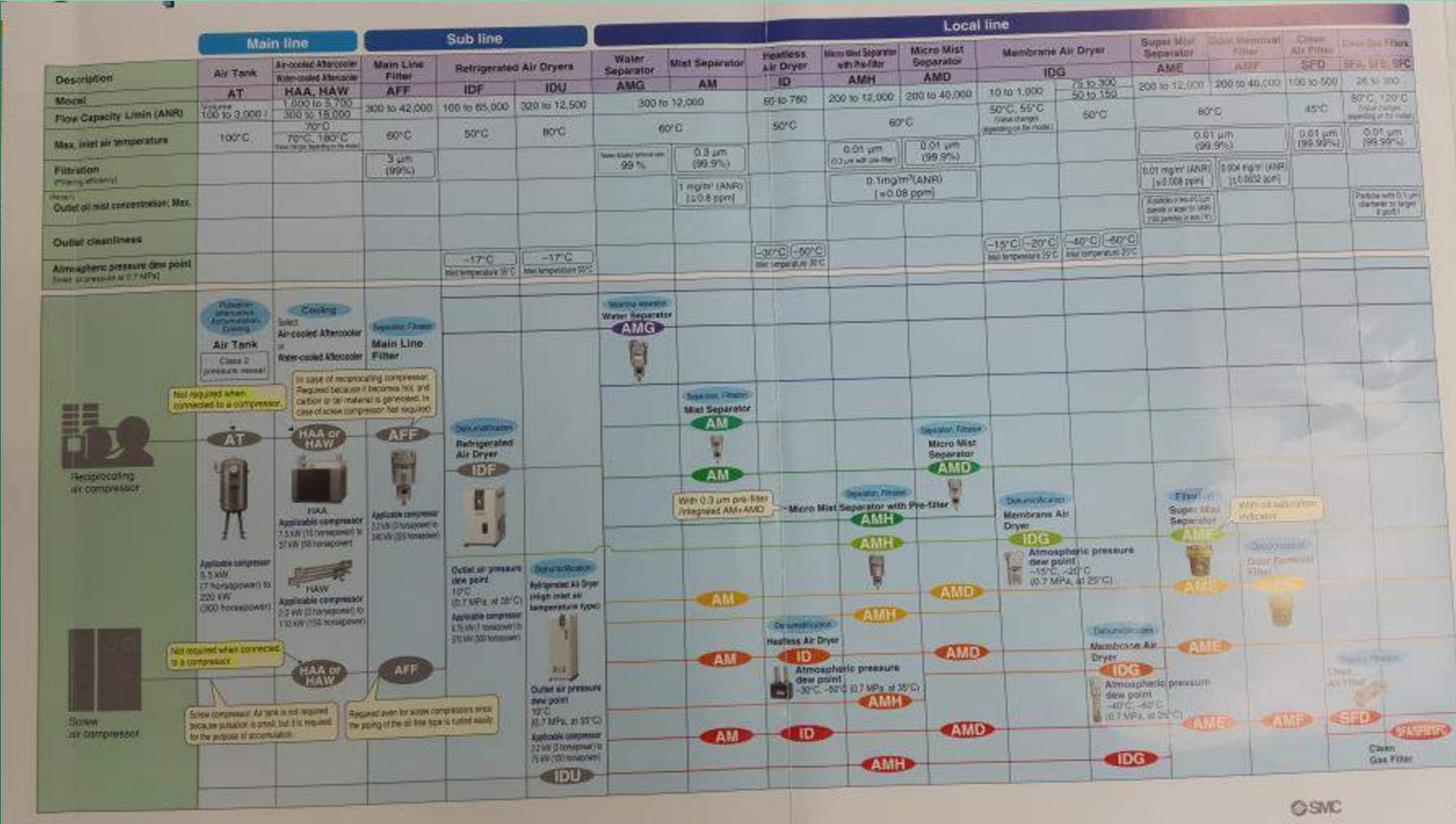
ISO 8573-1: 2010 Compressed Air Contaminants and Purity Classes						
Class	Particles			Water	Oil	
	By Particle Size, d (Maximum number of particles per m ³)			By Mass, C _p	Pressure dewpoint	Concentration of liquid water, C _w
	0.1μm < d ≤ 0.5μm	0.5μm < d ≤ 1.0μm	1.0μm < d ≤ 5.0μm	mg/m ³	°c	g/m ³
0	As specified by the equipment user or supplier and more stringent than class 1.					
1	≤ 20 000	≤ 400	≤ 10	-	≤ -70	-
2	≤ 400 000	≤ 6 000	≤ 100	-	≤ -40	-
3	-	≤ 90 000	≤ 1 000	-	≤ -20	-
4	-	-	≤ 10 000	-	≤ +3	-
5	-	-	≤ 100 000	-	≤ +7	-
6	-	-	-	0 < C _p ≤ 5	≤ +10	-
7	-	-	-	5 < C _p ≤ 10	-	C _w ≤ 0.5
8	-	-	-	-	-	0.5 < C _w ≤ 5
9	-	-	-	-	-	5 < C _w ≤ 10
X	-	-	-	C _p > 10	-	C _w > 10
						> 5

(Source: International Standard ISO 8573-1 Third Edition 2010-04-15)

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Compressed Air Purification

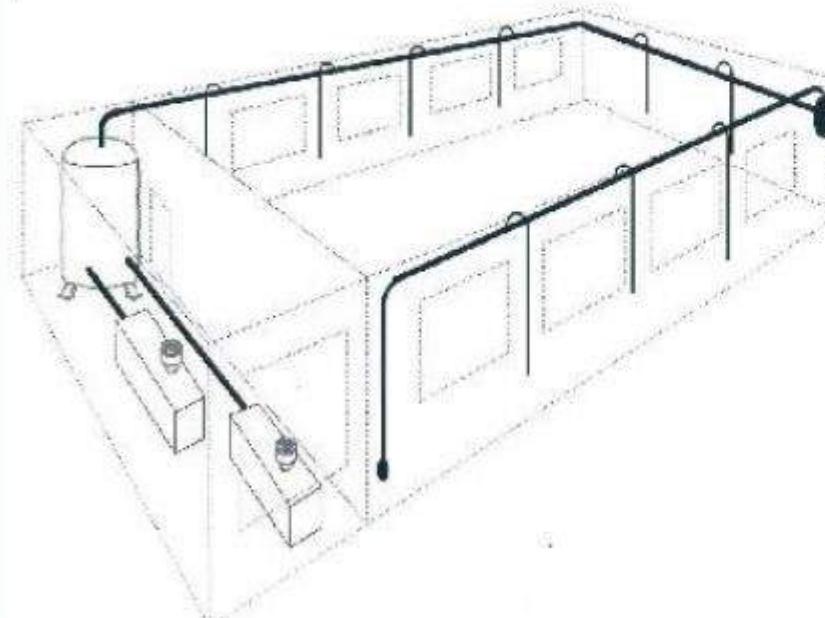
Category	Particulate			Water		Gases	
	By particle size & concentration (number of particles per m³)		By water type	By water assessment	Concentration of dissolved water (ppm)	Concentration of dissolved gases (ppm)	
	Quality of air system	Concentration of water (ppm)	Concentration of water (ppm)	Concentration of water (ppm)	Concentration of water (ppm)	Concentration of water (ppm)	Concentration of water (ppm)
Information from ISO 8573-1:2001 with permission from International Organization for Standardization, ISO Central Secretariat, CH-1214 Geneva, Switzerland.							
System	Application example	Impurity in compressed air					
		Filtration	Dust concentration	Cleanliness	Oil odor	Moisture	
			(ppm)			Dew point	Moisture contents
							ppm (ARI)
A	Water droplets removed air					Ambient pressure dew point, °C - 0.7 MPa pressure dew point, °C	7 g/m³ (ARI)
A	- Air blowing - Simple removal of particles - General pneumatic tool						3 - 10
B	Dry air	3 µm (Filtering efficiency 99%)	—				2, 4, 6
B	- Used to blow away dust and when there is a large temperature drop in the middle of a pipe						2, 4, 6
C	Dry air	0.5 µm (Filtering efficiency 99.9%)	Max 1 mg/m³ (ARI) 0.8 ppm			Ambient pressure dew point - 0.7 MPa pressure dew point, °C	2, 4, 6
C	- General pneumatic equipment - General painting						2, 4, 6
D	Dry & Clean air		Max 0.1 mg/m³ (ARI) 0.08 ppm			Ambient pressure dew point - 14 to -29°C 0.7 MPa pressure dew point 15 to 30°C	1, 4, 6
D	- Dry powder handling - Separation of liquids - Measurement device instrumentation - Dry & Cooling Phoenix series - Motion tests (pneumatic bending)						1, 4, 6
E	Dry & Clean air	0.01 µm (Filtering efficiency 99.9%)	Max 0.01 mg/m³ (ARI) 0.002 ppm	20 particles or less 0.025 µm			1, 4, 6
E	- When a refrigerated air dryer is not pressurized air line - Integrated into air compressor - Moisture-free, 30 measurement devices						1, 4, 6
F	Deodorized air		Max 0.006 mg/m³ (ARI) 0.002 ppm	Smell of ozone 700 µPa 100 particles or less	No oil odor		1, 4, 6
F	- Sterilizing, deodorizing, drying and packaging - Food industry (Exempt for direct blowing to food)						1, 4, 6
G	Low dew point clean air		Max 0.01 mg/m³ (ARI) 0.005 ppm			Ambient pressure dew point 30 to -60°C	0.6 g/m³ (ARI)
G	- Drying metal and electronic parts - Cleaning a circuit board - Transporting powders - Ozone generator - Activation device in a filter degassing room						1, 4, 6
H	Low dew point clean air (for clean rooms)	0.01 µm (Filtering efficiency 99.99%)	Max 0.004 mg/m³ (ARI) 0.002 ppm	Particles with 0.1 µm diameter or larger 0.05 l	No oil odor	Ambient pressure dew point - 0.7 MPa pressure dew point - 6 to -40°C	1, 2, 4, 6
H	- Blowing semiconductor parts in a clean room						1, 2, 4, 6



Compressed Air Distribution

The Correct Piping System

DEAD END LINE MAIN



Advantages :

- **Distribute compressed air over the shortest possible run.**
- **Lower piping cost.**

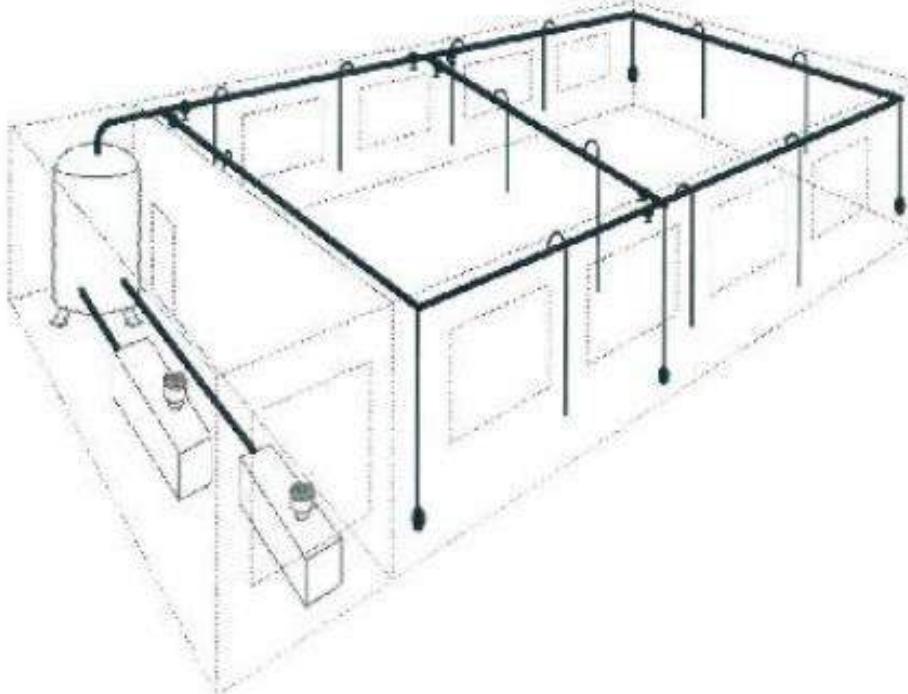
Disadvantages :

The pressure at the last few points are weaker due to high air consumption in the front points.

Compressed Air Distribution

The Correct Piping System

RING MAIN



Minimise pressure drop

Compressed air can be fed from two sides to a point of high consumption.

Efficient water drainage

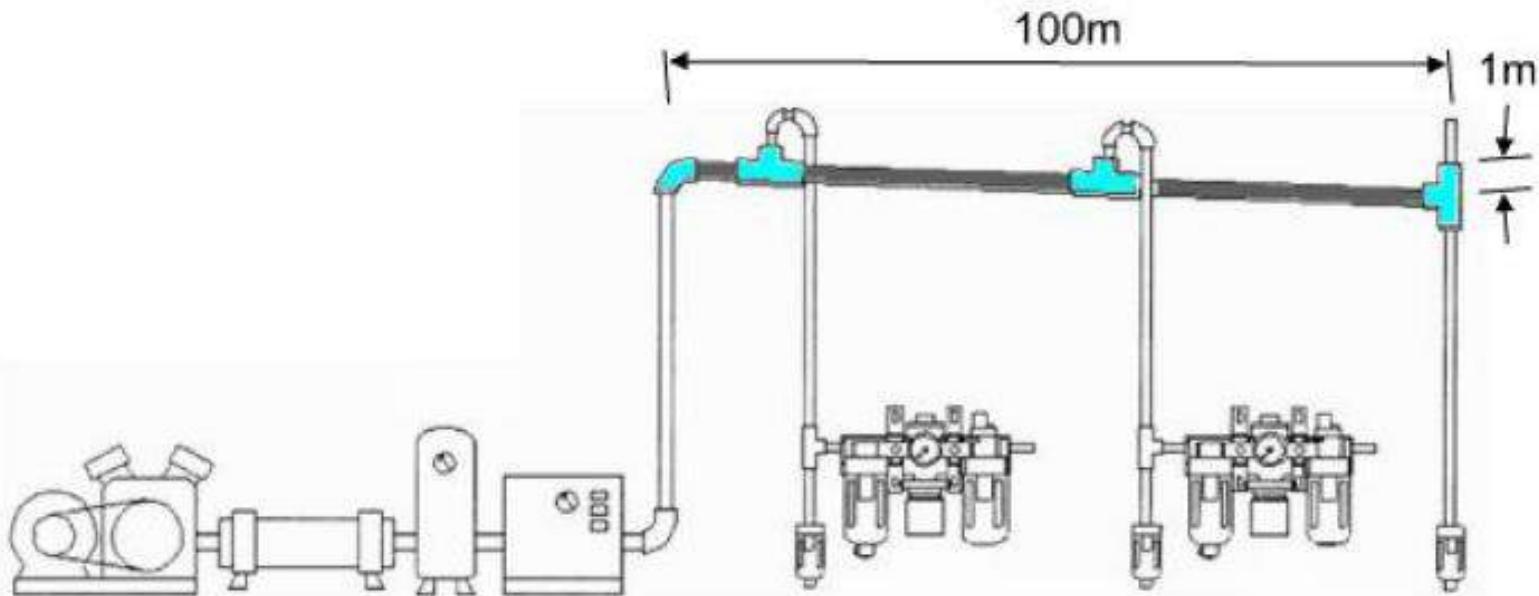
Water is driven in any direction and sufficient water take-off with auto drains.

But Piping cost is HIGH

Compressed Air Distribution

The Correct Piping System

Pipes to be installed with a gradient of 1%



It is essential to allow the water to be eliminated by gravity.

The following points are important for running of pipework :

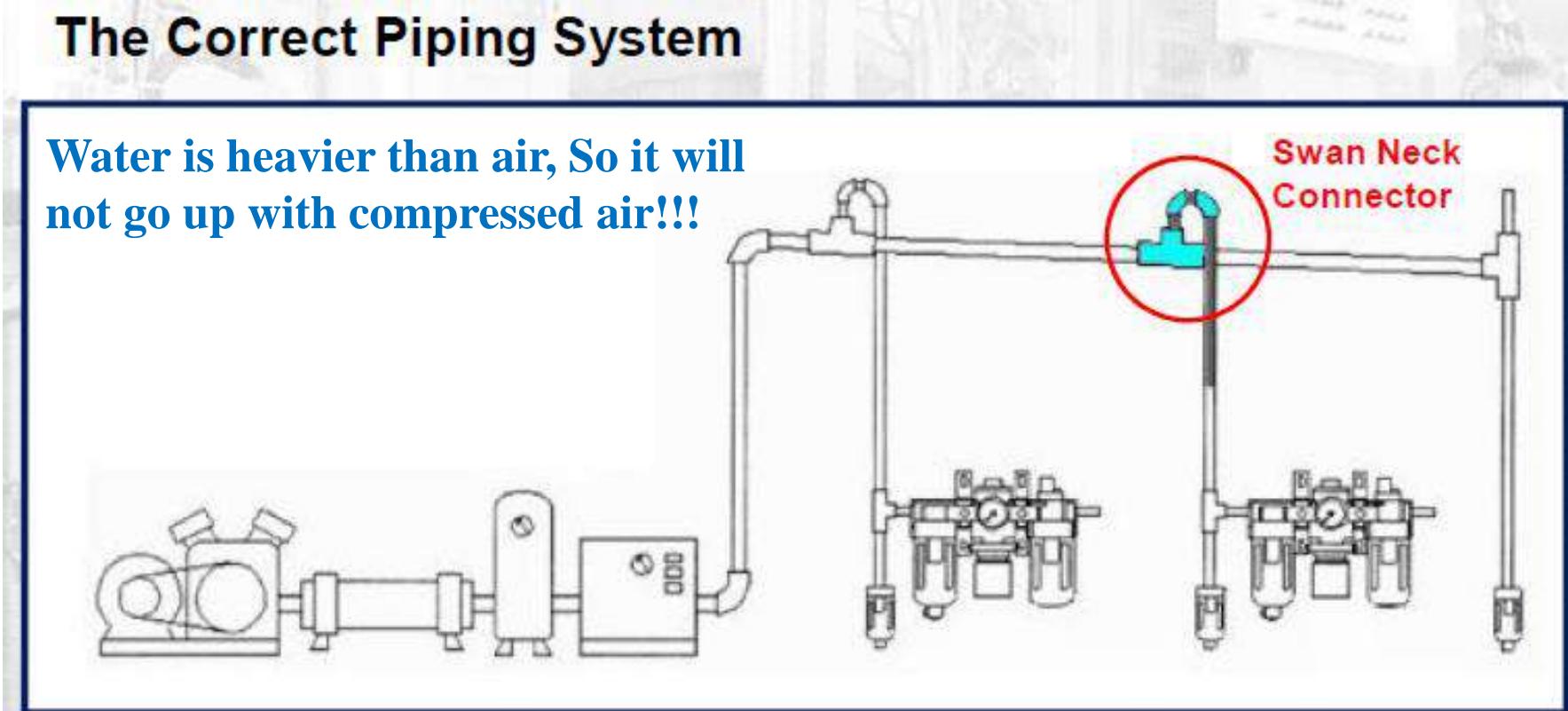
- All pipelines should have a slope of about 1 in 100 in the direction of flow and it should be adequately drained
- At suitable intervals, the main can be brought back to its original height by using two long sweep right angle bends and arranging a drain leg at the low point



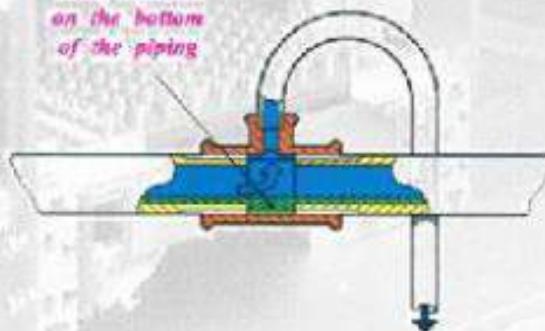
Compressed Air Distribution

The Correct Piping System

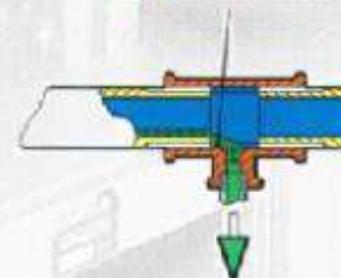
Water is heavier than air, So it will not go up with compressed air!!!



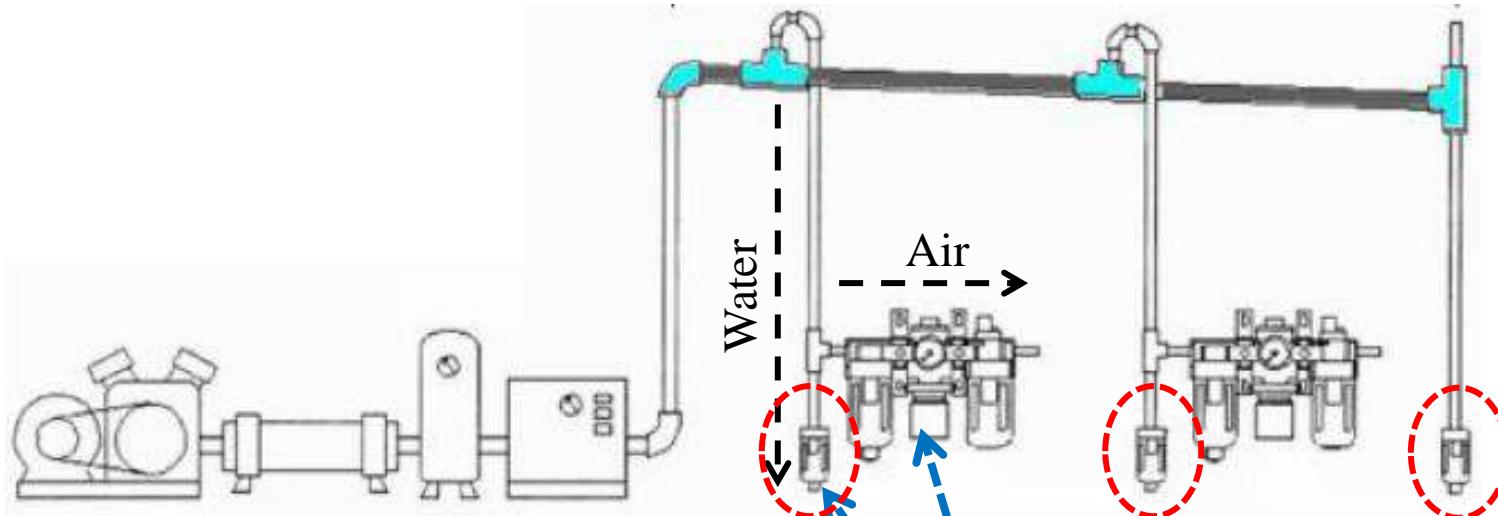
Water remains
on the bottom
of the piping



Water runs down
into the Auto Drain



Compressed Air Distribution



Apply Auto Drain at the end of Line.

**Do not Install Machine Straight From the Main Line
Due to water can flow into Machine.**

Compressed Air Distribution

Types of drain valves



Manual Drain



Float type Auto Drain

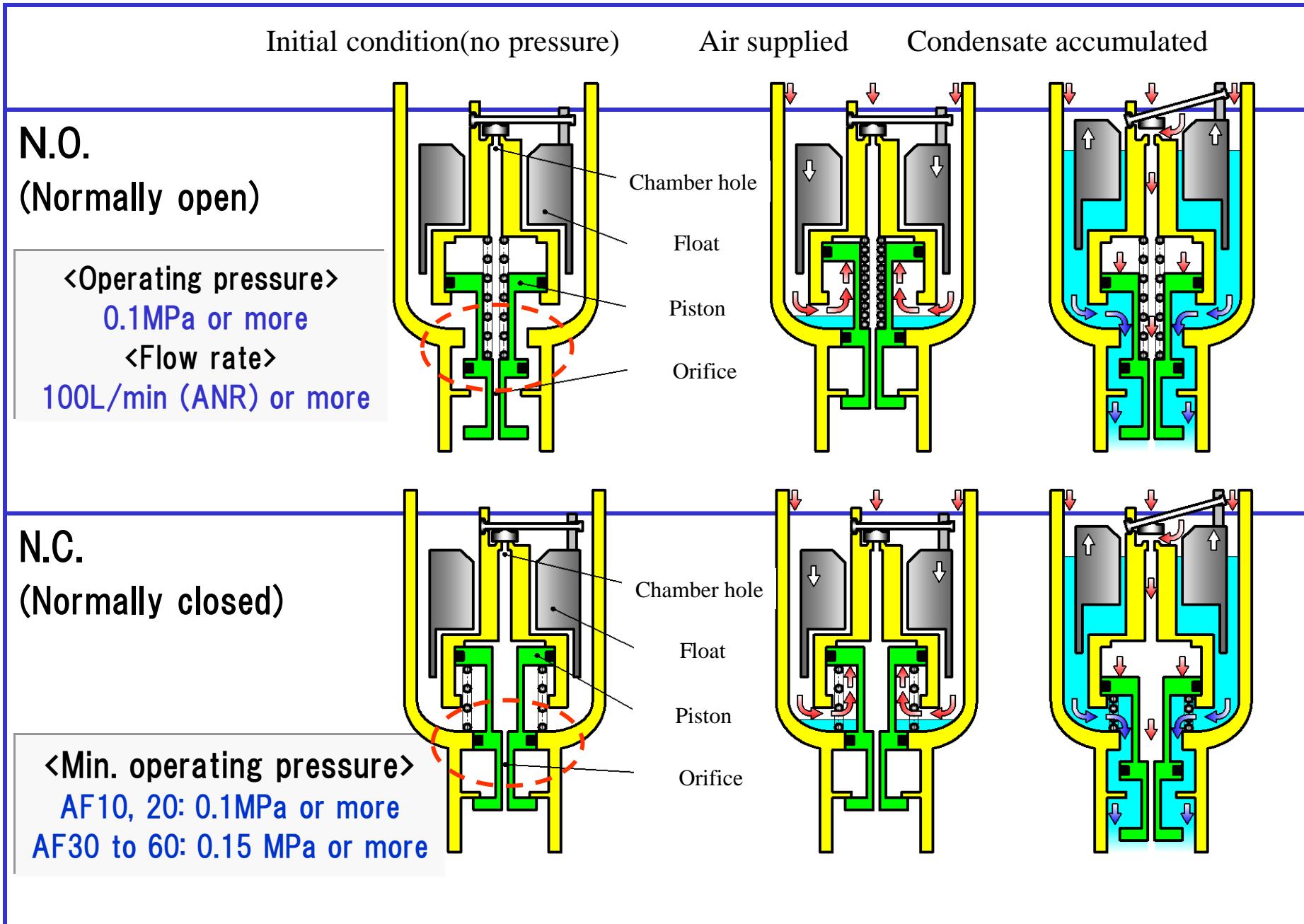


Electrical type Auto Drain

SMC Recommended not to use **Manual Drain** because of **Quality and Productivity** purpose.

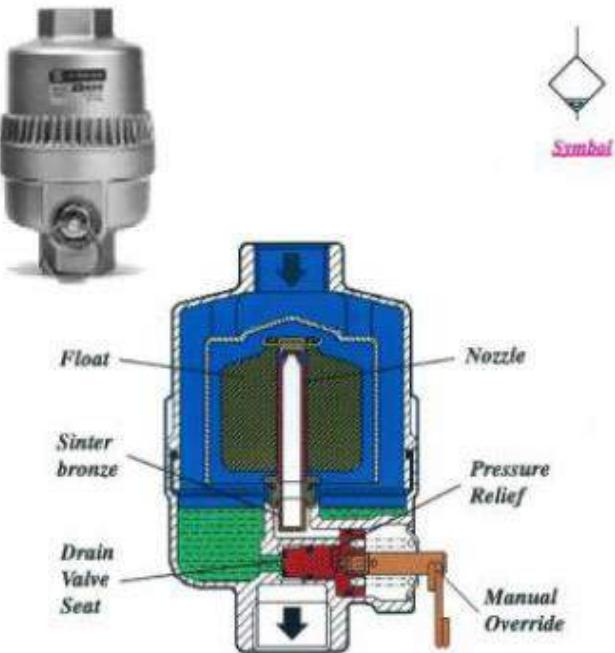
Compressed Air Treatment

Auto Drain



Compressed Air Distribution

FLOAT TYPE AUTO DRAIN



This valve is installed vertically at each lower drainage point

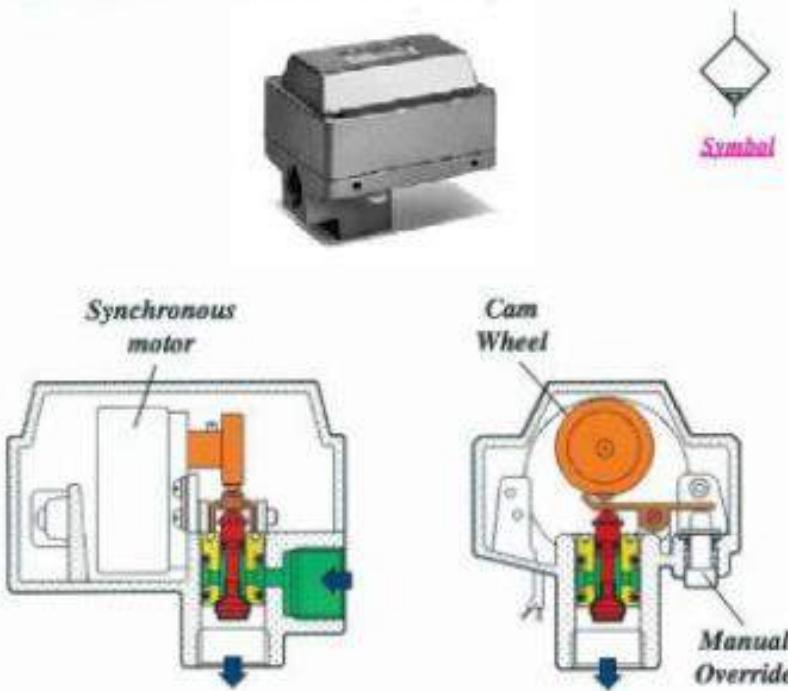


VIDEO

AUDIO

Compressed Air Distribution

MOTORIZED AUTO DRAIN



It is an electrically driven type which periodically purges the condensate by a rotating cam wheel tripping a lever operated poppet valve

Compressed Air Distribution

Electrical Timer Controlled Auto Drain



Benefits of using timer auto-drain valve:

- ★ Adjustable cycle time and purge time
- ★ Save maintenance time
- ★ Avoid the possibility of overlooking the drainage system
- ★ Simple and efficient

Compressed Air Distribution

Differences between Float and Electrical Auto-Drain

Float controlled AD	Motor controlled ADM	Timer controlled VXD
Incorporate a float	Incorporate a motor	Incorporate a solenoid valve and timer
Discharge automatically when auto drain bowl accumulates to a level threshold.	Discharge at fix interval.	Adjustable discharge interval
-	Cycle time and purge time are fixed . Standard: * Operating cycle : 1 time/min Purge time : 2s <i>* Other operating cycles are available.</i>	Cycle time and purge time are adjustable . Standard: Operating cycle : 0.5~45min Purge time : 0.5~10s

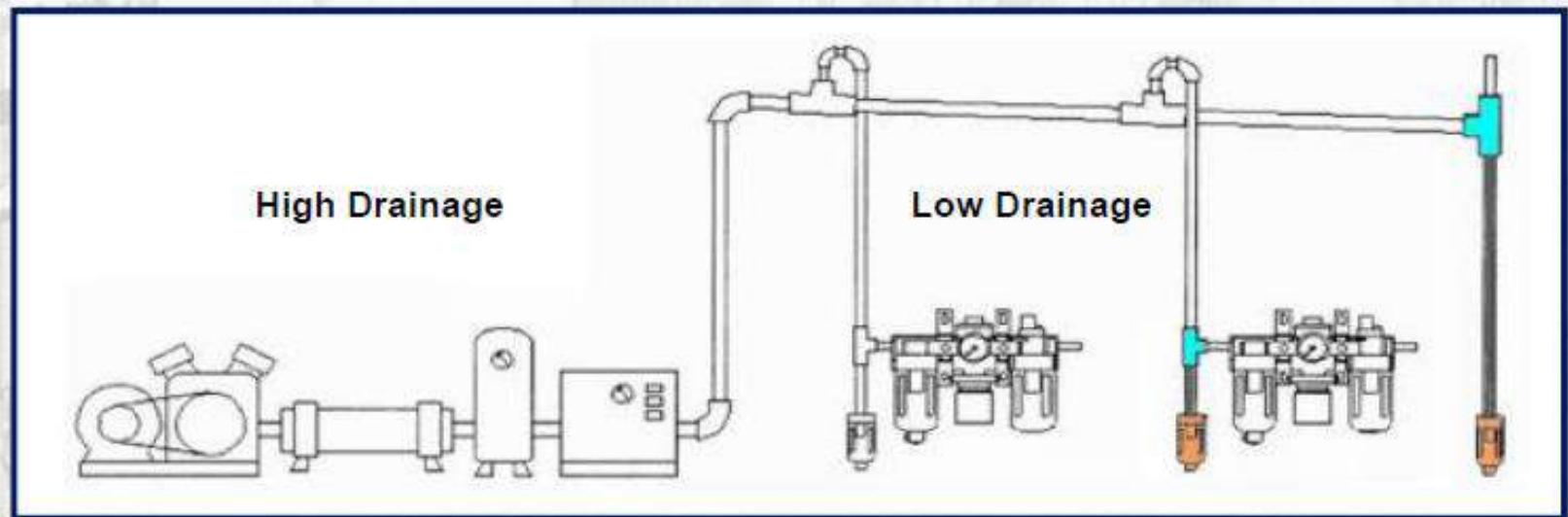
Compressed Air Distribution

How to select float or Electrical Auto-Drain?

Float controlled AD	Motor controlled ADM	Timer controlled VXD
Drain accumulation is slow, not frequent.	Drain accumulation is fast, very frequent.	
Low drain discharge		High drain discharge
Safe to be used in hazardous environment.	Relatively more compact and space saving.	

Compressed Air Distribution

Select the right auto drain based on your requirement



Before air dryer

- **100% Relative Humidity (RH)**
- **High drain discharge**

Recommend : **Timer Auto Drain**

- ***Compressor Room (Indoor or Outdoor)***

Heavy Duty Float Type Auto Drain

- ***Compressor Room (Indoor)***

After air dryer

- **Low drain discharge**



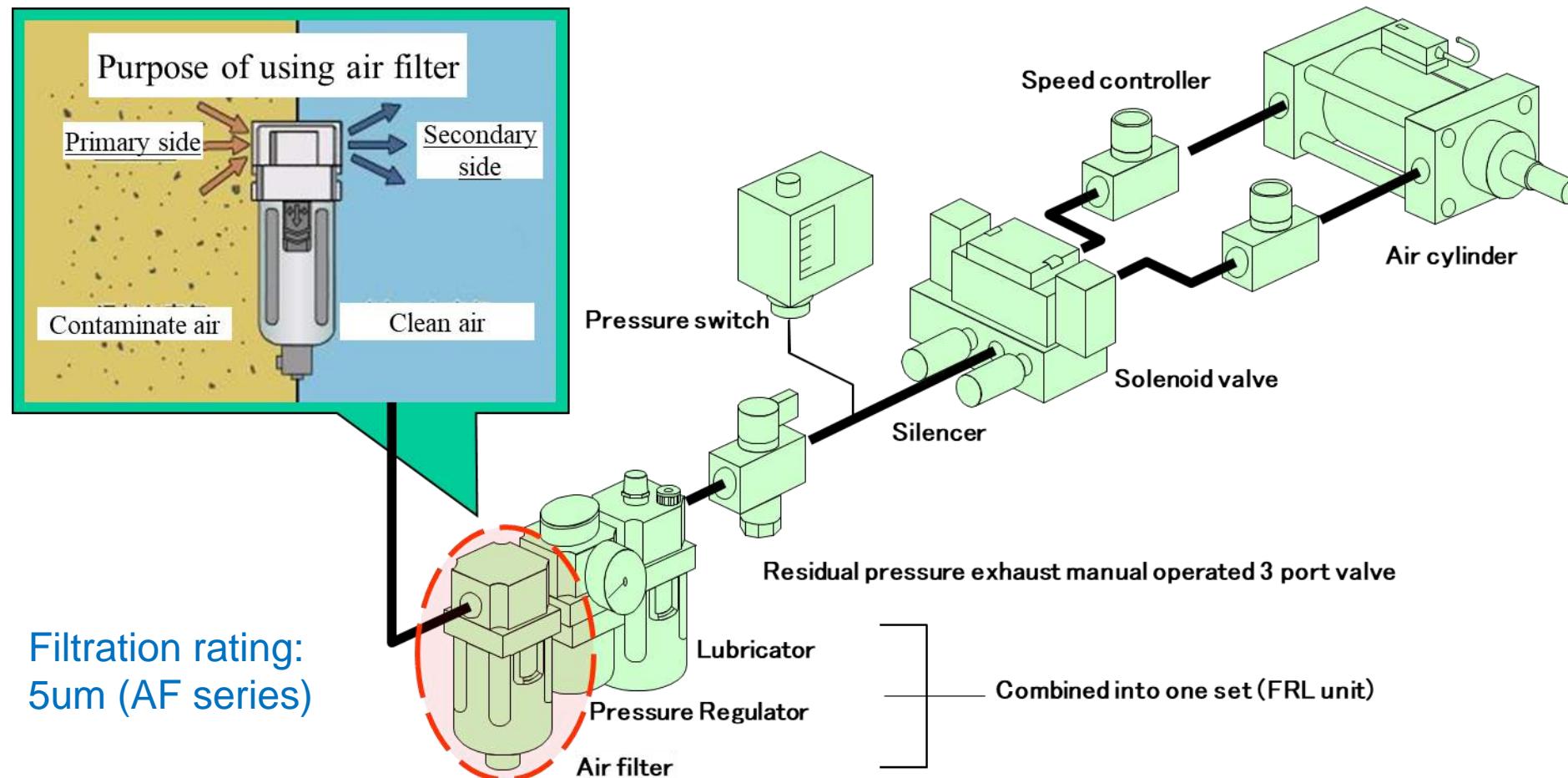
Recommend : **Float Type Auto Drain**



Compressed Air Treatment

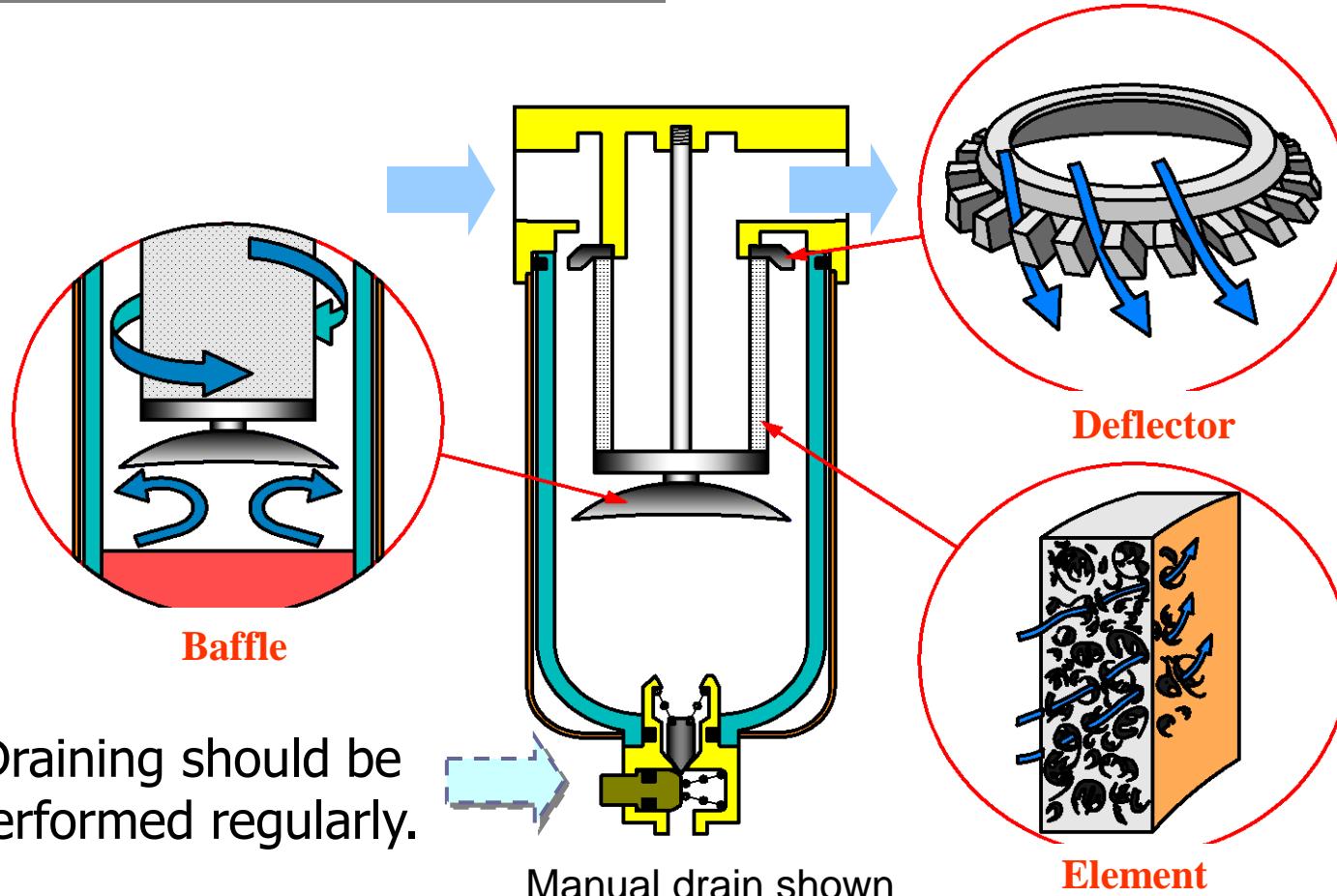
Air Filter

Installed directly before machinery to remove foreign matter generated in the piping such as pipe rust, condensate etc and to protect equipment.



Compressed Air Treatment

Cyclone effect + Filtration
(Centrifugal separation)



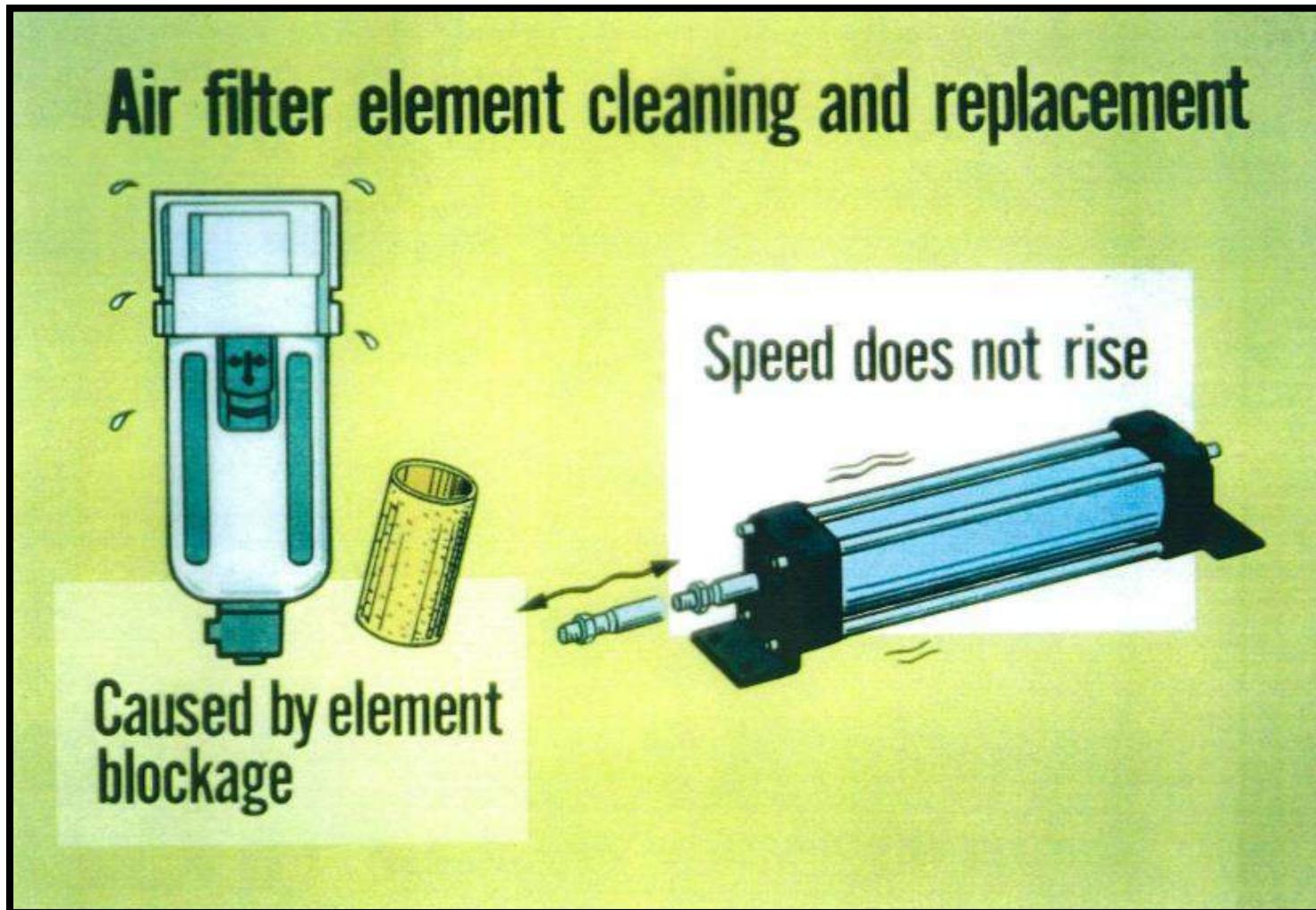
Filter element



VIDEO

Compressed Air Treatment

When Air Filter should clean or replace???

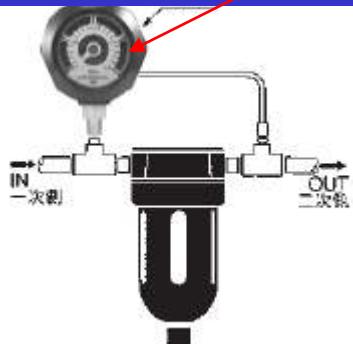


■ Replacement of filter element

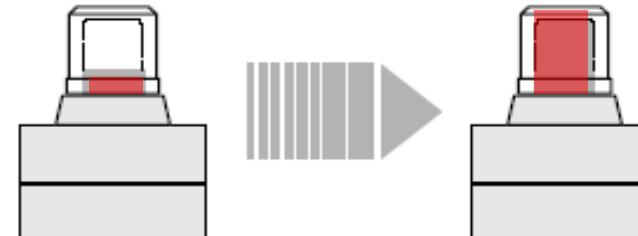
When pressure drop reaches 0.1MPa or every 2 years of operation, whichever comes earlier.

*Pressure drop: Pressure difference between input & output

Differential pressure gauge



Element service indicator

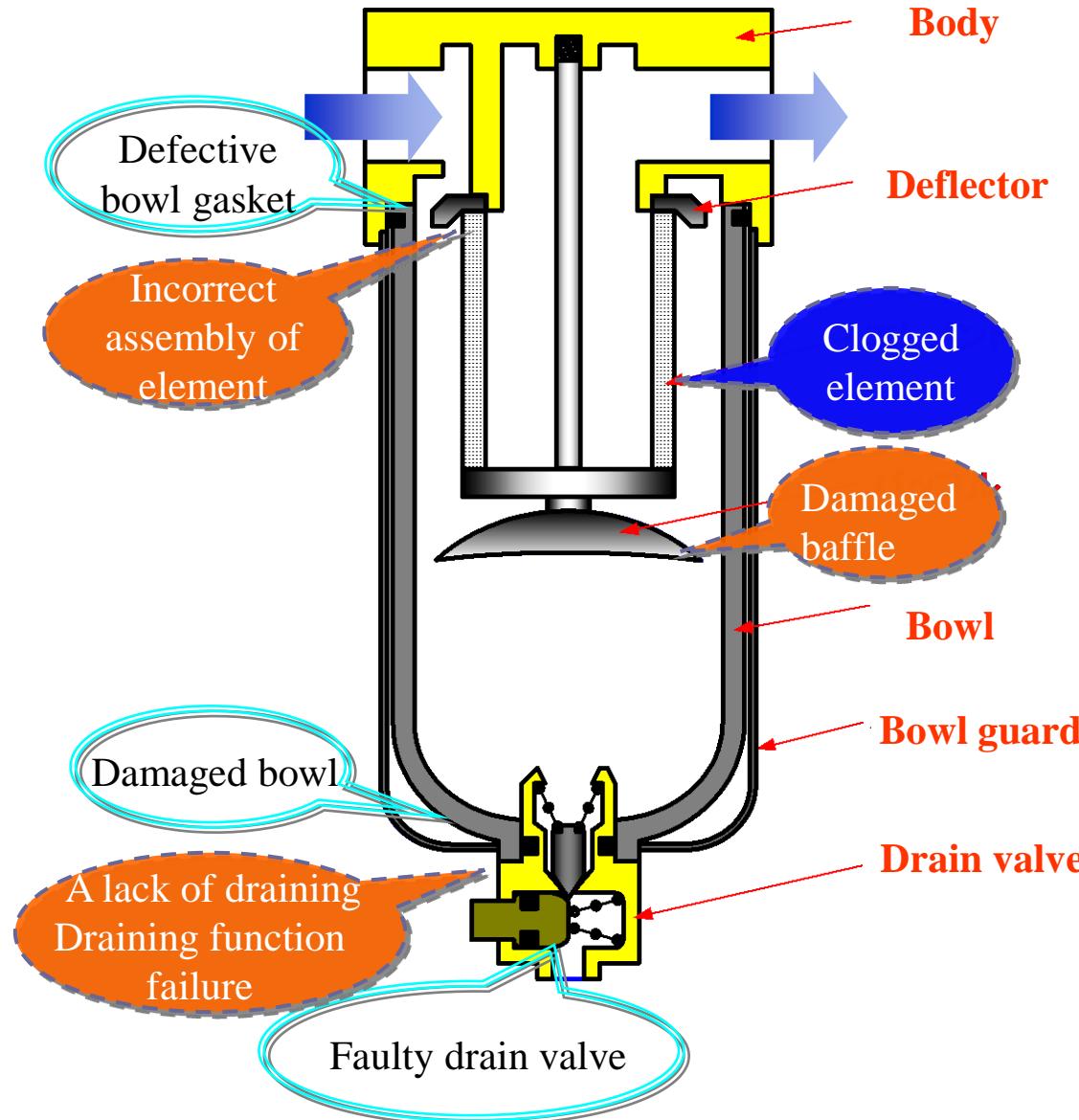


差圧が0.05MPa以下の時
(インジケーターの先端は少し見えています。)
差圧が0.1MPa以上の時
(インジケーターは一番上までできます。)

- Check external leakage and the appearance of the bowl and sight glass. If the bowl and sight glass are dirty, clean with neutral detergent, and if the bowl is damaged, replace with a new one immediately.
- Check the operation of the draining mechanism.

Compressed Air Treatment

Troubleshooting of Air Filter



Problems

Secondary pressure drop

Foreign matter gets into the secondary side

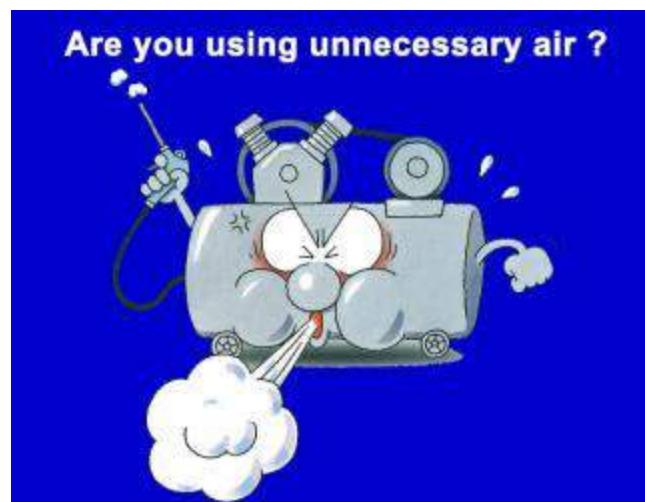
External leakage

Compressed Air Treatment

Pressure Regulator

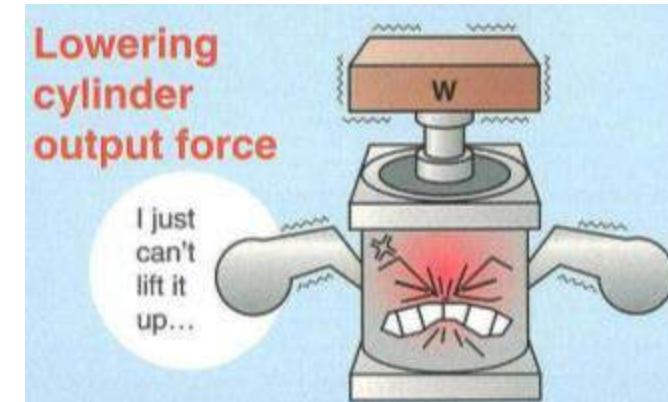
Air pressure too high :

- *Rapid wear will take place with little or no increase in output*
- *Energy losses*



Air pressure too low :

- *Uneconomical because it results in poor efficiency*
ie : Insufficient forces in the power section



Compressed Air Treatment

Pressure Regulator

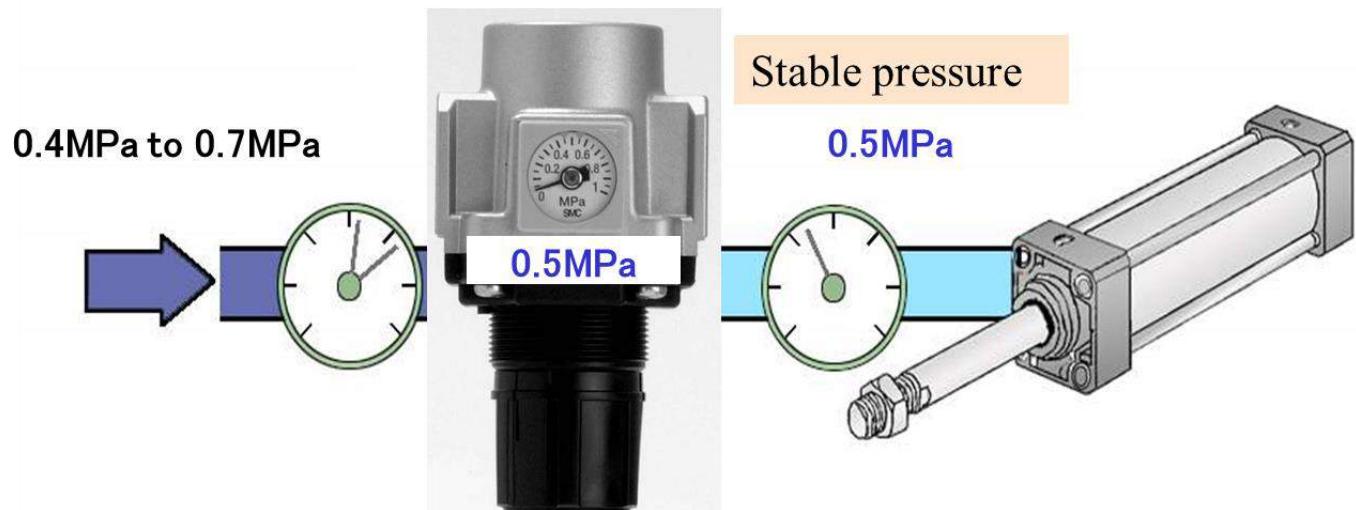
The pressure regulator is designed to :

- *Reduce the compressor outlet pressure to the constant (exact) supply pressure of the application*
- *Reduce fluctuations caused by variable demand*

By using a pressure regulator, savings can be made in :

- *The compressed air that is used*
- *The thrust used in the application*

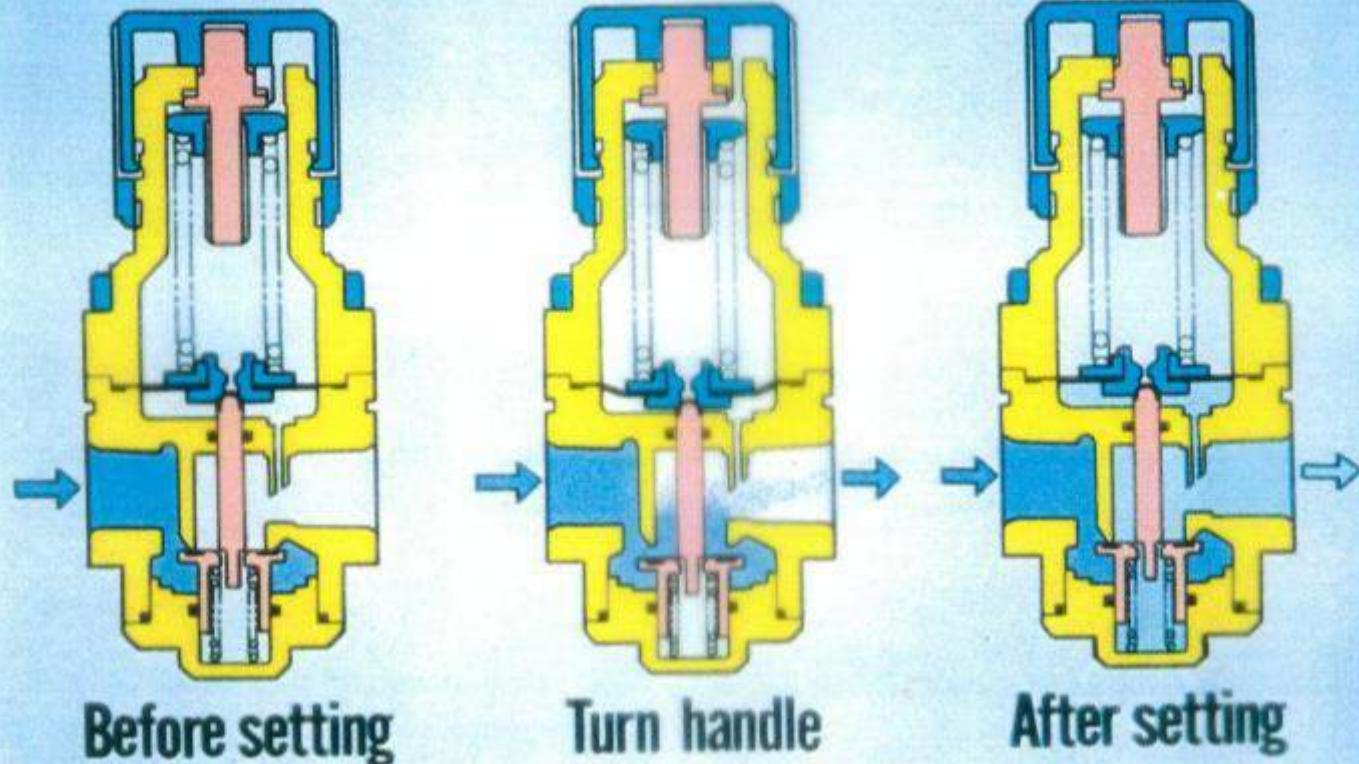
Stable pressure supply to machines (actuating parts)



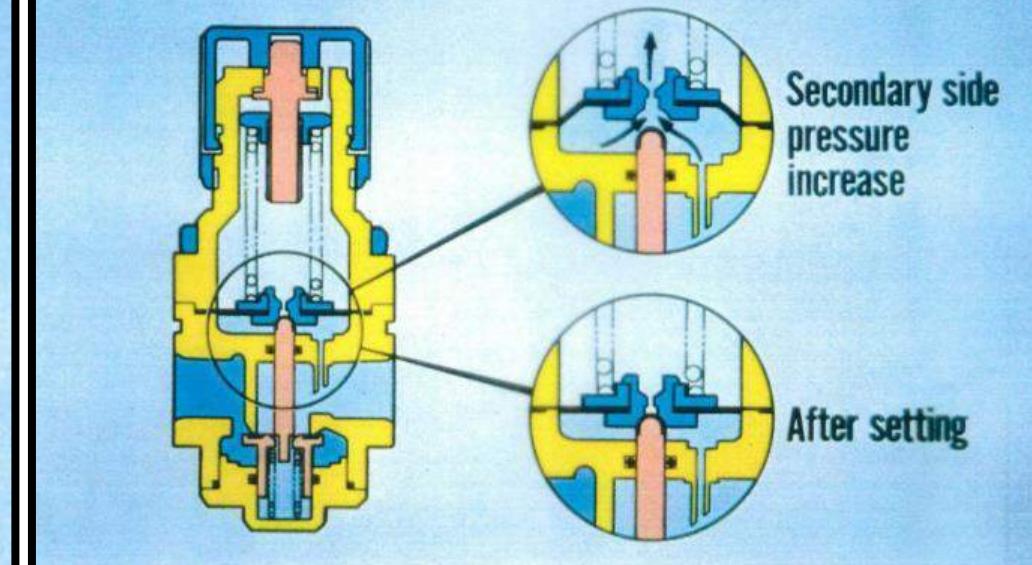
Compressed Air Treatment

Direct operated type

REGULATOR OPERATING PRINCIPLE (Secondary side pressure setting)



REGULATOR OPERATING PRINCIPLE (Secondary side pressure relief)



VIDEO

VIDEO

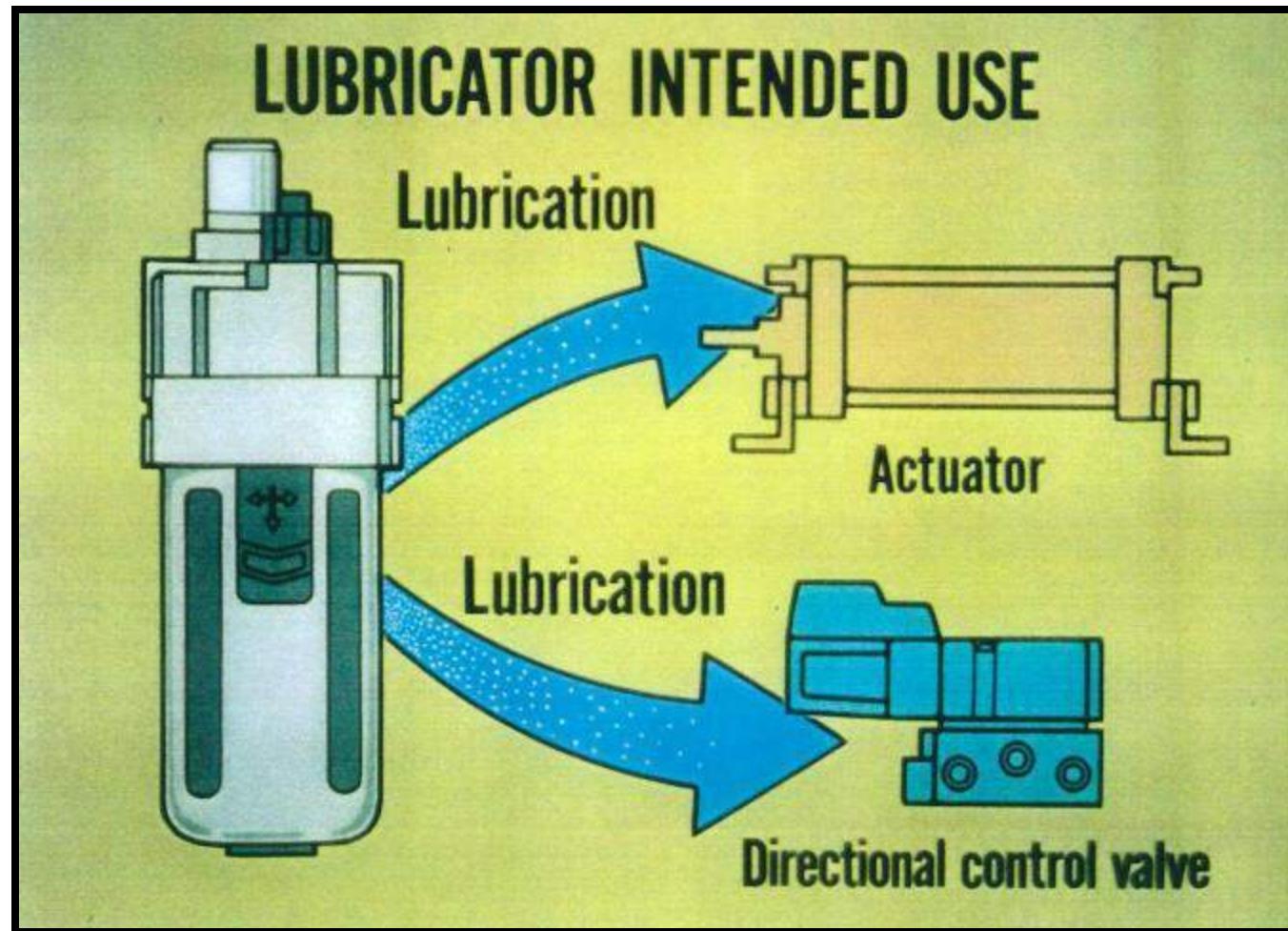
Compressed Air Treatment

Air Lubricators

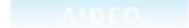
FUNCTION

- *Reduce wear and tear of the sliding parts*
- *Keep the frictional forces to a low level*
- *Protect the equipment against rusty and corrosion due to the presence of moisture*

Compressed Air Treatment



VIDEO



160

Compressed Air Treatment

COMPRESSED AIR LUBRICATION

Lubrication is no longer a necessity for modern Pneumatic components. They are available prelubricated for life, for use with air that has not been lubricated

Compressed Air Treatment

(1) Lubrication

Mix oil with air by the lubricator and feed it to the cylinder.

Use **turbine oil class 1/additive-free(VG32)** for lubrication.

Best lubrication performance, but not easy to control the oil and the oil gets mixed in exhaust air.

(2) Non-lube (Lubrication by grease)

Apply necessary amount of grease during assembly.

Grease which is equivalent to **lithium soap base grease JIS No.2** is used.

Although easy to control and it does not contaminate ambient environment.

(3) No-lube

Use sealing material which has self lubrication performance.

Performance is ideal, but the cost is high and sealing is not perfect. High level of air cleaning is required.

Compressed Air Treatment

Advantages of "Non - Lube" systems :

- Savings in the cost of lubrication equipment, lubricating oil and maintaining oil levels
- Cleaner. More hygenic systems; of particular importance in food and pharmaceutical industries
- Oil free atmosphere, for a healthier, safer working environment
- Reduce the malfunctions due to excessively lubrication

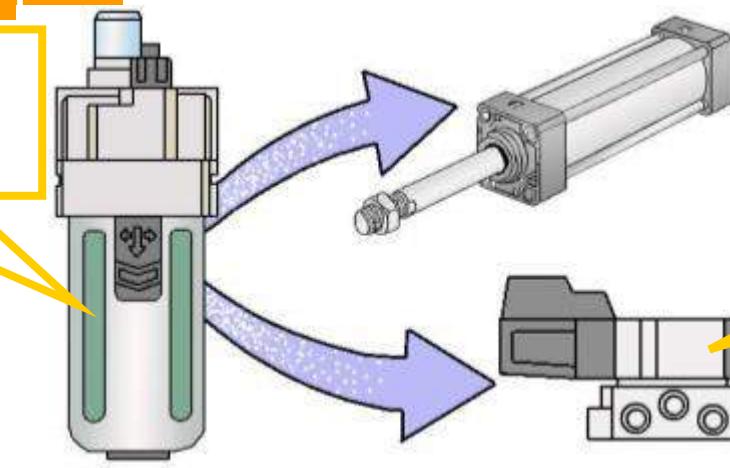
Compressed Air Treatment

Caution Points for Lubrication

Lubrication oil type

Turbine oil, class 1
(ISO VG32)

Rubber seal type



Other oils can cause the rubber seal to swell or deteriorate
(Spindle oil and machine oil are not acceptable.)

Once equipment is lubricated, do not stop lubrication even if the lubricated equipment does not need it. Lubrication washes away grease, and equipment will no longer operate without lubrication.

SMCT P1 Course Content

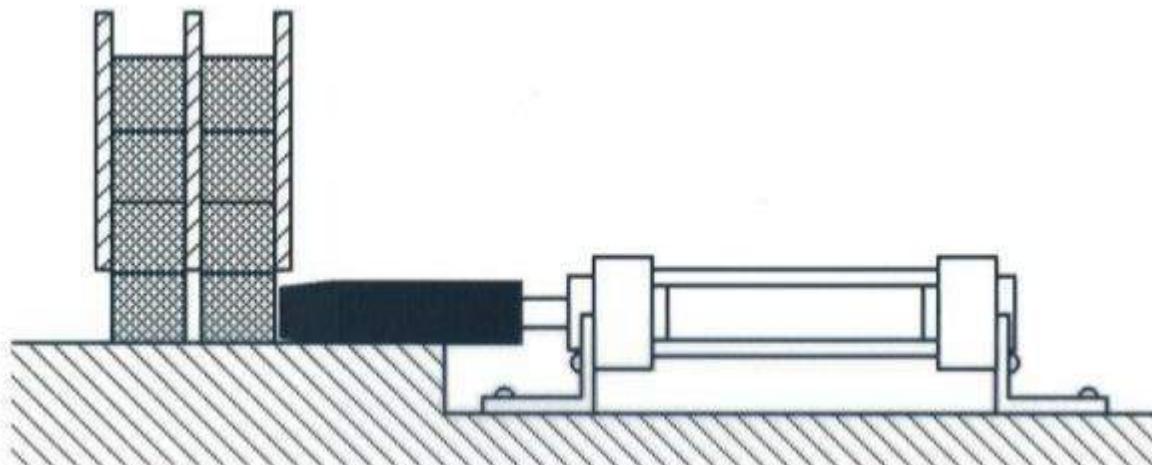
1. Properties of compressed air and its area of applications
2. The basic Pneumatic system
3. Compressed air theory
4. Compressed air production, purification and distribution
- 5. Construction and principle of Actuators and Valves**
6. Ancillary Pneumatic equipment

Directional Control Valves

Exercise 1

By pressing a push button, articles are pushed away from the gravity feed magazine into a conveyor system. A single acting cylinder is to facilitate this. When the push button is released, the piston rod returns to its start position.

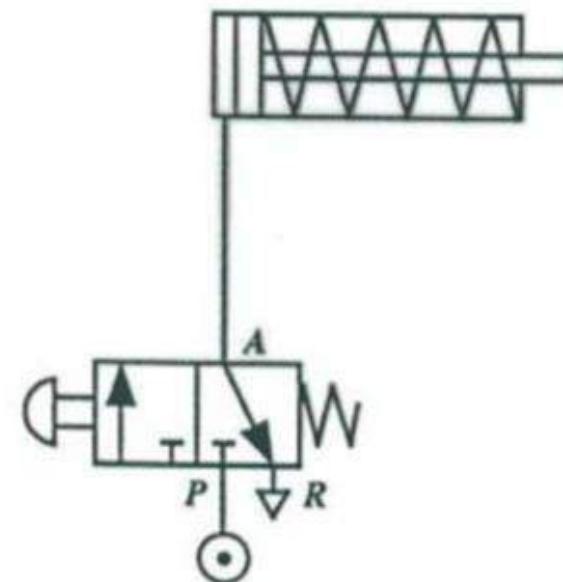
ជោយចុច Button, ប្រអប់ ត្រូវបានរួមចេញក្រោម នៅពេល យើងឃុំចុច Push Button, Cylinder ត្រូវបានការិកដំឡើងដើម្បីរួម ចុរប្រើប្រាស់ Single Acting Cylinder ដើម្បី រួម។



Directional Control Valves

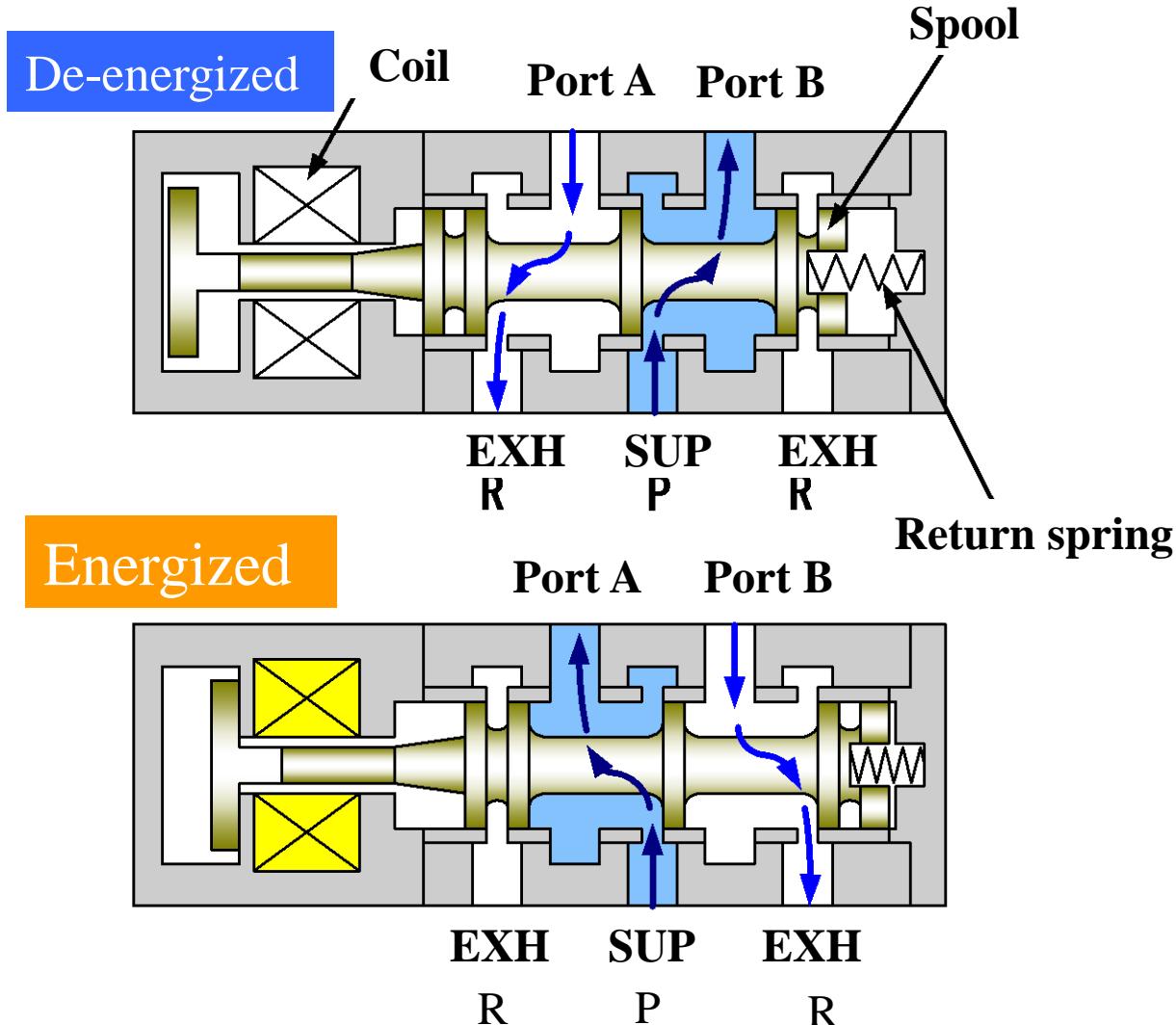
Exercise 1

Solution :



Directional Control Valves

Single solenoid [Return type]

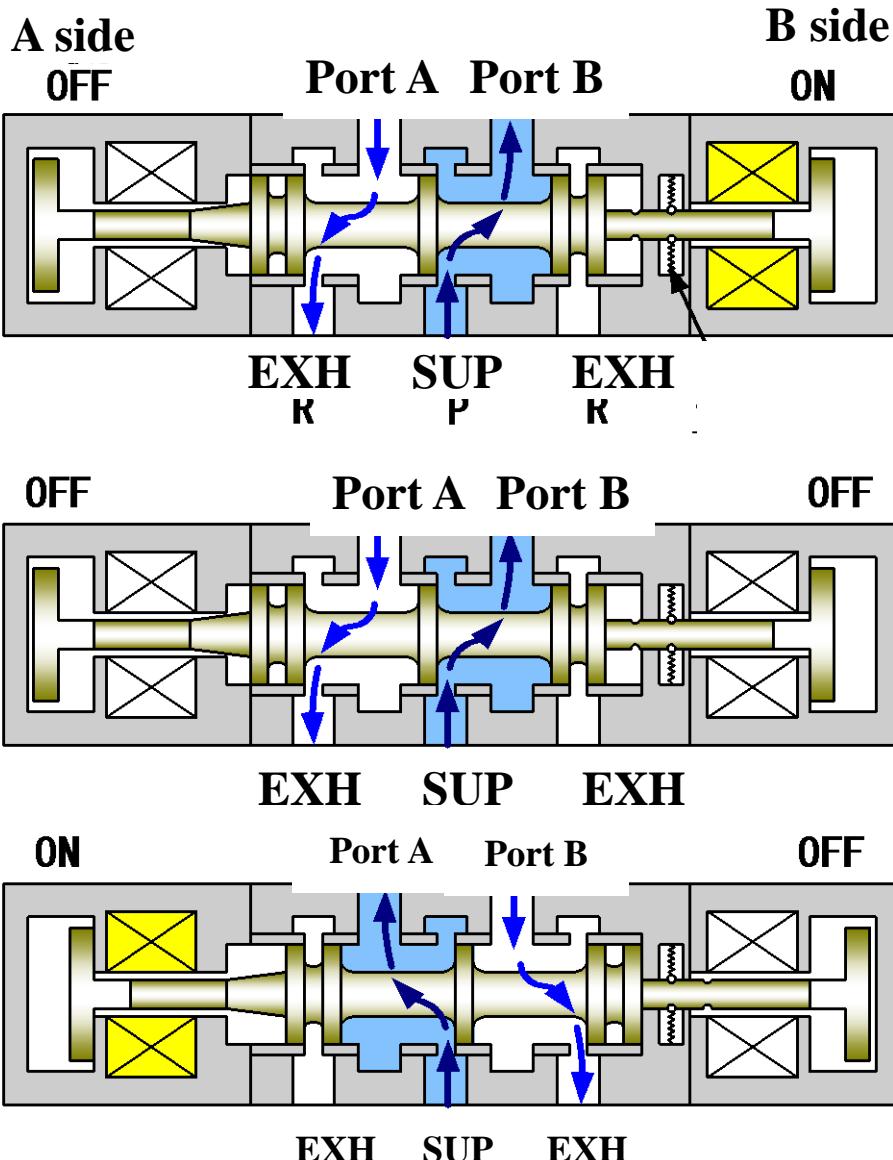


Original position of valve
(position when de-energized)
is fixed.

When de-energized, the
valve will return to its
original position
automatically by spring force.

Directional Control Valves

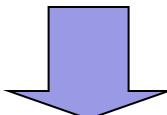
Double solenoid [Hold type]



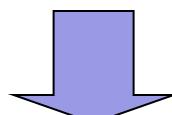
Original position (position when de-energised) is not fixed.

B side energized

Flow: $P \Rightarrow B, A \Rightarrow R$



The position is held even when de-energized.



A side energized

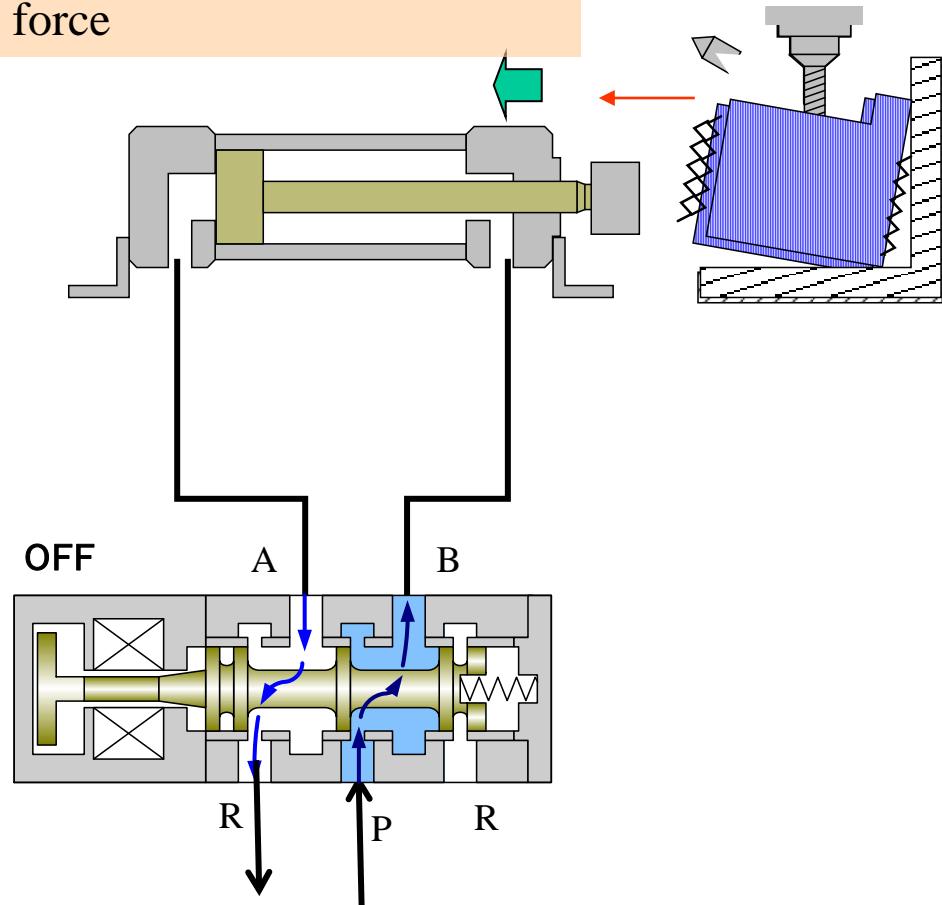
Flow: $P \Rightarrow A, B \Rightarrow R$

Directional Control Valves

When de-energized

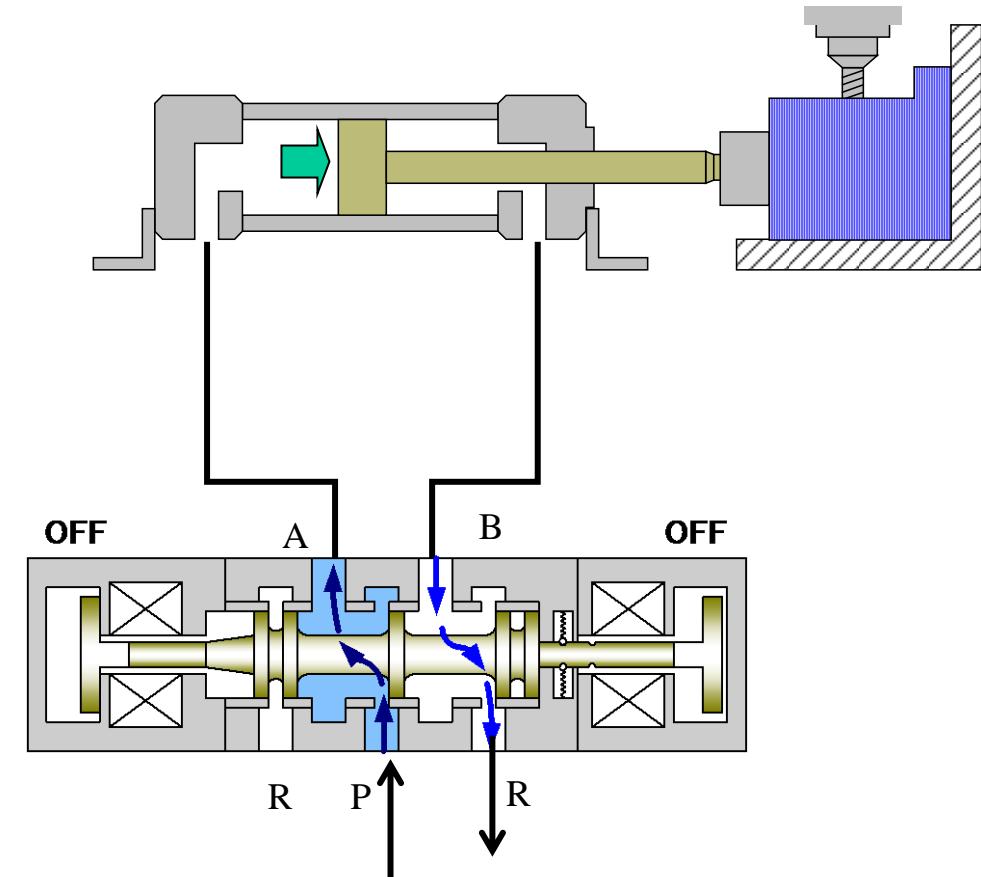
Single solenoid [Return type]

The valve is returned to original position by spring force



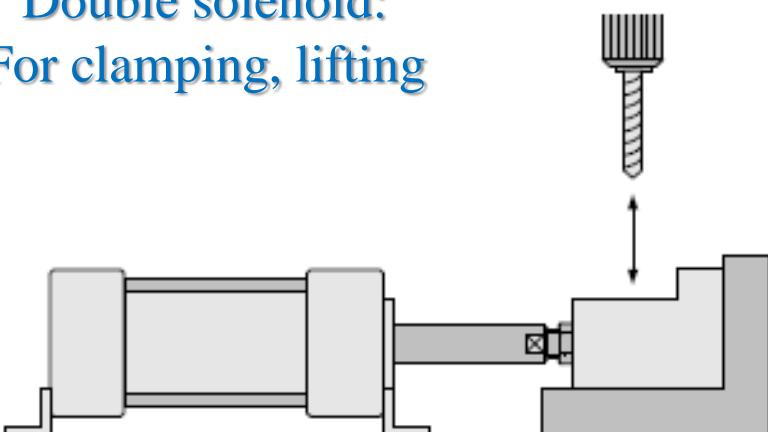
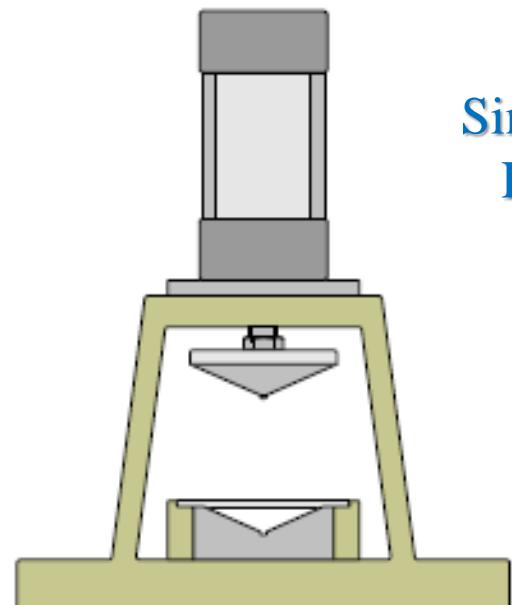
Double solenoid [Hold type]

The position is held.



Directional Control Valves

Question: Which should you choose for the following uses, single solenoid or double solenoid?

Workpiece clamping	Desktop press
<p>Double solenoid: For clamping, lifting</p>  <p>The cylinder is used to hold the workpiece to be processed. The valve is operated with a pushbutton.</p>	<p>Single solenoid: For pressing</p>  <p>The cylinder is used to press and form the workpiece. The valve is operated with a pushbutton.</p>

Directional Control Valves

SOLENOID VALVE

Direct Operated
3/4/5 Port Solenoid Valves



Pilot Operated
4/5 Port Solenoid Valves



(1) Direct-operated type

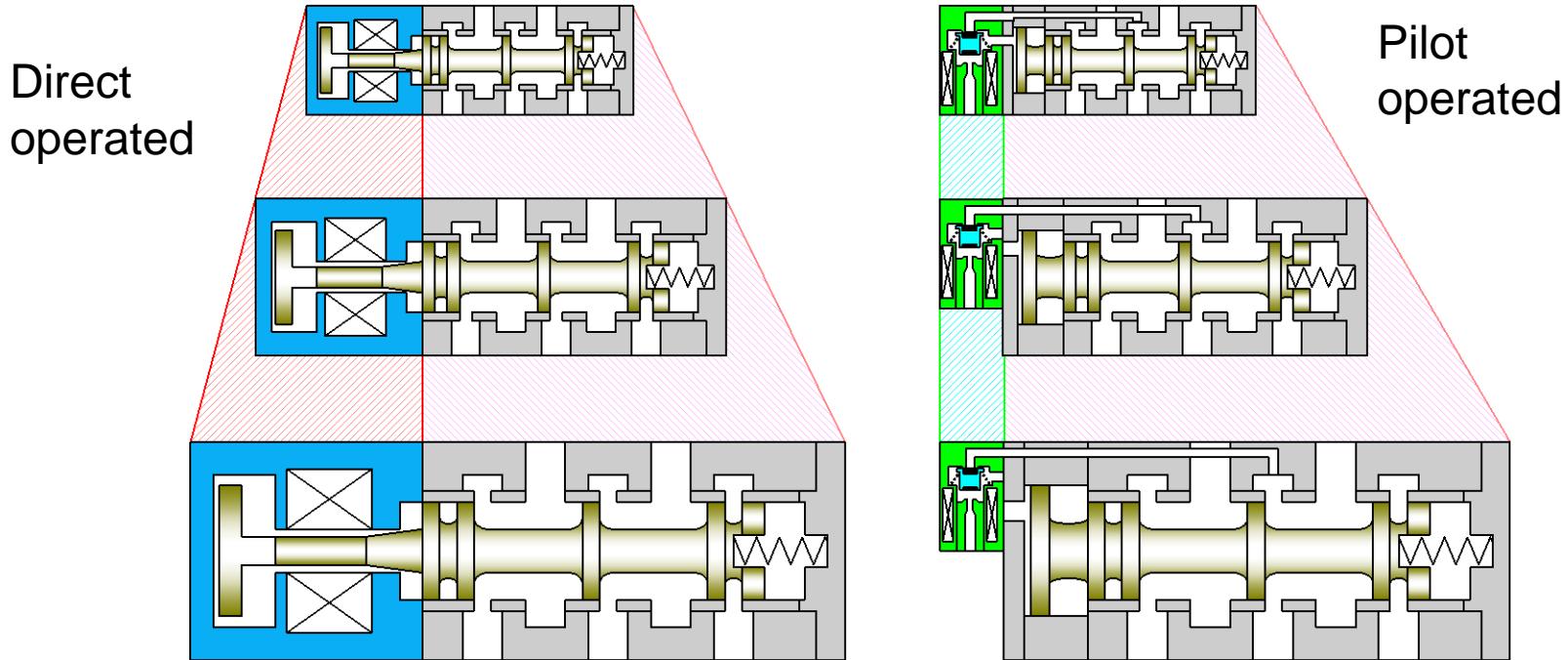
The force of the solenoid (electric magnet) attracts the plunger and actuates the valve element in order to switch the flow passage. This type of valve can switch the passage even when the air pressure is low or when compressed air is not supplied.

(2) Pilot-operated type

The solenoid switches the position of the small pilot valve (direct-operated three-port valve) that receives compressed air. The compressed air then acts on the main valve to switch its position. The pilot-operated type requires a smaller solenoid than that of the direct-operated type. This means lower power consumption, larger switching force and more stable operation. Even a large flow-rate valve is compact in size.

Directional Control Valves

Direct operated type and Pilot operated type



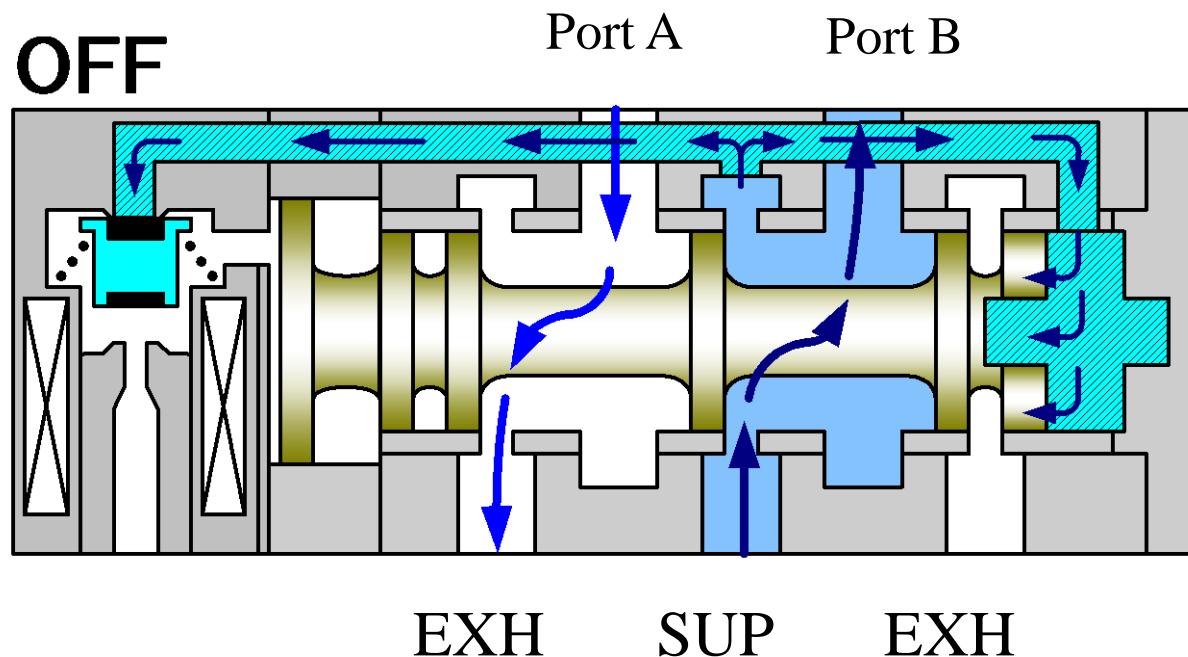
Direct operated

Pilot operated

Power consumption	Large	Small
Size	Large	Small
Min. operating pressure	Available at 0MPa. [Switched]	Need 0.1 to 0.2MPa or more (depending on model)

Directional Control Valves

Pilot Operated Solenoid Valve



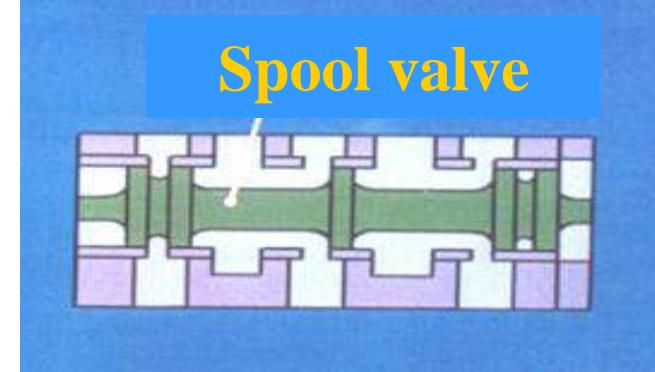
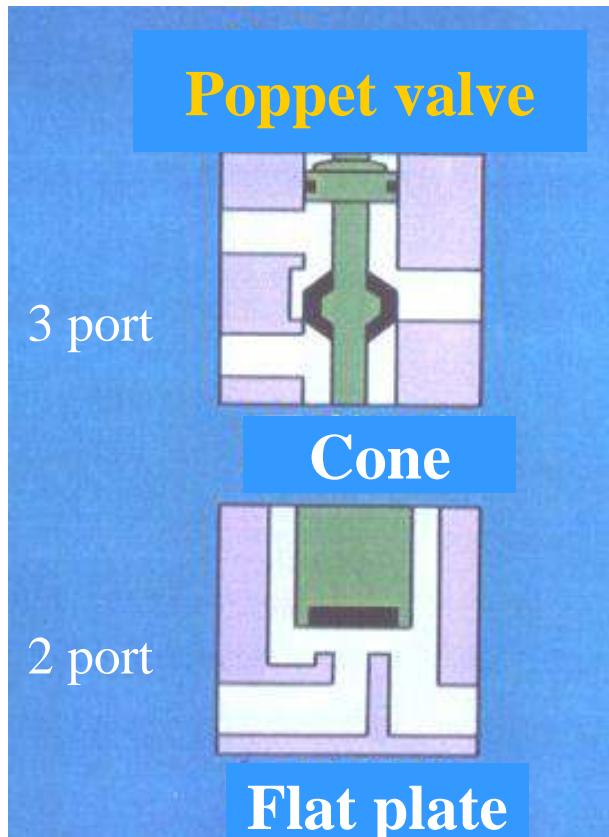
VIDEO

VIDEO

Directional Control Valves

Poppet type: Type of valve where the valve member moves vertically from the valve seat (popular for small 2 and 3 port valves).

Spool type: Type of valve where a stick type valve member moves in the axial direction to switch fluid path (popular for 5 port valves).



VIDEO

Directional Control Valves

POPPET VALVES

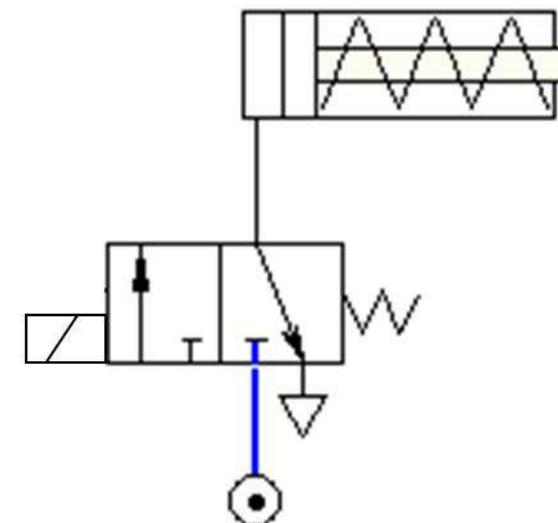
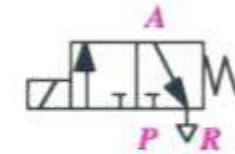
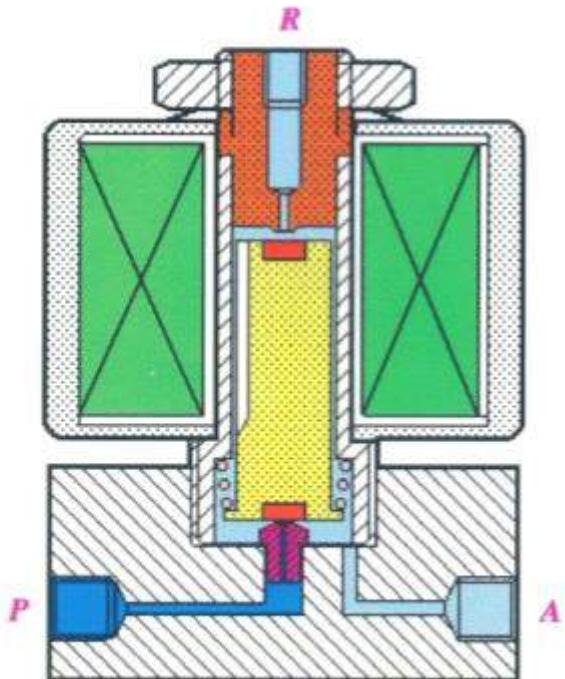
Flow through a poppet valve is controlled by a disc or plug lifting at right angles to a seat with an elastic seal

ADVANTAGES :

- *A short lift gives maximum flow offering fast response and rapid cycling capabilities*
- *Short stroke results in minimum wear to give maximum working life and less maintenance*
- *Sealing effect is good*
- *Simple construction results in low cost*

Directional Control Valves

3/2 NC SOLENOID VALVE
(SPRING RETURN, POPPET TYPE)

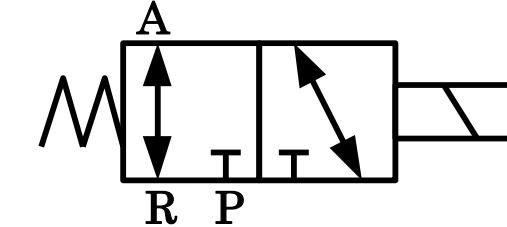
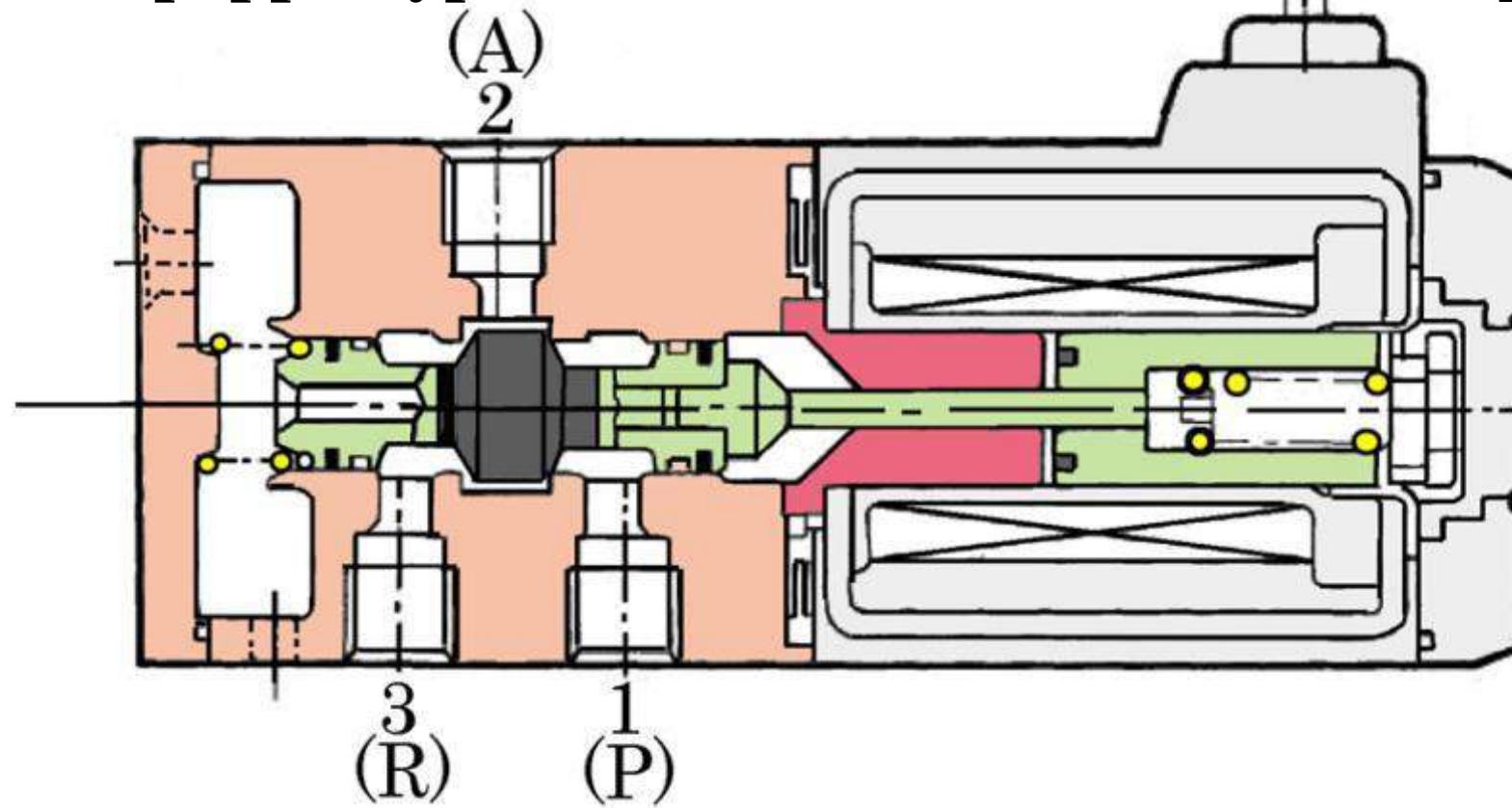


Directional Control Valves

3/2 Way Universal Type Solenoid Valve

3/2 Way solenoid valve

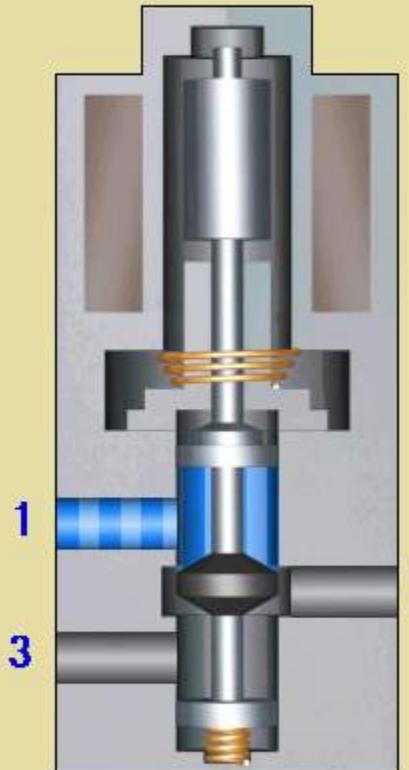
**Direct operating and
poppet type**



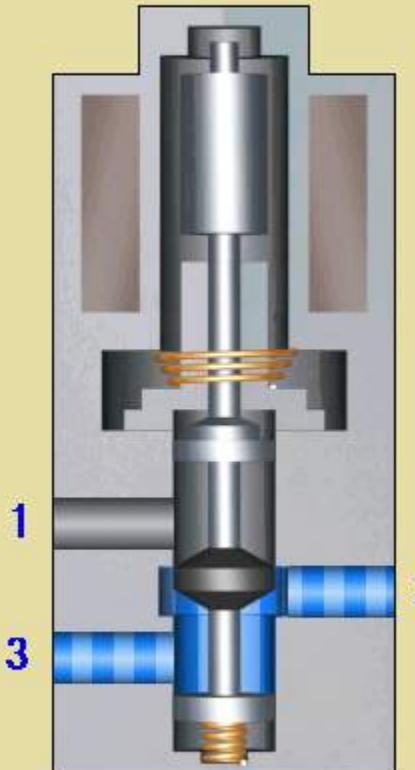
Directional Control Valves

3/2 Way Universal Type Solenoid Valve

Normally
Closed



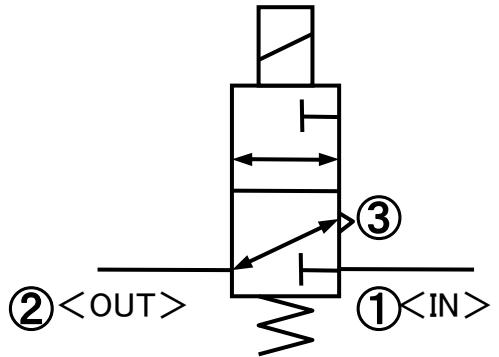
Normally
Open



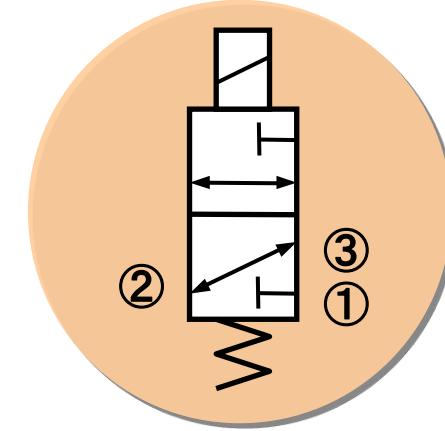
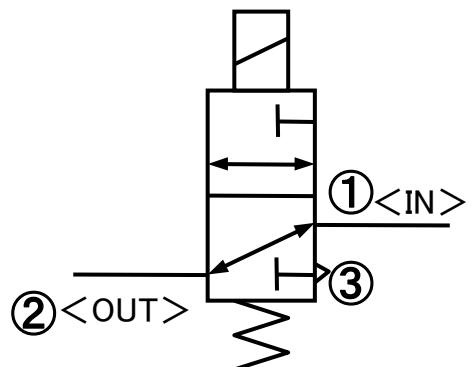
Directional Control Valves

3/2 Way Universal Type Solenoid Valve

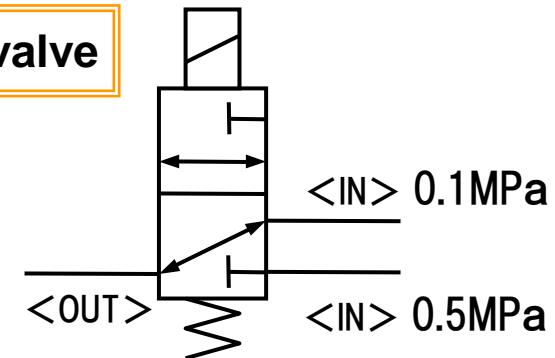
NC: Normally Closed



NO: Normally Open

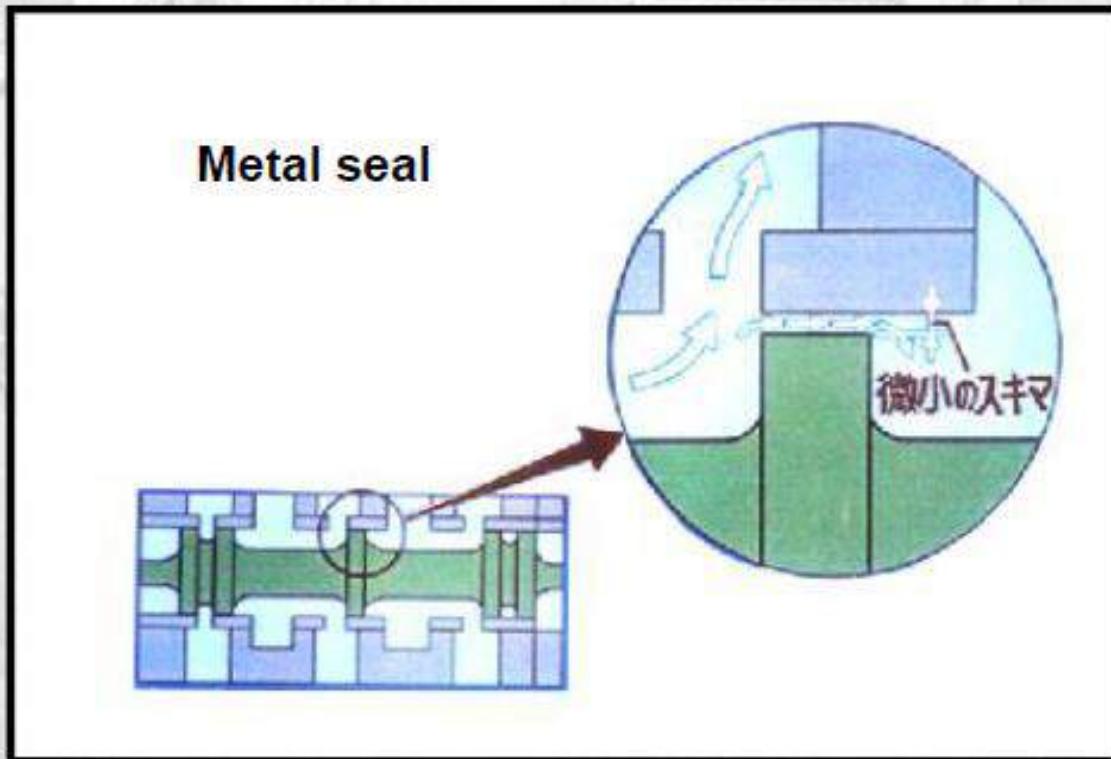


Selector valve



Directional Control Valves

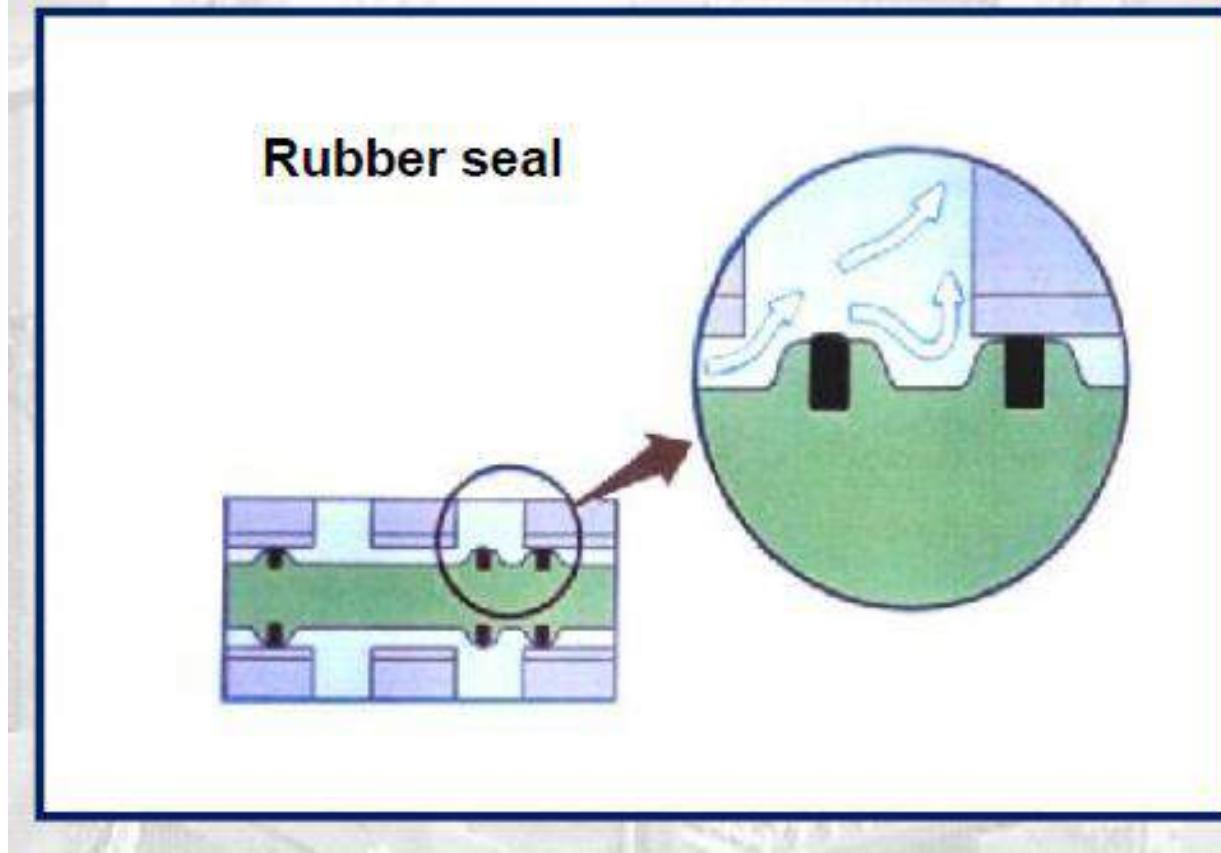
Metal Seal



- **High durability and light operation.**
- **Slight air leakage from the clearance at the sliding surface.**
- **Possibility of foreign matter and sticking.**
- **Better to have a Mist Separator on the primary side.**

Directional Control Valves

Rubber Seal

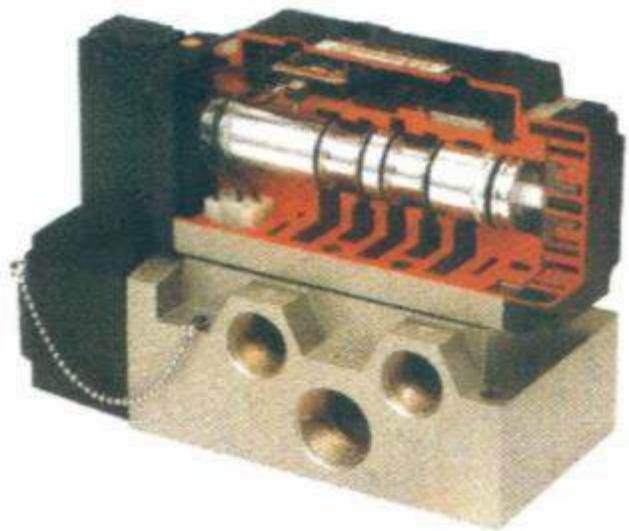


- ***Almost no air leakage.***
- ***Little concern about foreign matter, but seals may swell and grease may get washed away.***
- ***Heavier operation than metal seal.***

Directional Control Valves

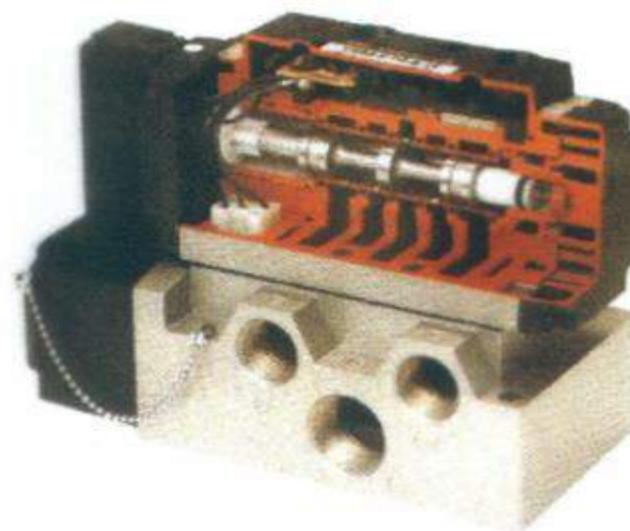
RUBBER SEAL

(30 million cycles)



METAL SEAL

(50 million cycles)



Directional Control Valves

Troubleshooting [Example of solenoid valve with rubber seal]

The valve does not switch.

Is supply voltage
normal ? (Incorrect
voltage or wiring ?)

$\pm 10\%$ of rated voltage*

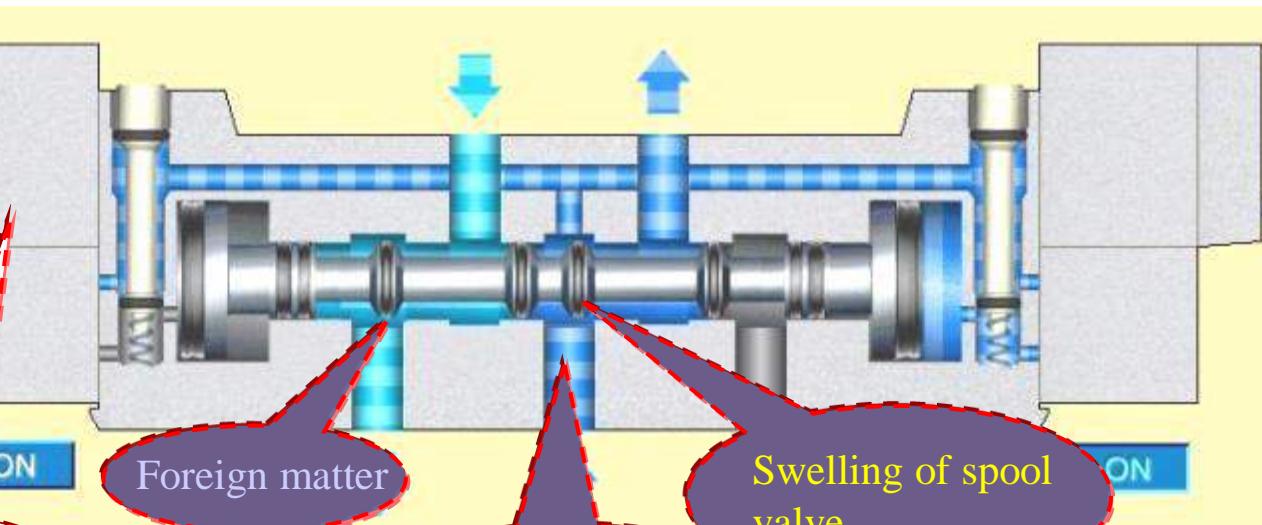
Broken wiring
or burnt coil and
board

Energizing time of
double solenoid
(instantaneous
energizing)

Min: 0.1s

Current leakage
(the valve is not
turned off.)

- Operational check by manual override
- Check for air leakage
- Check connections to connectors and cables



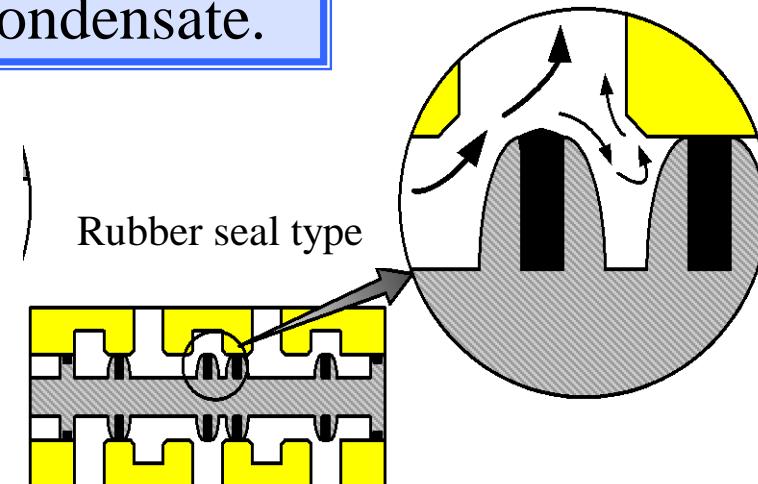
Directional Control Valves

Swelling of Spool Valve

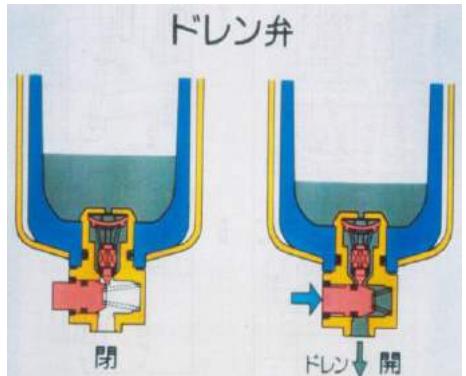
Need to take measures against condensate.

Deterioration of sealing
performance of seals

Decline of wear
resistance



Manual draining type



Skip

Drain regularly!

Auto draining type [with an auto drain]



Check the
operating
conditions.

Float type

Directional Control Valves

SAFETY CAUTION

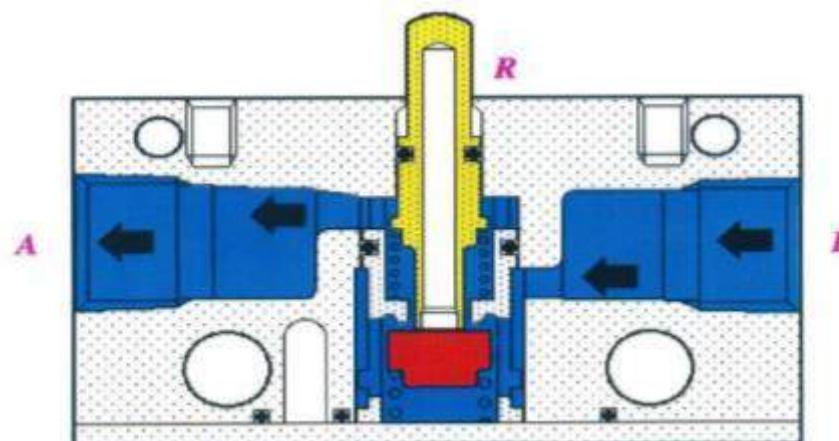
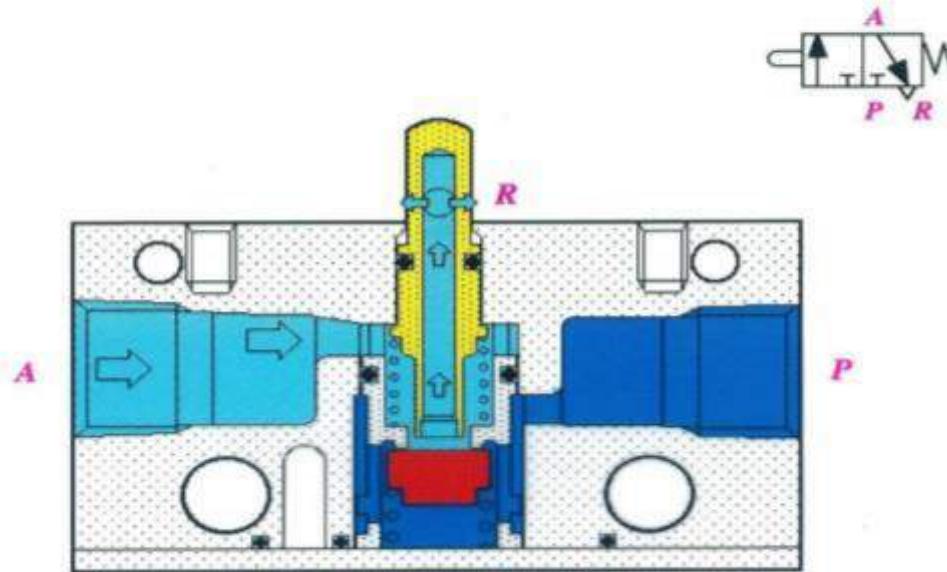
- *Actuators must be securely mounted*
- *Check that actuators will not hit objects or person when they move*
- *Check fittings and tubing are secure prior to turning on air supply*
- *Turn the supply off and ensure the system is vented before disconnecting any air line*
- *Do not assume that an actuator at rest will remain at rest while supply is on*



Skip

Directional Control Valves

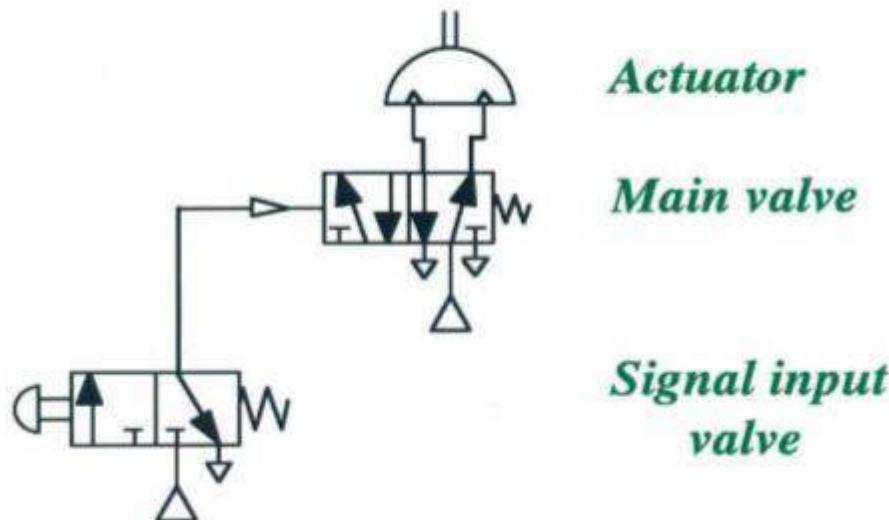
3/2 NC POPPET VALVE
(MECHANICALLY OPERATED)



Directional Control Valves

AIR OPERATION

Main valves can be located close to a cylinder or other actuator, and switched by remote control from signal input valves or limit switches

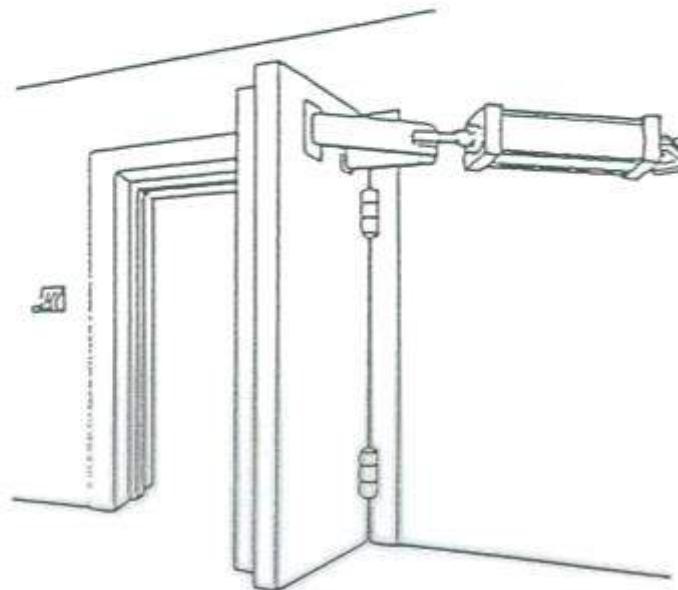


Directional Control Valves

Exercise 2

A heavy fire door is to be opened or closed by a double acting cylinder. The opening and closing signals are to be given by a lever operated hand valve.

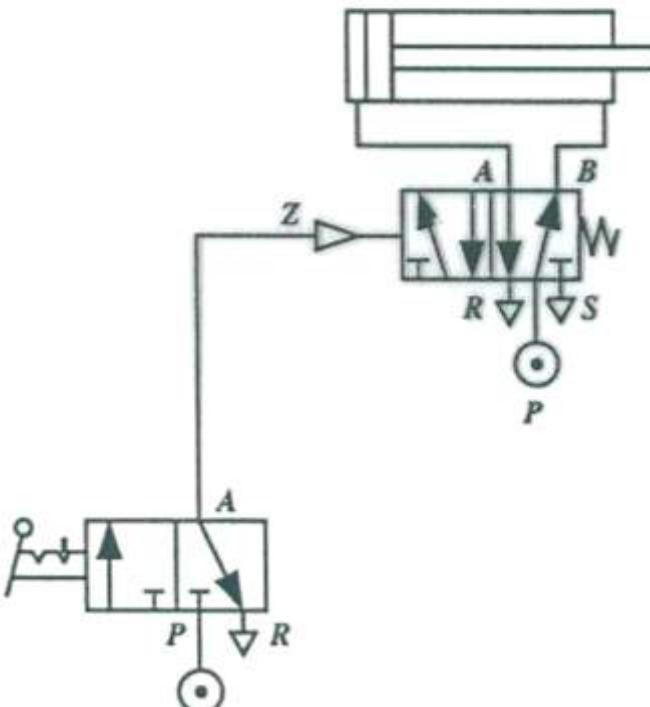
ទ្វារដែកមួយគ្រឿរបានបញ្ចាំងបិទ បុ ហើកដោយ Double Acting Cylinder
ដោយប្រើ Lever Hand Valve, ចូរបង្កើតសៀវភៅ។



Directional Control Valves

Exercise 2

Solution :



Because we don't have Lever Valve, We can use Switch button by Off 1 Outlet Port.

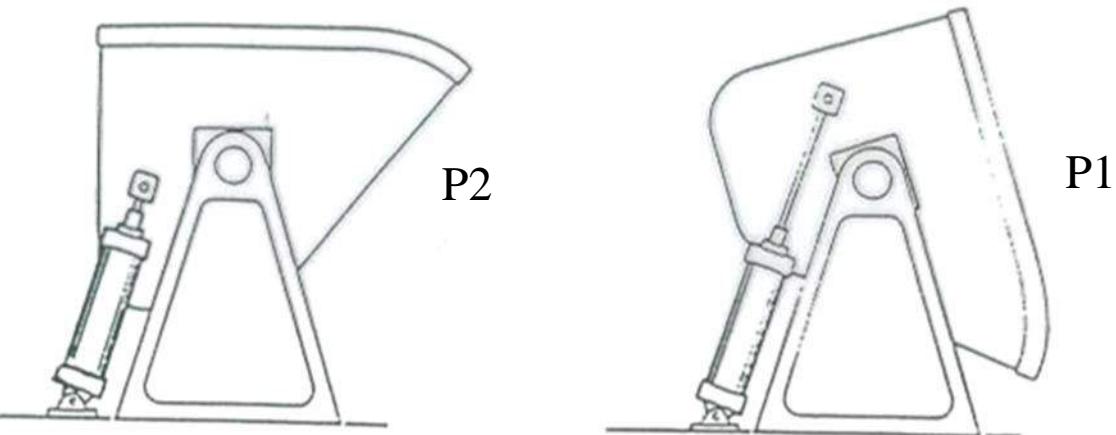
Directional Control Valves

Exercise 3

Bulk loose material is to be emptied from a dump hopper.

By pressing a push button P1, the dump hopper is tilted and the bulk loose material is emptied out.

By pressing another push button P2, the dump hopper is returned to its initial position.



ម៉ាសីន កាត់ Material ដើរដោយការបញ្ចា Push Button P1 និង P2.

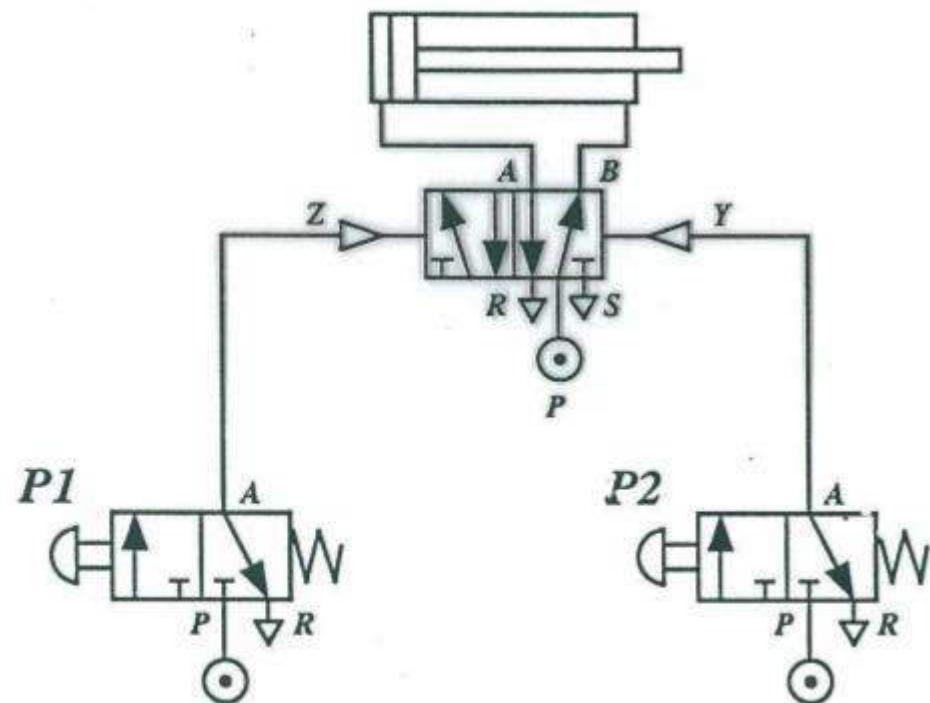
ពេលចុចបូតុង P1 Double Acting Cylinder រួចកំបិតដើម្បីកាត់។

ពេលចុចបូតុង P2 Cylinder ត្រួលប់មកទីតាំងដើមវិញ។ ចូរតម្លៃងសៀវភៅ!!!

Directional Control Valves

Exercise 3

Solution :



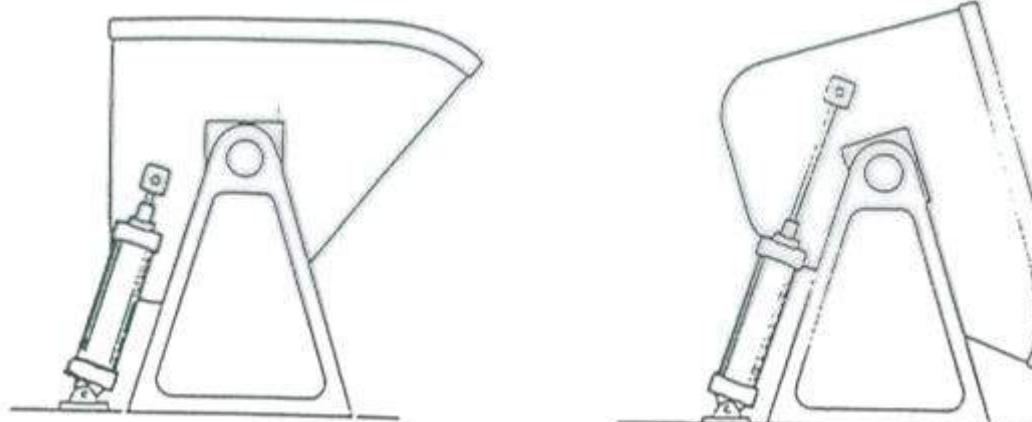
Directional Control Valves

Exercise 4

បន្ទាត់លំហាត់មុន នៅពេលចូចបូកឯកងទាំងពីរអាយកំណើរការ តាំងកាលត្រូវ
កំបិតត្រូវបែងកកទីតាំងដើម (បូកឯកង P1 មិនដោយការពេល ចូចបូកឯកង P2)

Additional Condition From exercise 3

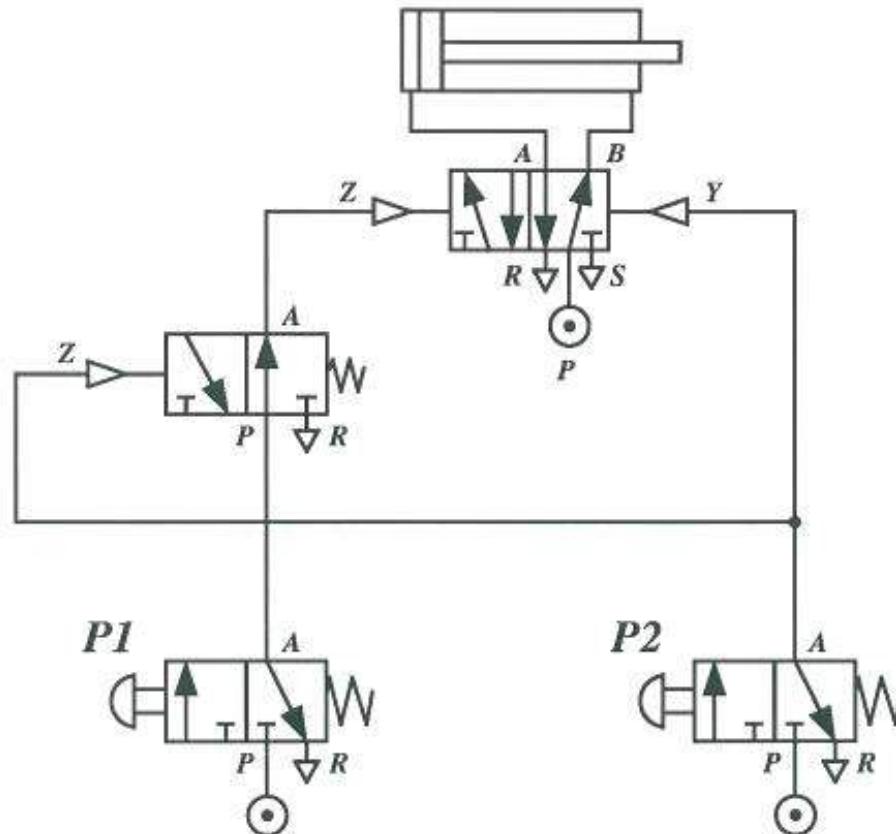
The system is to have an exclusive function to give priority to the signal for retraction of the cylinder.



Directional Control Valves

Exercise 4

Solution : Because of We don't have 3/2 Way N.O Single Air Operate, Spring Return We can use 5/2 way, Single Air Operate Valve.



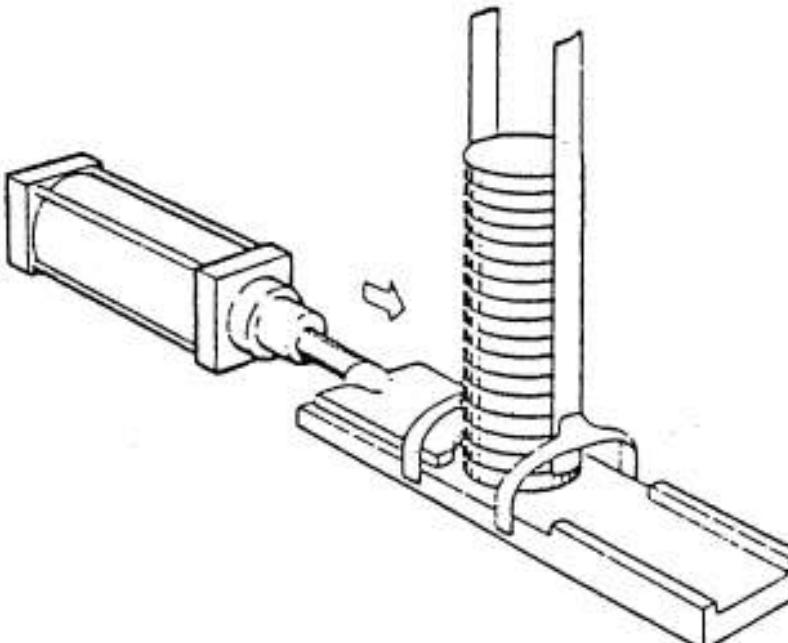
Directional Control Valves

Exercise 5

In a production process, workpieces are to be fed into a jig from a gravity magazine by using a double acting cylinder.

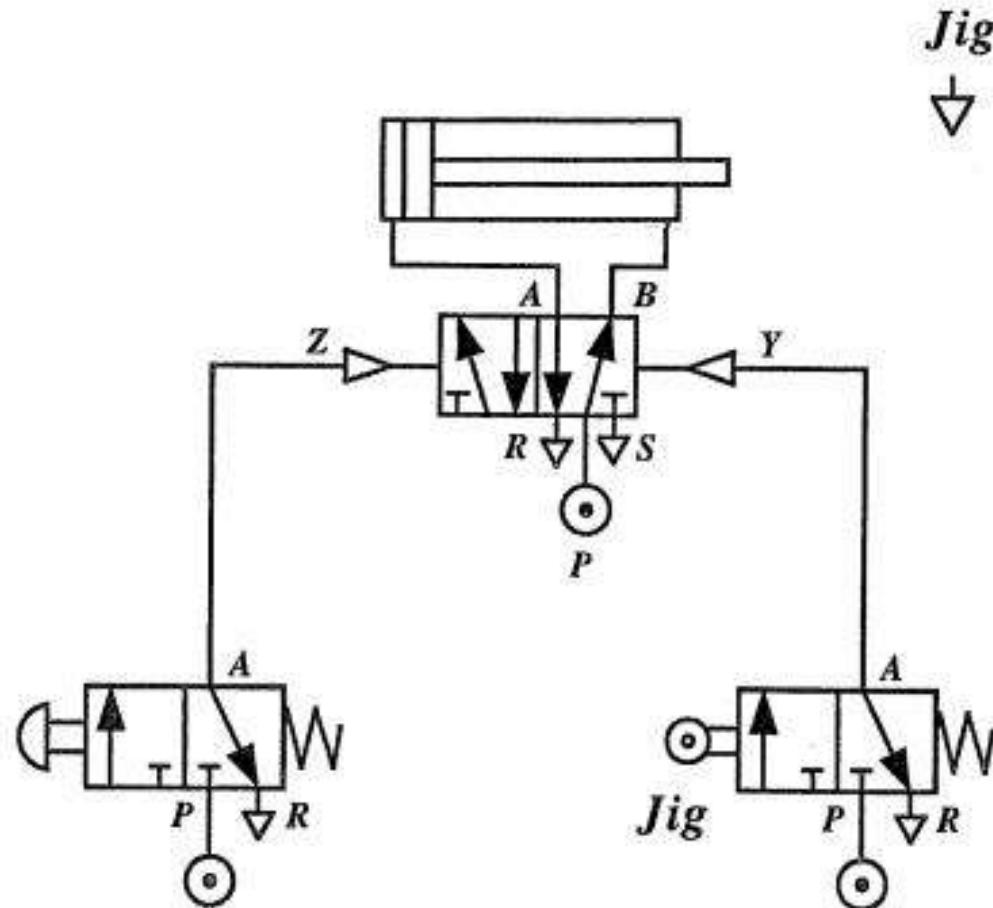
Feeding takes place when a push button is pressed, and return automatically to its start position after the workpiece has reached the jig position.

ជោយប្រើ Double Acting Cylinder, ពេលចូច Push Button, Piston Rod រួចរាល់
ចូលក្នុង ដីក។ ពេលរាល់ចូលដល់ដីក ហើយ Piston Rod ត្រលប់មកទីតាំងដើម្បី
រួច។



Directional Control Valves

Solution 5



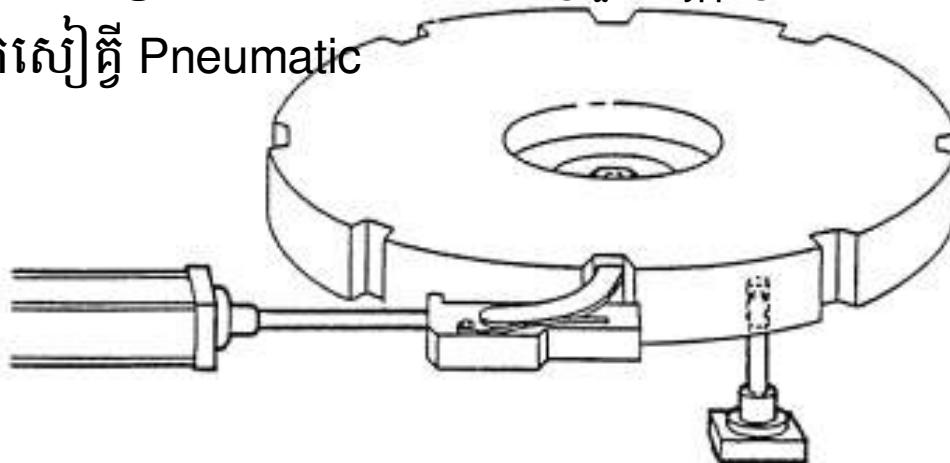
Directional Control Valves

Exercise 6

Using a rotary indexing table, parts are to be indexed out in sequence to next operation.

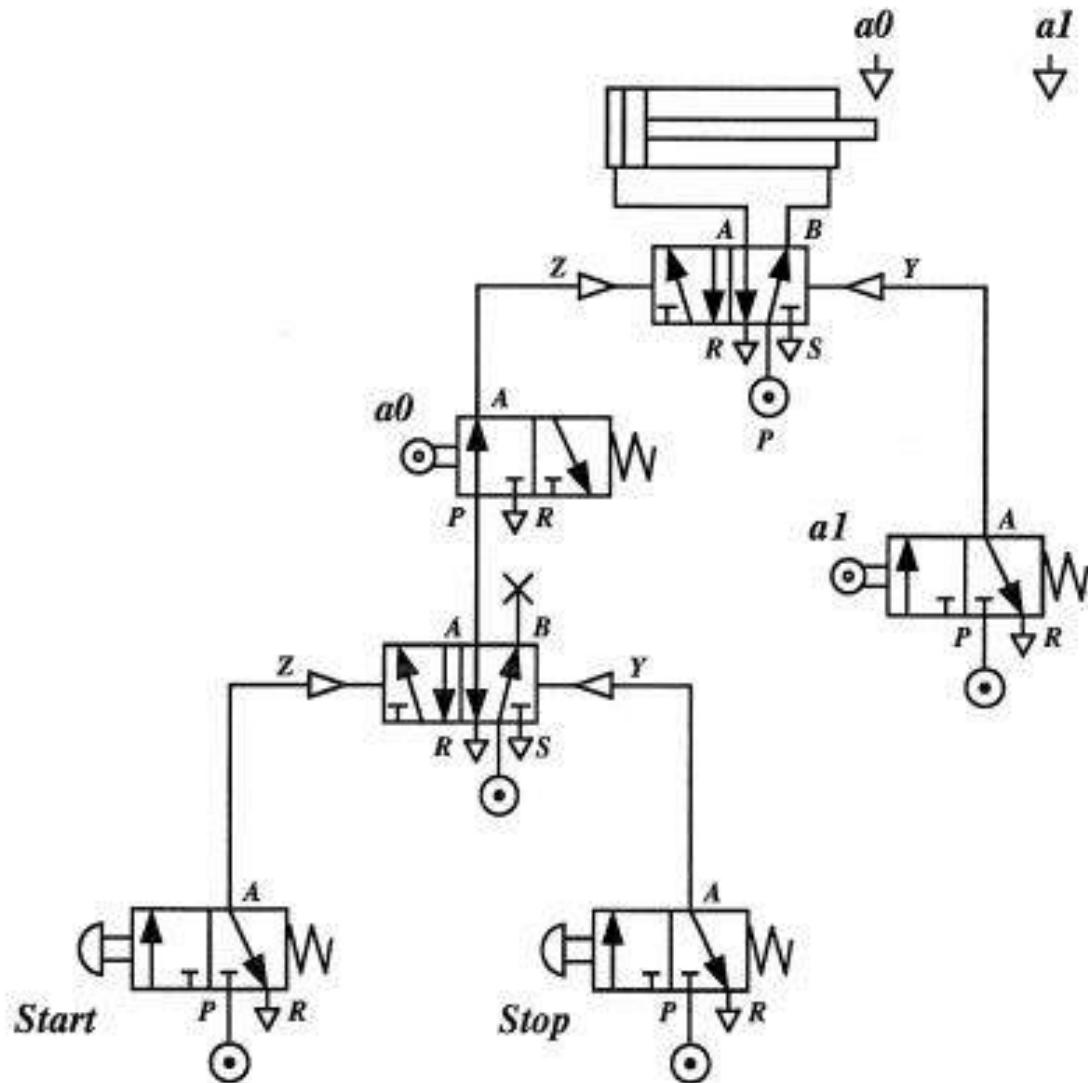
By pressing a START push button, the rotary table is indexed by the oscillating piston rod of a cylinder via a stop pawl. When the STOP push button is pressed, this drive is switched off.

យើងត្រូវប្រើ Double Acting Cylinder ដើម្បីបញ្ចូន ការងារទៅកន្លែងមួយឡើត។ នៅយើងពេលចុច ឬកុង Start, Cylinder Extend ហើយវាត្រូវបានបង្កើតដោយប្រើប្រាស់ការងារដោយខ្ពស់នៃឡើតរហូត Button Stop ត្រូវបានចុច. ចុរបដឹងតែសៀវភៅ Pneumatic



Directional Control Valves

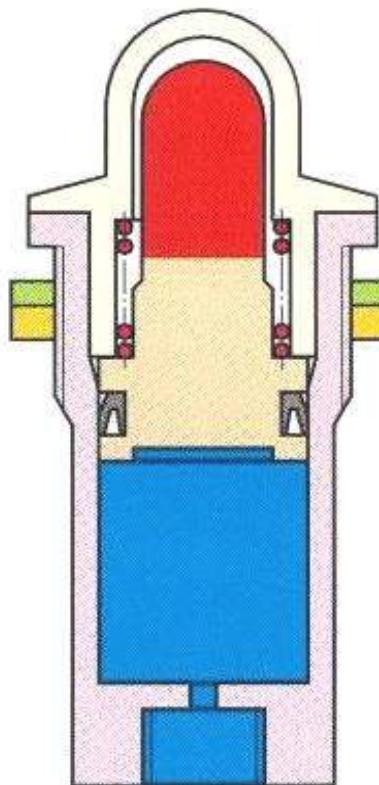
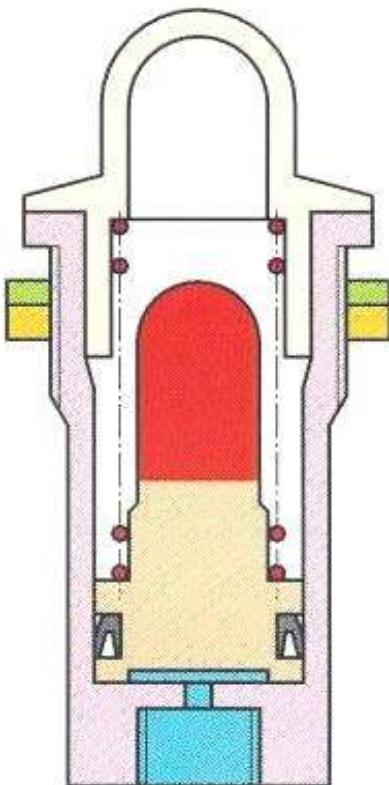
Solution 6



Directional Control Valves

PNEUMATIC INDICATOR

Red color is popped up when air is Applied.

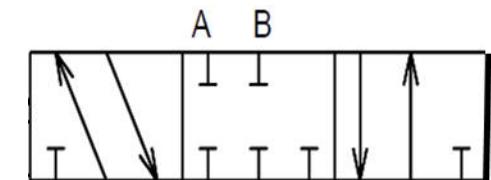
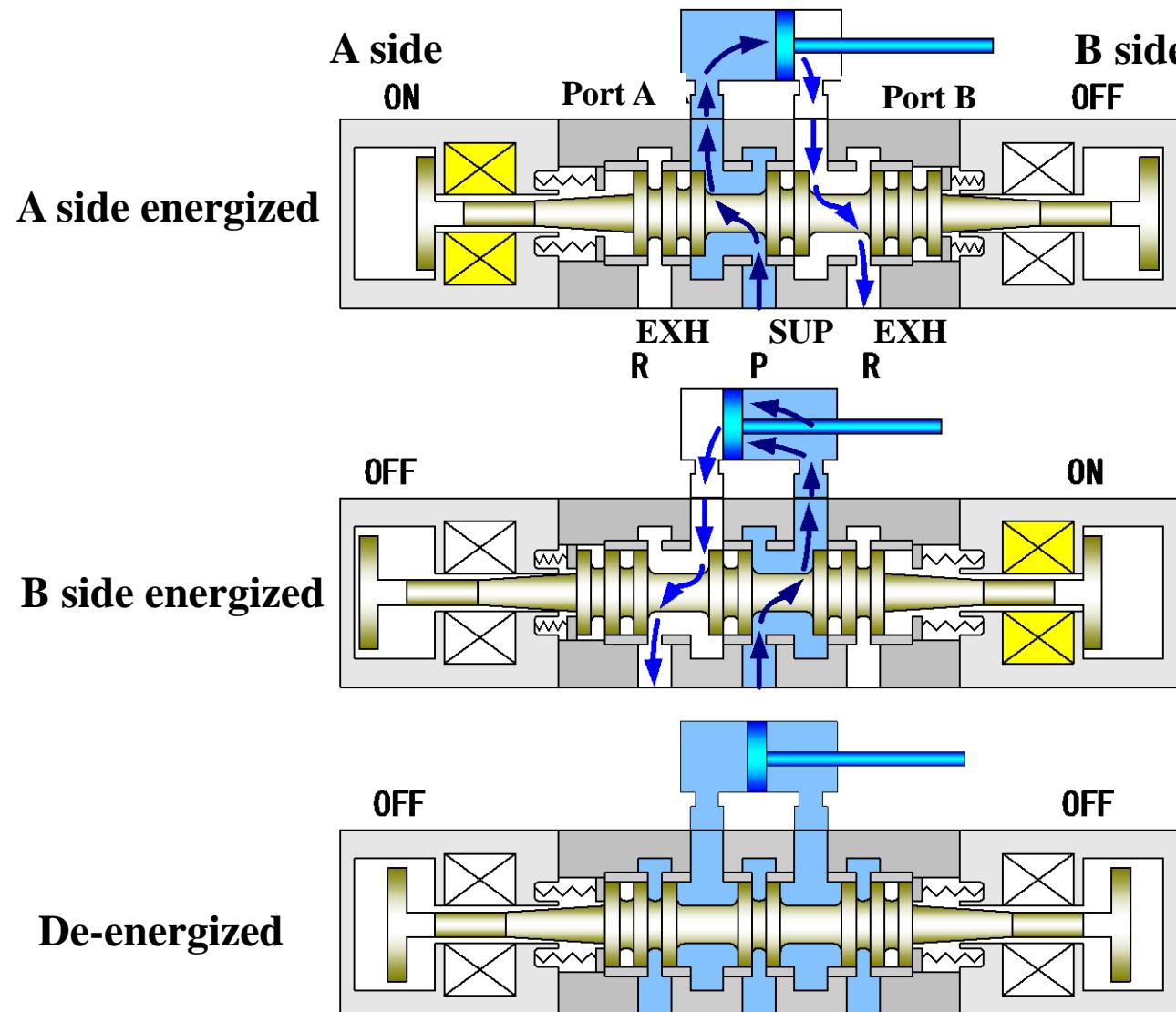


Directional Control Valves

5 port solenoid

3-Position Valves

All ports blocked
[Closed center]



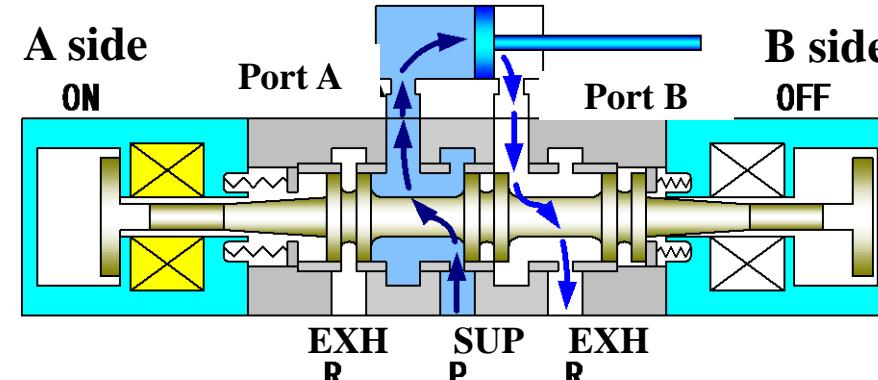
Directional Control Valves

5 port solenoid

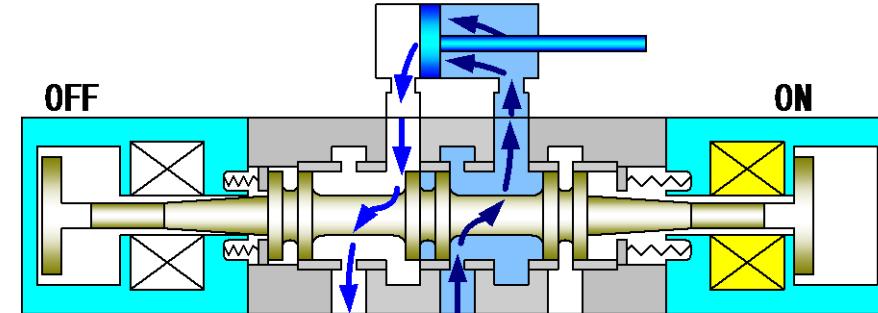
3-Position Valves

ABR connection [Exhaust center]

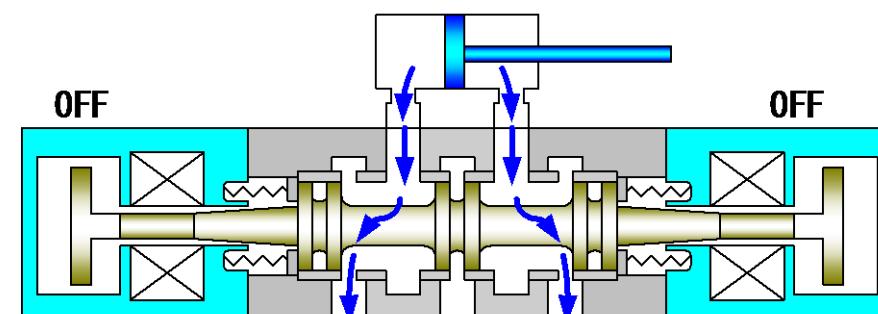
A side energized



B side energized



De-energized



VIDEO

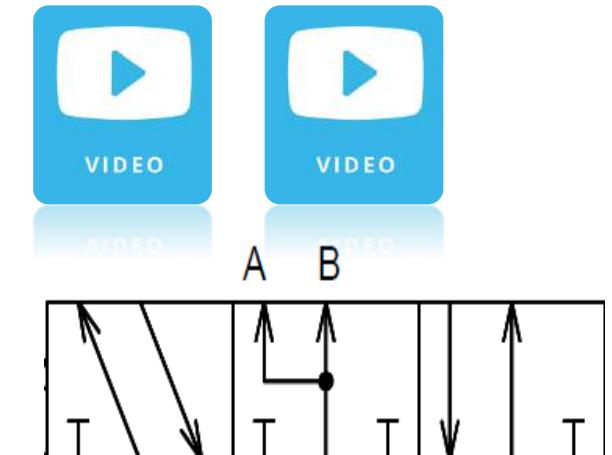
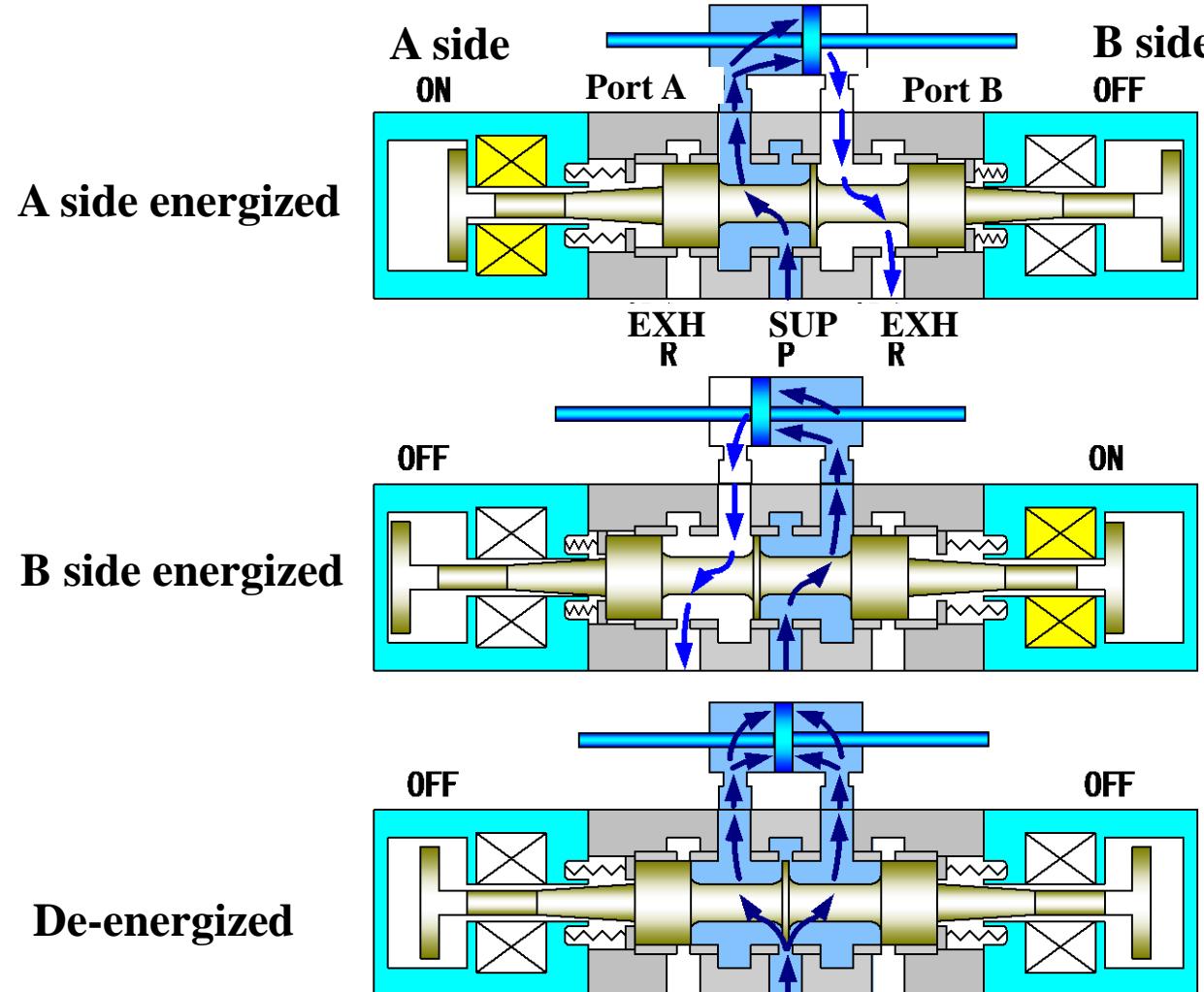
VIDEO

Directional Control Valves

5 port solenoid

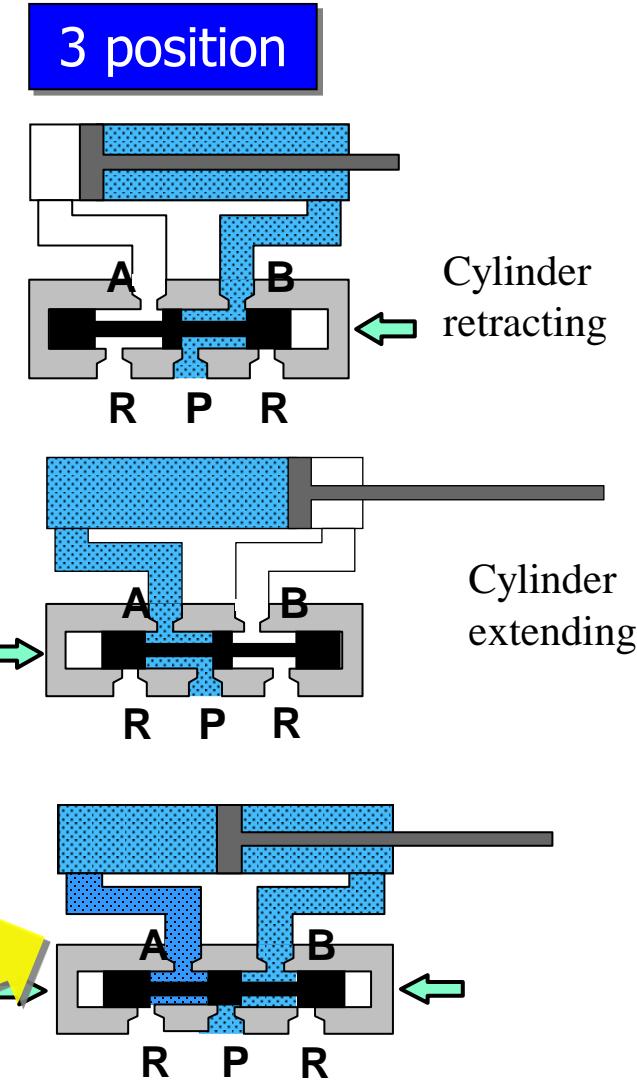
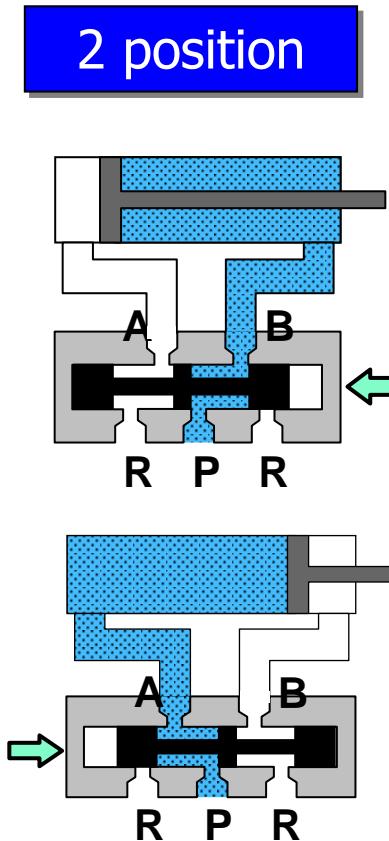
3-Position Valves

PAB connection [Pressure center]



Directional Control Valves

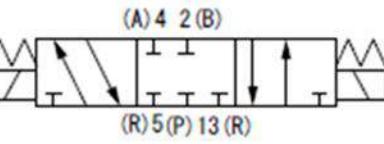
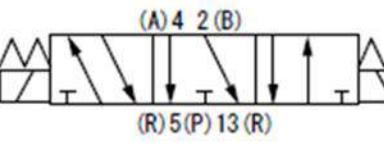
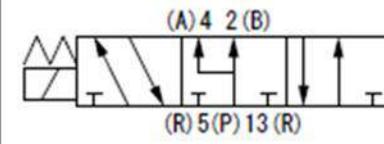
3-Positions vs 2-Positions Valves



Directional Control Valves

5 port solenoid 3-Position Valves

Comparison of the three types of three-position valves

	All ports blocked	ABR port connection	PAB port connection
JIS Symbol	 (A) 4 2 (B) (R) 5 (P) 13 (R)	 (A) 4 2 (B) (R) 5 (P) 13 (R)	 (A) 4 2 (B) (R) 5 (P) 13 (R)
Purpose	Intermediate stop or emergency stop	Emergency stop with minimized hazards (residual pressure exhaust)	Prevention of lunging of a cylinder with a brake
Non-energized	The pressure is kept in the cylinder.	The pressure is released from the cylinder.	A pressure is applied to both ports of the cylinder.
By external forces, the cylinder is...	Not moved	Moved	Moved
Cylinder mounting position	No restrictions (when the load is light)	Horizontal only	No restrictions
Precautions	The stop position may not be held if air leaks.		A pressure balance must be kept.

Directional Control Valves

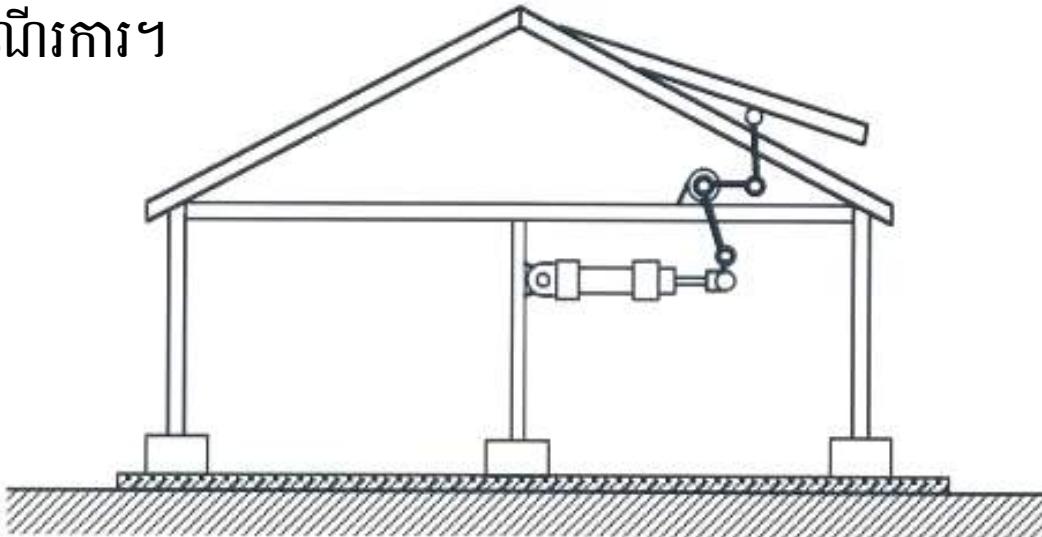
Exercise 7

In a production plant, a pneumatically actuated window is mounted at the roof to control the ventilation.

The opening or closing of this window is controlled by push buttons. It must be possible to stop the window in any intermediate position, eg : quarter, half or fully open.

A visual indicator is to show the closed position.

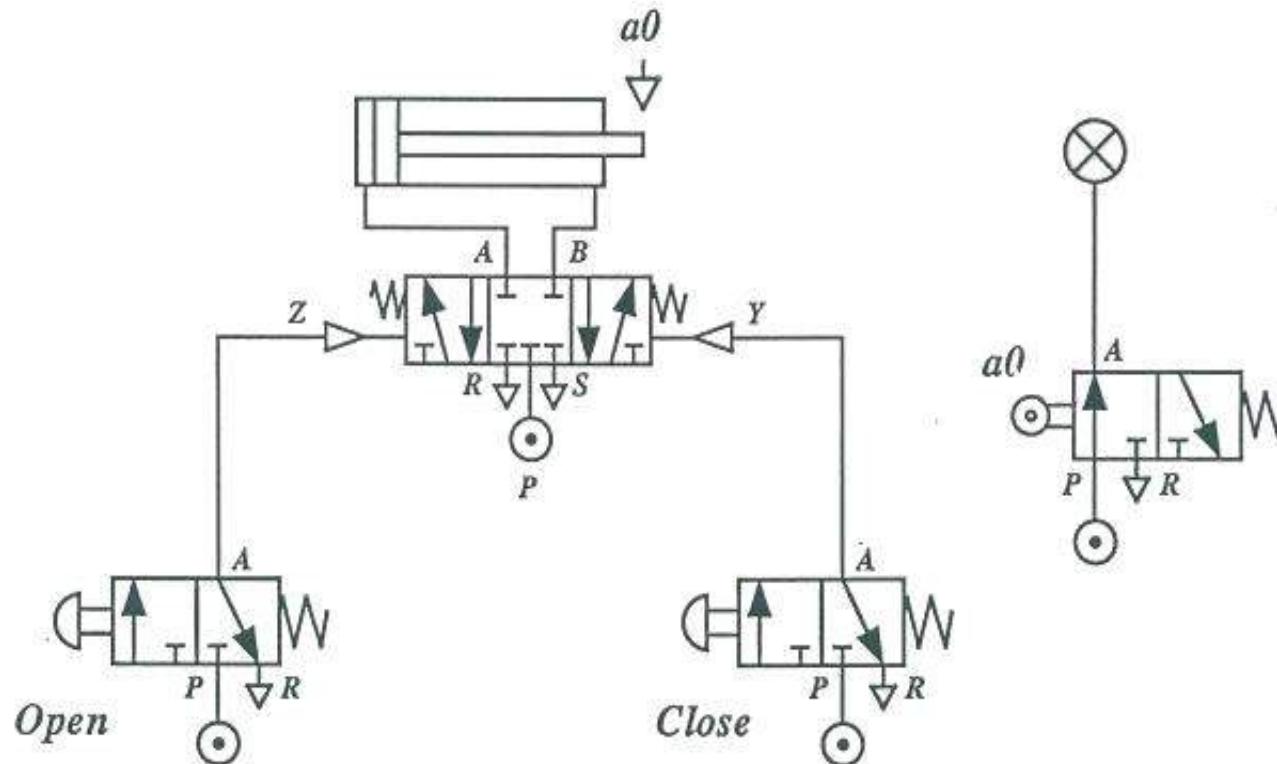
ដើម្បីបង្កើត ប្រើប្រាស់ ដំបូលអូក្រុ គោប្រើ Push Buttons 2 សម្រាប់បិទប្រើបិទ ពេលដំបូល
បើក យើងអាចឈប់នៅចំនួចណាដែលយើង ចង់បាន។ នៅពេលដំបូលបិទជីត Visual
Indicator ដំណឹករករ។



Directional Control Valves

Exercise 7

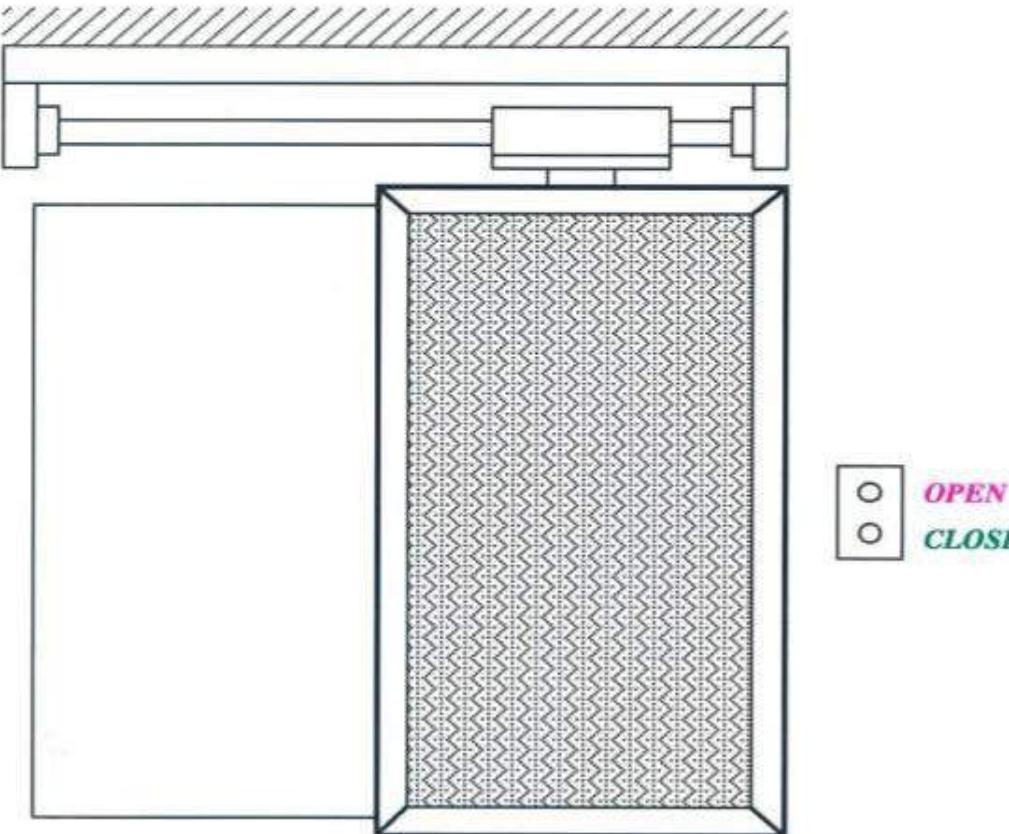
Solution :



Problem

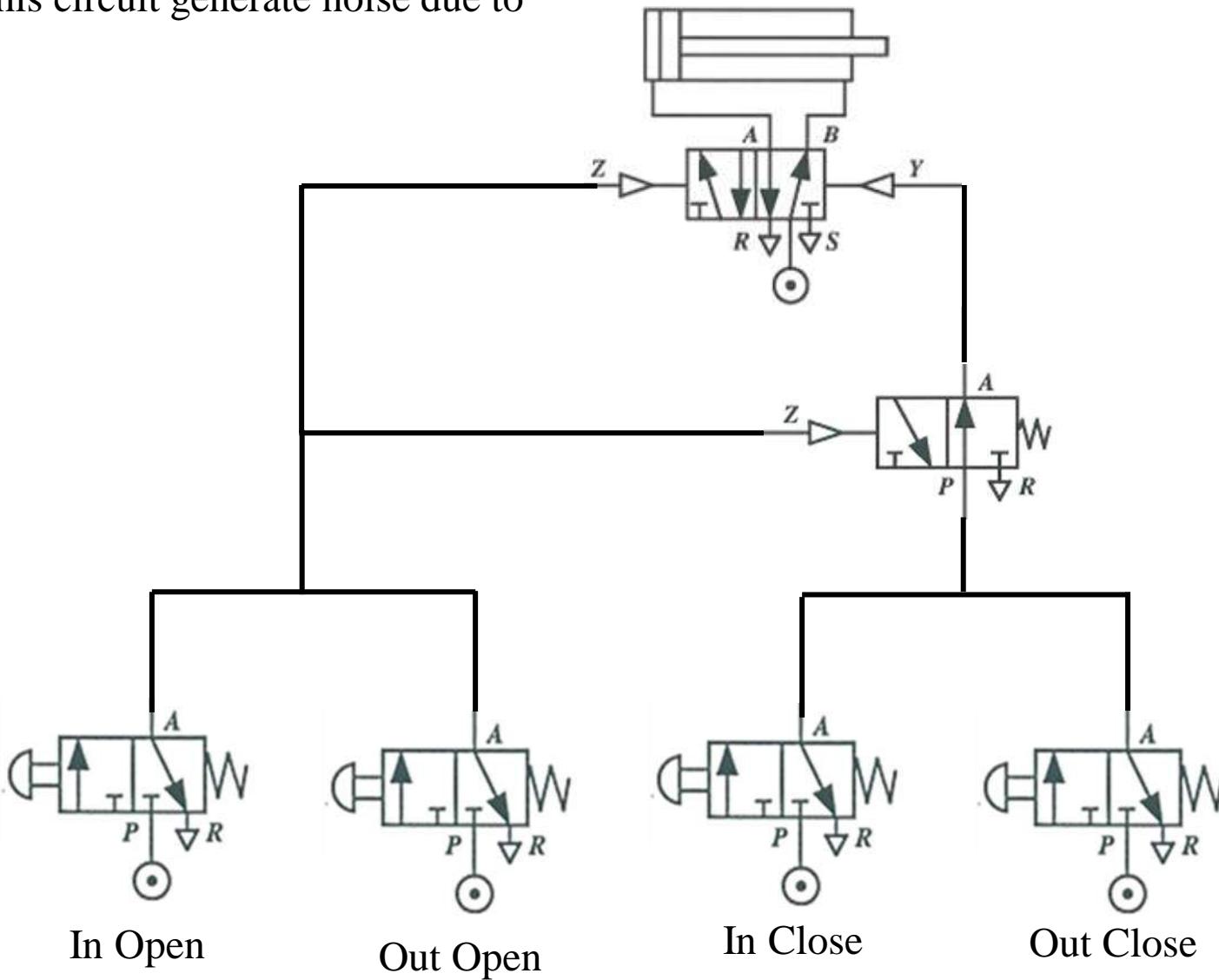
ដើម្បីបង្កប្ញបិទ ទ្វាគេប្រើ Push Button ខាងក្រោម 2 (បើក និង បិទ) និង ខាងក្រោម 2 (បើក និង បិទ)។ នៅពេលបូតុងបើក បុរិចណាមួយ ចុចតាំណាលត្តា បូតុងបើកមានអនិភាព។

A huge steel door is installed in a deep mining tunnel. This door may be opened or closed by two push buttons, either from outside or inside.



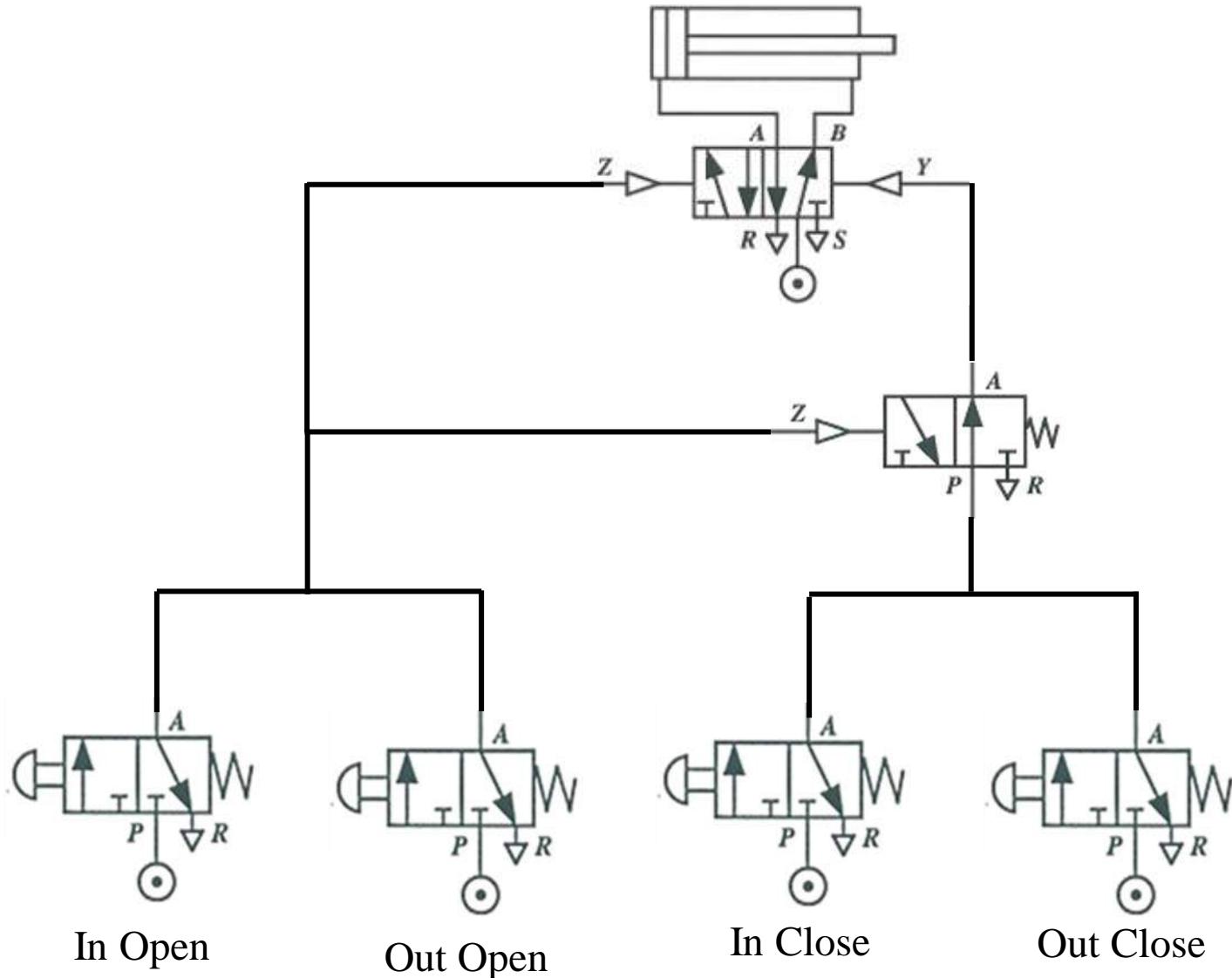
Problem

This circuit generate noise due to



Problem

Or we can use 2 5/3 close centre valve. The result will not make noise.



SMCT P1 Course Content

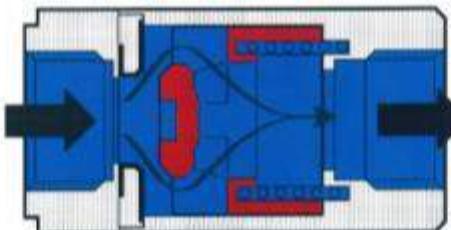
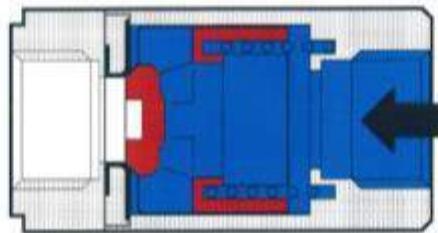
1. Properties of compressed air and its area of applications
2. The basic Pneumatic system
3. Compressed air theory
4. Compressed air production, purification and distribution
5. Construction and principle of Actuators and Valves
6. Ancillary Pneumatic equipment

Ancillary Valve

CHECK VALVE



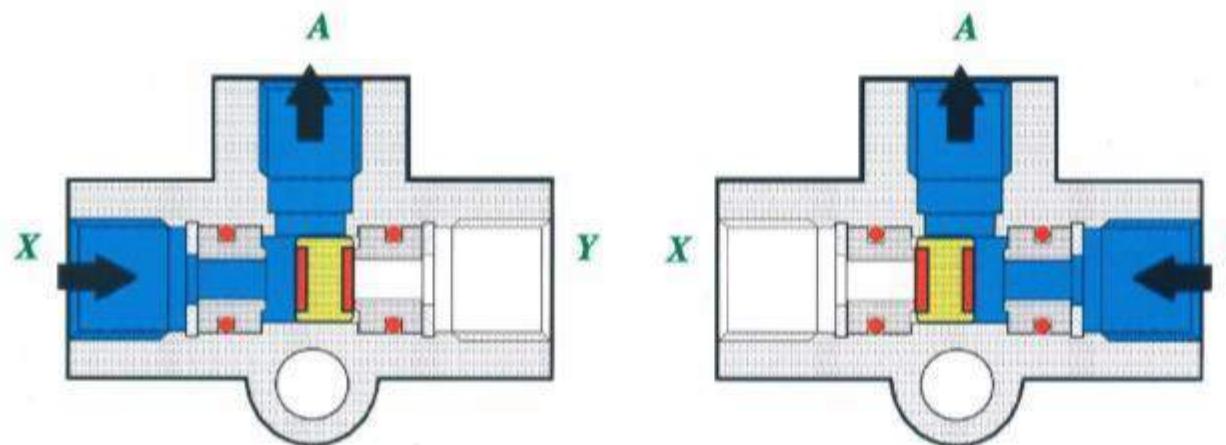
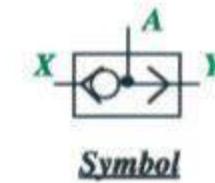
Symbol



A check valve allows free air flow in one direction and seals it off in the opposite

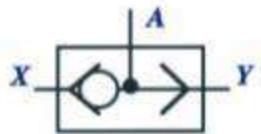
Ancillary Valve

SHUTTLE VALVE (OR VALVE)

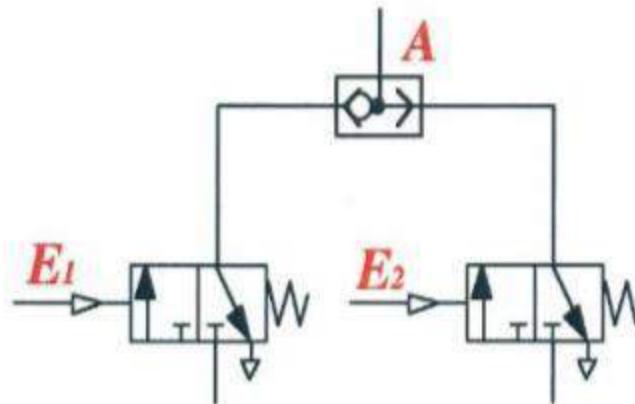


Ancillary Valve

OR FUNCTION



SHUTTLE VALVE

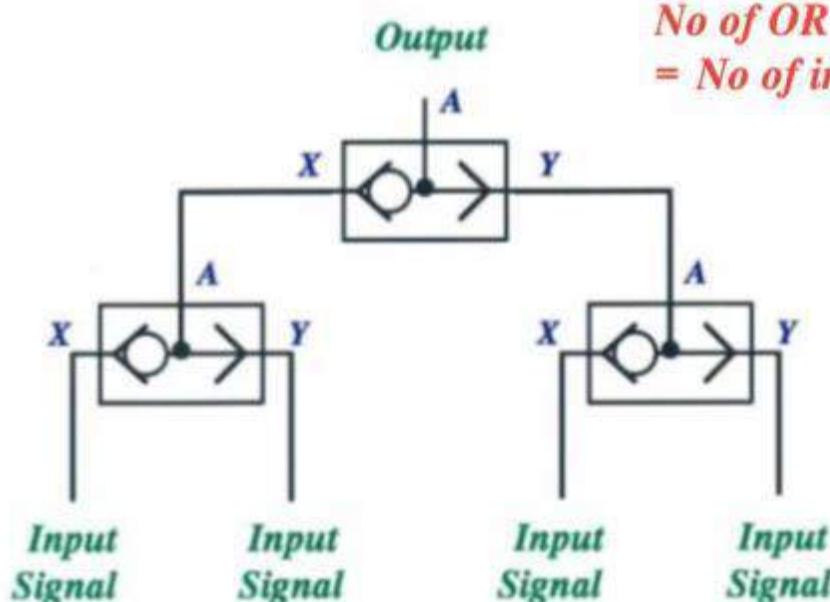


TRUTH TABLE

X	Y	A
0	0	0
0	1	1
1	0	1
1	1	1

PNEUMATICS
- *Shuttle (OR)*
Valve

No of OR elements
= No of input signals - 1

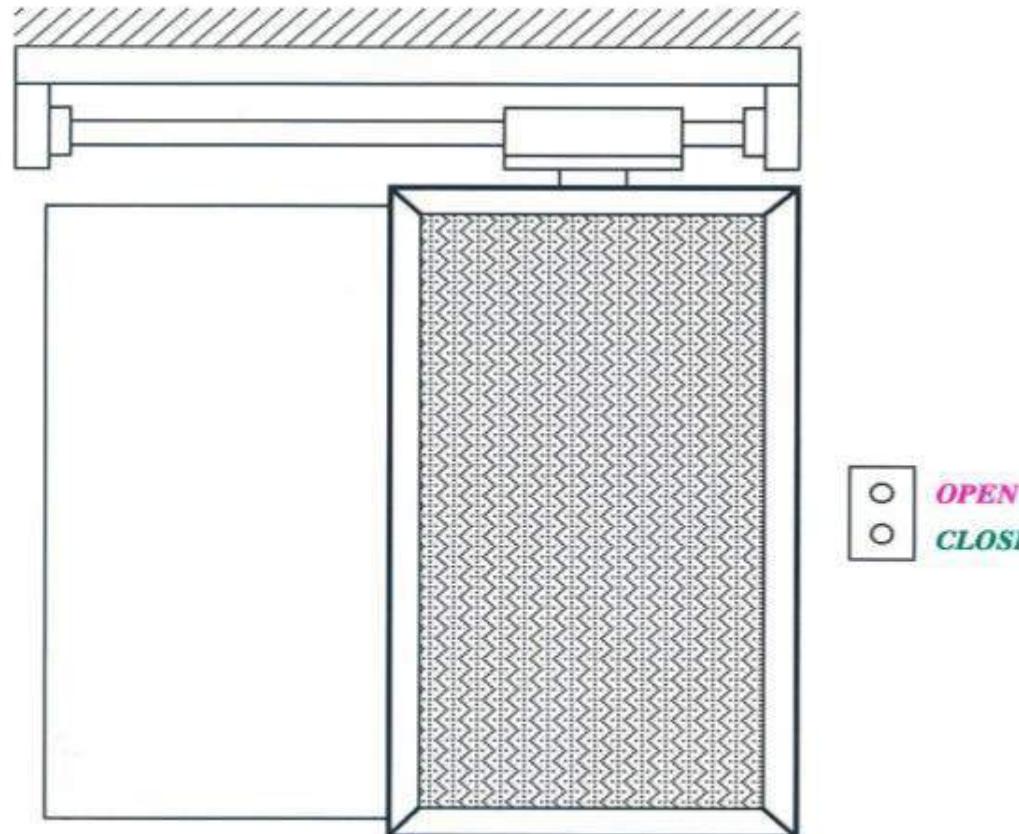


Ancillary Valve

Exercise 8

A huge steel door is installed in a deep mining tunnel. This door may be opened or closed by two push buttons, either from outside or inside.

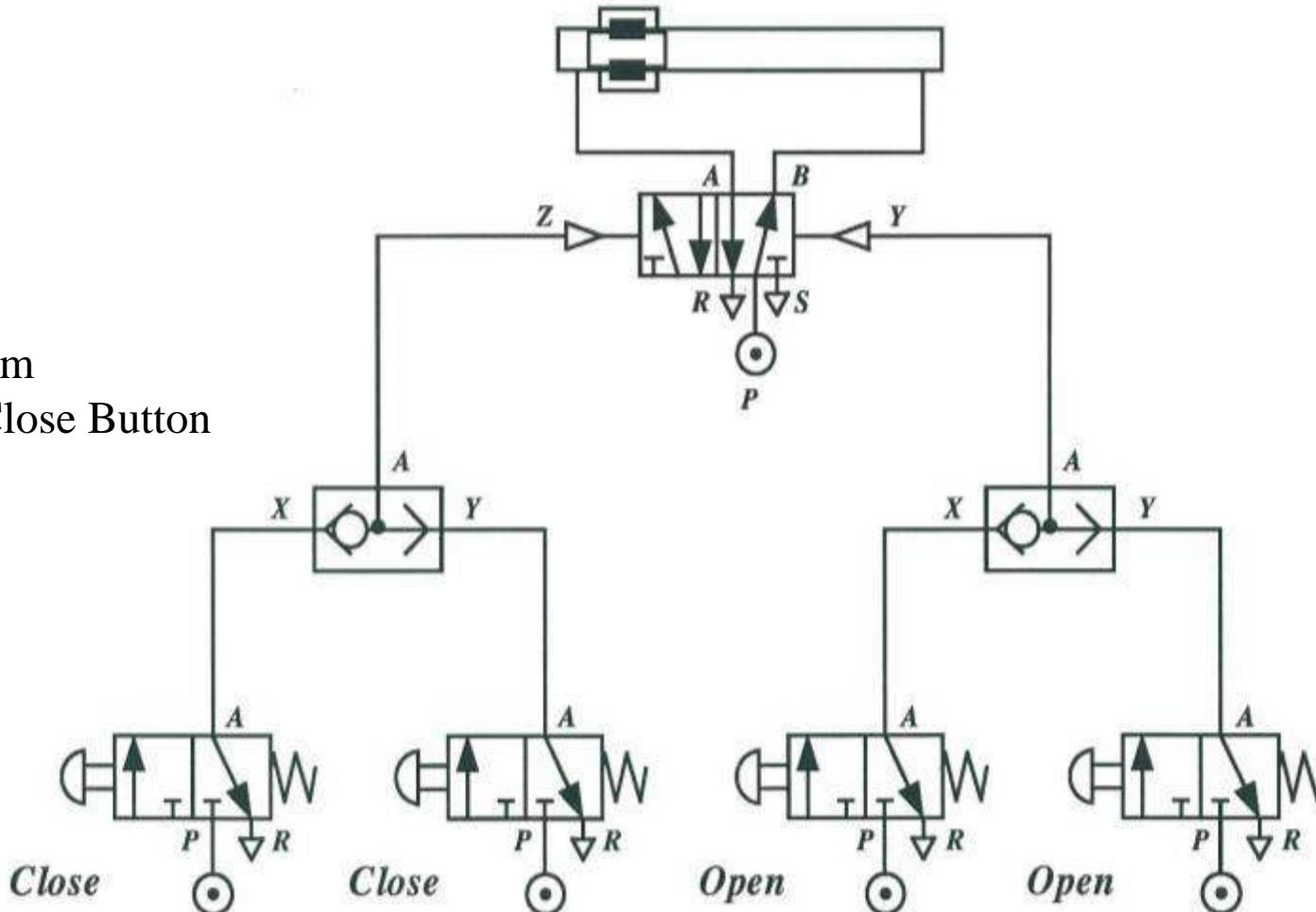
ធ្វើម្យីបើក បុបិទ ទ្វាគេប្រើ Push Button ខាងក្បង 2 នឹង ខាងក្រោម 2 ។ ចូរបង្កើតសៀវភៅ
ដោយប្រើ OR Valve!



Ancillary Valve

Solution : 8

Air Cannot Flow from
Close Button In to Close Button
Outside.

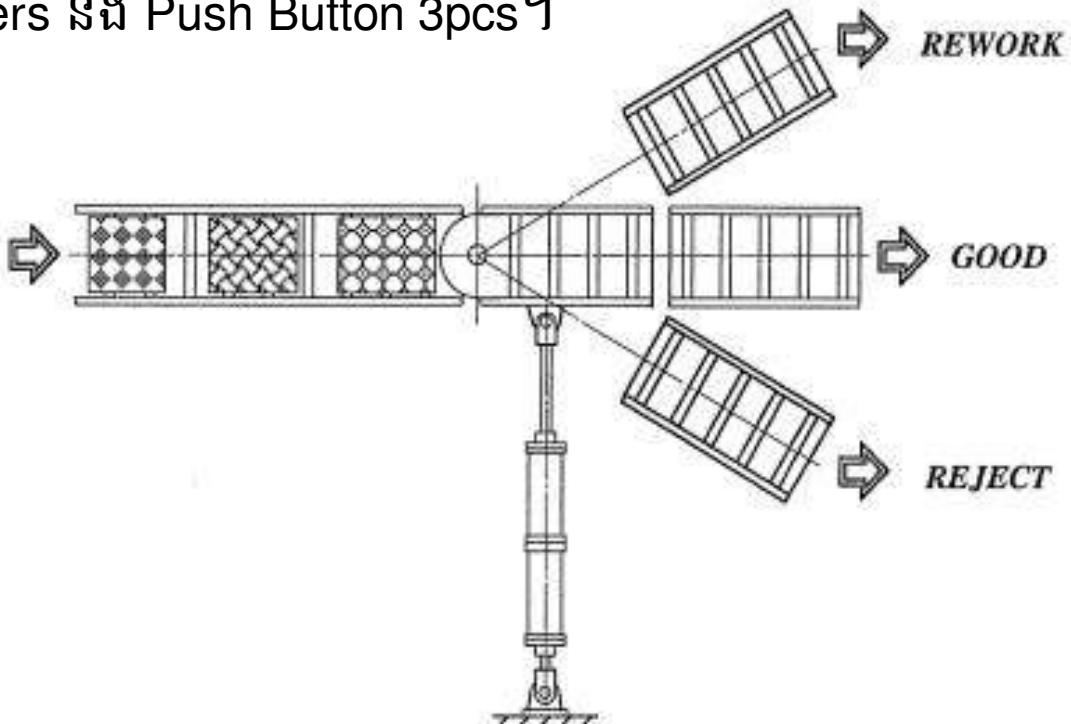


Ancillary Valve

Exercise 9

*The tested parts are distributed to three conveyors (Good / Reject / Rework).
Shifting to the required positions must be possible in any sequence by push buttons.*

ការងារ ដែលយើងដលិតចេញមកត្រូវបានបែងចែកជា ព្យប្រភេទ តី Good, Reject, Rework។ ការងារទាំងព្យប្រភេទនេះត្រូវបានបែងចែកជាយប្បី Cylinders និង Push Button 3pcs។

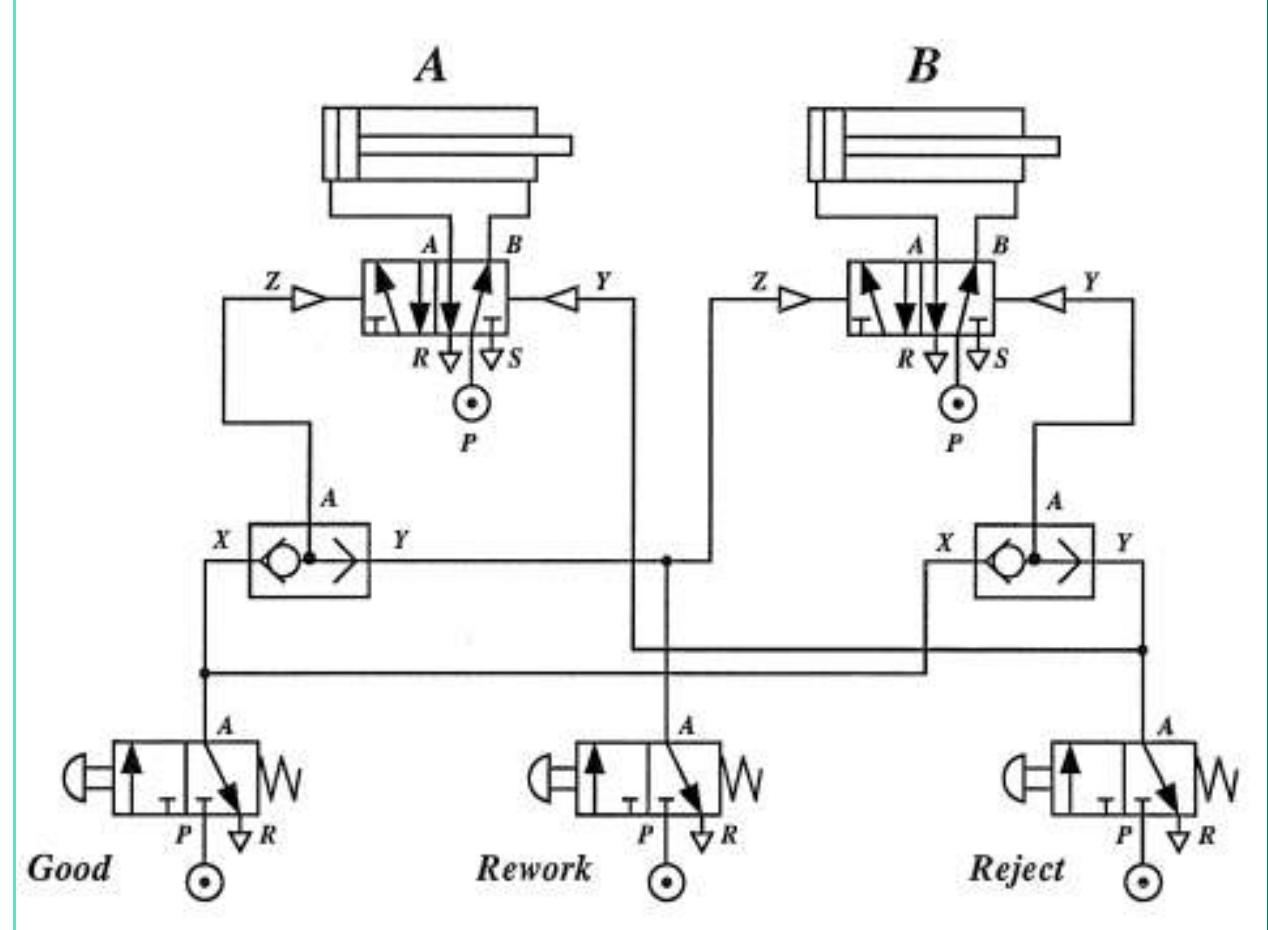


Ancillary Valve

Exercise 9

Solution :

Position	A	B
Good	+	-
Reject	-	-
Rework	+	+



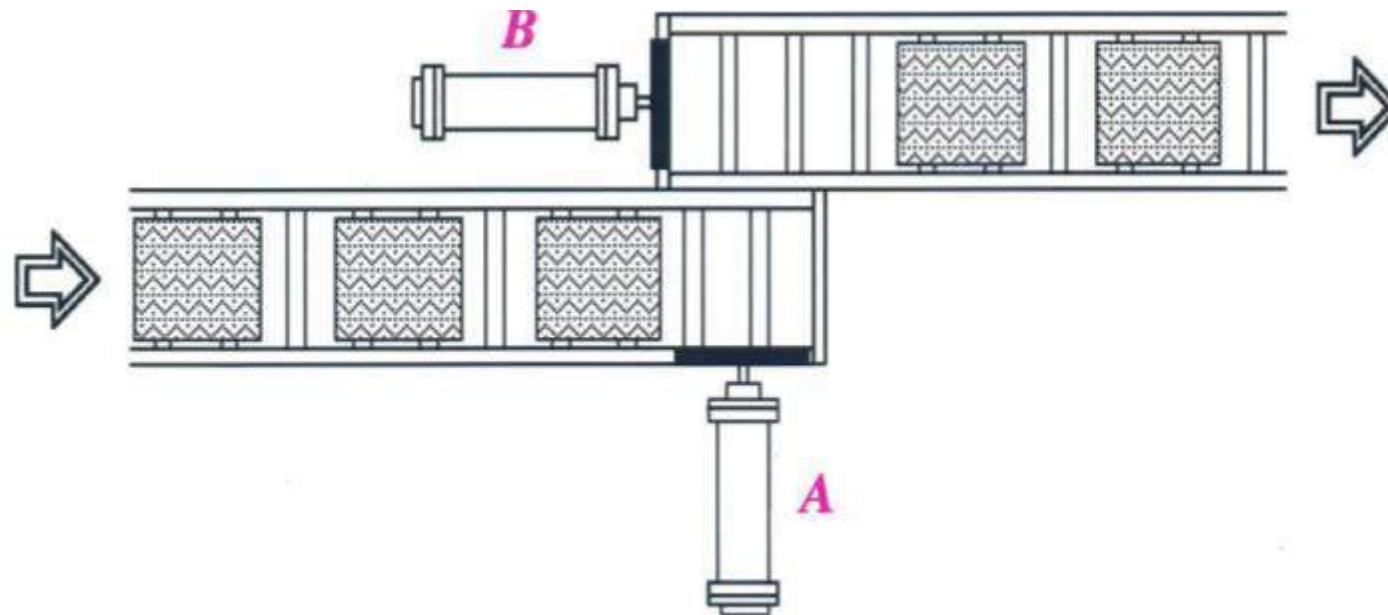
Ancillary Valve

Exercise 10

The boxes arrive on a roller conveyor and are transported onto the second roller conveyor by cylinder A and B.

Cylinder B must not return until cylinder A has reached the retracted position.

Box ត្រូវការបញ្ចុនពី Conveyor ក្រោមទៅ Conveyor លើ ដោយប្រើប្រាស់ Cylinder ចំនួន 2 និងចាប់ផ្តើមដំណើរការនៅពេល Push Button ត្រូវបានចូច។ Cylinder B មិនត្រូវ ត្រួលប់មក ទីតាំងដើមឡើយ លើក្រាត់ Cylinder A ត្រួលប់មកដល់ទីតាំងដើមវិញ។



Ancillary Valve

REPRESENTATION OF MOTION SEQUENCE

ABBREVIATED NOTATION

Cylinder : A, B, C etc

Extension : +

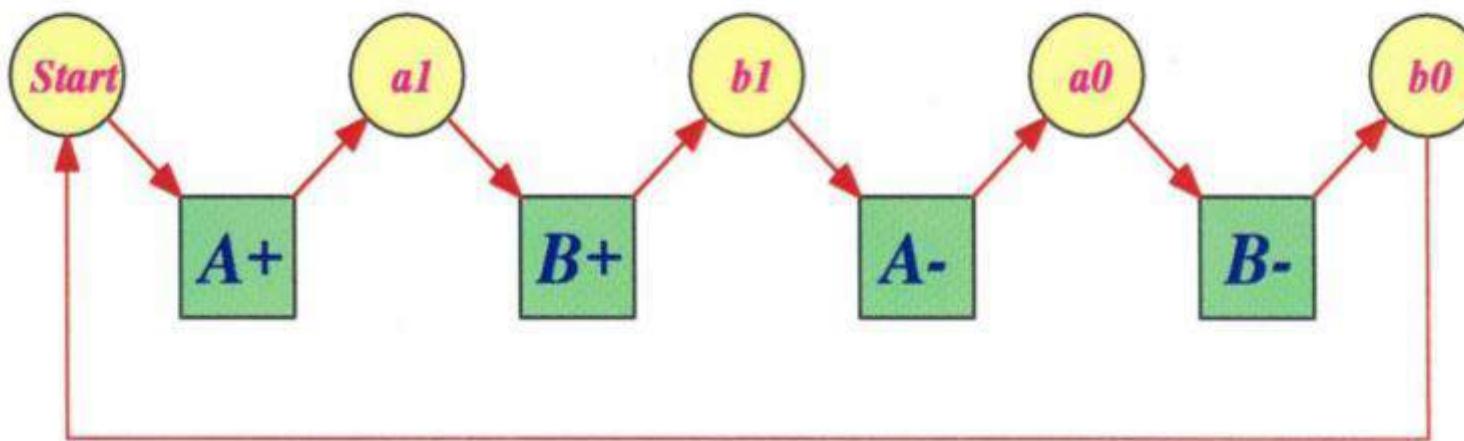
Retraction : -

EXAMPLE

A+ B+ A- B-

Ancillary Valve

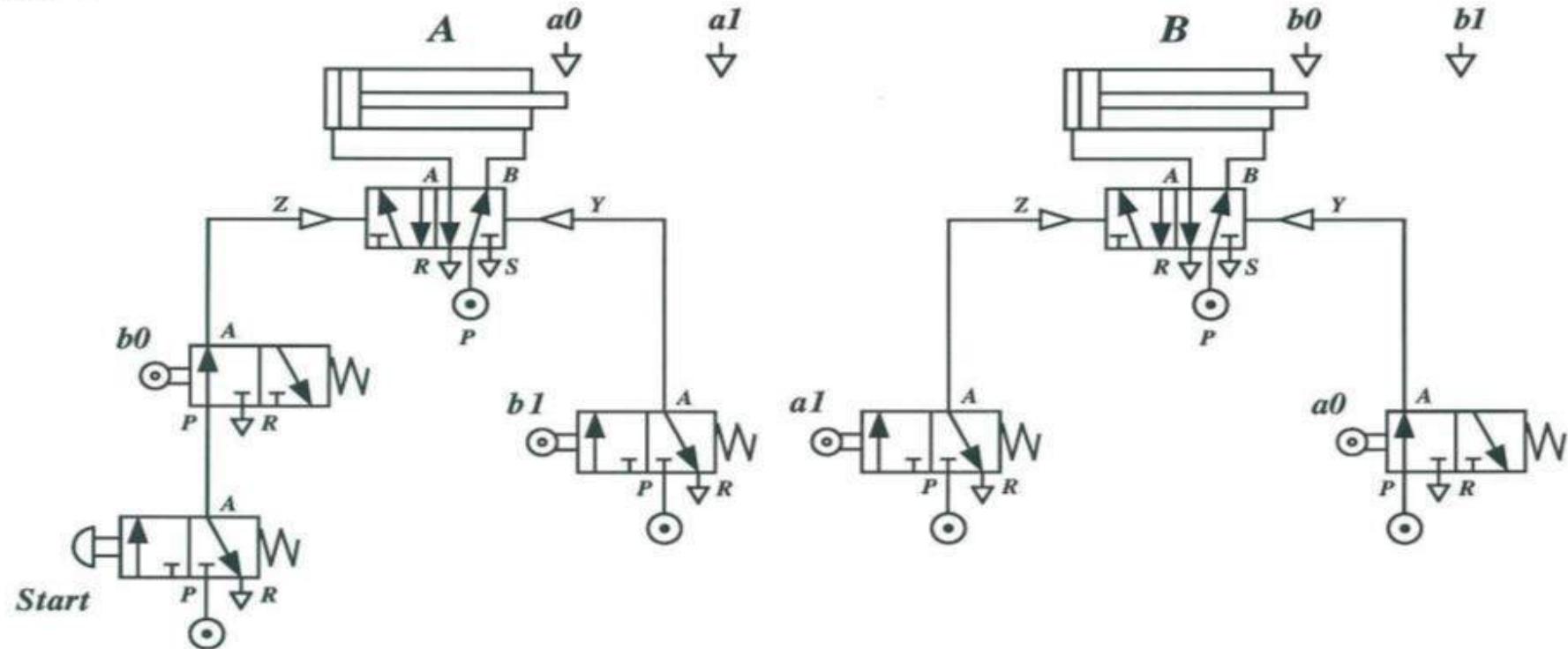
MOTION SEQUENCE



Ancillary Valve

Exercise **10**

Solution :

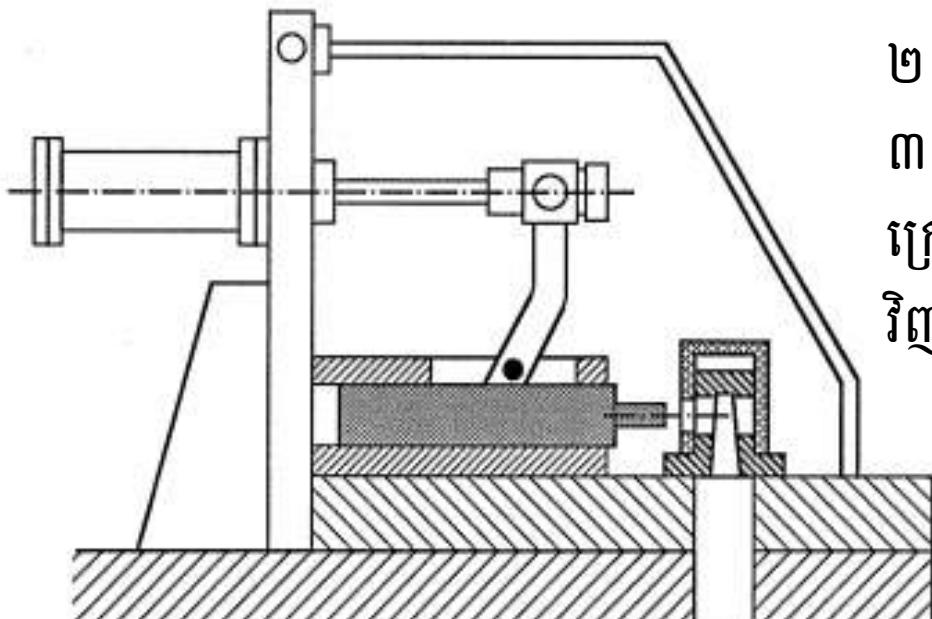


Ancillary Valve

Exercise 11

Parts are to be punched using a double acting cylinder via a mechanical linkage. Punching is only possible when the workpiece is in position (mandrel), the safety cover closed and either a push button or a foot pedal is actuated. After the punching cylinder has reached the rear end position, it is automatically returned to its extended position.

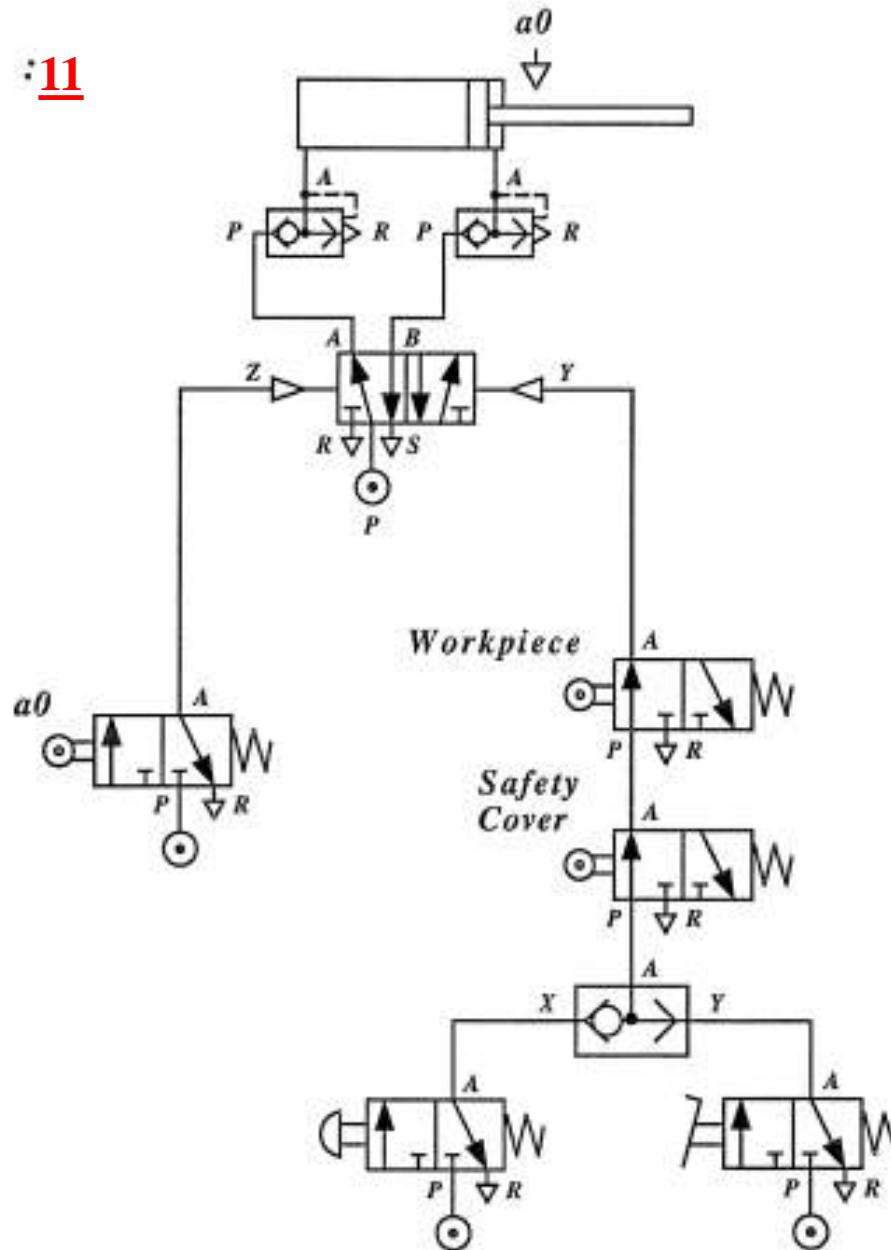
Both cylinder speeds are to be very fast.



ក្នុង Process ដំជាតម្លៃយ គេប្រើ Double Acting Cylinder ។
Cylinder អាចដំណើរការចាន លុះត្រាគ់
១ មានការងារក្នុងជីក
២ តម្រូវការស្ថិតិភាព បិទ
៣ Push Button ឬ Foot Pedal ដំណើរការ។
ត្រាយ សង្គត់ជាត បញ្ចូលត្វាស្ងាម Piston Rod ត្រូវ Extend
វិញ្ញាស្ងាម។ ចូរដំឡើងប្រព័ន្ធនេះ!!!

Ancillary Valve

Solution : 11



Ancillary Valve

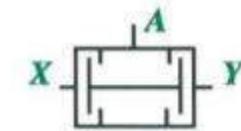
AND FUNCTION

In some cases two conditions have to be fulfilled to allow a certain operation. A typical example could be that a pneumatic press may only operate if a safety cover is closed and a manual valve is operated, this logical function is known as "AND" function

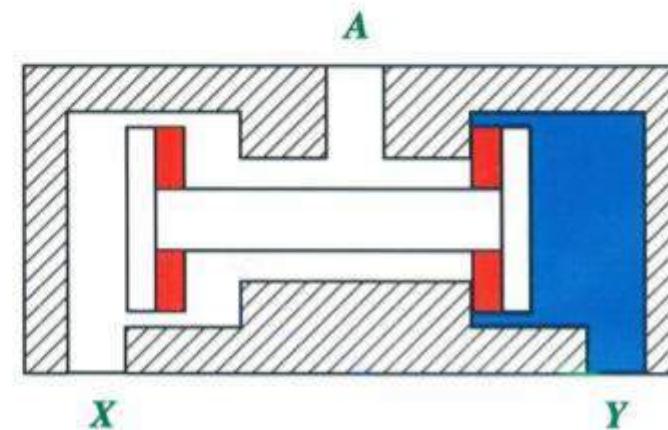
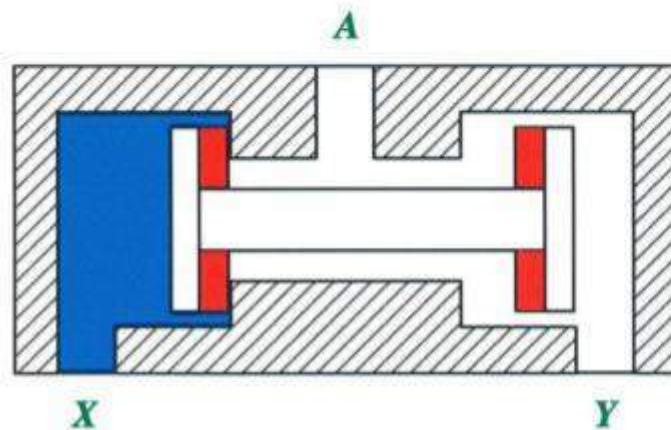
AND function is often used for checking (monitoring) function, interlocking controls and safety controls

Ancillary Valve

TWO PRESSURE VALVE (AND VALVE)

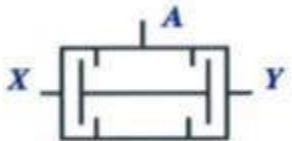


Symbol



Ancillary Valve

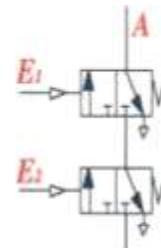
AND FUNCTION



TWO PRESSURE VALVE

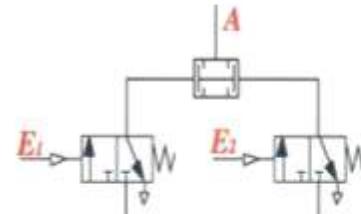
TRUTH TABLE

X	Y	A
0	0	0
0	1	0
1	0	0
1	1	1

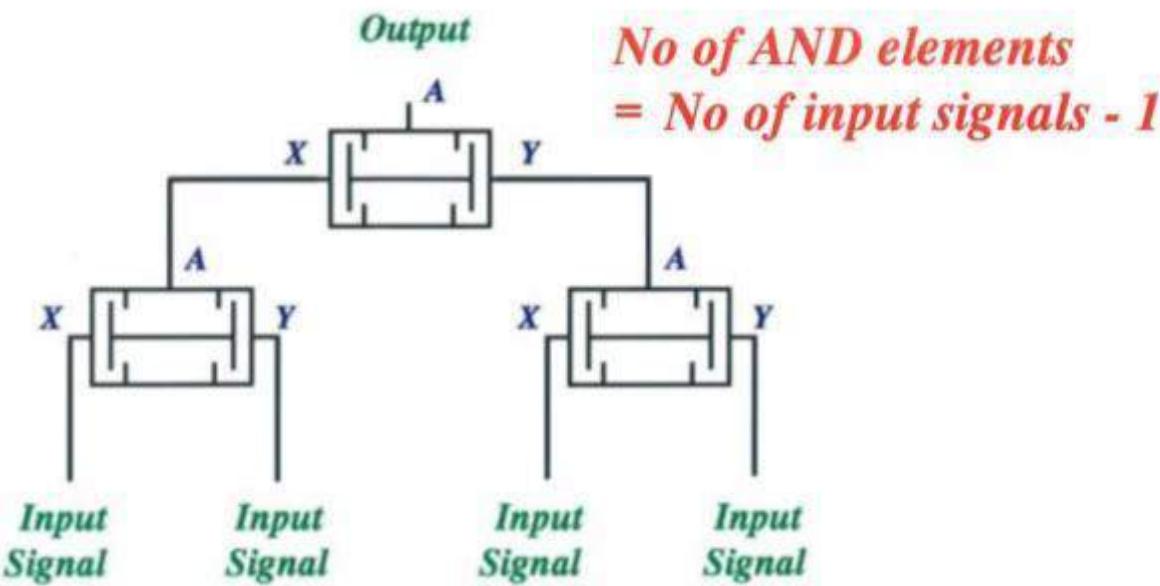


PNEUMATICS

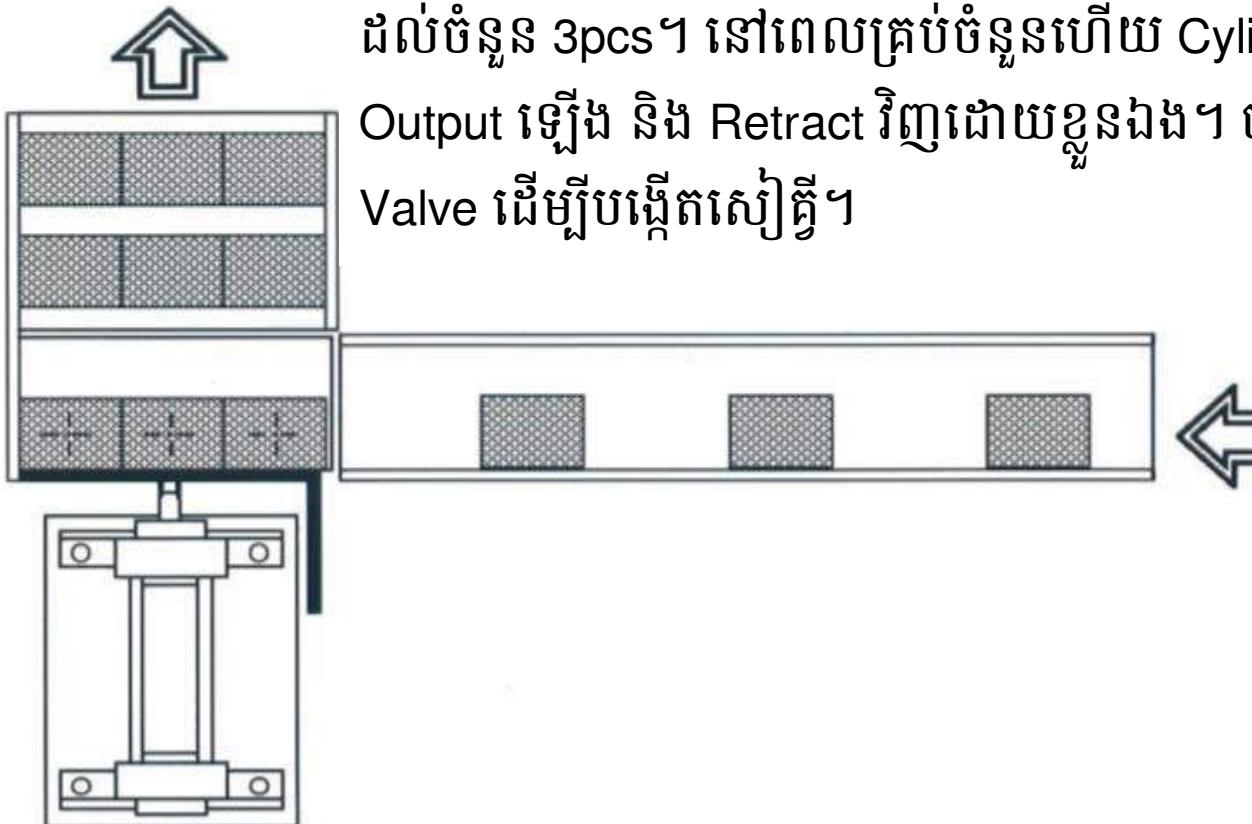
- In series



- Two Pressure Valve
(And valve)



By using a diverting device, articles are to be moved from one conveyor to another conveyor. Diverting device is pushed forward once the articles are in position by sensors. After the diverting device has reached the forward end position, it is automatically returned to its start position.

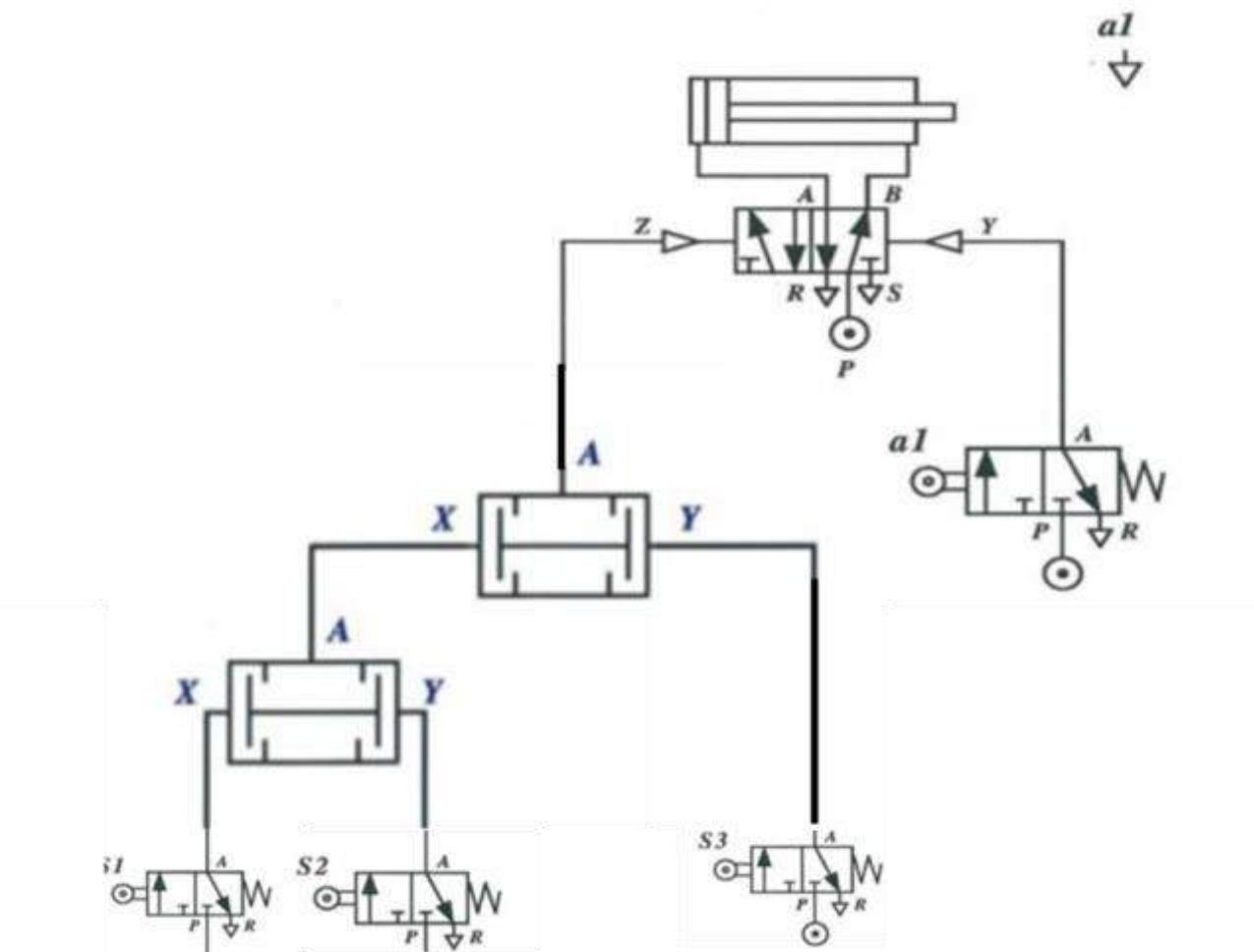


យើងត្រូវការលើក Output ដែលផលិតបានឡើ ដែចខ្លះប់ បីនេន
ដើម្បីអាយ Cylinder ដំណើរការបាន លុះត្រាតែក Output មក
ដល់ចំនួន 3pcs។ នៅពេលត្រូវចំនួនហើយ Cylinder រួច
Output ទឹកឱ្យ និង Retract វិញ្ញាដោយខ្លួនឯង។ ចូរប្រើ AND
Valve ដើម្បីបង្កើតសេវ្ឃតី។

Ancillary Valve

Exercise

Solution :

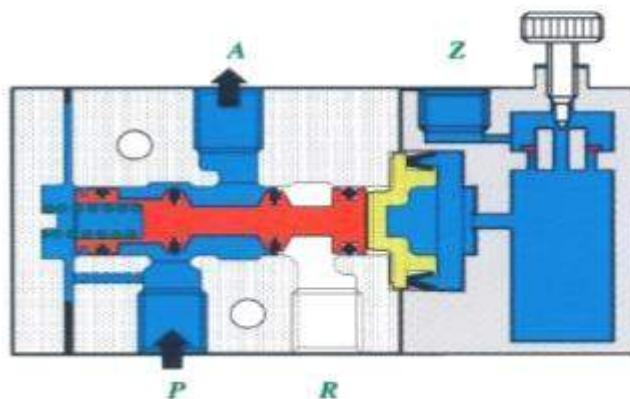
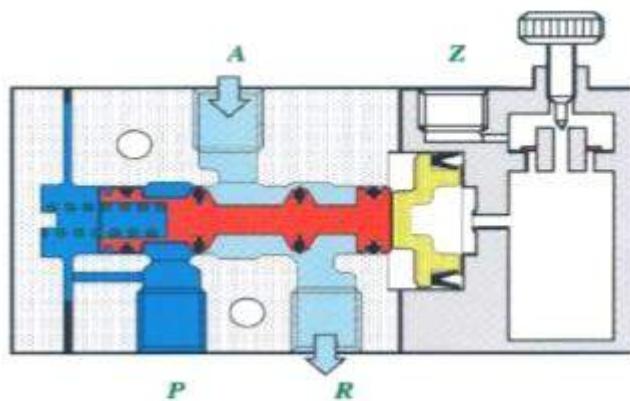
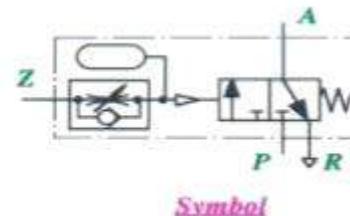


Ancillary Valve

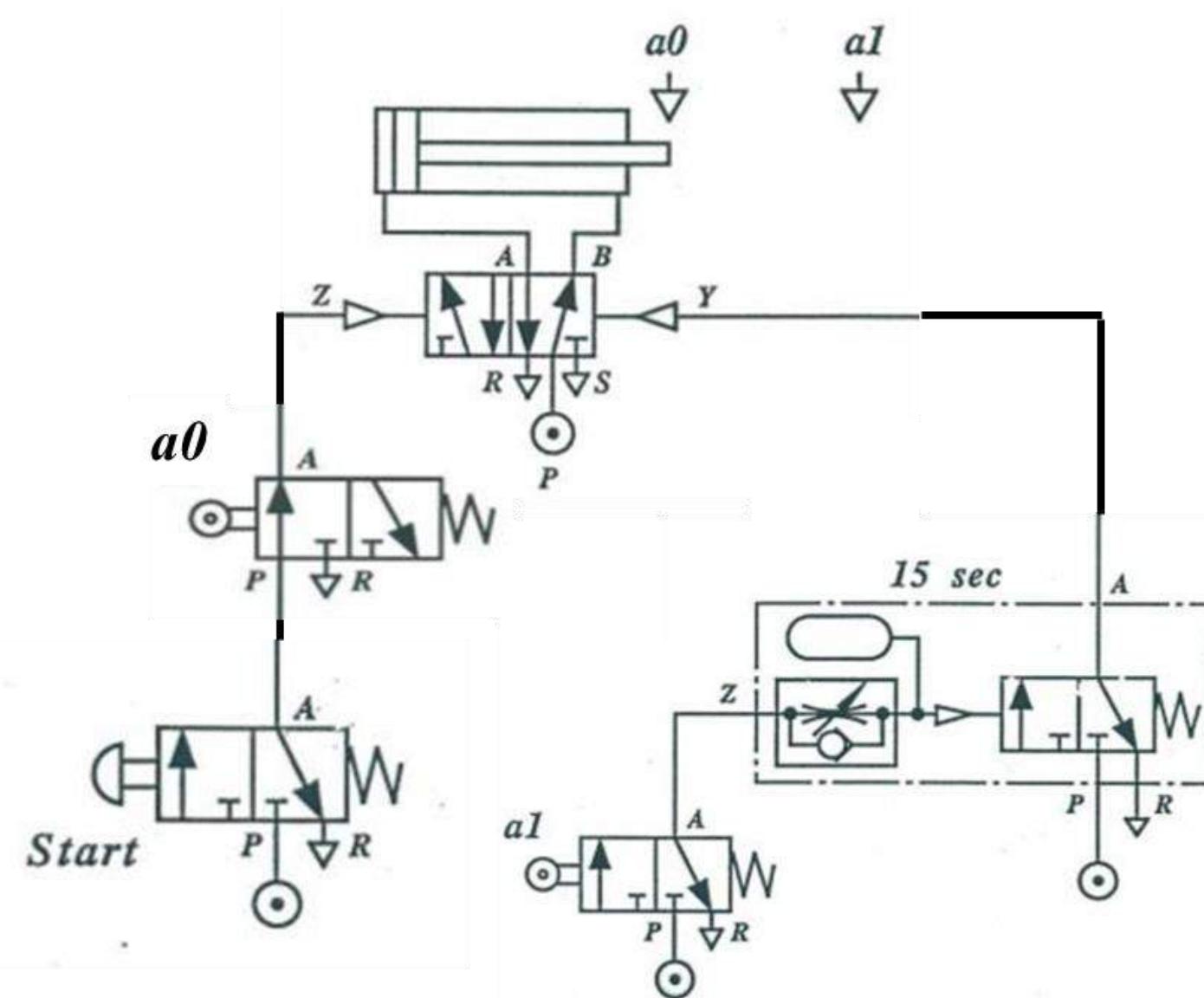
TIME DELAY VALVE

A time delay valve consists of :

- *A 3/2 air operated directional control valve*
- *A flow restrictor*
- *A reservoir*



Ancillary Valve



Ancillary Valve

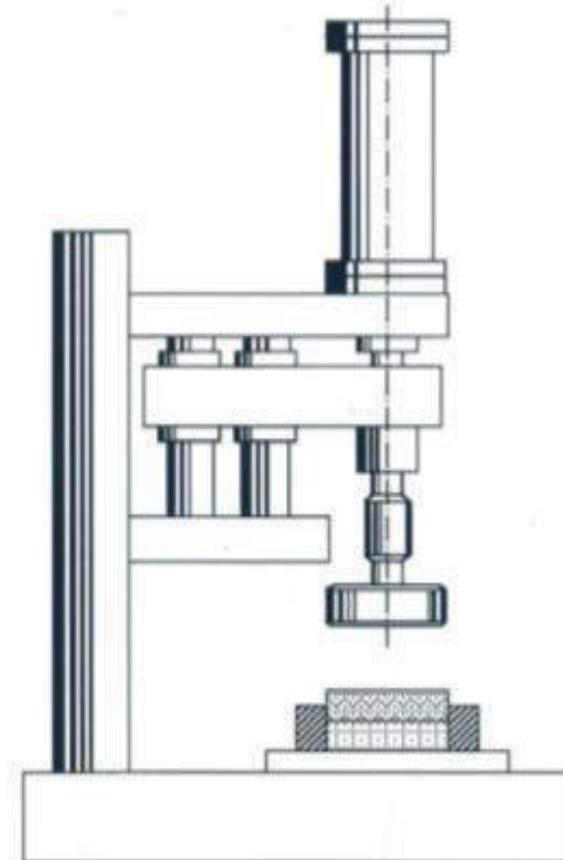
Exercise 13

Plastic components are to be joined together by the application of adhesive, heat and pressure.

Operation takes place when a push button is pressed. On reaching the forward end position, the components are to be pressed together for 15 seconds and then the piston rod is to return automatically to its start position.

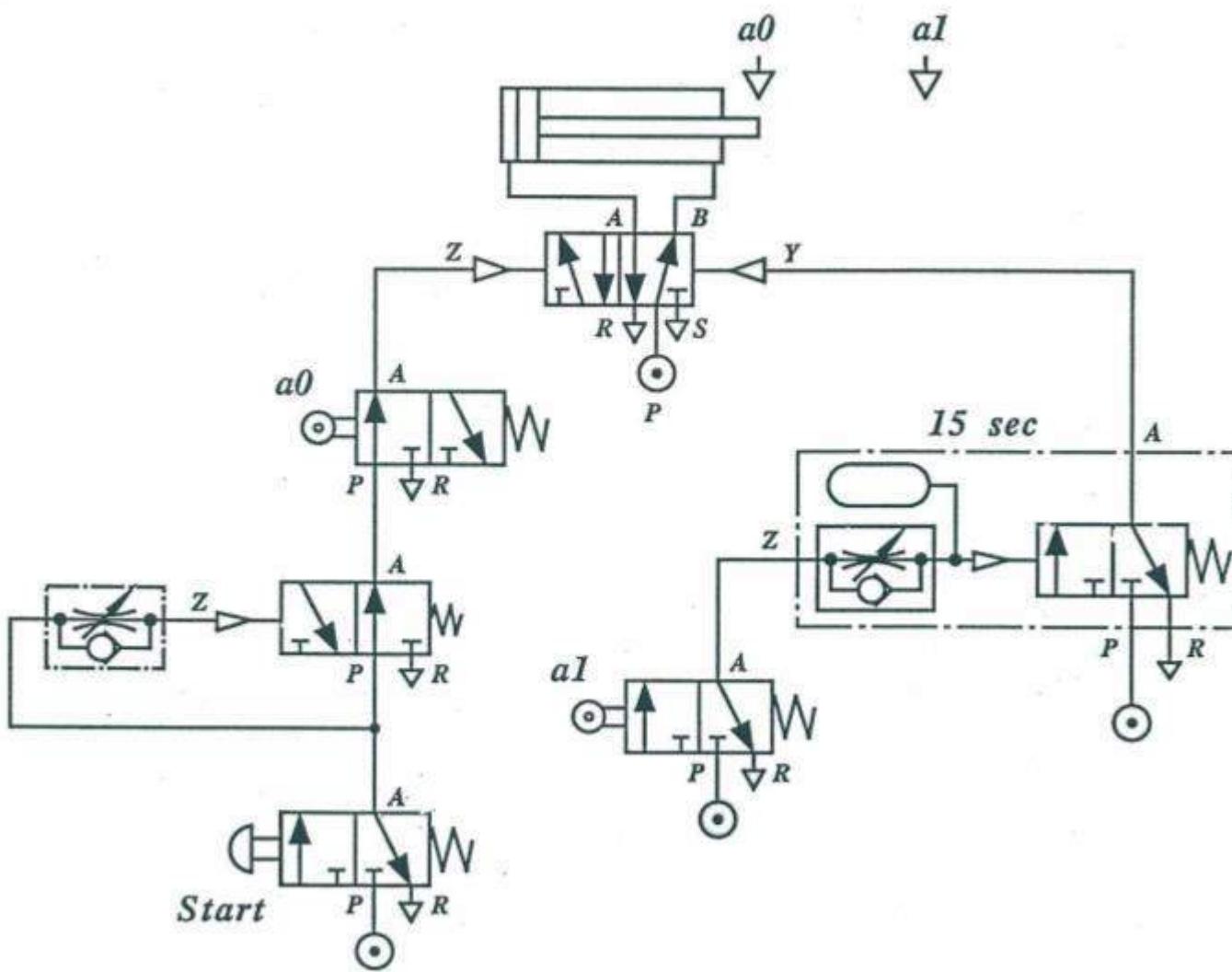
Additional conditions :

- *The return movement must always be made even if the push button is still depressed.*
- *To prevent overheating of components due to the malfunction, operation must be made with the cylinder at its start position and a new start signal.*



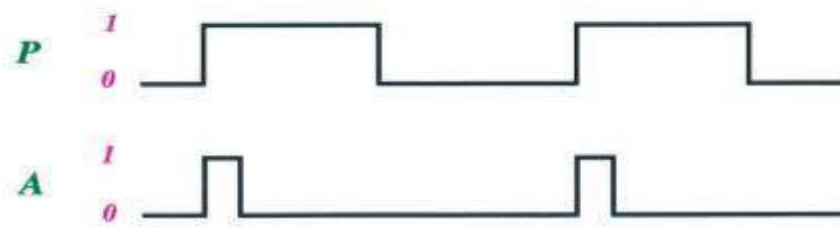
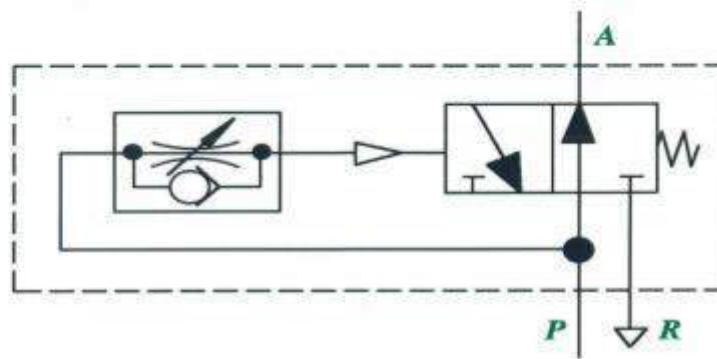
Ancillary Valve

Solution : 13

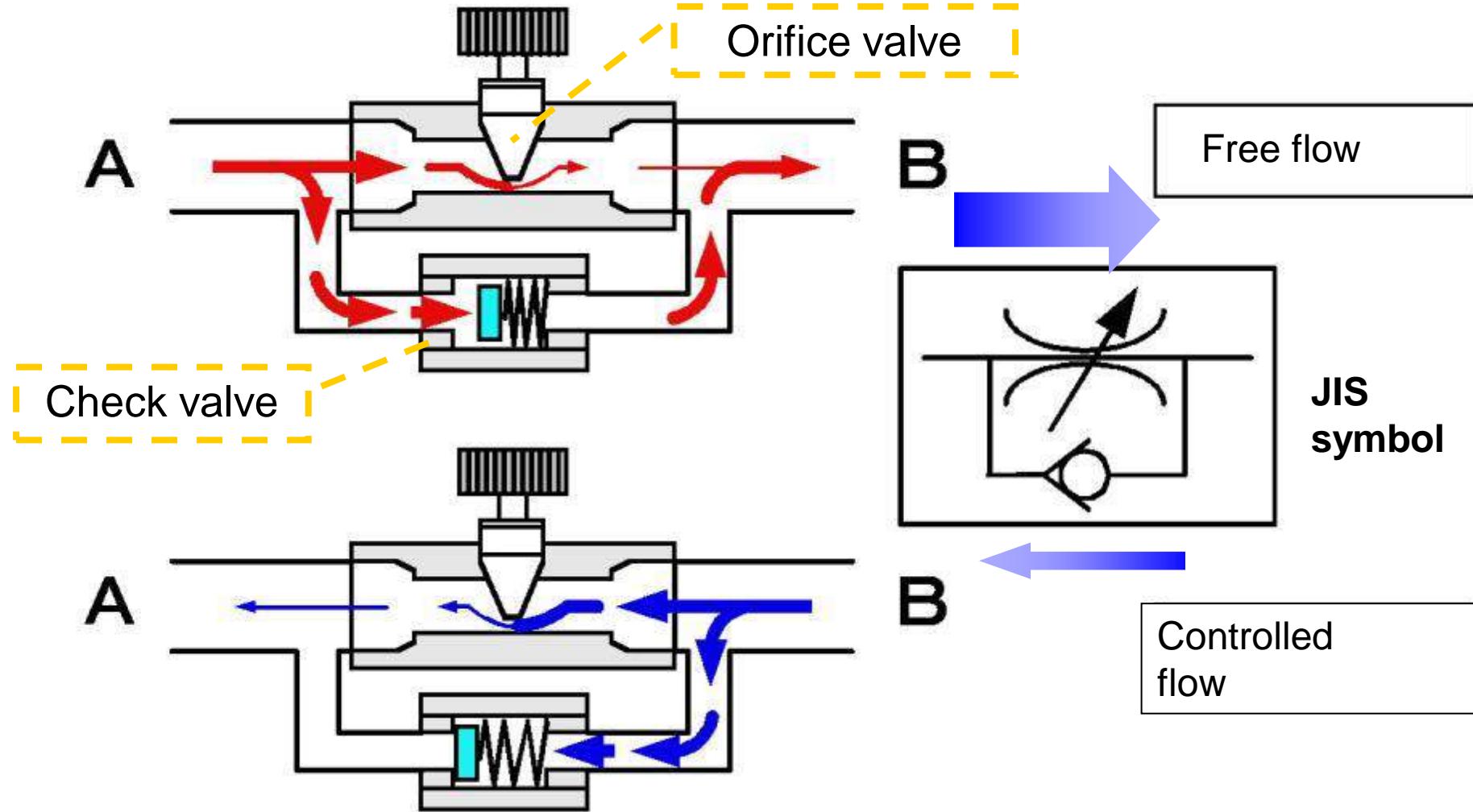


Ancillary Valve

ONE SHOT VALVE



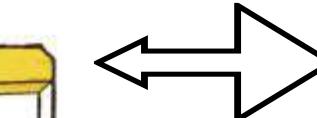
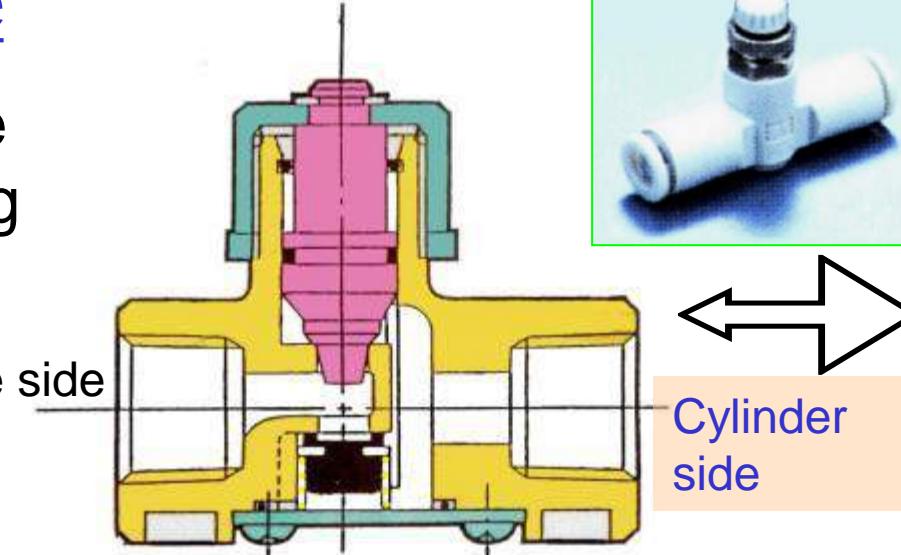
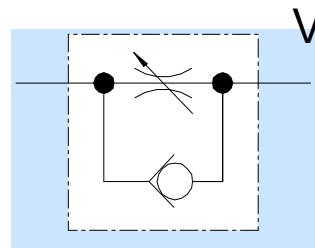
Speed controller structure



Ancillary Valve

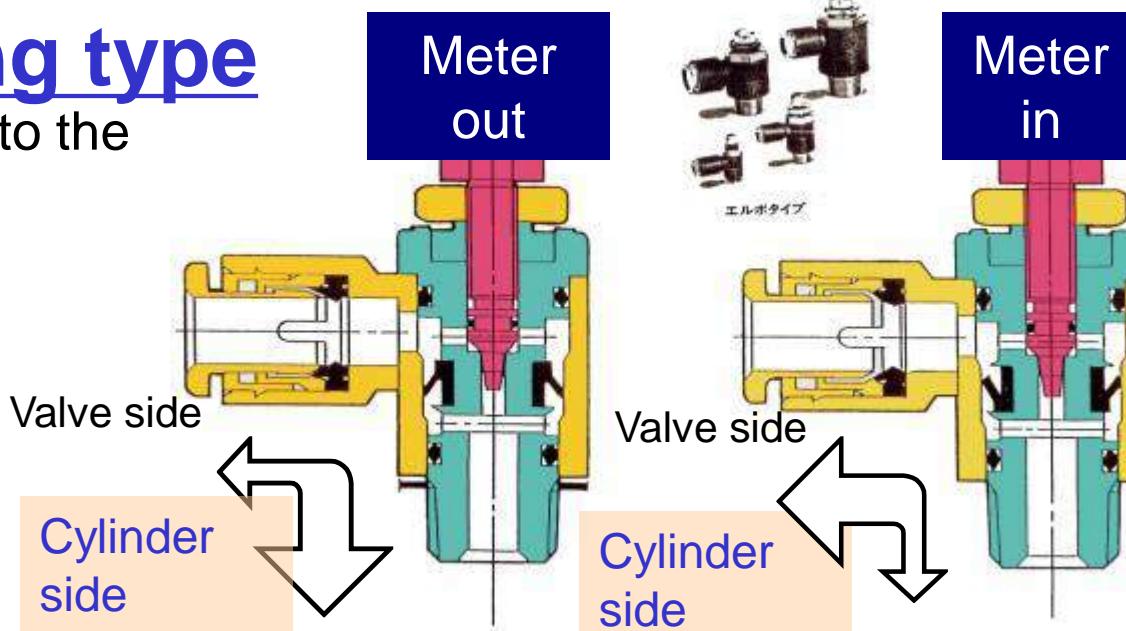
Inline type

Mounted in the middle of piping



Direct piping type

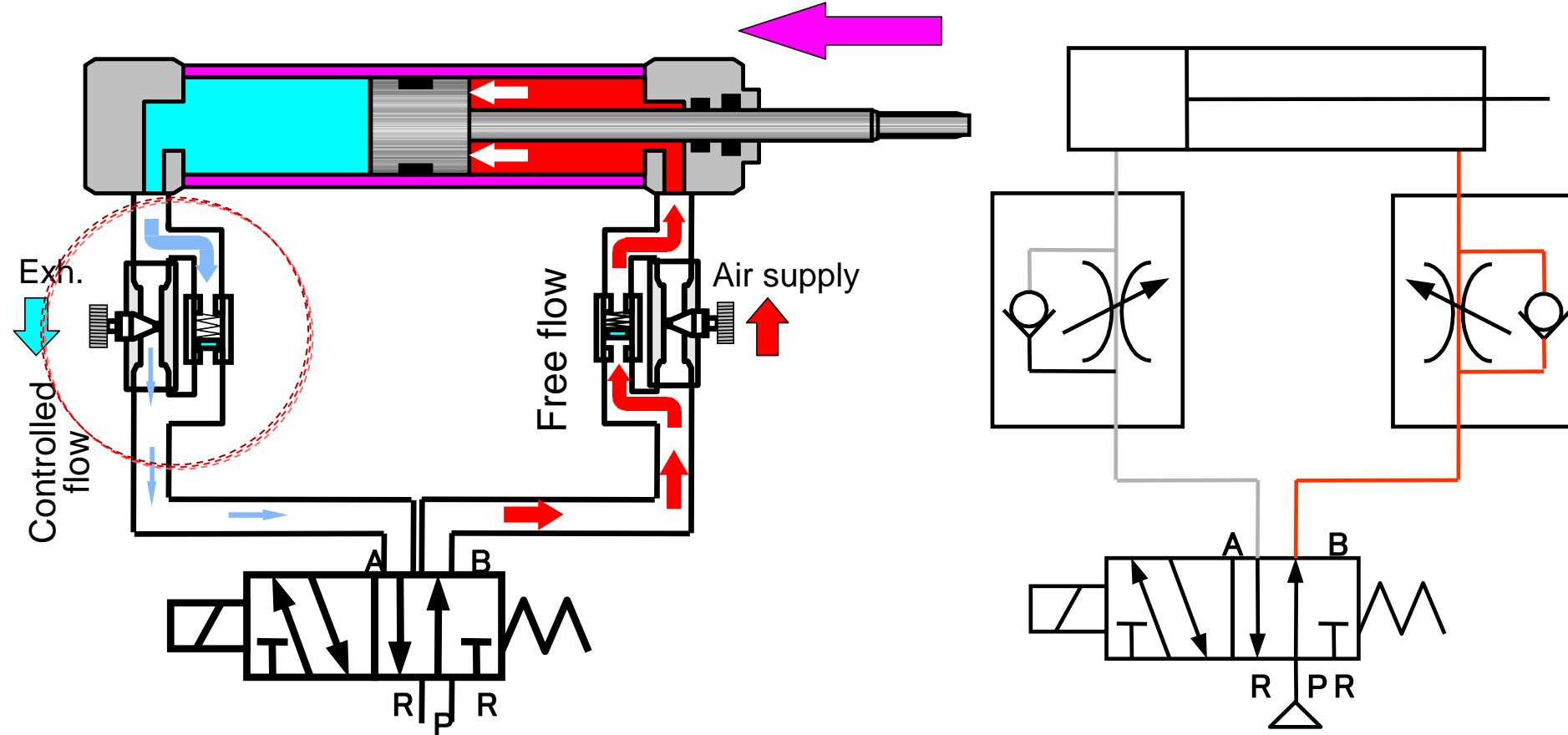
Mounted directly to the cylinder



Ancillary Valve

Meter Out control

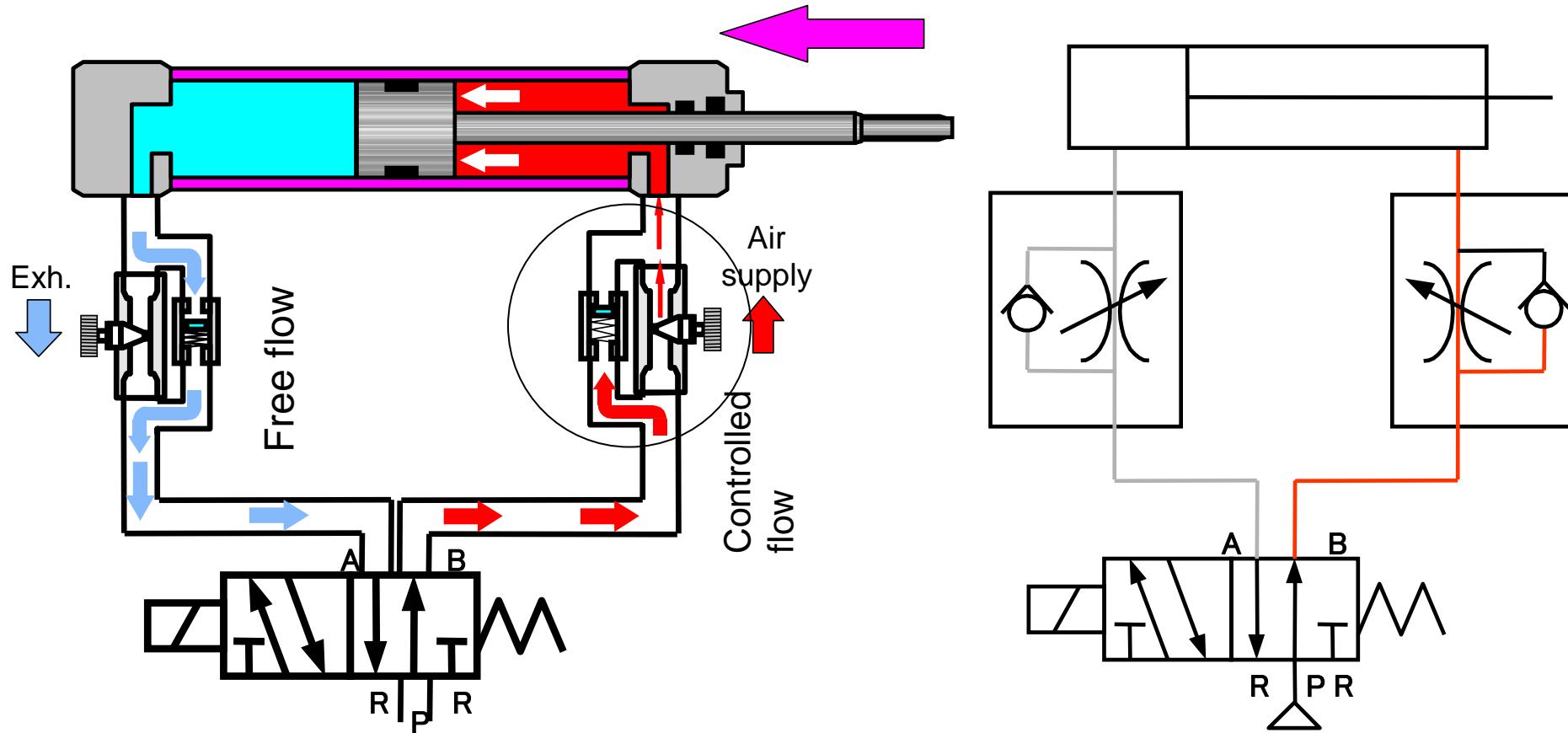
Adjust the exhausted air of the cylinder



Ancillary Valve

Meter In control

Adjust air entering the cylinder

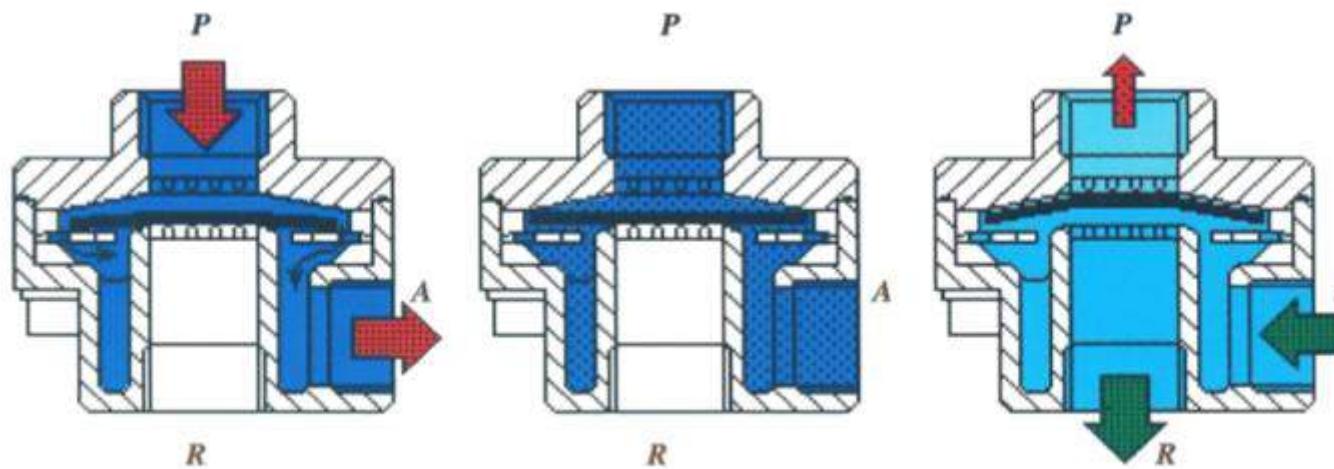
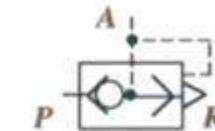


Precaution on Handling

1. Install the speed controller close to the actuator as much as possible (Faster response, easy to adjust)
2. In general, meter-out control is used.
3. Increase the speed by gradually increasing from low speed to specified speed. Fix with lock nut after adjustment.

Ancillary Valve

QUICK EXHAUST VALVE



Standard port threads are 1/8"; 1/4"; 3/8"; 1/2"; 3/4"; 1"; 1 1/4"; 1 1/2"

NOTE :

G = (B.S.P) *British Standard Pipe Parallel thread (mainly used in the European countries)*

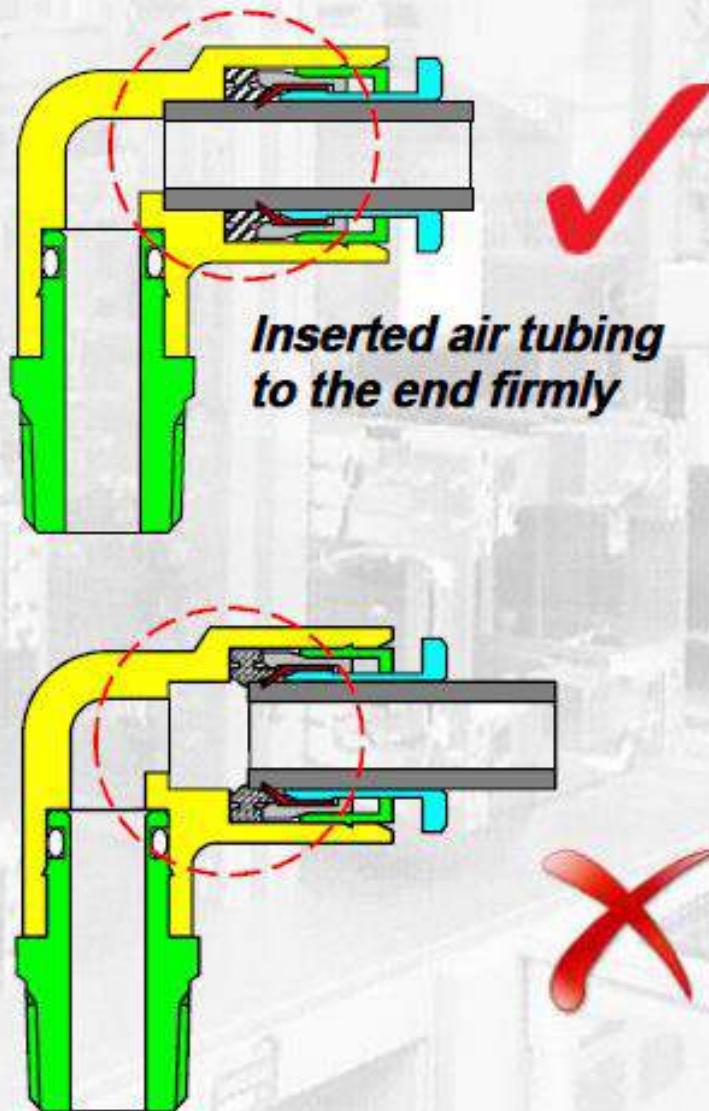
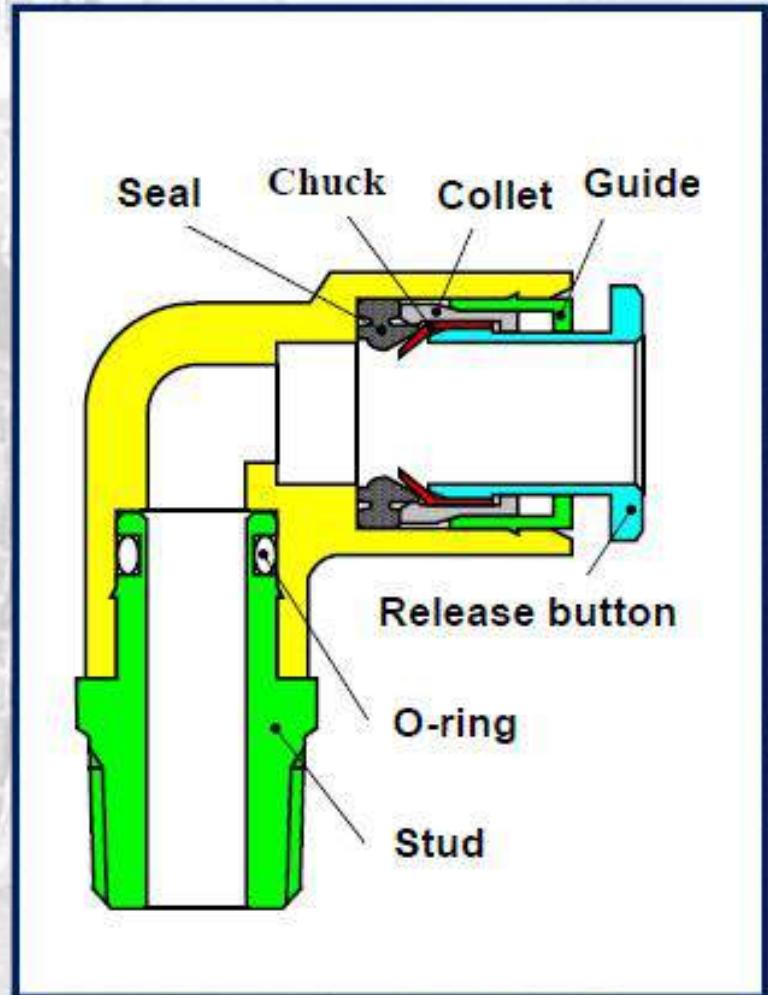
Rc = (B.S.P.T) *British Standard Pipe Tapered thread (mainly used in the Asian countries)*

NPT = *National Pipe Thread Tapered (mainly used in the USA)*

M = *Metric Thread, ie : M3 and M5 are used for miniaturised pneumatic components*

Ancillary Valve

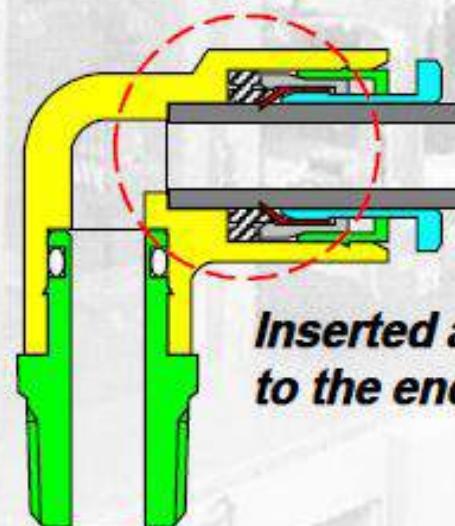
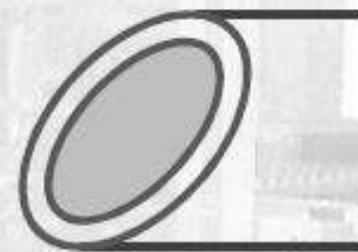
One-Touch Fittings



Ancillary Valve

Air Tubing

Air tubing needs to be cut **perpendicularly** with a specific tube cutter.



Inserted air tubing to the end firmly

Ancillary Valve

Exercise

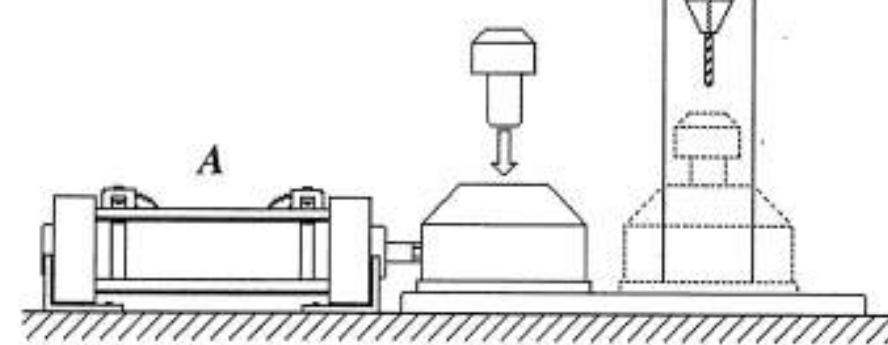
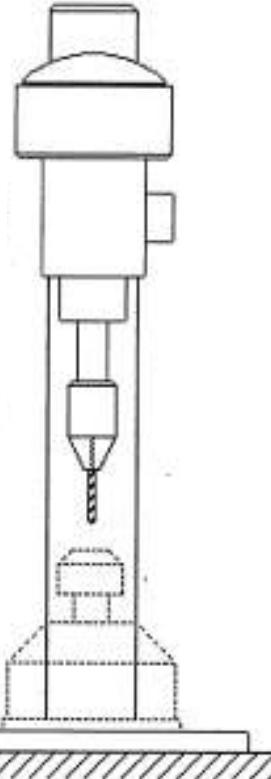
Parts are manually placed in a receptacle. A pneumatic cylinder A pushes the receptacle under the drilling operation. The drill feed unit is controlled by a pneumatic-hydraulic actuator B. After drilling, the cylinder A must not return until drill feed unit has reached its start position.

Part ត្រូវបានដាក់ចូលក្នុង កន្លែងដោយ ដែលបន្ទាប់មក Cylinder A

Extend រួច part ទៅកន្លែងស្តាន ដែលដើរដោយ Cylinder B

រយៈពេល 5 sec ។ Cylinder A មិនត្រូវត្រូលប់មកទីតាំងដើម្បី

ឡើយ ប្រសិនបើការស្តាន មិនទាន់ ចប់ (Cylinder B មិនទាន់មក
ដល់ទីតាំងដើម្បី) ។



Ancillary Valve



-- The End --