



FONTAL INDUSTRIAL CO., LTD.



Directional Control Valves



Actuators



Air Combination Unit



Additional Equipment



*World's Leading Contributor Among the
Mechanical Engineering Industry*

WWW.FONTAL-AUTO.COM



FONTAL INDUSTRIAL CO., LTD.

PNEUMATIC AUTOMATION COMPONENTS



WWW.FONTAL-AUTO.COM



History

- 1956** Fontal Trading Co., LTD. was founded.
- 1974**
 - Exclusive agency for KURODA in Taiwan.
 - Agency for NKE, Legris, BIMBA, etc.
- 1989**
 - Introduced latest technology from Japan.
 - Taipei Plant was constructed specializes in developing and manufacturing pneumatic components.
- 2002** Ended exclusive agency for KURODA.
- 2003** Started cooperating with Japanese manufacturers for flagship brand FONTAL.
- 2005** FONTAL's products approached international market and participated in global exhibitions.
- 2006** Taipei Plant was expanded.
- 2007** Zuzhou Plant was constructed.
- 2013** Started production and sales of Servo Motor.
- 2014** All products meet the requirements of ISO-9001



FONTAL

FONTAL INDUSTRIAL CO., LTD.

About Us

FONTAL was founded in 1956 and fully representing the KURODA pneumatic components for over 40 years until year of 2002, 3 years after KURODA was acquired by Parker in 1999.

FONTAL is concentrating on industrial upgrading for automation and delivers high-quality and reliable products. Based upon the solid foundation, FONTAL is able to provide and guarantee products' stability, longevity, and their superior quality in order to become world's leading contributor among the mechanical engineering industry.

Since 1989, FONTAL strives in meeting customer' needs and requirements. Because FONTAL has acquired the latest technology from Japan and established Pneumatic Cylinder Processing Plant, which provides and customizes a variety of products to the customers in an efficient, timely manner. These guarantees are the edges of the company, differentiating us from others and making us standing out in this industry.

FONTAL is leading the industry in the categories of safety operation features, and the usage longevity among the products such as Solenoid Valve and HI-ROTOR. In addition, the company materializes its promises into product warranties thus customers need not worry about the product's maintaining and repairing issues.

Since when it was first founded in 1956, over 50 years FONTAL has strived and insisted on using the best parts and spare parts for the products to deliver first-class business solutions to our customers through superior products. Concentration leads to professionalism. That is FONTAL's motto.



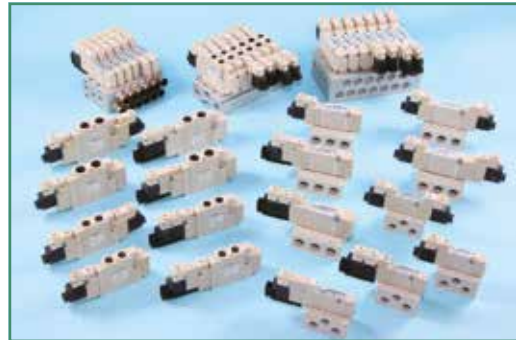
FONTAL

Actuators



MINIATURE HI-ROTOR/PRN Series
 Standard type
 Variable oscillation angle type
 Switch unit
 HI-ROTOR/PRN Series
 HYDRO-CUSHION/CRN Series
 AIR-HYDRO HI-ROTOR/PRF Series
 HYDRAULIC HI-ROTOR/HRN Series
 FLAT CYLINDER/X Series
 Standard type
 Double rod type
 Custom made
 MINIATURE CYLINDER/Z Series
 Standard type
 Non-rotating piston rod type
 MINIATURE CYLINDER/J Series
 Standard type
 Double rod type
 With air cushion type
 Direct mount type
 Custom made
 AIR CYLINDER/K Series
 Standard type
 Double rod type
 Custom made
 AIR CYLINDER/A Series
 Heavy duty type
 AIR CYLINDER WITH LOCK MECHANISM
 AIR CYLINDER WITH BRAKE MECHANISM
 FLOAT COUPLER
 SHOCK ABSORBER
 M TYPE REED SWITCH
 M TYPE PROXIMITY SWITCH

Directional Control Valves



2 PORT SOLENOID VALVE/
 AS Series
 2•3 PORT SOLENOID VALVE/
 SS Series
 3 PORT MINIATURE SOLENOID VALVE/
 SS Series
 3 PORT SOLENOID VALVE/
 AS307 Series
 5 PORT SOLENOID VALVE/
 PC5, RC5 Series
 PC13, RC13 Series
 5 PORT LATCHED TYPE SOLENOID VALVE
 3 PORT MINIATURE SOLENOID VALVE/
 A00 Series
 5 PORT SOLENOID VALVE/
 A05, 12, 20 Series
 4•5 PORT SOLENOID VALVE/
 PC06, RC06 Series
 PC08, RC08 Series
 PC15 Series
 5 PORT SOLENOID VALVE/
 RK20 Series
 RK50 Series
 PK80 Series
 3•5 PORT SOLENOID VALVE/
 A Series
 3•5 PORT SOLENOID VALVE/
 PM Series
 MANUAL CONTROL VALVE/
 FMR Series
 HHV - HSV Series
 MECHANICAL VALVE/
 MSV Series
 3•5 PORT AIR OPERATED VALVE/
 VC Series, YC Series, V Series
 5 PORT AIR OPERATED VALVE/
 VM Series

Additional Equipment



SPEED CONTROLLER WITH PUSH-IN FITTING
 SPEED CONTROLLER
 METERING VALVE
 CHECK VALVE
 PERMANENT STOP
 PUSH-IN FITTING
 TUBE
 MINIATURE IN-LINE FILTER FOR VACUUM
 AIR MUFFLER
 CLEANUP MUFFLER
 ROTARY JOINT

Air Combination Unit



QUBE SERIES AIR FILTER
 QUBE SERIES COALESCING FILTER
 QUBE SERIES SLUDGE FILTER
 QUBE SERIES AIR REGULATOR
 QUBE SERIES INTEGRAL FILTER-REGULATOR
 QUBE SERIES AIR LUBRICATOR
 QUBE SERIES AIR COMBINATION UNIT
 QUBE SERIES SHUT-OFF VALVE
 QUBE SERIES PRESSURE SWITCH
 QUBE SERIES ATTACHMENT
 AIR FILTER
 Standard type
 Miniature type
 COALESCING FILTER
 SLUDGE FILTER
 Standard type
 Miniature type
 MICRO MIST FILTER
 Standard type
 Miniature type
 AIR REGULATOR
 Standard type
 Miniature type
 AIR LUBRICATOR
 Standard type
 Miniature type
 INTEGRAL FILTER-REGULATOR
 Standard type
 Miniature type
 AIR COMBINATION UNIT
 Miniature type
 Standard type
 WATER REGULATOR
 RELIEF VALVE
 DRAIN VALVE
 PRECISION PRESSURE REGULATOR
 PILOT REGULATOR

Actuators

Actuators

MINIATURE HI-ROTOR PRN Series

Vane type rotary actuator



| Model No. | Vane Type | Oscillation angle | Oscillation starting point | Output torque N.cm (kgf.cm) | Switch | Accessories |
|-----------|-------------|-------------------|----------------------------|-----------------------------------|--|-----------------------------|
| PRNA1S | Single vane | 90° | 90° | 10.7 (1.1) | | Flange Plate, Foot Plate |
| | | 180° | | | | |
| PRNA3S | | 90° | 90° | 27.4 (2.8) | FR-3PRNA FU-3PRNA SR-3,SU-3 | |
| | | 180° | | | | |
| PRNA10S | | 90° | 90° | 84.3 (8.6) | FR-10PRNA FU-10PRNA SR-10 SU-10 | |
| | | 180° | | | | |
| | | 270° | 45° | | | |
| PRNA20S | | 90° | 90° | 156 (16) | FR-20PRNA FU-20PRNA SR-20,SU-20 | |
| | | 180° | 90° | | | |
| PRN30S | | | 90° | 45° | 313 (32) | |
| | | 180° | | | | |
| | | 270° | | | | |
| PRN30D | Double Vane | 90° | 45° | 755 (77) | | |

《Note》 Pressure Range:0.49MPa(5kgf/cm²)

MINIATURE HI-ROTOR PRO Series

Variable oscillation angle type



| Model No. | Vane Type | Oscillation angle | Oscillation starting point | Output torque N.cm (kgf.cm) | Switch | Accessories |
|-----------|-------------|-------------------|----------------------------|-----------------------------|------------------------|--|
| PROA3S | Single vane | 30° ~180° | 90° | 27.4 (2.8) | FR-3PROA FU-3PROA | Flange Plate, Foot Plate, Protective Cover |
| | | | | 84.3 (8.6) | FR-10PROA FU-10PROA | |
| PROA10S | | | | | 156 (16) | |
| PROA20S | | | | | | |
| PRO30S | Double Vane | 30° ~270° | 45° | 313 (32) | FR-30PRO FU-30PRO | |
| PRO30D | | 30° ~90° | | 755 (77) | | |

《Note》 Pressure Range:0.49MPa(5kgf/cm²)

SWITCH UNIT FOR MINIATURE HI-ROTOR

Proximity type



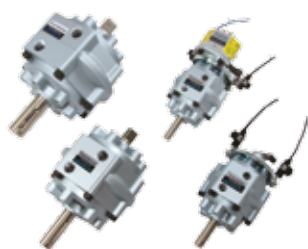
| Model No. | Load Voltage (V) | Load current (mA) | Wiring | Indicator light | Applicable unit |
|-----------|------------------|-------------------|-----------|-----------------|--------------------|
| SR-□ | DC5~30 | 5~200 | Lead wire | Provided | PRN3~30 |
| CT-3□ | DC5~30 | 5~200 | Lead wire | Provided | PRN1~30 PRO3~30 |
| CT-3□U | | | | | |
| CTP-3□ | DC5~30 | 5~200 | Lead wire | Provided | |

《Note》 CT-3: PNP Specifications

Actuators

HI-ROTOR PRN Series

Vane type rotary actuator



| Model No. | Vane Type | Oscillation angle | Oscillation starting point | Output torque N.cm (kgf.cm) | Switch | Accessories |
|-----------|-------------|-------------------|----------------------------|-----------------------------|--------|---|
| PRN50S | Single vane | 90° | 45° | 470 (48) | FM50 | Flange Plate, Foot Plate, Hydro-cushion |
| | | 180° | 45° | | | |
| | | 270° | 45° | | | |
| | | 280° | 40° | | | |
| PRN150S | | 90° | 45° | 1470 (150) | FM150 | |
| | | 180° | 45° | | | |
| | | 270° | 45° | | | |
| | | 280° | 40° | | | |
| PRN300S | | 90° | 45° | 2794 (285) | FM300 | Foot Plate, Hydro-cushion |
| | | 180° | 45° | | | |
| | | 270° | 45° | | | |
| | | 280° | 40° | | | |
| PRN800S | | 90° | 45° | 10032 (1023) | FM800 | |
| | | 180° | 45° | | | |
| | | 270° | 45° | | | |
| | | 280° | 40° | | | |
| PRN50D | Double Vane | 90° | 45° | 1019 (104) | FM50 | Flange Plate, Foot Plate, Hydro-cushion |
| | | 100° | 40° | | | |
| PRN150D | | 90° | 45° | 3432 (350) | FM150 | |
| | | 100° | 40° | | | |
| PRN300D | | 90° | 45° | 6668 (680) | FM300 | Foot Plate, Hydro-cushion |
| | | 100° | 40° | | | |
| PRN800D | | 90° | 45° | 20152 (2055) | FM800 | |
| | | 100° | 40° | | | |

《Note》 Pressure Range:0.49MPa(5kgf/cm²)

HYDRO-CUSHION CRN Series

Shock absorber for HI-ROTOR



| Model No. | Oscillation angle | Oscillation starting point | Range of load kg.cm ² (kgf.cm.csc ²) | Max. absorbed energy mJ(kgf.cm) | Applicable HI-ROTOR |
|-----------|-------------------|----------------------------|---|------------------------------------|---------------------|
| CRN50 | 90° | 45° | 981 (1) | 2942 (30) | PRN50 |
| | 100° | 40° | | | |
| | 180° | 45° | | | |
| | 270° | 45° | | | |
| | 280° | 40° | | | |
| CRN150 | 90° | 45° | 2942 (3) | 9807 (100) | PRN150 |
| | 100° | 40° | | | |
| | 180° | 45° | | | |
| | 270° | 45° | | | |
| | 280° | 40° | | | |
| CRN300 | 90° | 45° | 5884 (6) | 19613 (200) | PRN300 |
| | 100° | 40° | | | |
| | 180° | 45° | | | |
| | 270° | 45° | | | |
| | 280° | 40° | | | |
| CRN800 | 90° | 45° | 19613 (20) | 58840 (600) | PRN800 |
| | 100° | 40° | | | |
| | 180° | 45° | | | |
| | 270° | 45° | | | |
| | 280° | 40° | | | |

Actuators

CUSTOM MADE HI-ROTOR



AIR-HYDRO HI-ROTOR PRF Series

PRF series are exclusively used for air-hydro systems and are suitable for operation at low speed

PRF 50S, 150S, 300S, 800S
PRF 50D, 150D, 300D, 800D

HYDRAULIC HI-ROTOR WITH CUSHION HRN Series

Hydraulic vane type rotary actuator with cushion mechanism



| Model No. | Max. oscillation angle | Rated pressure MPa(kgf/cm ²) | Min. operating pressure MPa(kgf/cm ²) | Allowable load N(kgf) | |
|------------|------------------------|---|--|-----------------------|---------------|
| | | | | Radial | Thrust |
| HRN-10S-C | 180° | 7 (70) | 1 (10) | 9.8 (1) | 4.9 (0.5) |
| | 90° | | | | |
| HRN-15S-C | 180° | | | 19.6 (2) | 9.8 (1) |
| | 90° | | | | |
| HRN-20S-C | 180° | | | 49 (5) | 24.5 (2.5) |
| | 90° | | | | |
| HRN-30S-C | 180° | | | 78.4 (8) | 39.2 (4) |
| | 90° | | | | |
| HRN-100S-C | 180° | | | 147 (15) | 68.6 (7) |
| | 90° | | | | |
| HRN-200S-C | 180° | | | 294 (30) | 137.2 (14) |
| | 90° | | | | |
| HRN-400S-C | 180° | | | 343 (35) | 166.6 (17) |
| | 90° | | | | |
| HRN-700S-C | 180° | | | 343 (35) | 166.6 (17) |
| | 90° | | | | |

- Shaft/Double end(keyway and square)
- Mounting/Flange mounting

Actuators

FLAT CYLINDER X Series

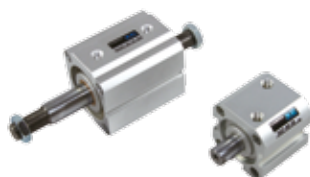
Slim and space-saving design suitable for clamping work



| Series | Acting | Bore size (mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm²) |
|--|-----------------------------|-------------------|---------------------------------|--------------------------------|
| XC 1 (No magnet) XG 1 (Built-in magnet) | Singe acting (Extended) | φ 10 | 5,10 | 0.25~0.7(2.5~7) |
| | | φ 16 | | 0.2~0.7 (2~7) |
| | | φ 20 | | |
| | | φ 25 | | |
| | | φ 32 | | |
| | | φ 40 | | |
| | φ 50 | 5,10,15,20 | | |
| XC 0 (No magnet) XG 0 (Built-in magnet) | Singe acting (Retracted) | φ 10 | 5,10 | 0.25~0.7(2.5~7) |
| | | φ 16 | | 0.2~0.7 (2~7) |
| | | φ 20 | | |
| | | φ 25 | | |
| | | φ 32 | | |
| | | φ 40 | | |
| | φ 50 | 5,10,15,20 | | |
| XC 2 (No magnet) XG 2 (Built-in magnet) | Double acting | φ 10 | 5,10 | 0.1~0.7 (1~7) |
| | | φ 16 | | |
| | | φ 20 | 5,10,15,20,25 30,35,40,45,50 | |
| | | φ 25 | | |
| | | φ 32 | | |
| | | φ 40 | | |
| | | φ 50 | | |
| | | φ 63 | 10,20,30,40,50 | 0.05~0.7 (0.5~7) |
| | | φ 80 | | |
| | | φ 100 | | |
| | | | | |

- Rod end screw/ Female screw(Standard), Male screw
- Mounting/Nose(Standard), Both sides tap
- Switch/M type switch(reed type, proximity type) mountable.
- Cushion/No cushion(Standard), Rubber cushion (Double acting only)

FLAT CYLINDER DOUBLE ROD TYPE X□7 Series



| Series | Acting | Bore size (mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm²) |
|--|---------------|----------------|---|-----------------------------|
| XC 7 (No magnet) XG 7 (Built-in magnet) | Double acting | φ 10 | 5, 10, 15, 20, 25 | 0.1~0.7 (1~7) |
| | | φ 16 | 30 | |
| | | φ 20 | 5, 10, 15, 20, 25 30, 35, 40, 45, 50 | |
| | | φ 25 | | |
| | | φ 32 | | |
| | | φ 40 | | |
| | | φ 50 | | |
| | | φ 63 | 10, 20, 30, 40, 50 | 0.05~0.7 (0.5~7) |
| | | φ 80 | | |
| | | φ 100 | | |

- Rod end screw/ Female screw(Standard), Male screw
- Mounting/Nose(Standard), Both sides tap
- Switch/M type switch(reed type, proximity type) mountable.
- Cushion/No cushion(Standard), Rubber cushion (Double acting only)

Actuators

CUSTOM MADE CYLINDER

SINGLE ROD DUAL STROKE FLAT CYLINDER X□D2 Series

This cylinder consists of two cylinders connected in series and united as one unit



| Acting | Double acting |
|---|---|
| Bore size(mm) | φ 10, φ 16, φ 20, φ 25, φ 32, φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range MPa(kgf/cm ²) | φ 10~φ 50 : 0.1~0.7(1~7) φ 63~φ 100 : 0.05~0.7(0.5~7) |

DOUBLE ROD DUAL STORK FLAT CYLINDER X□D7 Series

This cylinder consists of two cylinders connected back to back to form one unit



| Acting | Double acting |
|---|---|
| Bore size(mm) | φ 10, φ 16, φ 20, φ 25, φ 32, φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range MPa(kgf/cm ²) | φ 10~φ 50 : 0.1~0.7(1~7) φ 63~φ 100 : 0.05~0.7(0.5~7) |

ADJUSTABLE STROKE FLAT CYLINDER X□A7 Series

On the end where the rod is extended, the stroke is adjustable with a stopper within a range of 0 to 10mm



| Acting | Double acting |
|---|---|
| Bore size(mm) | φ 10, φ 16, φ 20, φ 25, φ 32, φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range MPa(kgf/cm ²) | φ 10~φ 50 : 0.1~0.7(1~7) φ 63~φ 100 : 0.05~0.7(0.5~7) |

ADJUSTABLE STROKE FLAT CYLINDER X□A2 Series

On the rod retracted end, the stroke is adjustable with an adjustable bolt within a range of 0 to 10mm



| Acting | Double acting |
|---|---|
| Bore size(mm) | φ 10, φ 16, φ 20, φ 25, φ 32, φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range MPa(kgf/cm ²) | φ 10~φ 50 : 0.1~0.7(1~7) φ 63~φ 100 : 0.05~0.7(0.5~7) |

Actuators

MINIATURE CYLINDER Z Series

Bore Ø10, Ø16 built-in magnet is a standard equipment. Non-lubricated air applicable



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------------------|---------------|----------------------|--|
| ZC1 | Single acting (Extended) | φ 2.5 | 5,10 | 0.35~0.7 (3.5~7) |
| | | φ 4 | | |
| | | φ 6 | 15,30,45,60 | 0.3~0.7 (3~7) |
| | | φ 10 | | 0.15~0.7 (1.5~7) |
| | | φ 16 | | |
| ZC0 | Single acting (Retracted) | φ 6 | 15,30,45,60 | 0.3~0.7 (3~7) |
| | | φ 10 | | 0.15~0.7 (1.5~7) |
| | | φ 16 | | |
| ZG2 | Double acting | φ 6 | 15,30,45,60 | 0.12~0.7 (1.2~7) |
| | | φ 10 | | 0.1~0.7 (1~7) |
| | | φ 16 | | |

- Mounting/Bore Ø2.5~ Ø4: Nose mounting only
Bore Ø6, Ø10, Ø16: Nose, Foot, Flange and Female clevis mounting
- Switch/ Bore Ø6, Ø10, Ø16: M type switch (reed type, proximity type) mountable.
- Cushion/Bore Ø2.5, Ø4: Non-cushion
Bore Ø6, Ø10, Ø16: Rubber cushion

NON-ROTATING PISTON ROD CYLINDER Z□U Series



| Series | Acting | Bore size (mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------------------|----------------|----------------------|--|
| ZCU1 | Single acting (Extended) | φ 10 | 15,30,45,60 | 0.15~0.7 (1.5~7) |
| | | φ 16 | | |
| ZCU0 | Single acting (Retracted) | φ 10 | 15,30,45,60 | 0.15~0.7 (1.5~7) |
| | | φ 16 | | |
| ZGU2 | Double acting | φ 10 | 15,30,45,60 | 0.1~0.7 (1~7) |
| | | φ 16 | | |

MINIATURE CYLINDER J Series

Built-in magnet is a standard equipment. Non-lubricated air applicable



| Series | Acting | Bore size (mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------------------|----------------|-------------------------|--|
| JC1 | Single acting (Extended) | φ 20 | 15,25,50 | 0.2~0.7 (2~7) |
| | | φ 25 | 25,50 | |
| JC0 | Single acting (Retracted) | φ 20 | 15,25,50 | |
| | | φ 25 | 25,50 | |
| JG2 | Double acting | φ 20 | 15,25,50,75,100 | 0.1~0.7 (1~7) |
| | | φ 25 | 25,50,75,100 | |
| | | φ 32 | 25,50,75,100 125,150 | |
| | | φ 40 | 50,75,100 125,150 | |

- Mounting/ Nose, Foot, Flange and Male clevis mounting
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Rubber cushion(Standard), Air cushion(Double acting only)

Actuators

MINIATURE CYLINDER DOUBLE ROD TYPE J□7 Series



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|-------------------------|--|
| JG7 | Double acting | φ 20 | 15,25,50,75,100 | 0.1~0.7 (1~7) |
| | | φ 25 | 25,50,75,100 | |
| | | φ 32 | 25,50,75,100 125,150 | |
| | | φ 40 | 50,75,100 125,150 | |

- Mounting/ Nose, Foot, Flange and Male clevis mounting
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Rubber cushion(Standard), Air cushion(Double acting only)

AIR CYLINDER WITH AIR CUSHION J Series



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|-------------------------|--|
| JG2-※B | Double acting | φ 20 | 15,25,50,75,100 | 0.1~0.7 (1~7) |
| | | φ 25 | 25,50,75,100 125,150 | |
| | | φ 32 | 25,50,75,100 125,150 | |
| | | φ 40 | 50,75,100 125,150 | |

- Mounting/ Nose, Foot, Flange and Male clevis mounting
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Built-in air cushion

DIRECT MOUNT CYLINDER J□E Series

The rectangular rod cover of the cylinder is directly mountable on the unit to be mated. Using this cylinder will result not only in saving space but also improving the mounting strength and accuracy



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|---------------------------------|---------------|---------------|-------------------------|--|
| JGES2 (Bottom) JGEF2 (Front) | Double acting | φ 20 | 15,25,50,75,100 | 0.1~0.7 (1~7) |
| | | φ 25 | 25,50,75,100 125,150 | |
| | | φ 32 | 25,50,75,100 125,150 | |
| | | φ 40 | 50,75,100 125,150 | |

- Mounting/ Bottom surface, Front surface
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Rubber cushion

CUSTOM MADE CYLINDER

SINGLE ROD DUAL STROKE CYLINDER J□D2 Series

This cylinder consists of two cylinders connected in series and united as one unit



| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |

DOUBLE ROD DUAL STORK CYLINDER J□D7 Series

This cylinder consists of two cylinders connected back to back to form one unit



| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |

CUSTOM MADE CYLINDER



ADJUSTABLE STROKE CYLINDER J□A7 Series

On the end where the rod is extended, the stroke is adjustable with a stopper within a range of 0 to 50mm

| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |



ADJUSTABLE STROKE CYLINDER J□A2 Series

On the rod retracted end, the stroke is adjustable with an adjustable bolt within a range of 0 to 50mm

| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |



LOW-SPEED CYLINDER J□J2 Series

None stick operation at 10mm/s

| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |



HIGH-TEMPERATURE CYLINDER J□X2 Series

Made of heat-resistant materials which can operate at high temperatures up to 150 °C

| | |
|----------------|-------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.1~0.7MPa(1~7kgf/cm ²) |



AIR-HYDRO CYLINDER J□O2 Series

Cylinder of this series are for air-hydro systems and are suitable for use at low speeds of 50mm/s or less

| | |
|----------------|--|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.12~0.7MPa(1.2~7kgf/cm ²) |



SHORT LENGTH CYLINDER J□ND2 Series

Cylinder short in overall length: The nose screw portion on the head cover has been cut off

| | |
|----------------|--|
| Acting | Double acting |
| Bore size(mm) | φ 20, φ 25, φ 32, φ 40 |
| Pressure range | 0.12~0.7MPa(1.2~7kgf/cm ²) |

Actuators

AIR CYLINDER K Series

Supplied with magnet. Multipurpose cylinder designed for easy selection of mountings



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|----------------------------------|--|
| KG2 | Double acting | φ 40 | 50,75,100 150,200, 250,300 | 0.05~1 (0.5~10) |
| | | φ 50 | | |
| | | φ 63 | | |
| | | φ 80 | | |
| | | φ 100 | | |

- Mounting/ Nose, Foot, Flange, Male clevis, Female clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable
- Cushion/ Both sides air cushion

AIR CYLINDER DOUBLE ROD TYPE K□7 Series



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|---------------------------------|--|
| KG7 | Double acting | φ 40 | 50,75,100 150,200 250,300 | 0.05~1 (0.5~10) |
| | | φ 50 | | |
| | | φ 63 | | |
| | | φ 80 | | |
| | | φ 100 | | |

- Mounting/ Nose, Foot, Flange, Male clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable
- Cushion/ Both sides air cushion

CUSTOM MADE CYLINDER

SINGLE ROD DUAL STROKE CYLINDER K□D2 Series

This cylinder consists of two cylinders connected in series and united as one unit



| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |

DOUBLE ROD DUAL STORK CYLINDER K□D7 Series

This cylinder consists of two cylinders connected back to back to form one unit



| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |

ADJUSTABLE STROKE CYLINDER K□A7 Series

On the end where the rod is extended, the stroke is adjustable with a stopper within a range of 0 to 50mm



| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |

CUSTOM MADE CYLINDER



ADJUSTABLE STROKE CYLINDER K□A2 Series

On the rod retracted end, the stroke is adjustable with an adjustable bolt within a range of 0 to 50mm

| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |



LOW-FRICTION CYLINDER K□K2 Series

Reduced piston sliding friction are suitable when smooth movement at low pressure is required

| | |
|----------------|--|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.01~0.7MPa(0.1~7kgf/cm ²) |



HIGH-TEMPERATURE CYLINDER K□X Series

Made of heat-resistant materials which can operate at high temperatures up to 150 °C

| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |



AIR-HYDRO CYLINDER K□O Series

Cylinder of this series are for air-hydro systems and are suitable for use at low speeds of 50mm/s or less

| | |
|----------------|---------------------------------------|
| Acting | Double acting |
| Bore size(mm) | φ 40, φ 50, φ 63, φ 80, φ 100 |
| Pressure range | 0.05~1MPa(0.5~10kgf/cm ²) |

AIR CYLINDER A Series

Heavy duty type cylinder



| Series | Acting | Bore size(mm) | Standard stroke (mm) | Pressure range MPa(kgf/cm ²) |
|--------------------------|---------------|---------------|-----------------------------------|--|
| AG2 (Built-in magnet) | Double acting | φ 125 | 100,150,200 250,300,400 500 | 0.05~1 (0.5~10) |
| | | φ 140 | | |
| | | φ 160 | | |
| | | φ 180 | | |
| | | φ 200 | | |

- Mounting/ Foot, Flange, Male clevis, Female clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable
- Cushion/ Both sides air cushion

Actuators

MINIATURE CYLINDER WITH LOCK MECHANISM JGL□ Series

Built-in drop prevention and designed to lock at stroke end



| Series | Acting | Bore size(mm) | Standard stroke(mm) | Lock position | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|-------------------------|------------------|--|
| JGL□2 | Double acting | φ 20 | 25,50,75,100 | Rod or head side | 0.1~0.7 (1~7) |
| | | φ 25 | 25,50,75,100 | | |
| | | φ 32 | 25,50,75,100 125,150 | | |
| | | φ 40 | 50,75,100 125,150 | | |

- Mounting/ Nose, Foot, Flange, and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Rubber cushion(Standard), Air cushion

AIR CYLINDER WITH LOCK MECHANISM KGL□ Series

Built-in drop prevention and designed to lock at stroke end



| Series | Acting | Bore size(mm) | Standard stroke(mm) | Lock position | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|---------------------------------|------------------|--|
| KGL□2 | Double acting | φ 40 | 50,75 100,150,200 250,300 | Rod or head side | 0.15~1 (1.5~10) |
| | | φ 50 | | | |
| | | φ 63 | | | |
| | | φ 80 | | | |
| | | φ 100 | | | |

- Mounting/ Nose, Foot, Flange, Male clevis, Female clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable
- Cushion/ Both sides air cushion

AIR CYLINDER WITH LOCK MECHANISM AGL□ Series

Built-in drop prevention and designed to lock at stroke end



| Series | Acting | Bore size(mm) | Standard stroke(mm) | Lock position | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|-----------------------------------|------------------|--|
| AGL□2 | Double acting | φ 125 | 100,150,200 250,300,400 500 | Rod or head side | 0.15~1 (1.5~10) |
| | | φ 140 | | | |
| | | φ 160 | | | |
| | | φ 180 | | | |
| | | φ 200 | | | |

- Mounting/ Foot, Flange, Male clevis, Female clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable.
- Cushion/ Both sides air cushion

AIR CYLINDER WITH BRAKE MECHANISM KGSP Series

High-precision orientation of brake cylinder arbitrary by air pressure



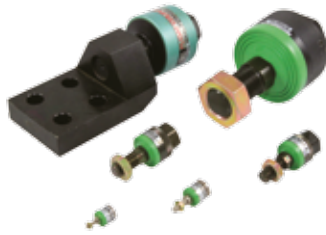
| Series | Acting | Bore size(mm) | Standard stroke (mm) | Service life | Pressure range MPa(kgf/cm ²) |
|--------|---------------|---------------|----------------------------------|--------------------|--|
| KGSP2 | Double acting | φ 40 | 50,75,100 150,200, 250,300 | >500 million times | 0.05~1 (0.5~10) |
| | | φ 50 | | | |
| | | φ 63 | | | |
| | | φ 80 | | | |
| | | φ 100 | | | |

- Mounting/ Nose, Foot, Flange, Male clevis, Female clevis and Center trunion mounting
- Switch/ M type switch (reed type, proximity type) mountable
- Cushion/ Both sides air cushion

Actuators

FLOAT COUPLER FCM Series

Absorbs inclination and eccentricity between cylinder and piston rod and aligns shaft center



| Model No. | Applicable cylinder bore size | Oscillation angle | Allowable eccentricity(mm) | Mounting |
|-------------|---------------------------------|-------------------|----------------------------|---|
| FCM3-0.5 | Z Series ϕ 6 | $\pm 5^{\circ}$ | 0.5 | Direct mounting |
| FCM4-0.7 | Z,X Series ϕ 10 | | | |
| FCM5-0.8 | Z Series ϕ 16 | | | |
| FCM8-1.25 | J Series ϕ 20 | | 0.75 | Direct mounting, Flange mounting, Foot mounting |
| FCM10-1.25 | X Series ϕ 32 | | | |
| FCM10-1.5 | J Series ϕ 25 | | | |
| FCM12A-1.25 | J Series ϕ 32 | | | |
| FCM14A-1.5 | J,K,X Series ϕ 40 | | | |
| FCM18A-1.5 | K,X Series ϕ 50, ϕ 63 | | 1.0 | |
| | | | 1.5 | |
| FCM22A-1.5 | K,X Series ϕ 80 | | 2.0 | |
| FCM26A-1.5 | K,X Series ϕ 100 | 3.0 | | |

M TYPE REED SWITCH



| Model No. | Rated voltage (V) | Rated current range(mA) | Wiring | Indicator light | Applicable actuator |
|-----------|-------------------|-------------------------|-----------|-----------------|--|
| MA-1 | AC110 | 5~45 | Lead wire | Provided | HI-ROTOR, Z, J, X, K and A series cylinder |
| | DC24 | 5~45 | | | |
| MD-1 | DC24 | 25~65 | | | |
| MD-3 | DC5~DC6 | ~50 | | | |
| MR | AC,DC5~110 | ~50 | | | |
| MA-2L | AC110 | 5~150 | | | |
| MA-2H | AC220 | 5~150 | | | |
| | | | | Not provided | |
| | | | | Provided | |

M TYPE PROXIMITY SWITCH



| Model No. | Rated voltage (V) | Rated current range(mA) | Wiring | Indicator light | Applicable actuator |
|-----------|-------------------|-------------------------|-------------|-----------------|----------------------------------|
| MT-3 | DC5~30 | 5~200 | 3-Lead wire | Provided | Z, J, X, K and A series cylinder |
| MT-3U | | | | | |
| MT-2 | DC24 (DC10~30) | 5~200 | 2-Lead wire | Provided | |
| MT-2U | | | | | |

Actuators

SHOCK ABSORBER SA, SAE, SAR Series

Compact design and large absorbing capacity. Various types are available according to your load and speed requirements



| Model No. | Adjustment | Stroke absorption (mm) | Max. absorbed energy J(kgf.m) | Max. collision speed (m/s) | Option |
|-------------|-------------------------------|------------------------------|-------------------------------------|----------------------------------|---|
| SA-0805AA1 | Fixed type | 5 | 0.392(0.04) | 1 | Stopper nut, Deflection angle adapter |
| SA-0805AA2 | | | 0.686(0.07) | | |
| SA-1005AA1 | | 5 | 0.686(0.07) | 1 | |
| SA-1005AA2 | | | 0.98(0.1) | | |
| SA-1008AA1 | | 8 | 0.98(0.1) | 1 | |
| SA-1008AA2 | | | 1.47(0.15) | | |
| SA-1210AA1 | | 10 | 1.96(0.2) | 1 | |
| SA-1210AA2 | | | 2.45(0.25) | | |
| SA-1412AC1 | | 12 | 3.92(0.4) | 1.5 | |
| SA-1412AC2 | | | 5.88(0.6) | | |
| SA-1008BB1 | Analog adjusting type | 8 | 1.47(0.15) | 1 | Stopper nut, Deflection angle adapter |
| SA-1210BB1 | | 10 | 2.94(0.3) | 2 | |
| SA-1410BB1 | | 10 | 3.92(0.4) | 1.5 | |
| SA-1612BB1 | | 12 | 9.8(1.0) | 2 | |
| SA-2016BB1 | | 16 | 29.4(3.0) | 1 | |
| SA-2530BB1 | | 30 | 49(5.0) | 1 | |
| SA-2540BB1 | | 40 | 63.7(6.5) | 1 | Stopper nut |
| SA-2725BB1 | | 25 | 79.4(8.1) | 3 | Stopper nut, Deflection angle adapter |
| SA-1008CC1 | Analog fine adjusting type | 8 | 1.76(0.81) | 3 | Stopper nut, Deflection angle adapter |
| SA-1210CC1 | | 10 | 4.9(0.5) | 3 | |
| SA-1410CC1 | | 10 | 5.88(0.6) | 3 | |
| SA-1612CC1 | | 12 | 9.8(1.0) | 3 | |
| SA-2016CC1 | | 16 | 29.4(3.0) | 3 | |
| SA-2530CC1 | | 30 | 49(5.0) | 3 | Stopper nut |
| SA-2540CC1 | | 40 | 63.7(6.5) | 3 | |
| SA-2725CC1 | | 25 | 79.4(8.1) | 3 | |
| SA-3035CC1 | | 35 | 196(20) | 3 | Stopper nut, Deflection angle adapter |
| SA-3650CC1 | | 50 | 392(40) | 3 | |
| SA-4250CC1 | | 50 | 441(45) | 3 | — |
| SA-4280CC1 | | 80 | 720(73.5) | 3 | |
| SA-1008CD1 | Analog fine adjusting type | 8 | 1.76(0.18) | 2 | Stopper nut, Deflection angle adapter |
| SA-1210CD1 | | 10 | 4.9(0.5) | 2 | |
| SA-1410CD1 | | 10 | 5.88(0.6) | 2 | |
| SA-1612CD1 | | 12 | 9.8(1.0) | 2 | |
| SA-2016CD1 | | 16 | 29.4(3.0) | 2 | |
| SA-2530CD1 | | 30 | 49(5.0) | 2 | |
| SA-2540CD1 | | 40 | 63.7(6.5) | 2 | Stopper nut |
| SA-2725CD1 | | 25 | 79.4(8.1) | 2 | Stopper nut, Deflection angle adapter |
| SA-3035CD1 | | 35 | 196(20) | 2 | |
| SA-3650CD1 | | 50 | 392(40) | 2 | — |
| SA-4250CD1 | | 50 | 441(45) | 2 | |
| SA-4280CD1 | | 80 | 720(73.5) | 2 | Stopper nut, Deflection angle adapter |
| SA-1214CCH | Analog fine adjusting type | 14 | 5.39(0.55) | 3 | |
| SA-1417CCH | | 17 | 14.7(1.5) | 3 | |
| SA-1620CCH | | 20 | 17.6(1.8) | 3 | |
| SAE-2010 | Fixed type | 10 | 19.6(2.0) | 2 | — |
| SAE-3020 | | 20 | 98(10) | 2 | |
| SAR-1415AC1 | Fixed type | 15 | 11.76(1.2) | 2 | Stopper nut |
| SAR-1415AC2 | | | 19.6(2) | | |

- SA: Spring return
- SAE: For emergency purpose
- SAR: Air return



FONTAL INDUSTRIAL CO., LTD.

Directional Control Valves

Directional Control Valves

2 PORT SOLENOID VALVE AS Series



Diaphragm

| Model No. | Type | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------|------|----------|-----------|-----------------------------------|---|
| AS2200 | Pilot | 2 | 2 | Rc1/4 | 17 | 0.05~0.7 (0.5~7) |
| AS2201A | | | | Rc3/8 | 48 | |
| AS2202 | | | | Rc1/2 | 100 | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire

2•3 PORT SOLENOID VALVE SS Series



Poppet

| Model No. | Type | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|--------|------|----------|-----------|-----------------------------------|---|
| SS2200 | Direct | 2 | 2 | Rc1/4 | 2.1 | 0~0.7 (0~7) |
| SS2300 | | 3 | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire

3 PORT MINIATURE SOLENOID VALVE SS Series



Poppet

| Model No. | Type | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|--------|------|----------|-----------|-----------------------------------|---|
| SS23F | Direct | 3 | 2 | M3 | 0.1 | 0~0.7(0~7) |
| SS23J | | | | M5 | 0.35 | 0~0.8(0~8) |
| SS231 | | | | M5,Rc1/8 | 0.6 | 0~1(0~10) |

- Voltage/ DC24V – SS23F
- AC110, 220V (50/60Hz), DC24V – SS23J
- AC110, 220V (50/60Hz), DC24V – SS231
- Wiring/Lead wire, Connector with lead wire – SS23F, SS23J
- Lead wire, Terminal grommet, Terminal conduit – SS231

3 PORT SOLENOID VALVE AS307

Compact size with high flow rate and long life.



Direct operate/Poppet

| Model No. | Type | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|--------|------|----------|-----------|-----------------------------------|---|
| AS307 | Direct | 3 | 2 | Rc1/8 | 4 | 0~0.9(0~9) |
| | | | | Rc1/4 | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, DIN connector

Directional Control Valves

5 PORT SOLENOID VALVE PC5, RC5 Series

Compact design with 15mm width. Flap type solenoid is mounted to assure long service life



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------------------|------|----------|-------------------|-----------|-----------------------------------|---|
| PCS245 | Sub-base mounting | 5 | Single | 2 | M5 Rc1/8 | 3.7(M5) 4(Rc1/8) | 0.2~0.8 (2~8) |
| PCD245 | | | Double | 3●Closed center | | 2.2(M5) 2.5(Rc1/8) | |
| PCD345 | | | | 3●Exhaust center | | | |
| PCE345 | | | | 3●Pressure center | | | |
| PCO345 | | | | | | | |
| RCS245 | In-line mounting | 5 | Single | 2 | M5 | 4 | 0.2~0.8 (2~8) |
| RCD245 | | | Double | 3●Closed center | | 2.2 | |
| RCD345 | | | | 3●Exhaust center | | | |
| RCE345 | | | | 3●Pressure center | | | |
| RCO345 | | | | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, Connector with lead wire

5 PORT SOLENOID VALVE PC13, RC13 Series

Compact design with 18mm width. Flap type solenoid is mounted to assure long service life



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------------------|------|----------|-------------------|-----------|-----------------------------------|---|
| PCS2413 | Sub-base mounting | 5 | Single | 2 | Rc1/4 | 12 | 0.2~0.8 (2~8) |
| PCD2413 | | | Double | | | 3●Closed center | |
| PCD3413 | | | | 3●Exhaust center | | | |
| PCE3413 | | | | 3●Pressure center | | 5 | |
| PCO3413 | | | | | | | |
| RCS2413 | In-line mounting | 5 | Single | 2 | Rc1/8 | 12.5 | 0.2~0.8 (2~8) |
| RCD2413 | | | Double | | | 3●Closed center | |
| RCD3413 | | | | 3●Exhaust center | | | |
| RCE3413 | | | | 3●Pressure center | | 5 | |
| RCO3413 | | | | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, Connector with lead wire

5 PORT LATCHED TYPE SOLENOID VALVE



Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm²) | Pressure range MPa (kgf/cm²) | | | |
|-----------|-------------------|------|--------------|----------|-----------|----------------------|------------------------------|--|--|--|
| PCL245 | Sub-base mounting | 5 | Latched type | 2 | M5,Rc1/8 | 3.5,3.8 (Rc1/8) | 0.2~0.8 (2~8) | | | |
| PCL2413 | | | | | Rc1/4 | 12 | | | | |
| RCL245 | In-line mounting | | | | M5 | 3.7 | | | | |
| RCL2413 | | | | | Rc1/8 | 12.5 | | | | |

- Voltage/DC24V
- Wiring/Lead wire, Connector with lead wire

Directional Control Valves

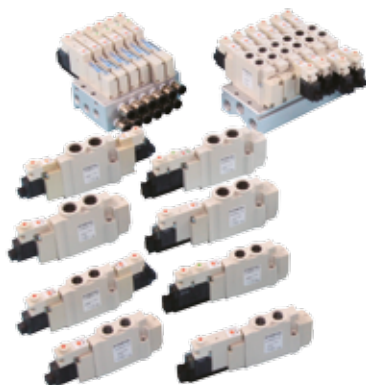
3 PORT MINITURE SOLENOID VALVE A00 Series

5 PORT SOLENIOD VALVE A05, 12, 20 Series

Body width remains the same, but the flow rate 1.5 to 3 times more than conventional valves

Direct Operate/ Poppet A00 Series

Pilot Operate/ Rubber seal A05, 12, 20 Series

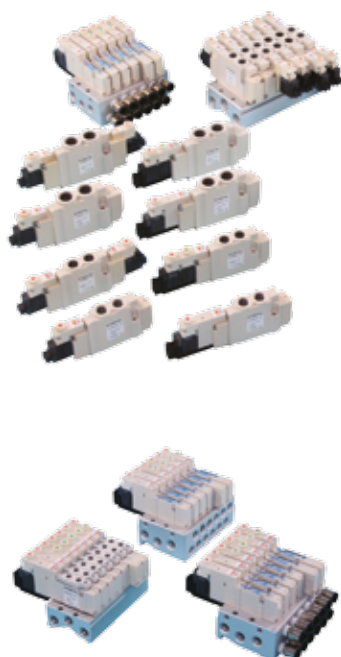


| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range (MPa) | | |
|-----------|-------------------|-----------------|-------------------|-------------------|-------------|-----------------------------------|----------------------|---------|-------------------|
| A00SC23 | Sub-base mounting | 3 | Single | 2•NC | M3 | 0.14 | 0~0.7 | | |
| A00SC23J | | | | 0.22 | | | | | |
| A00SO23 | | | | 0.14 | | 0~0.5 | | | |
| A00SO23J | | | | 0.22 | | | | | |
| A05PS25 | | 5 | Double | 2 | Rc1/8 | 5.8 | 0.15~0.7 | | |
| A05PD25 | | | | 0.1~0.7 | | | | | |
| A05PD35 | | | | 3•Closed center | | 4.5 | 0.2~0.7 | | |
| A05PE35 | | | | 3•Exhaust center | | | | | |
| A05PO35 | | | 3•Pressure center | 6.7 | | | | | |
| A05RS25 | In-line mounting | 5 | Single | 2 | M5 | 4 | 0.15~0.7 | | |
| A05RD25 | | | Double | | | 3•Closed center | 3.7 | 0.1~0.7 | |
| A05RD35 | | | | | | | | | 3•Exhaust center |
| A05RE35 | | | | 3•Pressure center | | | | | |
| A05RO35 | | | | 4.5 | | | | | |
| A12PS25 | | | Sub-base mounting | 5 | | Single | 2 | Rc1/4 | 11.1 |
| A12PD25 | Double | 3•Closed center | | | 7.6 | 0.1~0.7 | | | |
| A12PD35 | | | | | | | | | 3•Exhaust center |
| A12PE35 | | | | | | | | | 3•Pressure center |
| A12PO35 | | | | | | | | | |
| A12RS25 | In-line mounting | 5 | Single | 2 | Rc1/8 | 8.8 | 0.15~0.7 | | |
| A12RD25 | | | Double | | | 3•Closed center | 8.5 | 0.1~0.7 | |
| A12RD35 | | | | | | | | | 3•Exhaust center |
| A12RE35 | | | | | | | | | 3•Pressure center |
| A12RO35 | | | | | | | | | |
| A20PS25 | Sub-base mounting | 5 | Single | 2 | Rc1/4、Rc3/8 | 20.6 | 0.15~0.7 | | |
| A20PD25 | | | Double | | | 3•Closed center | 15.9 | 0.1~0.7 | |
| A20PD35 | | | | | | | | | 3•Exhaust center |
| A20PE35 | | | | | | | | | 3•Pressure center |
| A20PO35 | | | | | | | | | |
| A20RS25 | In-line mounting | 5 | Single | 2 | Rc1/4 | 17.6 | 0.15~0.7 | | |
| A20RD25 | | | Double | | | 3•Closed center | 15.7 | 0.1~0.7 | |
| A20RD35 | | | | | | | | | 3•Exhaust center |
| A20RE35 | | | | | | | | | 3•Pressure center |
| A20RO35 | | | | | | | | | |

- Voltage/ AC110(50/60Hz), DC24V
- Wiring/Plug-in connector

Directional Control Valves

Pilot Operate/ Rubber seal



| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range (MPa) |
|-----------|-------------------|------|----------|--------------------|---------------|-----------------------------------|----------------------|
| A05GD25 | Sub-base mounting | 5 | Double | 2 | Rc1/8 | 5.8 | 0.1~0.7 |
| A05GD35 | | | | 3•Closed center | | 4.5 | 0.2~0.7 |
| A05GE35 | | | | 3•Exhaust center | | | |
| A05GO35 | | | | 3•Pressure center, | | 6.7 | |
| A05FD25 | In-line mounting | 5 | Double | 2 | M5 | 4 | 0.1~0.7 |
| A05FD35 | | | | 3•Closed center | | 3.7 | 0.2~0.7 |
| A05FE35 | | | | 3•Exhaust center | | | |
| A05FO35 | | | | 3•Pressure center, | | 4.5 | |
| A12GD25 | Sub-base mounting | 5 | Double | 2 | Rc1/4 | 11.1 | 0.1~0.7 |
| A12GD35 | | | | 3•Closed center | | 7.6 | 0.2~0.7 |
| A12GE35 | | | | 3•Exhaust center | | | |
| A12GO35 | | | | 3•Pressure center, | | 14.1 | |
| A12FD25 | In-line mounting | 5 | Double | 2 | Rc1/8 | 8.8 | 0.1~0.7 |
| A12FD35 | | | | 3•Closed center | | 8.5 | 0.2~0.7 |
| A12FE35 | | | | 3•Exhaust center | | | |
| A12FO35 | | | | 3•Pressure center, | | 12 | |
| A20GD25 | Sub-base mounting | 5 | Double | 2 | Rc1/4 ~ Rc3/8 | 20.6 | 0.1~0.7 |
| A20GD35 | | | | 3•Closed center | | 15.9 | 0.2~0.7 |
| A20GE35 | | | | 3•Exhaust center | | | |
| A20GO35 | | | | 3•Pressure center, | | 20.5 | |
| A20FD25 | In-line mounting | 5 | Double | 2 | Rc1/4 | 17.6 | 0.1~0.7 |
| A20FD35 | | | | 3•Closed center | | 15.8 | 0.2~0.7 |
| A20FE35 | | | | 3•Exhaust center | | | |
| A20FO35 | | | | 3•Pressure center, | | 18.1 | |

- Voltage/DC24V
- Wiring/Plug-in connector

4.5 PORT SOLENOID VALVE PC06, RC06 Series

Pilot Operate/ Rubber seal



| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------------------|------|----------|------------------|-----------|-----------------------------------|---|
| PCS2406 | Sub-base mounting | 4 | Single | 2 | Rc1/4 | 10 | 0.2~1 (2~10) |
| PCD2406 | | | Double | 3•Closed center | | 9 | 0.2~0.8 (2~8) |
| PCD3406 | | | | 3•Exhaust center | | | |
| PCE3406 | | | | | | | |
| RCS2406 | In-line mounting | 5 | Single | 2 | Rc1/4 | 12 | 0.2~1 (2~10) |
| RCD2406 | | | Double | 3•Closed center | | 11 | 0.2~0.8 (2~8) |
| RCD3406 | | | | 3•Exhaust center | | | |
| RCE3406 | | | | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, Terminal grommet, Terminal conduit, DIN connector

Directional Control Valves

5 PORT SOLENOID VALVE PC08, RC08 Series



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------------------|-------------------|------------------|-------------------|-----------|-----------------------------------|---|
| PCS2408 | Sub-base mounting | 5 | Single | 2 | Rc3/8 | 30 | 0.2~0.8 (2~8) |
| PCD2408 | | | Double | 3●Closed center | | 25 | |
| PCD3408 | | | | 3●Exhaust center | | | |
| PCE3408 | | | | 3●Pressure center | | 19 | |
| PCO3408 | | | In-line mounting | 5 | Single | 2 | Rc3/8 |
| RCS2408 | Double | 3●Closed center | | | 25 | | |
| RCD2408 | | 3●Exhaust center | | | | | |
| RCD3408 | | 3●Pressure center | | | 19 | | |
| RCE3408 | Single | 2 | | | 30 | | |
| RCO3408 | Double | 3●Closed center | 25 | | | | |

● Voltage/ AC110, 220V (50/60Hz), DC24V

● Wiring/Lead wire, Terminal grommet, Terminal conduit, DIN connector

5 PORT SOLENOID VALVE PC15 Series



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|-------------------|------|----------|-------------------|-----------|-----------------------------------|---|
| PCS2415 | Sub-base mounting | 5 | Single | 2 | Rc1/2 | 70 | 0.2~0.8 (2~8) |
| PCD2415 | | | Double | | | 3●Closed center | |
| PCD3415 | | | | 3●Exhaust center | | 0.2~0.8 (2~8) | |
| PCE3415 | | | | 3●Pressure center | | | 45 |
| PCQ3415 | | | | | | | |

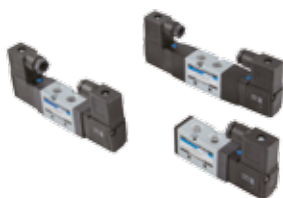
● Voltage/ AC110, 220V (50/60Hz), DC24V

● Wiring/Lead wire, Terminal grommet, Terminal conduit, DIN connector

5 PORT SOLENOID VALVE

High-flow rate, low-cost

RK20 Series



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa |
|-----------|------------------|------|----------|-------------------|-----------|-----------------------------------|--------------------|
| RKS2420 | In-line mounting | 5 | Single | 2 | Rc1/4 | 18 | 0.15~1.0 |
| RKD2420 | | | Double | 3•Closed center | | 14.4 | 0.1~10 |
| RKD3420 | | | | 3•Exhaust center | | | 0.15~1.0 |
| RKE3420 | | | | 3•Pressure center | | | |
| RKO3420 | | | Single | 2 | | 18 | |

● Voltage/ AC110, 220V (50/60Hz), DC24V

● Wiring/Lead wire, DIN connector

Directional Control Valves

RK50 Series



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range (MPa) |
|-----------|------------------|------|----------|-------------------|-----------|-----------------------------------|----------------------|
| RKS2450 | In-line mounting | 5 | Single | 2 | Rc3/8 | 45 | 0.15~1.0 |
| RKD2450 | | | Double | 3•Closed center | | 36 | 0.1~1.0 |
| RKD3450 | | | | 3•Exhaust center | | | 0.15~1.0 |
| RKE3450 | | | | 3•Pressure center | | | |
| RKO3450 | | | | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, DIN connector

PK80 Series



Pilot Operate/ Rubber seal

| Model No. | Mounting | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range (MPa) |
|-----------|-------------------|------|----------|-------------------|------------|-----------------------------------|----------------------|
| PKS2480 | Sub-base mounting | 5 | Single | 2 | Rc1/2, 3/4 | 80(Rc1/2) | 0.15~1.0 |
| PKD2480 | | | Double | 3•Closed center | | 90(Rc3/4) | 0.1~1.0 |
| PKD3480 | | | | 3•Exhaust center | | 70 | 0.15~1.0 |
| PKE3480 | | | | 3•Pressure center | | | |
| PKO3480 | | | | | | | |

- Voltage/ AC110, 220V (50/60Hz), DC24V
- Wiring/Lead wire, DIN connector

Directional Control Valves

3•5 PORT SOLENOID VALVE A Series

Main valve is of sleeve spool type with metal seal.

Heavy duty type solenoid valve made of aluminum alloy.

Usable in low vacuum application

Direct operate/Metal Seal/Sub-base Mounting



| Model No. | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) | |
|-----------|------|----------|----------|-----------------|-------------------------------------|---|-------------------------------------|
| AS2306 | 3 | Single | 2 | Rc1/8,1/4 | 9 | 0~1 (0~10) | |
| AS2406 | 5 | | | | Double | | 3●Closed center 3●Exhaust center |
| AD2406 | | 9 | | | | | |
| AD3406 | | | | | | | |
| ADE3406 | | | | | | | |
| AS2308 | 3 | Single | 2 | Rc1/4,3/8 | 22 | 0~1 (0~10) | |
| AS2408 | 5 | | | | Double | | 3●Closed center 3●Exhaust center |
| AD2408 | | 25 | | | | | |
| AD3408 | | | | | | | |
| ADE3408 | | | | | | | |
| AS2310 | 3 | Single | 2 | Rc1/4, 3/8, 1/2 | 38 | 0~1 (0~10) | |
| AS2410 | 5 | | | | Double | | 3●Closed center 3●Exhaust center |
| AD2410 | | | | | | | |
| AD3410 | | | | | | | |
| ADE3410 | | | | | | | |
| AS2315 | 3 | Single | 2 | Rc1/2,3/4 | 80 | 0~1 (0~10) | |
| AS2415 | 5 | | | | Double | | 3●Closed center 3●Exhaust center |
| AD2415 | | | | | | | |
| AD3415 | | | | | | | |
| ADE3415 | | | | | | | |
| AS2325 | 3 | Single | 2 | Rc1 | 190 | 0~1 (0~10) | |
| AS2425 | 5 | | | Double | 3●Closed center 3●Exhaust center | | Rc3/4,1,1¼ |
| AD2425 | | | | | | | |
| AD3425 | | | | | | | |
| ADE3425 | | | | | | | |

● Voltage/ AC110, 220V (50/60Hz)

● Wiring/Lead wire conduit (06 type only)
Terminal conduit (08~25 type)

Directional Control Valves

3•5 PORT SOLENOID VALVE PM Series

Main valve is of sleeve spool type with metal seal. Interface between sub-base and body is common to direct acting type solenoid valve A series



Pilot operate/Metal Seal/Sub-base Mounting

| Model No. | Port | Solenoid | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|------|----------|------------------|-----------------|-----------------------------------|---|
| PMS246 | 5 | Single | 2 | Rc1/8 | 6.5 | 0.15~1 (1.5~10) |
| PMD246 | | Double | 3•Closed center | | | |
| PMD346 | | | 3•Exhaust center | | | |
| PME346 | | | | | | |
| PMS2306 | 3 | Single | 2 | Rc1/8, 1/4 | 11 | 0.2~0.7 (2~7) |
| PMS2406 | 5 | Double | 3•Closed center | | 12.5 | 0.2~0.8 (2~8) |
| PMD2406 | | | 3•Exhaust center | | 12 | |
| PMD3406 | | | | | | |
| PME3406 | | | | | | |
| PMS2308 | 3 | Single | 2 | Rc1/4, 3/8 | 22 | 0.2~0.7 (2~7) |
| PMS2408 | 5 | Double | 3•Closed center | | 30 | 0.2~0.8 (2~8) |
| PMD2408 | | | 3•Exhaust center | | 25 | |
| PMD3408 | | | | | | |
| PME3408 | | | | | | |
| PMS2310 | 3 | Single | 2 | Rc3/8, 1/2 | 38 | 0.2~0.7 (2~7) |
| PMS2410 | 5 | Double | 3•Closed center | | 50 | 0.2~0.8 (2~8) |
| PMD2410 | | | 3•Exhaust center | | | |
| PMD3410 | | | | | | |
| PME3410 | | | | | | |
| PMS2315 | 3 | Single | 2 | Rc1/2, 3/4 | 80 | 0.2~0.7 (2~7) |
| PMS2415 | 5 | Double | 3•Closed center | | 75 | 0.2~0.8 (2~8) |
| PMD2415 | | | 3•Exhaust center | | | |
| PMD3415 | | | | | | |
| PME3415 | | | | | | |
| PMS2325 | 3 | Single | 2 | Rc1 | 190 | 0.2~0.7 (2~7) |
| PMS2425 | 5 | Double | 3•Closed center | Rc3/4, 1, 1 1/4 | 210 | 0.2~0.8 (2~8) |
| PMD2425 | | | 3•Exhaust center | | 195 | |
| PMD3425 | | | | | | |
| PME3425 | | | | | | |

● Voltage/ AC110, 220V (50/60Hz), DC24V

● Wiring/Lead wire, Terminal grommet, Terminal conduit, DIN connector

MANUAL CONTROL VALVE FMR Series

Rotary type selector valve with metal seal



Metal Seal

| Model No. | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------|------|-----------------|-----------|-----------------------------------|---|
| FMR2402 | 4 | 2 | Rc1/4 | 17 | 0~1 (0~10) |
| FMR2403 | | | Rc3/8 | 20 | |
| FMR2404 | | | Rc1/2 | 23 | |
| FMR3402 | 4 | 3•Closed center | Rc1/4 | 17 | |
| FMR3403 | | | Rc3/8 | 20 | |
| FMR3404 | | | Rc1/2 | 23 | |

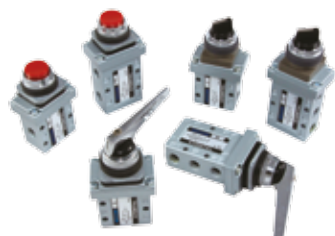
● Lock mechanism available

Directional Control Valves

MANUAL CONTROL VALVE HHV \ HSV Series

Hand-operated valve with large effective sectional area designed for direct control of actuator

Metal Seal/In-line Mounting



| Type | Model No. | Port | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-----------------------------------|------------|------|-----------|-----------------------------------|---|
| Selector | HHV2306-S | 3 | Rc1/4 | 11 | 0~1 (0~10) |
| | HHV2406-S | 5 | | | |
| Long lever selector | HHV2306-SL | 3 | | | |
| | HHV2406-SL | 5 | | | |
| Flat type push button | HSV2306-F | 3 | | | |
| | HSV2406-F | 5 | | | |
| Medium-size flat type push button | HSV2306-M | 3 | | | |
| | HSV2406-M | 5 | | | |
| Large-size flat type push button | HSV2306-L | 3 | | | |
| | HSV2406-L | 5 | | | |

MECHANICAL VALVE MSV Series

Mechanical valve with large effective sectional area. Direct control of actuator at fixed sequence is possible

Metal Seal/In-line Mounting



| Type | Model No. | Port | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) |
|-------------------|------------|------|-----------|-----------------------------------|---|
| Adjustment rod | MSV2306-VR | 3 | Rc1/4 | 11 | 0~1 (0~10) |
| | MSV2406-VR | 5 | | | |
| Roller adjustment | MSV2306-VA | 3 | | | |
| | MSV2406-VA | 5 | | | |
| Roller arm | MSV2306-RA | 3 | | | |
| | MSV2406-RA | 5 | | | |
| Roller plunger | MSV2306-RP | 3 | | | |
| | MSV2406-RP | 5 | | | |
| Plunger | MSV2306-PG | 3 | | | |
| | MSV2406-PG | 5 | | | |

Directional Control Valves

5 PORT AIR OPERATED VALVE VC Series

Rubber Seal/Sub-base mounting

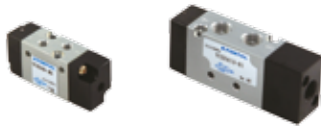


| Model No. | Port | Position | Port size | Effective area (mm²) | Pressure range MPa (kgf/cm²) | Pilot pressure MPa (kgf/cm²) |
|-----------|------|-------------------|-----------|----------------------|------------------------------|------------------------------|
| VCS245 | 5 | 2 | M5,Rc1/8 | 4 | 0.2~0.8 (2~8) | 0.2~0.8 (2~8) |
| VCD245 | | | | 2.5 | 0~0.8 (0~8) | |
| VCD345 | | | | | | |
| VCE345 | | | | | | |
| VCO345 | | | | | | |
| VCS2413 | | 2 | Rc1/4 | 12 | 0.2~0.8(2~8) | |
| VCD2413 | | | | | | |
| VCD3413 | | | | | | |
| VCE3413 | | | | | | |
| VCO3413 | | 3•Pressure center | 7.5 | | | |
| VCS2406 | | | | | | |
| VCD2406 | | | | | | |
| VCD3406 | | | | | | |
| VCE3406 | | 3•Exhaust center | 10 | 9 | 0.25~0.8 (2.5~8) | |
| VCO3406 | | | | | | |
| VCS2408 | | | | | | |
| VCD2408 | | | | | | |
| VCD3408 | | 3•Closed center | 30 | 25 | | |
| VCE3408 | | | | | | |
| VCO3408 | | | | | | |
| VCS2415 | | | | | | |
| VCD2415 | | 2 | Rc3/8 | 70 | 60 | 0.25~0.8 (2.5~8) |
| VCD3415 | | | | | | |
| VCE3415 | | | | | | |
| VCO3415 | | | | | | |

Directional Control Valves

5 PORT AIR OPERATED VALVE YC Series

Rubber Seal/In-line mounting



| Model No. | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) | Pilot pressure MPa (kgf/cm ²) | | |
|-----------|------|----------------------|-----------|--------------------------------------|--|--|--------------------|--------------------|
| YCS245 | 5 | 2 | M5 | 4 | 0.2~0.8 (2~8) | 0.2~0.8 (2~8) | | |
| YCD245 | | | | | 2.5 | | 0~0.8 (0~8) | |
| YCD345 | | | | | | | | |
| YCE345 | | | | | | | | |
| YCO345 | | 3●Pressure center | | | | | | |
| YCS2413 | | 2 | Rc1/8 | 12 | 0.2~0.8(2~8) | | | |
| YCD2413 | | | | | | | | |
| YCD3413 | | | | 3●Closed center | | | 7.5 | |
| YCE3413 | | | | 3●Exhaust center | | | | |
| YCO3413 | | | | 3●Pressure center | | | | |
| YCS2406 | | 2 | Rc1/4 | 12 | 0.25~0.8 (2.5~8) | | | |
| YCD2406 | | | | | | | 3●Closed center | |
| YCD3406 | | | | 3●Exhaust center | | | 11 | |
| YCE3406 | | | | 3●Pressure center | | | | |
| YCO3406 | | | | | | | | |
| YCS2408 | | 2 | Rc3/8 | 30 | | | | |
| YCD2408 | | | | | | | | 3●Closed center |
| YCD3408 | | | | 3●Exhaust center | | | | |
| YCE3408 | | | | 3●Pressure center | | | | |
| YCO3408 | | | | | | | | |

3•5 PORT AIR OPERATED VALVE V Series

Metal Seal/In-line mounting



| Model No. | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) | Pilot pressure MPa (kgf/cm ²) |
|-----------|------|----------|------------|--------------------------------------|--|--|
| VS2306 | 3 | 2 | Rc1/4 | 11 | 0~1 (0~10) | 0.15~1 (1.5~10) |
| VP2306 | | | | | | |
| VS2406 | 5 | | | | | |
| VP2406 | | | | | | |
| VS2410 | | | Rc3/8, 1/2 | 40 | | |
| VP2410 | | | | | | |

Directional Control Valves

5 PORT AIR OPERATED VALVE VM Series

Metal Seal/Sub-base mounting



| Model No. | Port | Position | Port size | Effective area (mm ²) | Pressure range MPa (kgf/cm ²) | Pilot pressure MPa (kgf/cm ²) |
|-----------|------|---------------------|-------------------|--------------------------------------|--|--|
| VMS246 | 5 | 2 | Rc1/8 | 6.5 | 0~1 (0~10) | 0.15~1 (1.5~10) |
| VMD246 | | | | | | |
| VMD346 | | 3●Closed center | | | | |
| VME346 | | 3●Exhaust center | | | | |
| VMS2406 | | 2 | Rc1/8,1/4 | 12.5 | | 0.2~0.8 (2~8) |
| VMD2406 | | | | | | |
| VMD3406 | | 3●Closed center | | | | |
| VME3406 | | 3●Exhaust center | | | | |
| VMS2408 | | 2 | Rc1/4,3/8 | 30 | | |
| VMD2408 | | | | | | |
| VMD3408 | | 3●Closed center | | | | |
| VME3408 | | 3●Exhaust center | | | | |
| VMS2410 | | 2 | Rc3/8,1/2 | 50 | | |
| VMD2410 | | | | | | |
| VMD3410 | | 3●Closed center | | | | |
| VME3410 | | 3●Exhaust center | | | | |
| VMS2415 | | 2 | Rc1/2,3/4 | 75 | | |
| VMD2415 | | | | | | |
| VMD3415 | | 3●Closed center | | | | |
| VME3415 | | 3●Exhaust center | | | | |
| VMS2425 | | 2 | Rc3/4,1, 1 1/4 | 210 | | |
| VMD2425 | | | | | | |
| VMD3425 | | 3●Closed center | | | | |
| VME3425 | | 3●Exhaust center | | | | |



FONTAL INDUSTRIAL CO., LTD.

Additional Equipment

Additional Equipment

SPEED CONTROLLER WITH PUSH-IN FITTING

For nylon and polyurethane tubes.

Sealant is coated on threaded portion, eliminating need for sealing tap



| Model No. | | Screw size | Applicable tube No. | Pressure range MPa(kgf/cm²) |
|----------------|------------|------------|---------------------|-----------------------------|
| Universal type | Elbow type | | | |
| MB4R-M3 | M4R-M3 | M3 | 100U04 | 0.7 (7) |
| MB4R-M5 | M4R-M5 | M5 | | |
| MB4R-01 | M4R-01 | R1/8 | | |
| MB6R-M5 | M6R-M5 | M5 | 100U06 | |
| MB6R-01 | M6R-01 | R1/8 | | |
| B6R-M5SC | 6R-M5SC | M5 | | |
| B6R-01SC | 6R-01SC | R1/8 | | |
| B6R-02SC | 6R-02SC | R1/4 | 100U08 | |
| B8R-01SC | 8R-01SC | R1/8 | | |
| B8R-02SC | 8R-02SC | R1/4 | | |
| B8R-03SC | 8R-03SC | R3/8 | | |
| B10R-02SC | 10R-02SC | R1/4 | 100U10 | |
| B10R-03SC | 10R-03SC | R3/8 | | |
| B10R-04SC | 10R-04SC | R1/2 | | |
| B12R-03SC | 12R-03SC | R3/8 | 100U12 | |
| B12R-04SC | 12R-04SC | R1/2 | | |

• Meter-out type and meter-in type available

SPEED CONTROLLER

Outstanding controllability attainable in low flow rate region



| Model No. | Type | Port size | Effective area (mm ²) | Pressure range MPa(kgf/cm ²) |
|-------------|-----------------|----------------------------------|--------------------------------------|---|
| SP-Z-M3 | Straight | M3 | 0.4 | 0~0.8 (0~8) |
| SPE-Z-M3 | Elbow | | | |
| SPF-Z-M3 | Flat | | | |
| SPER-Z-M3 | Universal elbow | | | |
| SPSR-Z-M3 | Universal | | | |
| SPR-Z-M3 | | | | |
| SP-H-M5 | Straight | M5 | 1.0 | |
| SPE-H-M5 | Elbow | | | |
| SPF-H-M5 | Flat | | | |
| SPER-H-M5 | Universal elbow | | | |
| SPSR-H-M5 | Universal | | | |
| SPR-H-M5 | | | | |
| SP-2H-1,2 | Straight | Rc1/8,1/4 | 2.7 | 0~1 (0~10) |
| SPE-2H-1,2 | Elbow | R,Rc1/8,1/4 | | |
| SP-06-1,2 | Straight | Rc1/8,1/4 | 17 | |
| SPE-06-1,2 | Elbow | R,Rc1/8,1/4 | 12 | |
| SPE-10-3 | Elbow | R,Rc3/8 | 39 | |
| SPE-10-3,4 | | External R1/2, Internal Rc3/8 | 45 | |
| SP-15-3,4,6 | | Straight | Rc3/8,1/2,3/4 | |
| SP-20-6,8 | Straight | Rc3/4,1 | 174 | |

Additional Equipment

METERING VALVE



| Model No. | Screw size |
|-----------|------------|
| MV-00 | M5 |
| MV-01 | R1/8 |
| MV-02 | R1/4 |
| MV-03 | R3/8 |
| MV-04 | R1/2 |
| MV-06 | R3/4 |
| MV-08 | R1 |

CHECK VALVE



| Model No. | Port size | Effective area (mm ²) | Pressure range MPa(kgf/cm ²) |
|-----------|-----------|-----------------------------------|--|
| S/520 | G1/8 | 14 | 0.03~1 (0.3~10) |
| S/521 | G1/4 | 18 | |
| S/522 | G1/2 | 90 | |
| S/523 | G3/4 | 195 | |
| S/524 | G1 | 317 | |

PERMANENT STOP

Connects cylinder and valve to stop cylinder halfway, preventing adverse effect by leak in valve



| Model No. | Port size | Effective area (mm ²) | Pressure range MPa(kgf/cm ²) |
|-----------|-----------|-----------------------------------|--|
| ST-10 | Rc1/4,3/8 | 45 | 0.15~1 (1.5~10) |
| ST-15 | Rc1/2 | 70 | |
| ST-25 | Rc3/4,1 | 190 | |

Additional Equipment

PUSH-IN FITTING

For nylon and polyurethane tubes.

Sealant is coated on threaded portion, eliminating need for sealing tap



| Type | Model | Connection | Applicable tube O.D. | | | | |
|-----------------------------------|---------------------|------------|----------------------|-----|-----|------|------|
| | | | φ 4 | φ 6 | φ 8 | φ 10 | φ 12 |
| Straight | FPC | M5 | • | • | | | |
| | | M6 | • | • | | | |
| | | PT1/8 | • | • | • | • | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | | • | • | • | • |
| | | PT1/2 | | | • | • | • |
| Union Straight | FPU | — | • | • | • | • | • |
| Different Diam. Union Straight | FPG | φ 6 | • | | | | |
| | | φ 8 | | • | | | |
| | | φ 10 | | | • | | |
| | | φ 12 | | | | • | |
| Elbow | FPL | M3 | • | | | | |
| | | M5 | • | • | | | |
| | | M6 | • | • | | | |
| | | PT1/8 | • | • | • | • | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | | • | • | • | • |
| | | PT1/2 | | | • | • | • |
| Long Elbow | FPLL | M5 | • | • | | | |
| | | PT1/8 | • | • | • | | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | | • | • | • | • |
| | | PT1/2 | | | | • | • |
| Union Elbow | FPV | — | • | • | • | • | • |
| Union Tee | FPE | — | • | • | • | • | • |
| Union Y | FPY | — | • | • | • | • | • |
| Different Diam. Union Y | FPW | φ 6 | • | | | | |
| | | φ 8 | | • | | | |
| | | φ 10 | | | • | | |
| | | φ 12 | | | | • | |
| Tee | FPB | M3 | • | | | | |
| | | M5 | • | • | | | |
| | | M6 | • | • | | | |
| | | PT1/8 | • | • | • | • | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | • | • | • | • | • |
| | | PT1/2 | | | • | • | • |
| Branch Tee | FPD | M3 | • | | | | |
| | | M5 | • | • | | | |
| | | M6 | • | • | | | |
| | | PT1/8 | • | • | • | • | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | • | • | • | • | • |
| | | PT1/2 | | | • | • | • |
| Branch Y | FPX | M5 | • | • | | | |
| | | PT1/8 | • | • | • | | |
| | | PT1/4 | • | • | • | • | • |
| | | PT3/8 | | • | • | • | • |
| | | PT1/2 | | | | • | • |
| Bulkhead Union | FPM | — | • | • | • | • | • |
| Bulkhead Female Straight | FPMF ^(G) | G1/8 | • | • | • | | |
| | | G1/4 | | • | • | • | |
| | | G3/8 | | | • | • | • |
| | | G1/2 | | | | | • |

Additional Equipment

TUBE

Polyurethane tube



| Type | O.D.(mm) | I.D.(mm) | Length(mm) |
|------|----------|----------|------------|
| 100U | 4 | 2.5 | 100 |
| | 6 | 4 | |
| | 8 | 5 | |
| | 10 | 6.5 | |
| | 12 | 8 | |

● Color/Black, Green, Red, Blue, Yellow

MINIATURE IN-LINE FILTER FOR VACUUM



| Model No. | Port size | pressure range (KPa) | filter element |
|-----------|-----------|----------------------|----------------|
| LF-M5A | M5 X 0.8 | -100~0 | 60 um |
| LF-M5AA | | | |
| LF-M5AA-A | | | |

AIR MUFFLER



| Model No. | Screw size | Effective area (mm ²) | Exhaust noise reduction (dB) |
|-----------|------------|-----------------------------------|------------------------------|
| SL-1 | R1/8 | 12 | 20UP |
| SL-2L | R1/4 | 30 | |
| SL-3 | R3/8 | 58 | 25UP |
| SL-4 | R1/2 | 80 | |
| SL-6 | R3/4 | 80 | |
| SL-8 | R1 | 150 | |

CLEANUP MUFFLER

Removes exhaust noise and oil mist to prevent deterioration of working environment



| Model No. | Port size | Max. flow ℓ/min(ANR) | Pressure range (MPa) | Oil mist removal (%) |
|-----------|-----------|----------------------|----------------------|----------------------|
| CM-03 | R3/8 | 450 | 0~1 | 99.9 |
| CM-06 | R3/4 | 1600 | | |
| CM-06 | R1 | 3000 | | |

ROTARY JOINT

Liquid supply to the rotating objects is easy even in a high pressure or a high speed



| Model No. | Port size | Fluid | Rated pressure MPa (kgf/cm ²) | Max. revolution (rpm) | Pass diam. (mm) | Numbers of pass |
|-----------|-----------|-----------|---|-----------------------|-----------------|-----------------|
| RJC-062L | Rc1/4 | Hydraulic | 3(30) | 3000 | φ 6 | 2 |
| | | Air | 1(10) | | | |
| RJH-062M | | Hydraulic | 14(140) | | | |



FONTAL INDUSTRIAL CO., LTD.

Air Combination Unit

Air Combination Unit

QUBE SERIES AIR FILTER

Separates and removes water and dust in compressed air



| Model No. | Port size | Bowl capacity (cm³) | Filter element (µm) | Option |
|------------|---------------|---------------------|---------------------|--|
| F45-2,3 | Rc1/4,3/8 | 22 | 5 | Bracket, Spring drain, Drainmaster |
| F45-2,3D | | | | |
| F55-2,3,4 | Rc1/4,3/8,1/2 | 47 | | Bracket, Automatic drain, Spring drain |
| F55-2,3,4D | | | | |
| F105-4,6 | Rc1/2,3/4 | 140 | | |
| F105-4.6D | | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES COALESCING FILTER

High-performance air filter capable of removing more than 99.99998% of aerosol consisting of water and oil of more than 0.01 μm



| Model No. | Port size | Recommended max. flow ℓ/min(ANR) | Bowl capacity (cm³) | Filter element (μm) | Option |
|------------|---------------|--|------------------------|------------------------|---|
| M45-2,3 | Rc1/4,3/8 | 200 | 22 | 0.01 | Bracket, Spring drain, Drainmaster |
| M45-2,3D | | | | | |
| M55-2,3,4 | Rc1/4,3/8,1/2 | 340 | 45 | | Bracket, Automatic drain, Spring drain |
| M55-2,3,4D | | | | | |
| M105-4,6 | Rc1/2,3/4 | 750 | 100 | | |
| M105-4.6D | | | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES SLUDGE FILTER

Separates and removes sludge and drain produced by compressor



| Model No. | Port size | Recommended max. flow ℓ/min(ANR) | Bowl capacity (cm³) | Filter element (μm) | Option |
|------------|---------------|--|------------------------|------------------------|---|
| S45-2,3 | Rc1/4,3/8 | 250 | 22 | 0.3 | Bracket, Spring drain, Drainmaster |
| S45-2,3D | | | | | |
| S55-2,3,4 | Rc1/4,3/8,1/2 | 340 | 45 | | Bracket, Automatic drain, Spring drain |
| S55-2,3,4D | | | | | |
| S105-4,6 | Rc1/2,3/4 | 750 | 100 | | |
| S105-4,6D | | | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES AIR REGULATOR

Easy-to-use and high-performance regulator with one-touch locking adjust knob



| Model No. | Port size | Reduced pressure range MPa(kgf/cm ²) | Max. supply pressure MPa(kgf/cm ²) | Option |
|------------|---------------|--|--|--|
| R45-2,3 | Rc1/4,3/8 | 0.03~0.8(0.3~8) | 1 (10) | Bracket, Pressure gauge, Ring for panel-mounting |
| R45-2,3L | | 0.02~0.42(0.2~4.2) | | |
| R55-2,3,4 | Rc1/4,3/8,1/2 | 0.02~0.8(0.2~8) | | |
| R55-2,3,4L | | 0.01~0.42(0.1~4.2) | | |
| R105-4,6 | Rc1/2,3/4 | 0.02~0.8(0.2~8) | | |

Air Combination Unit

QUBE SERIES INTEGRAL FILTER-REGULATOR

Compact design with united air filter and air regulator



| Model No. | Port size | Filter element (μm) | Bowl capacity (cm³) | Reduced pressure range MPa(kgf/cm²) | Option |
|-------------|---------------|---------------------|---------------------|-------------------------------------|---|
| B45-2,3 | Rc1/4,3/8 | 5 | 22 | 0.03~0.8 (0.3~8) | Bracket, Pressure gauge, Ring for panel-mounting, Drainmaster, Spring drain |
| B45-2,3D | | | | 0.02~0.42 (0.2~4.2) | |
| B45-2,3L | | | | | |
| B45-2,3DL | | | | | |
| B55-2,3,4 | Rc1/4,3/8,1/2 | | 47 | 0.02~0.8 (0.2~8) | Bracket, Pressure gauge, Ring for panel-mounting, Automatic drain, Spring drain |
| B55-2,3,4D | | | | 0.01~0.42 (0.1~4.2) | |
| B55-2,3,4L | | | | | |
| B55-2,3,4DL | | | | | |
| B105-4,6 | Rc1/2,3/4 | 140 | 0.02~0.8 (0.2~8) | | |
| B105-4,6D | | | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES AIR LUBRICATOR

Sprays lubricating oil into compressed air



| Model No. | Port size | Bowl capacity (cm³) | Min. air flow for oil dropping ℓ/min(ANR) | Option |
|------------|---------------|---------------------|---|---------|
| L45-2,3 | Rc1/4,3/8 | 43 | 50 | Bracket |
| L45-2,3D | | | | |
| L55-2,3,4 | Rc1/4,3/8,1/2 | 78 | 50 | |
| L55-2,3,4D | | | | |
| L105-4,6 | Rc1/2,3/4 | 240 | 80 | |
| L105-4,6D | | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES AIR COMBINATION UNIT

FRL unit consisting to integral filter-regulator and air lubricator



| Model No. | Port size | Components | | Filter element (μm) | Reduced pressure range MPa (kgf/cm²) | Option |
|-------------|----------------|---------------------------|----------------|---------------------|--------------------------------------|--|
| | | Integral filter regulator | Air lubricator | | | |
| U45-2,3 | Rc1/4,3/8 | B45-2,3 | L45-2,3 | 5 | 0.03~0.8 (0.3~8) | Bracket, Pressure gauge, Drainmaster, Spring drain |
| U45-2,3D | | B45-2,3D | L45-2,3D | | | |
| U45-2,3L | | B45-2,3L | L45-2,3 | | | |
| U45-2,3DL | | B45-2,3DL | L45-2,3D | | | |
| U55-2,3,4 | Rc1/4,3/8, 1/2 | B55-2,3,4 | L55-2,3,4 | | 0.02~0.8 (0.2~8) | Bracket, Pressure gauge, Drainmaster, Spring drain |
| U55-2,3,4D | | B55-2,3,4D | L55-2,3,4D | | | |
| U55-2,3,4L | | B55-2,3,4L | L55-2,3,4 | | | |
| U55-2,3,4DL | | B55-2,3,4DL | L55-2,3,4D | | | |
| U105-4,6 | Rc1/2,3/4 | B105-4,6 | L105-4,6 | | 0.02~0.8 (0.2~8) | |
| U105-4,6D | | B105-4,6D | L105-4,6D | | | |

《Note》 D : Metal bowl without sight glass

Air Combination Unit

QUBE SERIES AIR COMBINATION UNIT

Modular type FRL unit consisting of air filter, air regulator and air lubricator



| Model No. | Port size | Components | | | Filter element (μm) | Reduced pressure range MPa (kgf/cm²) | Option |
|-------------|----------------|------------|---------------|---------------------|---------------------|--------------------------------------|---|
| | | Air filter | Air regulator | Air lubricator | | | |
| C45-2,3 | Rc1/4,3/8 | F45-2,3 | R45-2,3 | L45-2,3 | 5 | 0.03~0.8 (0.3~8) | Bracket, Pressure gauge, Drainmaster Spring drain |
| C45-2,3D | | F45-2,3D | | L45-2,3D | | | |
| C45-2,3L | | F45-2,3 | L45-2,3 | | | | |
| C45-2,3DL | | F45-2,3D | L45-2,3D | | | | |
| C55-2,3,4 | Rc1/4,3/8, 1/2 | F55-2,3,4 | R55-2,3,4 | L55-2,3,4 | | 0.02~0.8 (0.2~8) | Bracket, Pressure gauge, Drainmaster Spring drain |
| C55-2,3,4D | | F55-2,3,4D | | L55-2,3,4D | | | |
| C55-2,3,4L | | F55-2,3,4 | L55-2,3,4 | 0.01~0.42 (0.1~4.2) | | | |
| C55-2,3,4DL | | F55-2,3,4D | L55-2,3,4D | | | | |
| C105-4,6 | Rc1/2,3/4 | F105-4,6 | R105-4,6 | L105-4,6 | | 0.02~0.8 (0.2~8) | |
| C105-4,6D | | F105-4,6D | | L105-4,6D | | | |

《Note》 D : Metal bowl without sight glass

QUBE SERIES SHUT-OFF VALVE

3-way valve provided to stop main pressure and exhaust remaining pressure in pipes connecting to shut-off valve



| Model No. | Port size | |
|-----------|-----------|--------|
| | P port | R port |
| V45-2 | Rc1/4 | Rc1/8 |
| V45-3 | Rc3/8 | |
| V55-2 | Rc1/4 | |
| V55-3 | Rc3/8 | |
| V55-4 | Rc1/2 | |
| V105-4 | Rc1/2 | |
| V105-6 | Rc3/4 | |

QUBE SERIES PRESSURE SWITCH



| Model No. | Pressure setting range MPa(kgf/cm²) | Hysteresis MPa(kgf/cm²) | Rated current (A) | Screw size |
|-----------|-------------------------------------|-------------------------|---------------------|------------|
| PS-6-1 | 0.15~1(1.5~10) | 0.05(0.5) | 3(AC125V), 2(DC30V) | R1/8 |

Air Combination Unit

QUBE SERIES ATTACHMENT



| Name | Model No. | | |
|-----------------------|-----------------------|-----------------------|-------------------------|
| | 45 Series | 55 Series | 105 Series |
| Diverter | D45 | D55 | D105 |
| Direction plate | DP45 | DP55 | DP105 |
| Branch block | BB45 | BB55 | BB105 |
| Gauge base | GB45 | GB55 | - |
| Pressure switch block | PST-45 | PST-55 | PST-105 |
| Bracket | F45-0571-2 MR45Y57 | F55-0571-2 MR55Y57 | F105-0571-2 MR105Y57 |

AIR FILTER STANDARD TYPE F602 Series

Separates and removes water and dust in compressed air



| Model No. | Port size | Bowl capacity (cm³) | Filter element (μm) | Option |
|-------------|-----------|---------------------|---------------------|--|
| F602-02,03 | Rc1/4,3/8 | 148 | 5 | Bracket, Automatic drain, Drainmaster, Spring drain |
| F602-04 | Rc1/2 | 237 | | |
| F602W-02,03 | Rc1/4,3/8 | 148 | | |
| F602W-04 | Rc1/2 | 237 | | Bracket, Automatic drain, Spring drain |
| F602W-06,08 | Rc3/4,1 | 474 | | |

《Note》 W : Metal bowl encircled with sight glass

COALESCING FILTER STANDARD TYPE H604 Series

Air filter capable of removing aerosol consisting of water and oil of more than 1 μm



| Model No. | Port size | Recommended max. flow ℓ /min(ANR) | Filter element (μm) | Option | | |
|-------------|-----------|---|------------------------|--|--|--|
| H604-02,03 | Rc1/4,3/8 | 800 | 1 | Bracket, Spring drain | | |
| H604-04 | Rc1/2 | | | Bracket, Automatic drain, Spring drain | | |
| H604D-02,03 | Rc1/4,3/8 | 800 | | | | |
| H604D-04 | Rc1/2 | | | | | |
| H604D-06,08 | Rc3/4,1 | 4000 | | Automatic drain, Spring drain | | |

《Note》 D : Metal bowl without sight glass

SLUDGE FILTER STANDARD TYPE S604 Series

Separates and removes sludge and drain produced by compressor



| Model No. | Port size | Recommended max. flow ℓ/min(ANR) | Filter element (μm) | Option |
|------------|-----------|--|------------------------|--|
| S604(D)-02 | Rc1/4 | 750 | 0.3 | Bracket, Automatic drain, Spring drain |
| S604(D)-03 | Rc3/8 | | | |
| S604(D)-04 | Rc1/2 | | | |
| S604DF-02 | Rc1/4 | 1500 | | |
| S604DF-03 | Rc3/8 | | | |
| S604DF-04 | Rc1/2 | | | |
| S604D-06 | Rc3/4 | 3500 | | |
| S604D-08 | Rc1 | | | |

《Note》 D : Metal bowl without sight glass

Air Combination Unit

MICRO MIST FILTER STANDARD TYPE M600 Series

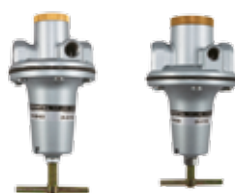
High-performance air filter capable of removing more than 99.99998% of aerosol consisting of water and oil of more than 0.01 μm



| Model No. | Port size | Recommended max. flow $\ell/\text{min}(\text{ANR})$ | Filter element (μm) | Oil mist removal (%) | Option |
|-------------------|---------------|---|----------------------------------|----------------------|-----------------|
| M600-02,03 | Rc1/4,3/8 | 283 | 0.01 | 99.99998 | Automatic drain |
| M600(Df)-02,03,04 | Rc1/4,3/8,1/2 | 566 | | | |
| M600D-06,08 | Rc3/4,1 | 1415 | | | |

《Note》 D : Metal bowl without sight glass

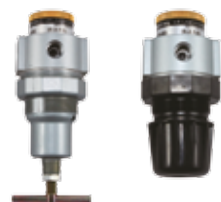
AIR REGULATOR STANDARD TYPE R119 Series



| Model No. | | Port size | Reduced pressure range MPa(kgf/cm²) | Max. supply pressure MPa(kgf/cm²) | Option |
|-----------------|---------------------|-----------|-------------------------------------|-----------------------------------|-------------------------|
| Pressure relief | Non-pressure relief | | | | |
| R119-02,03 | R118-02,03 | Rc1/4,3/8 | 0.02~0.75 (0.2~7.5) | 2.1 (21) | Bracket, Pressure gauge |
| R119-04 | R118-04 | Rc1/2 | | | |
| R119-06,08 | R118-06,08 | Rc3/4,1 | | | |
| R119-10,12 | R118-10,12 | Rc1¼,1½ | 0.03~0.75 (0.3~7.5) | | Pressure gauge |
| R119-16 | R118-16 | Rc2 | | | |
| R119L-02,03 | R118L-02,03 | Rc1/4,3/8 | | | 0.01~0.4 (0.1~4) |
| R119L-04 | R118L-04 | Rc1/2 | | | |
| R119H-02,03 | R118H-02,03 | Rc1/4,3/8 | 0.05~1.6 (0.5~16) | | |
| R119H-04 | R118H-04 | Rc1/2 | | | |
| R119H-06,08 | R118H-06,08 | Rc3/4,1 | | | |
| R119H-10,12 | R118H-10,12 | Rc1¼,1½ | | | |

《Note》 R119 (L,H) 02, 03, 04: panel mounting available

AIR REGULATOR STANDARD TYPE R010, R011 Series



| Model No. | | Port size | Reduced pressure range MPa(kgf/cm ²) | Max. supply pressure MPa(kgf/cm ²) | Option |
|----------------|----------------|---------------|--|--|--|
| T handle knob | Standard knob | | | | |
| R011-02, 03,04 | R010-02, 03,04 | Rc1/4,3/8,1/2 | 0.02~0.75 (0.2~7.5) | 1.4(14) | Bracket, Pressure gauge, Ring for panel mounting |

AIR LUBRICATOR STANDARD TYPE L606 Series

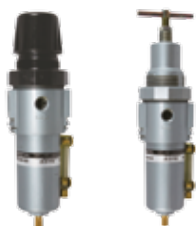


| Model No. | Port size | Bowl capacity (cm ³) | Max. supply pressure MPa(kgf/cm ²) |
|-------------|-----------|----------------------------------|--|
| L606-02,03 | Rc1/4,3/8 | 148 | 1(10) |
| L606-04 | Rc1/2 | 237 | |
| L606W-02,03 | Rc1/4,3/8 | 474 | |
| L606W-04 | Rc1/2 | 237 | |
| L606W-06,08 | Rc3/4,1 | 474 | |

《Note》 W : Metal bowl encircled with sight glass

Air Combination Unit

INTEGRAL FILTER-REGULATOR STANDARD TYPE B011 、 B012 Series



| Model No. | Port size | Filter element (μm) | Bowl capacity (cm ³) | Reduced pressure range MPa(kgf/cm ²) | Option |
|----------------|---------------|---------------------|----------------------------------|--|-------------------------|
| B012W-02,03,04 | Rc1/4,3/8,1/2 | 5 | 200 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge |
| B011W-02,03,04 | | | | | |

《Note》 W : Metal bowl encircled with sight glass

FRL AIR COMBINATION UNIT STANDARD TYPE C628, C668 Series MINIATURE TYPE C528 Series

Modular type FRL unit consisting of air filter, air regulator and air lubricator



| Model No. | Port size | Components | | | Filter element (μm) | Reduced pressure range MPa (kgf/cm ²) | Option |
|----------------|---------------|----------------|---------------|----------------|---------------------|---|--|
| | | Air filter | Air regulator | Air lubricator | | | |
| C628-02,03,04 | Rc1/4,3/8,1/2 | F602-02,03,04 | R119-02,03,04 | L606-02,03,04 | 5 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Spring drain |
| C628W-02,03,04 | Rc1/4,3/8,1/2 | F602W-02,03,04 | R119-02,03,04 | L606W-02,03,04 | | | |
| C628(W)-06,08 | Rc3/4,1 | F602(W)-06,08 | R119-06,08 | L606(W)-06,08 | | | |
| C668-04 | Rc1/2 | F602-04 | R011-04 | L606-04 | | | |
| C668W-04 | Rc1/2 | F602W-04 | R011-04 | L606W-04 | | | |
| C528-02 | Rc1/4 | F504-02 | R364-02 | L508-02 | | | Bracket, Pressure gauge, Drainmaster, Spring drain |

《Note》 W : Metal bowl encircled with sight glass

BL AIR COMBINATION UNIT STANDARD TYPE U658, U668 Series MINIATURE TYPE U558 Series

FRL unit consisting to integral filter-regulator and air lubricator



| Model No. | Port size | Components | | Filter element (μm) | Reduced pressure range MPa(kgf/cm ²) | Option |
|-------------|-----------|---------------------------|----------------|---------------------|--|---|
| | | Integral filter regulator | Air lubricator | | | |
| U668-02,03 | Rc1/4,3/8 | B012-02,03 | L606-02,03 | 5 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| U668-04 | Rc1/2 | B012-04 | L606-04 | | | |
| U658-02,03 | Rc1/4,3/8 | B011-02,03 | L606-02,03 | | | |
| U658-04 | Rc1/2 | B011-04 | L606-04 | | | |
| U668W-02,03 | Rc1/4,3/8 | B012-02,03 | L606W-02,03 | | | |
| U668W-04 | Rc1/2 | B012-04 | L606W-04 | | | |
| U658W-02,03 | Rc1/4,3/8 | B011-02,03 | L606W-02,03 | | | |
| U658W-04 | Rc1/2 | B011-04 | L606W-04 | | | |
| U558-02 | Rc1/4 | B594-02 | L508-02 | | | Bracket, Pressure gauge, Drainmaster, Spring drain |

《Note》 W : Metal bowl encircled with sight glass

Air Combination Unit

FR AIR COMBINATION UNIT STANDARD TYPE U628 Series

MINIATURE TYPE U528 Series

Consisting of air filter and air regulator



| Model No. | Port size | Components | | Filter element (μm) | Reduced pressure range MPa (kgf/cm ²) | Option |
|-------------|-----------|-------------|---------------|---------------------|---|---|
| | | Air filter | Air regulator | | | |
| U628-02,03 | Rc1/4,3/8 | F602-02,03 | R119-02,03 | 5 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| U628-04 | Rc1/2 | F602-04 | R119-04 | | | |
| U628W-02,03 | Rc1/4,3/8 | F602W-02,03 | R119-02,03 | | | |
| U628W-04 | Rc1/2 | F602W-04 | R119-04 | | | |
| U628W-06,08 | Rc3/4,1 | F602W-06,08 | R119-06,08 | | | |
| U528-02 | Rc1/4 | F504-02 | R364-02 | | | Bracket, Pressure gauge, Drainmaster, Spring drain |

《Note》 W : Metal bowl encircled with sight glass

FSR AIR COMBINATION UNIT STANDARD TYPE C728 Series

Consisting of air filter, sludge filter and air regulator



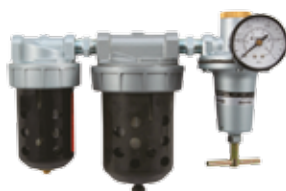
| Model No. | Port size | Components | | | Reduced pressure range MPa (kgf/cm ²) | Option |
|-------------|-----------|-------------|---------------|---------------|---|---|
| | | Air filter | Sludge filter | Air regulator | | |
| C728-02,03 | Rc1/4,3/8 | F602-02,03 | S604-02,03 | R119-02,03 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| C728-04 | Rc1/2 | F602-04 | S604-04 | R119-04 | | |
| C728W-02,03 | Rc1/4,3/8 | F602W-02,03 | S604D-02,03 | R119-02,03 | | |
| C728W-04 | Rc1/2 | F602W-04 | S604D-04 | R119-04 | | |
| C728W-06,08 | Rc3/4,1 | F602W-06,08 | S604D-06,08 | R119-06,08 | | |

《Note》 W : Metal bowl encircled with sight glass

D : Metal bowl without sight glass

FMR AIR COMBINATION UNIT STANDARD TYPE C828 Series

Consisting of air filter, micro mist filter and air regulator



| Model No. | Port size | Components | | | Reduced pressure range MPa (kgf/cm ²) | Option |
|-------------|-----------|-------------|-------------------|---------------|---|---|
| | | Air filter | Micro mist filter | Air regulator | | |
| C828-02,03 | Rc1/4,3/8 | F602-02,03 | M600-02,03 | R119-02,03 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| C828-04 | Rc1/2 | F602-04 | M600-04 | R119-04 | | |
| C828W-02,03 | Rc1/4,3/8 | F602W-02,03 | M600D-02,03 | R119-02,03 | | |
| C828W-04 | Rc1/2 | F602W-04 | M600D-04 | R119-04 | | |
| C828W-06,08 | Rc3/4,1 | F602W-06,08 | M600D-06,08 | R119-06,08 | | |

《Note》 W : Metal bowl encircled with sight glass

D : Metal bowl without sight glass

Air Combination Unit

FSRL AIR COMBINATION UNIT STANDARD TYPE A728 Series

Consisting of air filter, sludge filter, air regulator and air lubricator



| Model No. | Port size | Components | | | | Reduced pressure range MPa (kgf/cm ²) | Option |
|-------------|-----------|-------------|---------------|---------------|----------------|---|---|
| | | Air filter | Sludge filter | Air regulator | Air lubricator | | |
| A728-02,03 | Rc1/4,3/8 | F602-02,03 | S604-02,03 | R119-02,03 | L606-02,03 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| A728-04 | Rc1/2 | F602-04 | S604-04 | R119-04 | L606-04 | | |
| A728W-02,03 | Rc1/4,3/8 | F602W-02,03 | S604D-02,03 | R119-02,03 | L606W-02,03 | | |
| A728W-04 | Rc1/2 | F602W-04 | S604D-04 | R119-04 | L606W-04 | | |
| A728W-06,08 | Rc3/4,1 | F602W-06,08 | S604D-06,08 | R119-06,08 | L606W-06,08 | | |

《Note》 W : Metal bowl encircled with sight glass

D : Metal bowl without sight glass

FMRL AIR COMBINATION UNIT STANDARD TYPE A828 Series

Consisting of air filter, micro mist filter, air regulator and air lubricator



| Model No. | Port size | Components | | | | Reduced pressure range MPa (kgf/cm ²) | Option |
|-------------|-----------|-------------|-------------------|---------------|----------------|---|---|
| | | Air filter | Micro mist filter | Air regulator | Air lubricator | | |
| A828-02,03 | Rc1/4,3/8 | F602-02,03 | M600-02,03 | R119-02,03 | L606-02,03 | 0.02~0.75 (0.2~7.5) | Bracket, Pressure gauge, Automatic drain, Drainmaster, Spring drain |
| A828-04 | Rc1/2 | F602-04 | M600-04 | R119-04 | L606-04 | | |
| A828W-02,03 | Rc1/4,3/8 | F602W-02,03 | M600D-02,03 | R119-02,03 | L606W-02,03 | | |
| A828W-04 | Rc1/2 | F602W-04 | M600D-04 | R119-04 | L606W-04 | | |
| A828W-06,08 | Rc3/4,1 | F602W-06,08 | M600D-06,08 | R119-06,08 | L606W-06,08 | | |

《Note》 W : Metal bowl encircled with sight glass

D : Metal bowl without sight glass

AIR FILTER MINIATURE TYPE F504 Series

Separates and removes water and dust in compressed air



| Model No. | Port size | Bowl capacity (cm ³) | Filter element (μm) | Option |
|-----------|-----------|----------------------------------|---------------------|---------------------------|
| F504-02 | Rc1/4 | 10 | 5 | Drainmaster, Spring drain |

SLUDGE FILTER S504 Series

Separates and removes sludge and drain produced by compressor



| Model No. | Port size | Recommended max. flow ℓ/min(ANR) | Filter element (μm) | Option |
|-----------|-----------|----------------------------------|---------------------|---------------------------|
| S504-02 | Rc1/4 | 250 | 0.3 | Drainmaster, Spring drain |

Air Combination Unit

MICRO MIST FILTER M500 Series

High-performance air filter capable of removing more than 99.99998% of aerosol consisting of water and oil of more than 0.01 μm



| Model No. | Port size | Recommended pressure range $\text{kg}/\text{min}(\text{ANR})$ | Filter element (μm) | Oil mist removal $(\%)$ | Option |
|-----------|-----------|--|-----------------------------------|----------------------------|---------------------------|
| M500-02 | Rc1/4 | 250 | 0.01 | 99.99998 | Drainmaster, Spring drain |

AIR REGULATOR MINIAUTRE TYPE R364 Series



| Model No. | Port size | Reduced pressure range $\text{MPa}(\text{kgf}/\text{cm}^2)$ | Max. supply pressure $\text{MPa}(\text{kgf}/\text{cm}^2)$ | Option |
|-----------|-----------|--|--|-------------------------|
| R364-02 | Rc1/4 | 0.02~0.75(0.2~7.5) | 1.4(14) | Bracket, Pressure gauge |
| R364L-02 | | 0.01~0.3(0.1~3) | | |

《Note》 Pressure relief and non-pressure relief types are available

AIR LUBRICATOR MINIATURE TYPE L508 Series



| Model No. | Port size | Bowl capacity (cm^3) | Max. supply pressure $\text{MPa}(\text{kgf}/\text{cm}^2)$ |
|-----------|-----------|----------------------------------|--|
| L508-02 | Rc1/4 | 30 | 1(10) |
| | | | 1.2(12) |

INTEGRAL FILTER-REGULATOR MINIATURE TYPE B549 Series



| Model No. | Port size | Filter element (μm) | Bowl capacity (cm^3) | Reduced pressure range $\text{MPa}(\text{kgf}/\text{cm}^2)$ | Option |
|-----------|-----------|-----------------------------------|----------------------------------|--|------------------------------------|
| B549-02 | Rc1/4 | 5 | 10 | 0.02~0.75 (0.2~7.5) | Bracket, Spring drain, Drainmaster |

Air Combination Unit

WATER REGULATOR W361 Series



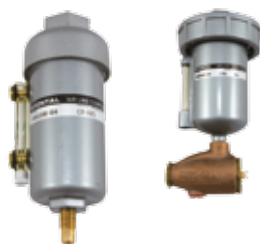
| Model No. | Port size | Reduced pressure range MPa(kgf/cm ²) | Max. supply pressure MPa(kgf/cm ²) |
|-----------|-----------|---|---|
| W361-02 | Rc1/4 | 0.02~0.75 (0.2~7.5) | 1.4(14) |
| W361L-02 | | 0.01~0.3 (0.1~3) | |

RELIEF VALVE



| Model No. | Port size | Reduced pressure range MPa(kgf/cm ²) |
|-----------|-----------|---|
| P130L-02 | Rc1/4 | 0.01~0.3(0.1~3) |
| P130-02 | | |
| P300-04 | Rc1/2 | 0.02~0.7(0.2~7) |

DRAIN VALVE



| Model No. | Port size | Bowl capacity (cm ³) | Max. supply pressure MPa(kgf/cm ²) |
|-----------|-----------|-------------------------------------|---|
| D011W-04 | Rc1/2 | 75 | 1.2(12) |
| D608W-04 | | 227 | |

《Note》 W : Metal bowl encircled with sight glass

PRECISION PRESSURE REGULATOR HP10



| Model No. | Port size | Reduced pressure range MPa(kgf/cm ²) | Max. supply pressure MPa(kgf/cm ²) |
|-----------|-----------|---|---|
| HP10-2 | Rc1/4 | 0.005~0.4 (0.05~4) | 0.7 (7) |

PILOT REGULATOR BR Series

Use pilot air pressure to operate regulator, also can use R364 series to control pilot regulator for long distance operating



| Model No. | Max. supply pressure MPa(kgf/cm ²) | Pilot pressure MPa(kgf/cm ²) | Port size | pilot port size |
|------------|---|---|-----------|-----------------|
| BR-N-2,3 | 2.1(21) | 1(10) | Rc1/4,3/8 | Rc1/8 |
| BR-N-4 | | | Rc1/2 | |
| BR-N-6,8 | | | Rc3/4,1 | Rc1/4 |
| BR-N-10,12 | | | Rc1¼,1½ | |

Air Combination Unit

AUTOMATIC DRIN

When drainage is collected, float rises to push up pin and open disc valve. Thus air enters top of piston, thereby pushing it down. Then sealing with V-seal comes off, automatically draining out collected drainage



SPRING DRAIN

Bowl is drained out by touching the pin lightly. When internal pressure of bowl is below 0.1 MPa, bowl is automatically drained out



DRAINMASTER

Bowl is drained out, when the reduced side air pressure changes intermittently





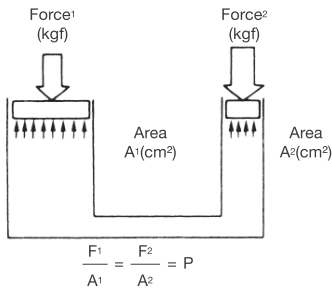
FONTAL INDUSTRIAL CO., LTD.

Technology

Technology

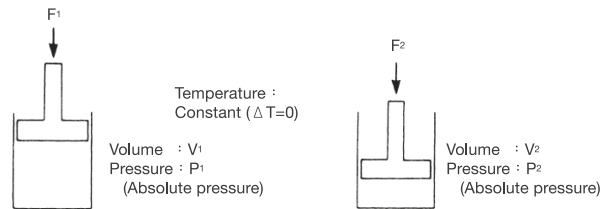
Blaise Pascal Principle

Force = Area x Pressure
(kgf) (cm²) (kgf/cm²)



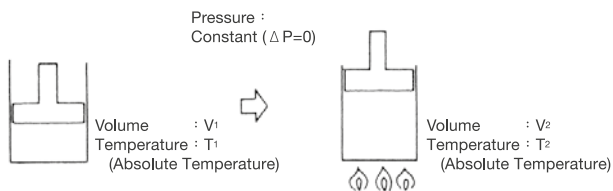
BOYLES LAW

$P_1 V_1 = P_2 V_2$



CHAR LAW

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$



Charles's Law, Boyle's Law

$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$

$PV = GRT$

$Pv = RT$

Where :

| | |
|--------------------------------------|-------------------------|
| P is the pressure | kgf/cm ² abs |
| V is the volume | m ³ |
| G is the mass of air | kgf |
| R is the universal gas constant | m/K |
| T is the temperature | K |
| v is the volume of air per unit mass | m ² /kgf |

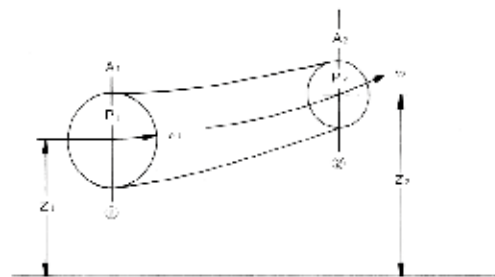
Bernoulli's Principle

$\frac{v_1^2}{2g} + \frac{P_1}{\gamma} + Z_1 = \frac{v_2^2}{2g} + \frac{P_2}{\gamma} + Z_2 = H = \text{const.}$

Where :

v is the speed.
P is the pressure
Z is the elevation of the point above reference plane
γ is the mass volume ratio
g is the gravity
H is the energy head

m/sec
kgf/m²
m
kgf/m³
9.8m/sec²
m



Celsius Fahrenheit Conversion

Celsius Tx - Fahrenheit Ty

$T_y = \frac{9}{5} T_x + 32 \quad ^\circ\text{F}$

$T_x = \frac{5}{9} (T_y - 32) \quad ^\circ\text{C}$

Speed of Sound in Air

$v = 331.5 + 0.61 T_x \text{ m/sec}$

T_x : Temperature $^\circ\text{C}$

Absolute temperature

$T = 273 + T_x$

T : Absolute Temperature K

T_x : Celsius $^\circ\text{C}$

Selection of Air Cylinder Bore Size

$$D = \sqrt{1.274 \times \frac{F_0}{P} \times 10^2} \quad \text{mm}$$

P : Used Pressure kgf/cm²
 F₀ : The ideal force output kgf

• The Ideal Force Output

$$F_0 = \frac{F}{\eta} \times 10^2 \quad \text{kgf}$$

F : Actual load kgf

η : Load rate(30~50%)

| | | |
|-----------------|-------------------------|-----|
| (note)Load rate | Rapid case | 30% |
| | Slow speed case | 50% |
| | Up and down moving case | 30% |

Single-acting Cylinders Force Output Theory

The spring in the single-acting cylinders is also the factor when calculating the force output

• Single-acting (Extended)

$$F_1 = \frac{\pi}{4} \times D^2 \times P - f$$

$$F_2 = f$$

• Single-acting (Retracted)

$$F_1 = f$$

$$F_2 = \frac{\pi}{4} \times (D^2 - d^2) \times P - f$$

F₁ : Piston rod out force

F₂ : Piston rod in force

D : Bore size

d : Rod diameter that attach to the piston

P : Used pressure

f : Spring force

kgf

kgf

cm

cm

kgf/cm²

kgf

Double-acting Cylinders Force Output Theory

$$F_1 = \frac{\pi}{4} \times D^2 \times P$$

$$F_2 = \frac{\pi}{4} \times (D^2 - d^2) \times P$$

F₁ : Piston rod out force

F₂ : Piston rod in force

D : Bore size

d : Rod diameter that attach to the piston

P : Used pressure

kgf

kgf

cm

cm

kgf/cm²

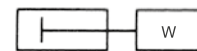
Calculation of Actual Load

The selection of air cylinder bore size is based on the applications and actual load of the cylinder



Load weight W = 300kgf

Actual load F = W
= 300kgf



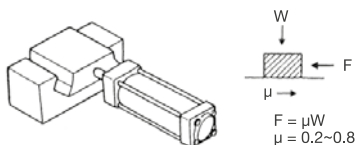
Load weight W = 300kgf

Friction factor μ = 0.2

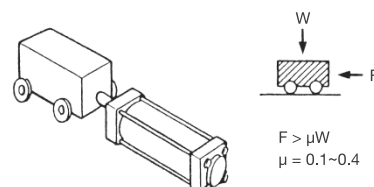
Actual load F = μW
= 60kgf

Examples

• Sliding

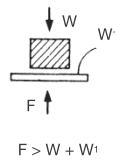
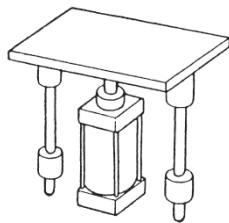


• Rolling



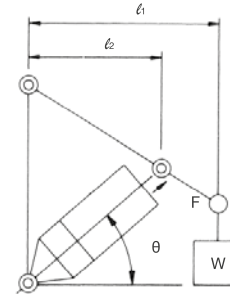
Technology

- Lift



- Link

$$F = \frac{W\ell_1}{\ell_2 \sin \theta}$$



- Rack-and-pinion

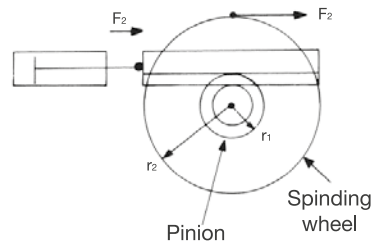
$$F_1 = \frac{r_2}{r_1} F_2$$

Where :

F_1 is the force into the system

F_2 is the force output from the system

r = radius



Characteristics of Cushion Cylinder

When the speed or load exceeds the cushion range, problems might be occurred.
Therefore, external hydraulic cushion is highly recommended

- Kinetic energy calculation

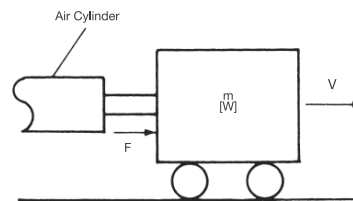
SI unite $E = 0.5m \cdot V^2$ (J)

Where :

E : Kinetic energy J(kgf • cm)

m : mass kg

V : velocity m/s



Cushion Range of Each Cylinder Series

- J series (Cushion is optional)

| Bore size (mm) | Cushioning stroke (mm) | Cushioning stroke cross area (cm ²) | The maximum absorbable kinetic energy J (kgf/cm) |
|----------------|------------------------|---|--|
| φ 20 | 10 | 1.8 | 25.5 (2.6) |
| φ 25 | 10 | 2.6 | 37.2 (3.8) |
| φ 32 | 15 | 6.0 | 130 (13.3) |
| φ 40 | 16 | 10.0 | 231 (23.6) |

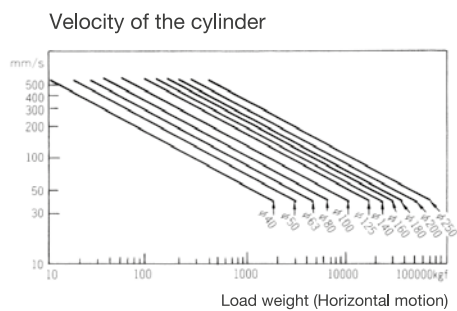
- K series

| Bore size (mm) | Cushioning stroke (mm) | Cushioning stroke cross area (cm ²) | The maximum absorbable kinetic energy J (kgf/cm) |
|----------------|------------------------|---|--|
| φ 40 | 16 | 10.0 | 235 (24) |
| φ 50 | 16 | 15.1 | 343 (35) |
| φ 63 | 16 | 26.6 | 617 (63) |
| φ 80 | 20 | 43 | 1245 (124) |
| φ 100 | 20 | 69 | 1990 (203) |

- A series

| Bore size (mm) | Cushioning stroke (mm) | Cushioning stroke cross area (cm ²) | The maximum absorbable kinetic energy J (kgf/cm) |
|----------------|------------------------|---|--|
| φ 30 | 15 | 5.1 | 127 (13) |
| φ 40 | 20 | 10.0 | 294 (30) |
| φ 50 | 20 | 15.1 | 490 (50) |
| φ 63 | 20 | 26.6 | 784 (80) |
| φ 80 | 20 | 40.6 | 1176 (120) |
| φ 100 | 22 | 69 | 2058 (210) |
| φ 125 | 22 | 107 | 3430 (350) |
| φ 140 | 22 | 138 | 4410 (450) |
| φ 160 | 22 | 177 | 5684 (580) |
| φ 180 | 22 | 231 | 7350 (750) |
| φ 200 | 30 | 286 | 11760 (1200) |

- Cushion cylinder absorbable kinetic energy



The Maximum Stroke of Each Mounting Type

$$D = \sqrt{\frac{n\pi^2 EI}{W}} \quad (\text{mm})$$

Where :

D : Maximum length of the mounting (mm)

W : Load (kgf)

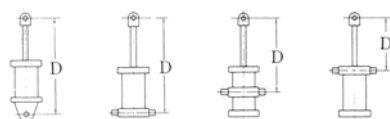
E : Young's modulus (=21000kgf/mm²)

I : Second moment of area (I=πd⁴/64) (mm⁴)

n : Terminal end coefficient

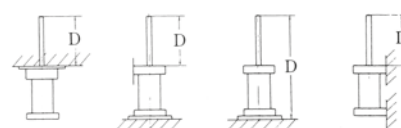
L : Stroke (mm)

- Both ends pin joint (D = L · n = 1)



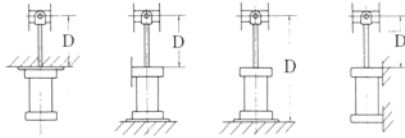
- Cylinder fixing, rod end unfixed

$$(D = \frac{L}{2} \cdot n = \frac{1}{4})$$

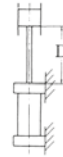


Technology

- Cylinder fixing, rod end guide (pin joint)
($D = 1.4L \cdot n = 2$)



- Cylinder fixing, rod end guide
($D = 2L \cdot n = 4$)



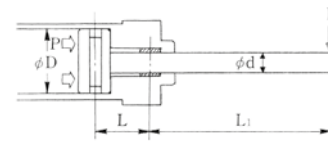
D : The length of mounting
L : Stroke
n : Terminal end coefficient

Cylinder Acceptable Load on Vertical Direction

$$F = K \frac{L}{(L+L_1)} \times \frac{\pi}{4} D^2 P \times \frac{1}{100} \quad (\text{kgf})$$

Where :

K : JIS standers' safety coefficient(1/20) center of bearing
L : The length between the center of piston and rod end (mm)
L₁ : The length between the center of bearing and rod end (mm)
D : Bore size (mm)
P : Used pressure (kgf/cm²)



The Required Torque of HI-ROTOR When Moving a Load

- Resistance torque

$$T_R = K \cdot F_R \cdot \ell \quad \text{kgf} \cdot \text{cm}$$

Where :

F_R : Required force (kgf)
ℓ : Arm length from HI-ROTOR (cm)
K : Safety factor
When there is no load variation K=2
When there is load variation K=5
(The safety factor varies with resistance moment of gravity)

- Accelerating torque

$$T_A = 5 \cdot J \cdot \alpha \quad \text{kgf} \cdot \text{cm}$$

J : Inertial moment of load (kgf · cm · s²)
α : Angular acceleration (rad · s²)
K : Coefficient

- Required torque

$$T = T_R + T_A \quad \text{kgf} \cdot \text{cm}$$

Angular acceleration

$$\alpha = \frac{\theta}{t^2} \quad \text{rad/s}^2$$

θ : Oscillating angle (rad)
90° = 1.5708 rad
180° = 3.1416 rad
270° = 4.7124 rad
t : Oscillating time (s)

Inertial Energy When Driving a HI-ROTOR

$$E = \frac{1}{2} J \omega^2 \quad \text{kgf} \cdot \text{cm}$$

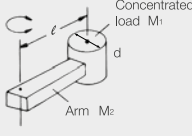
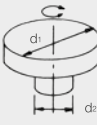
J : Inertial moment of load (kgf · cm · s²)
(see moment of inertia table)
ω : Angular velocity (rad · s)

Angular velocity

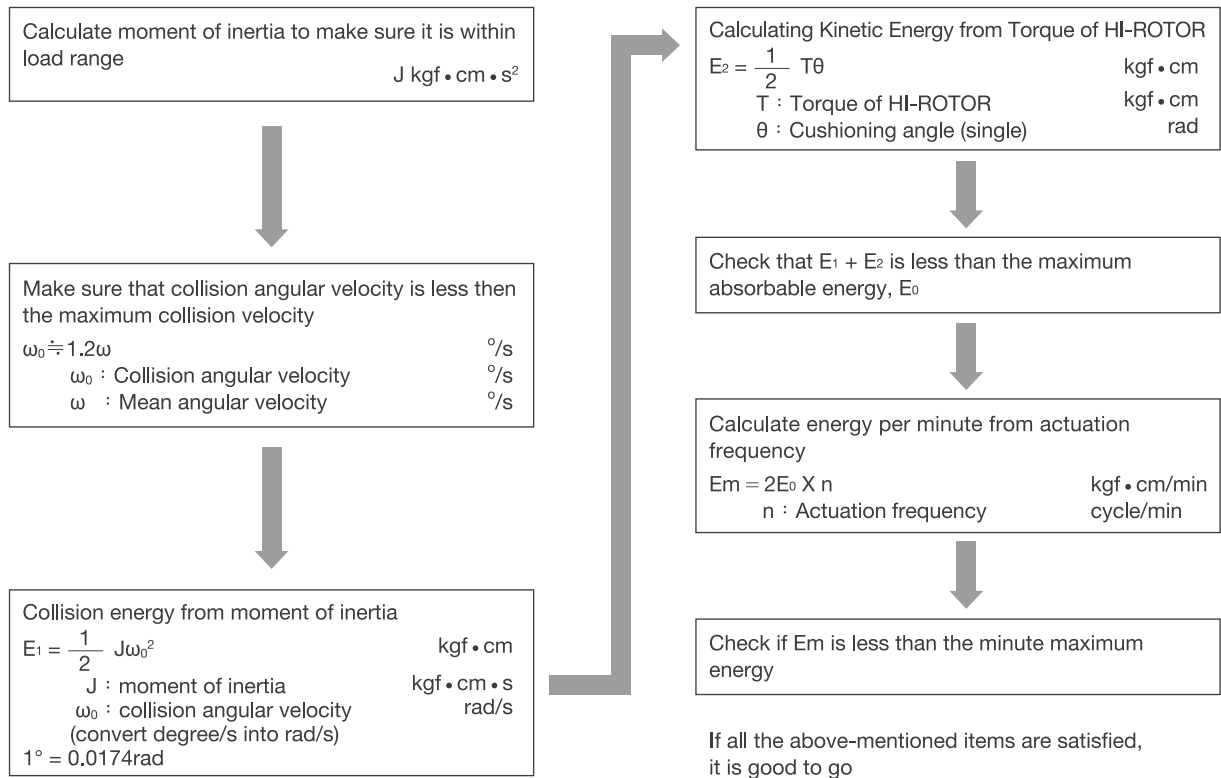
$$\omega = \frac{\theta}{t} \quad \text{rad/s}$$

θ : Oscillating angle (rad)
ω : Oscillating time (s)

Calculating moment of inertia

| Shape | Sketch | Requirement | Inertia moment 1(kg • m ³) | Radius of gyration K ₁ ² | Remarks |
|----------------------|---|--|---|---|--|
| Concentrated load |  | <ul style="list-style-type: none"> • Shape of Concentrated load Disc • Arm length l (m) • Mass of Concentrated load M_1(kg) • Mass of arm M_2(kg) | $I = M_1 \cdot l^2 + M_2 \cdot \frac{l^2}{3}$ | $K_1^2 : \text{Select from above this column (in case of left sketch } K_1^2 = \frac{d^2}{8}$ | When M_2 is much smaller than M_1 , assume M_2 to be 0 for calculation |
| Stepped disc |  | <ul style="list-style-type: none"> • Diameter d_1 (m) d_2 (m) • Mass Portion d_1 M_1 (kg) Portion d_2 M_2 (kg) | $I = M_1 \cdot \frac{d_1^2}{8} + M_2 \cdot \frac{d_2^2}{8}$ | | When portion d_2 is much smaller than portion d_1 , value of d_2 is negligible |

Checking Allowable Energy (When Cushion is Provided)

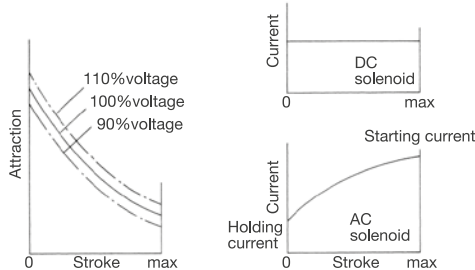


Apparent Power and Power consumption

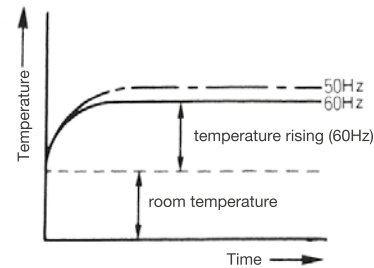
- AC solenoid
Apparent power (VA) = Voltage (V) × Current (A)
Power consumption(W) = Voltage (V) × Current (A) × Power factor
- DC solenoid
Power consumption(W) = Voltage (V) × Current (A)

Technology

Solenoid Attraction and Current Characteristics



Characteristics of Temperature Rising



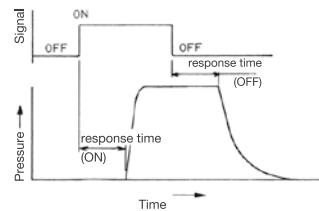
Insulation Types

| Insulation types | Temperature rising ° C (JIS B8375) | Maximum acceptable temperature (JIS C4003) |
|------------------|------------------------------------|--|
| A | Under 65 | 105 |
| E | Under 80 | 120 |
| B | Under 90 | 130 |
| F | Under 115 | 155 |
| H | Under 140 | 180 |

Response Time

The response time is measured by providing 5kgf / cm² of air pressure to P port and installing a pressure sensor on either one of A or B port to measure the pressure change with time

(The final measurement is obtained from the average of 10~20 times experimental data)



Effective Area

The net area of an air inlet or outlet system through which air can pass

$$S = (12.9V \frac{1}{t} \log_{10} \frac{P_0 + 1.03}{P + 1.03}) \sqrt{\frac{273}{T}}$$

Where :

S : P effective area mm²
V : The volume of air tank ℓ
P₀ : Initial pressure of the tank kgf/cm²
P : Pressure after the time(t) of releasing kgf/cm²
t : Time sec
T : Room temperature K

Method of Obtaining Composite Effective Cross-sectional Area

• Series Connection

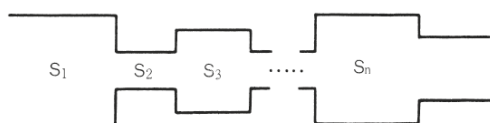
$$\frac{1}{S^2} = \frac{1}{S_1^2} + \frac{1}{S_2^2} + \dots + \frac{1}{S_n^2}$$

S : Composite effective area mm²
S_n : Effective area of each unit mm²

• Parallel Connection

$$S^2 = S_1^2 + S_2^2 + \dots + S_n^2$$

S : Composite effective area mm²
S_n : Effective area of each unit mm²



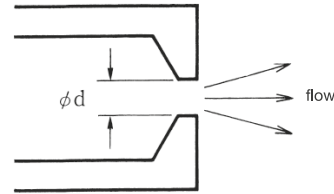
Method of Obtaining Orifice Effective Cross-sectional Area

$$S = 0.8 \times \frac{\pi}{4} d^2$$

Where :

S : Effective area mm²
d : Pipe diameter mm

(Note) If pipe is too thick, the method is not applicable



Method of Obtaining Piping Effective Cross-sectional Area

$$S = \frac{\frac{\pi}{4} d^2}{\sqrt{\lambda \cdot \frac{\ell}{d} + 1}}$$

Where :

S : Effective area mm²
d : Pipe i.d mm
ℓ : Length of pipe mm
λ : Friction coefficient inside a pipe
Metal pipe = 0.02
PU 、Nylon pipe = 0.013

(Note) If the pressure source is under 2kgf / cm², the method is not applicable.

Method Of Obtaining Centralized Airflow Rate

① $P_H \leq 1.89P_L$ (Subsonic velocity zone)

$$Q = 22.2 \times S \times \sqrt{P_L \times (P_H - P_L)} \times \sqrt{\frac{237}{T_H}}$$

② $P_H \geq 1.89P_L$ (Sonic velocity zone)

$$Q = 11.1 \times S \times P_H \times \sqrt{\frac{237}{T_H}}$$

Where :

Q : Flow rate ℓ/min(ANR)
S : Effective area of orifice mm²
P_H : Pressure on upper stream kgf/cm²abs
P_L : Pressure on lower stream kgf/cm²abs
T_H : Absolute temperature on upper stream K

Effective Area and Cv value

The flow coefficient (Cv) is in general determined experimentally and express the flow capacity in imperial units - GPM (US gallons per minute) of water that a valve will pass for a pressure drop of 1 lb/in² (psi)

$$S \div 18.45Cv$$

Air Related Unites Conversion

| | | | |
|-----------|---|----------|---------------------|
| 1 psi | = | 0.07031 | kgf/cm ² |
| 1 CFM | = | 28.317 | ℓ/min |
| 1 inch | = | 25.4 | mm |
| 1 pound | = | 0.453592 | kgf |
| 1 gal(us) | = | 3.78541 | ℓ |

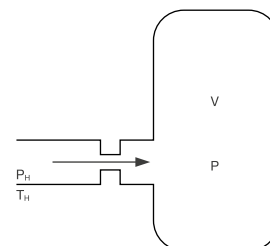
Filling Up an Air Tank

- Calculating the time to fill up an air tank to source pressure

$$t = (1.285 - \frac{1}{P_H + 1.033}) \cdot \frac{5.214}{n} \cdot \frac{V}{S} \cdot \sqrt{\frac{273}{T_H}} \quad s$$

Where :

P_H : Pressure source kgf/cm²
V : The Volume of air tank ℓ
S : Effective area of orifice mm²
T_H : Room temperature K
n : Heat capacity ratio (n = 1.4)



Technology

- Calculating the time to fill up an air tank to pressure P

$$(P + 1.033) \leq \frac{(P_H + 1.033)}{1.89} \quad (\text{Case 1})$$

$$t = \frac{P}{P_H + 1.033} \times \frac{5.217}{n} \cdot \frac{V}{S} \cdot \sqrt{\frac{273}{T_H}} \quad \text{s}$$

$$(P + 1.033) \geq \frac{(P_H + 1.033)}{1.89} \quad (\text{Case 2})$$

$$t = \frac{5.217}{n} \cdot \frac{V}{S} \cdot \sqrt{\frac{273}{T_H}} \left[\left(0.528 - \frac{1}{P_H + 1.033} \right) + \frac{1}{2} \left\{ \sin^{-1} \frac{2(P+1.033) - (P_H+1.033)}{(P_H+1.033)} - 0.056 \right\} \right] \quad (\text{s})$$

Where :

| | | |
|----------------|---------------------------------|---------------------|
| P | : Pressure of the tank | kgf/cm ² |
| P _H | : Pressure source | kgf/cm ² |
| V | : The volume of air tank | ℓ |
| S | : Effective area of orifice | mm ² |
| T _H | : Room temperature | K |
| n | : Heat capacity ratio (n = 1.4) | |

Releasing air pressure form an air tank

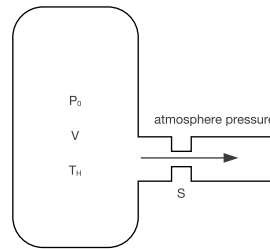
- Calculating the time of releasing air pressure of an air tank to atmosphere pressure

$$P_0 \geq 0.89 \text{ kgf/cm}^2$$

$$t = \left[\frac{2n}{n-1} \left\{ \left(\frac{P_0+1.033}{1.893} \right)^{\frac{n-1}{2n}} - 1 \right\} + 0.945n \right] \times \frac{5.217}{n} \cdot \frac{V}{S} \cdot \sqrt{\frac{273}{T_H}} \quad \text{s}$$

Where :

| | | |
|----------------|---------------------------------|---------------------|
| P ₀ | : Initial pressure of the tank | kgf/cm ² |
| V | : The volume of air tank | ℓ |
| S | : Effective area of orifice | mm ² |
| T _H | : Room temperature | K |
| n | : Heat capacity ratio (n = 1.4) | |



- Calculating the time of releasing air pressure of an air tank to pressure P

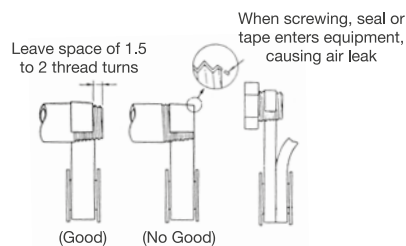
$$t = \frac{2n}{n-1} \left\{ \left(\frac{P_0+1.033}{P+1.033} \right)^{\frac{n-1}{2n}} - 1 \right\} \frac{5.217}{n} \cdot \frac{V}{S} \cdot \sqrt{\frac{273}{T_H}} \quad \text{s}$$

Where :

| | | |
|----------------|---------------------------------|---------------------|
| P ₀ | : Initial pressure of the tank | kgf/cm ² |
| P | : final pressure of the tank | kgf/cm ² |
| V | : The volume of air tank | ℓ |
| S | : Effective area of orifice | mm ² |
| T _H | : Room temperature | K |
| n | : Heat capacity ratio (n = 1.4) | |

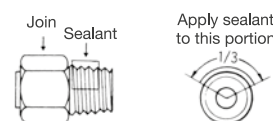
How to Wind a Steel Tape

When winding a seal tape around the threaded portion, leave space of 1.5 to 2 thread turns.



How to Apply Liquid Sealant

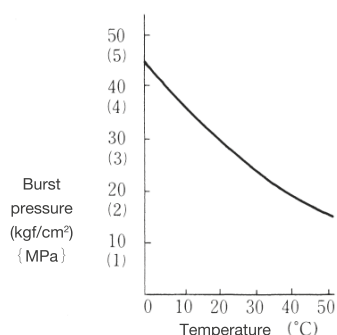
When applying liquid sealant to the threaded portion, apply a proper amount to about 1/3 of the periphery of the threaded portion and then screw it.



Polyurethane Burst Pressure

(Unit : kgf/cm² { MPa })

| Temperature(°C) | Burst pressure |
|------------------|----------------|
| 0 | 43 { 4.3 } |
| 10 | 37 { 3.7 } |
| 20 | 31 { 3.1 } |
| 30 | 24 { 2.4 } |
| 40 | 21 { 2.1 } |
| 50 | 16 { 1.6 } |

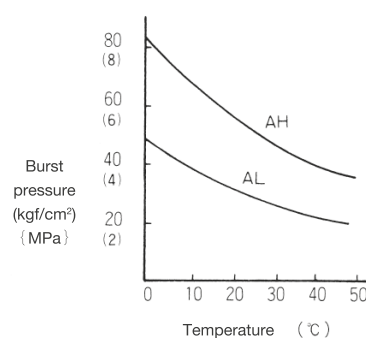


Nylon Tube Burst Pressure

(Unit : kgf/cm² { MPa })

| Temperature(°C) | Burst pressure | |
|------------------|----------------|------------|
| | AH | AL |
| 0 | 84 { 8.4 } | 50 { 5.0 } |
| 10 | 72 { 7.2 } | 40 { 4.0 } |
| 20 | 60 { 6.0 } | 32 { 3.2 } |
| 30 | 48 { 4.8 } | 27 { 2.7 } |
| 40 | 40 { 4.0 } | 23 { 2.3 } |
| 50 | 36 { 3.6 } | 20 { 2.0 } |

《Note》 AH: Nylon
AL: Soft Nylon



Polyurethane Small Bend Radius

(Unit : mm)

| I.D tube | Small bend radius |
|----------|-------------------|
| 4 | 10 |
| 6 | 15 |
| 8 | 24 |
| 10 | 30 |
| 12 | 36 |

Nylon Small Bend Radius

(Unit : mm)

| I.D tube | Small bend radius | |
|----------|-------------------|----|
| | AH | AL |
| 4 | 20 | 13 |
| 6 | 30 | 20 |
| 8 | 48 | 32 |
| 10 | 60 | 40 |
| 12 | 72 | 48 |

《Note》 AH: Nylon
AL: Soft Nylon

Screw of Pipe and Joint

When screwing the pipe and joint, use care to prevent chips and sealant from entering the pipe and joint. Tighten them within a proper range of tightening torque

| Port size | Tightening torque (N • m) |
|-----------|---------------------------|
| M3 | 0.3~0.5 |
| M5 | 1.5~2.0 |
| R 、 Rc1/8 | 7.0~9.0 |
| R 、 Rc1/4 | 12~14 |
| R 、 Rc3/8 | 22~24 |
| R 、 Rc1/2 | 28~30 |
| R 、 Rc3/4 | 28~30 |
| R 、 Rc1 | 36~38 |
| R 、 Rc1¼ | 40~42 |
| R 、 Rc1½ | 48~50 |

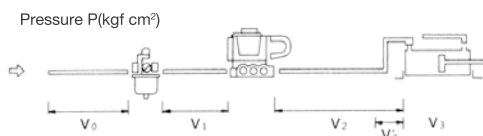
Technology

Common Indoor/ Outdoor Noise Levels

| Location | Performance Standard | Minimum Monitoring Frequency |
|---|---|--|
| Short-term | | |
| Residential (nighttime) | 65 decibels | Monitored for a full hour every four hours |
| Residential (daytime) | 75 decibels (Control level) 80 decibels | |
| Commercial/Industrial (daytime and nighttime) | 80 decibels | |
| Long-term | | |
| Residential (daytime and nighttime) | 65 decibels | 24-hours average noise level |
| Commercial/Industrial (daytime and nighttime) | 72 decibels | Monitored for a full hour every four hours |

«Note» Control level is the level at which measures are recommended or required

Effective Distance for Air Lubricator

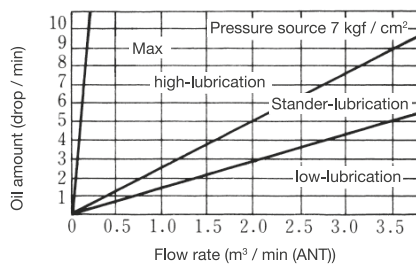


$$L < \frac{\alpha \times (V_3 - V_1) \times (P+1)}{0.785 \times D^2}$$

Where :

- L : The maximum acceptable distance (Lubricator to Cylinder) cm
- D : I.D tube cm
- V₁ : The volume between lubricator and valve cm³
- V₃ : The volume of cylinder cm³
- P : Used pressure kgf/cm²
- α : Tubing coefficient
- Horizontal 0.5~0.6
- Vertical 0.2~0.3
- (tube length > 300mm)

Proportional Lubricator with Precise Oil



ISO Viscosity Classification

| ISO Viscosity Grade | Midpoint Kinematic Viscosity cSt(mm²/s)(¹) (40°C) | Kinematic Viscosity Limits cSt(mm²/s) (40°C) | |
|---------------------|--|--|------------|
| | | Minimum | Maximum |
| ISO VG 10 | 10 | above 9.00 | below 11.0 |
| ISO VG 15 | 15 | above 13.5 | below 16.5 |
| ISO VG 22 | 22 | above 19.8 | below 24.2 |
| ISO VG 32 | 32 | above 28.8 | below 35.2 |
| ISO VG 46 | 46 | above 41.4 | below 50.6 |
| ISO VG 68 | 68 | above 61.2 | below 74.8 |
| ISO VG 100 | 100 | above 90.0 | below 110 |

«Note» 1cSt = 1mm²/s

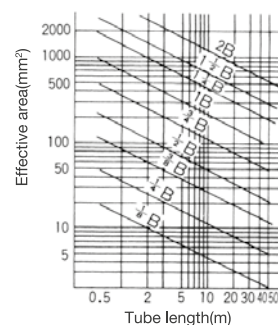
Tube Size Selection

$$S = \frac{Q_{max}}{22.2\sqrt{(P+1)X\Delta P}}$$

Where:

- S : Effective area mm²
- Q_{max} : Maximum air consumption of tube ℓ/min(ANR)
- P : Used pressure kgf/cm²
- ΔP : Pressure drop kgf/cm²

Determining the effective area and tube length then decide the size of the tube



Air Compressor Productivity

- Average air consumption (Air tank is used case)
 $Q_c \geq Q_a$
 Q_c : Amount of air produce by an air compressor
 $\ell / \text{min(ANR)}$
 Q_a : Average air consumption
 $\ell / \text{min(ANR)}$

- Maximum Air Consumption
 $Q_c \geq Q_{\text{MaX}}$
 Q_c : Amount of air produce by an air compressor
 $\ell / \text{min(ANR)}$
 Q_{MaX} : Maximum air consumption
 $\ell / \text{min(ANR)}$

Selection on Air Tank's Volume

- Instant Air Consumption

$$V \geq \frac{Q - Q_c \times t}{\Delta P}$$

Where:

V : Air tank volume
 Q : Centralized air consumption
 $\ell / \text{min(ANR)}$
 Q_c : Amount of air that into the air tank
 $\ell / \text{min(ANR)}$
 t : Centralized air consumption time
 S
 ΔP : Pressure drop in the air tank
 kgf/cm^2

Cylinder Air Consumption

- Maximum air consumption

$$Q_{\text{Amax}} = \frac{\pi}{4} \times D^2 \times \frac{L}{t} \times (P+1) \times 60 \times 10^{-3}$$

$$= 0.047 \times D^2 \times \frac{L}{t} \times (P+1)$$

Where:

Q_{Amax} : Maximum air consumption
 $\ell / \text{min(ANR)}$
 D : Cylinder bore size
 cm
 L : Cylinder stroke
 cm
 t : time per stroke
 S
 P : Used pressure
 kgf/cm^2

- Average air consumption

$$Q_{\text{Aa}} = 2 \times N \times \frac{\pi}{4} \times D^2 \times L \times (P+1) \times 10^{-3}$$

$$= 0.00157 \times N \times D^2 \times L \times (P+1)$$

Where:

Q_{Aa} : Average air consumption
 $\ell / \text{min(ANR)}$
 D : Cylinder bore size
 cm
 L : Cylinder stroke
 cm
 N : Frequency
 cycle/min
 P : Used pressure
 kgf/cm^2

HI-ROTOR Air Consumption

- Maximum air consumption

$$Q_{\text{Hmax}} = \frac{V}{t} \times (P+1) \times 60 \times 10^{-3}$$

$$= 0.06 \times \frac{V}{t} \times (P+1)$$

Where:

Q_{Hmax} : Maximum air consumption
 $\ell / \text{min(ANR)}$
 V : HI-ROTOR volume
 cm^3
 t : Oscillation time
 S
 P : Used pressure
 kgf/cm^2

- Average air consumption

$$Q_{\text{Ha}} = 2 \times N \times V \times (P+1) \times 10^{-3}$$

$$= 0.002 \times N \times V \times (P+1)$$

Where:

Q_{Ha} : Average air consumption
 $\ell / \text{min(ANR)}$
 V : HI-ROTOR volume
 cm^3
 N : Frequency
 cycle/min
 P : Used pressure
 kgf/cm^2

Piping Air Consumption

- Maximum air consumption

$$Q_{\text{TUmax}} = \frac{\pi}{4} \times d^2 \times \frac{\ell}{t} \times P \times 60 \times 10^{-3}$$

$$= 0.047 \times d^2 \times \frac{\ell}{t} \times P$$

Where:

Q_{TUmax} : Maximum air consumption
 $\ell / \text{min(ANR)}$
 d : Tube i.d
 cm
 ℓ : Tube length
 cm
 t : One way per a unit of time
 S
 P : Used pressure
 kgf/cm^2

- Average air consumption

$$Q_{\text{TUa}} = 2 \times N \times \frac{\pi}{4} \times d^2 \times \ell \times P \times 10^{-3}$$

$$= 0.00157 \times N \times d^2 \times \ell \times P$$

Where:

Q_{TUa} : Average air consumption
 $\ell / \text{min(ANR)}$
 d : Tube i.d
 cm
 ℓ : Tube length
 cm
 t : Frequency
 cycle/min
 P : Used pressure
 kgf/cm^2

Technology

Unit Conversion

| | → SI | SI → | | → SI | SI → |
|----------|---------------------------------|----------------------------------|--------------|--|---|
| Pressure | 1kgf/cm ² = 0.098MPa | 0.1MPa = 1.02kgf/cm ² | Energy | 1kgf/m = 9.8J | 1J = 0.102kgf/m |
| | 1mmHg = 133Pa | 1 kPa = 7.51mmHg | | 1kgf · cm = 0.098J | = 10.2kgf · cm |
| | 1mmH ₂ O = 9.8Pa | 10Pa = 0.102mmH ₂ O | | = 98mJ | 1mJ = 0.01kgf · cm |
| Load | 1kgf = 9.8N | 1N = 0.102kgf | Acceleration | 1G = 9.8m/s ² | 1m/s ² = 0.102G |
| | 1gf = 9.8mN | 1mN = 0.12gf | Pressure | 1kgf = 9.8N/mm ² | 1N/mm ² = 0.12kgf/mm ² |
| Torque | 1kgf · m = 9.8N · m | 1N · m = 0.102kgf · m | Inertia | 1kgf · cm · s ² = 980kg · cm ² | 1kg · cm ² = 1.02 × 10 ⁻³ kgf · cm · s ² |
| | 1kgf · cm = 9.8N · cm | 1N · m = 0.102kgf · cm | | 1kgf · m · s ² = 9.8kg · m ² | 1kg · m ² = 0.102kgf · m · s ² |

| Pa | bar | kgf/cm ² | atm | mmH ₂ O | mmHg or Torr |
|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1 | 1 × 10 ⁻⁵ | 1.0197 × 10 ⁻⁵ | 9.86923 × 10 ⁻⁶ | 1.01972 × 10 ⁻¹ | 7.50062 × 10 ⁻³ |
| 1 × 10 ⁵ | 1 | 1.01972 | 9.86923 × 10 ⁻¹ | 1.01972 × 10 ⁴ | 7.50062 × 10 ² |
| 9.80665 × 10 ⁴ | 9.80665 × 10 ⁻¹ | 1 | 9.67841 × 10 ⁻¹ | 1.00000 × 10 ⁴ | 7.35559 × 10 ² |
| 1.01325 × 10 ⁵ | 1.01325 | 1.03323 | 1 | 1.03323 × 10 ⁴ | 7.60000 × 10 ² |
| 9.80665 | 9.80665 × 10 ⁻⁵ | 1.00000 × 10 ⁻⁴ | 9.67841 × 10 ⁻⁵ | 1 | 7.35559 × 10 ⁻² |
| 1.33322 × 10 ² | 1.33322 × 10 ⁻³ | 1.35951 × 10 ⁻³ | 1.31579 × 10 ⁻³ | 1.35951 × 10 | 1 |





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