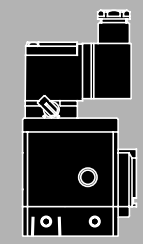
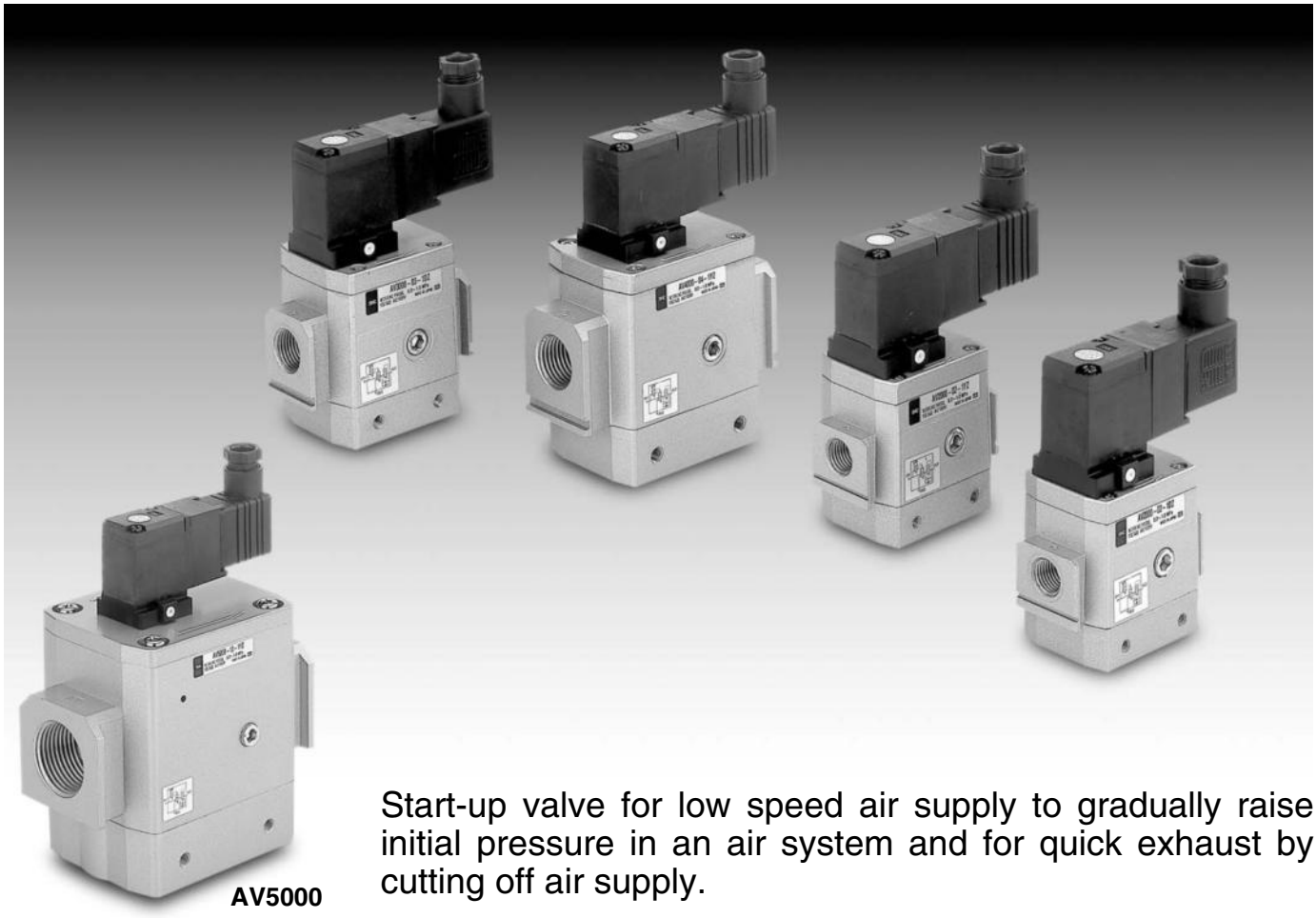


Soft Start-up Valve
AV2000/3000/4000/5000



AV5000

Start-up valve for low speed air supply to gradually raise initial pressure in an air system and for quick exhaust by cutting off air supply.

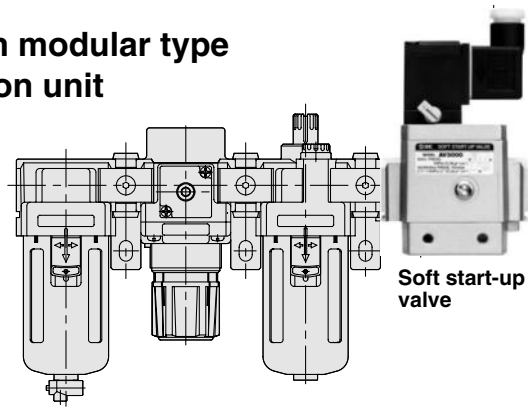
Large effective area (mm²)

AV2000/ 20 (Body size: 1/4)
AV3000/ 37 (Body size: 3/8)
AV4000/ 61 (Body size: 1/2)
AV5000/ 113 (Body size: 3/4)
AV5000/ 122 (Body size: 1)

With supply/exhaust function by manual operation

Low power consumption

Connectable with modular type F.R.L. combination unit



Soft start-up valve

F.R.L. combination

Combination with F.R.L. unit

Soft start-up valve \ F.R.L. combination	AC20	AC25	AC30	AC40	AC50	AC60
AV2000	●					
AV3000		●	●			
AV4000 (Except AC40-06)				●		
AV5000					●	●

F.R.L. combination

⚠ Precautions

Be sure to read before handling. Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Caution on Design

⚠ Warning

1. Actuator drive

When using solenoid valve or actuator in the outlet side of this product, implement appropriate measures to prevent potential danger caused by actuator operation.

2. Holding pressure

Since the valve might have slight interal leakage, it is not suitable for holding pressure in a tank or another vessel for a long period of time.

3. Maintenance space

Allow the sufficient space for maintenance and inspection.

Selection

⚠ Warning

1. Confirm the specifications.

The products presented in this catalog are designed only for use in compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to specifications.) Please contact SMC if using for other fluids than compressed air.

2. Extended periods of continuous energization

Please contact SMC if valves will be continuously energized for extended periods of time.

3. Operation of closed center solenoid valves

Even if this product is used for closed center solenoid valves or actuator with a load factor of more then 50%, jumping (stick-slip phenomenon) cannot be prevented.

4. Using a regulator in the outlet side

When mounting a regulator in the outlet side (A port side), use a residual pressure relief regulator (AR25K to 40K) or a check type regulator. With a standard regulator (AR10 to 60), the outlet side pressure may not be released when this valve is exhausted.

5. Operation of solenoid valves in the outlet side

To operate solenoid valves mounted on this product's outlet side (A port side), first confirm that the outlet side's pressure (P) has increased to become equal to the inlet side's pressure (P).

6. Operation

The residual pressure release function of this product is for emergency use only; therefore, avoid the operation in the same manner as ordinary 3 port valves.

7. Using a lubricator

If mounting a lubricator, mount it on the inlet side (P port side), of this product. If mounted on the outlet side (A port side), back flow of oil will occur and may spurt out of the valve's R port.

8. Operation for air blowing

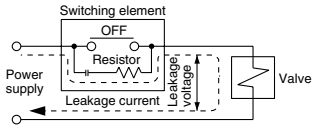
This product cannot be operated for air blowing due to the mechanism that switches the main valve to be fully open after the outlet side's pressure increases to approximately 1/2 of the inlet side.

Selection

⚠ Caution

1. Voltage leakage

Particularly when using a C-R element (surge voltage suppressor) for protection of the switching element, use cation that leakage voltage will increase due to leakage current flowing through the C-R element, etc.



AC coil is 20% or less of rated voltage.

DC coil is 3% or less of rated voltage.

2. Low temperature operation

Although the valve can be operated at temperature as low as 0°C, measures should be taken to avoid solidifying or freezing drainage and moisture, etc.

Mounting

⚠ Warning

1. If air leakage increases or equipment does not operate properly, stop operation.

After mounting or maintenance, etc., connect the compressed air and power supplies, and perform appropriate function and leakage tests to confirm that the unit is mounted properly.

2. Instruction manual

Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual in a place where it can be referred to as necessary.

3. Painting and coating

Warnings or specifications printed or labeled on a product should not be erased, removed or covered up.

Furthermore, please contact SMC before painting the resin parts, as this may cause adverse effects depending on the solvent.

Adjustment

⚠ Caution

1. To perform the initial speed adjustment of a outlet side actuator, supply air from this valve's inlet side and turn ON the pilot valve. Then, rotate the needle clockwise from the fully closed position.

⚠ Precautions

Be sure to read before handling. Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Piping

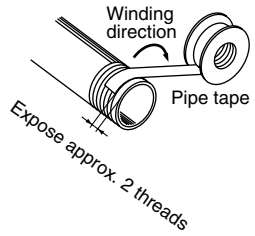
⚠ Caution

1. Preparation before piping

Before piping is connected, it should be thoroughly blown out by air (flushed) or washed to eliminate cutting chips, cutting oil, and other debris from the pipe inside.

2. How to wrap a pipe tape

When connecting pipes and fittings, etc., ensure that cutting chips and sealing materials from the pipe threads should not get inside the valve. When a pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.



3. Tighten threads with the proper tightening torque.

When screwing fittings into valves, tighten with the torques given below.

Tightening Torque when Piping

Connection threads	Proper tightening torque (N·m)
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38

4. Piping to products

When piping to products, avoid making an error of supply port, etc., by referring to the instruction manuals.

5. F.R.L. module combination

When connecting to a modular F.R.L. combinations (AC20 to 60), select one of the spacers, which are included. (Refer to page 14-2-10 for details.) However, modular combinations with AC40-06 are not possible.

Furthermore, connect soft start-up valves to the outlet side of the F.R.L. combination.

6. Inlet side piping conditions

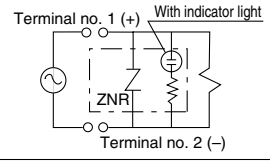
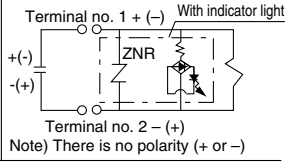
The nominal size of the piping material's or equipment's bore should be equal to or larger than the soft start-up valve's port size. The composite effective area of the inlet side's (P port side's) piping or equipment should be equal to or larger than the values below.

Model	Composite effective area (mm^2)
AV2000	5
AV3000	22
AV4000	35
AV5000	50

When the piping is restricted or the supply pressure is insufficient, the main valve will not switch and air leakage may occur from the R port.

Light/Surge Voltage Suppressor

⚠ Caution

Voltage	AC and 100 VDC	24 VDC or less
Electrical circuit		

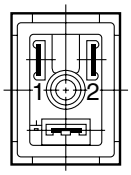
Note) There is no polarity (+ or –)

Electrical Connection

⚠ Caution

The internal connection of the DIN terminal is as shown below, connect to the power supply side as shown.

DIN terminal



Terminal	1	2
DIN terminal	+	–

Lubrication

⚠ Caution

1. The valve has been lubricated for life at the factory, and does not require any further lubrication.

2. Use turbine oil Class 1, ISO VG32 (with no additives), if lubricated. Besides, if the lubrication is suspended halfway, the original lubricant will be lost and may result in a malfunction. Be sure to keep lubricating continuously.

Refer to the brand name table given below for lubricants by each company, comforming to turbine oil Class 1 (with no additives), ISO VG32.

Turbine Oil Class 1 (With no additives), ISO VG32

Viscosity classification cSt (40°C)	ISO viscosity grade	**32**
Idemitsu Kosan Co.,Ltd.		Turbine oil P-32
Nippon Mitsubishi Oil Corp.		Turbine oil 32, Mitsubishi Turbine 32
Cosmo Oil Co.,Ltd.		Cosmo turbine 32
Japan Energy Corp.		Kyodo turbine 32

Viscosity classification cSt (40°C)	ISO viscosity grade	**32**
Kygnus Oil Co.		Turbine oil 32
Kyushu Oil Co.		Stork turbine 32
Showa Shell Sekiyu K.K.		Turbine 32
Tonengeneral Sekiyu K.K.		General R turbine 32
Fuji Kosan Co.,Ltd.		Fucoal turbine 32

Please contact SMC regarding turbine oil Class 2 (with additives), ISO VG32.

⚠Precautions

Be sure to read before handling. Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Air Supply

⚠Warning

1. Use clean air.
Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.

⚠Caution

1. Install air filters.
Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.

2. Implement countermeasures by installing after-cooler or air dryer, or water separator, etc.
The air including excess drain may result in a malfunction of valves and other pneumatic equipment. Implement countermeasures by installing after-cooler or air dryer, or water separator, etc.

Operating Environment

⚠Warning

1. Do not use valves in such environments where corrosive gases, chemicals, or brine or water or steam is airborne, or where valves can be directly exposed to any of those.

2. Do not use in an explosive environment.

3. Do not use in locations influenced by vibrations or impacts.

4. A protective cover, etc., should be used to shield valves from direct sunlight.

5. Shield valves from radiated heat generated by nearby heat sources.

6. Take suitable protective measures in locations where there are contacts with water droplets, oil, or welding spatter, etc.

7. In a dusty environment or when valve switching noise is intrusive, install a silencer in the R port to prevent dust from entering, and to reduce noise.

Maintenance

⚠Warning

1. Perform maintenance and inspection as shown in the instruction manual.
If handled improperly, damage may occur in machine or equipment or an operational error may result in.

2. Equipment removal and supply/exhaust of compressed air
When equipment is removed, first confirm that measures are implemented to prevent dropping of workpiece and runaway of equipment, etc. Then cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.

3. Low frequency operation
Valves should be switched at least once every 30 days to prevent malfunction. (Use caution regarding the air supply.)

4. Manual override operation
When the manual override is operated, connected equipment will be actuated.
Confirm the safety before operating.

⚠Caution

1. Drain removal
Remove drain from air filters periodically.

How to Find the Flow Rate

(At air temperature of 20°C)

Choke flow: $(P_2 + 0.1)/(P_1 + 0.1) \leq 0.5$

$$Q = 120 \times S \times (P_1 + 0.1) \times \sqrt{\frac{293}{273 + t}}$$

Subsonic flow: when $(P_2 + 0.1)/(P_1 + 0.1) > 0.5$

$$Q = 240 \times S \times \sqrt{(P_1 - P_2)(P_2 + 0.1)} \times \sqrt{\frac{293}{273 + t}}$$

Q: Air flow rate [ℓ/min (ANR)]
S: Effective area (mm^2)
P_1: Upstream pressure [MPa]
P_2: Downstream pressure [MPa]
t: Air temperature [°C]

Note 1) Formulas above are applied to pneumatics only.