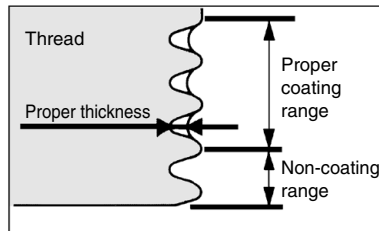
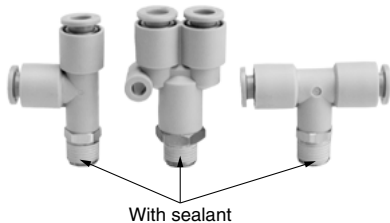


# For Pneumatic Piping/Fittings & Tubing Prior to Use

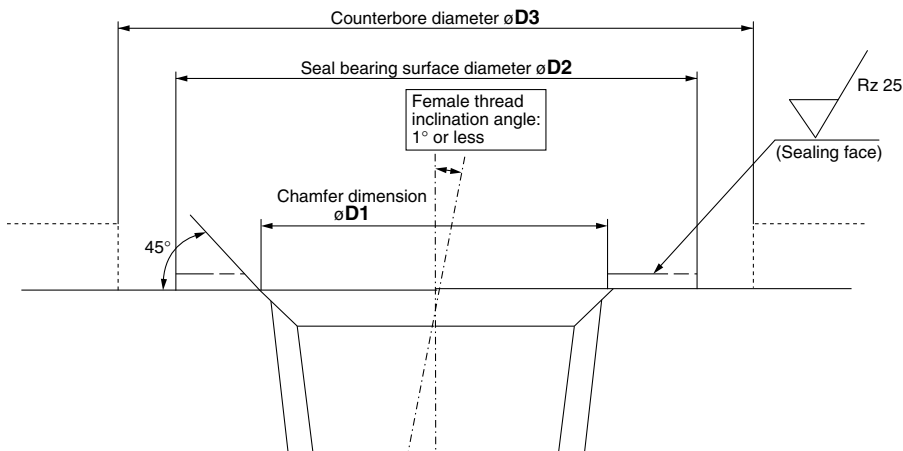
## Fittings with Sealant

Seal material (fluoresin) is coated on the thread part to the proper thickness and within the proper coating range, which reduces piping work, such as coating the seal on the thread.



## Female Thread Conditions Applicable to Face Seals

1. Surface roughness of bearing surface: Rz 25 or less
2. Chamfer dimension:  $\phi D1$ , Seal bearing surface diameter:  $\phi D2$  (Refer to the table below.)
3. Female thread inclination angle:  $1^\circ$  or less
4. Counterbore diameter when the female thread is counterbored:  $\phi D3$ 
  - Models with hexagonal flats: Body width across flats x 1.1 or more
  - Models other than hexagon (Hexagon socket head male connector, etc.): Body dimensions + 0.2 mm or more
- \* The width across flats and the body dimensions differ depending on the model even when the same thread size is used. Refer to the dimensions in the catalog.
5. If oil content or sealant is sticking to the female thread, this may cause damage to the product. Remove it before piping.



**Table 1**

Connection thread size	Chamfer dimension $\phi D1$ [mm]	Seal bearing surface diameter $\phi D2$ [mm]
R1/8	10.2 to 10.4	12 or more
R1/4	13.6 to 13.8	17 or more
R3/8	17.1 to 17.3	21 or more
R1/2	21.4 to 21.6	27 or more
NPT1/16	8.2 to 8.4	11.11 or more
NPT1/8	10.5 to 10.7	12.7 or more
NPT1/4	14.1 to 14.3	17.46 or more
NPT3/8	17.4 to 17.6	22 or more
NPT1/2	21.7 to 21.9	28.7 or more
G1/8	10.2 to 10.6	12 or more
G1/4	13.6 to 14.0	17 or more
G3/8	17.1 to 17.5	21 or more
G1/2	21.4 to 21.8	27 or more

### ⚠ Precautions

For products that do not satisfy the female thread conditions shown above and piping with a piping pitch narrower than the product dimension, use the current sealant type.

\* The rubber parts of the face seal cannot be replaced.

\* An air blow may cause the rubber parts of the face seal to fall off, and they cannot be remounted. Please refrain from performing an air blow.



# Fittings & Tubing Precautions 1

Be sure to read this before handling products.

## Design / Selection

### Warning

#### 1. Confirm the specifications.

Products represented in this catalog are designed only for use in compressed air systems (including vacuum). Do not operate at pressures, temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Please contact SMC when using a fluid other than compressed air (including vacuum).

We do not guarantee against any damage if the product is used outside of the specification range.

#### 2. Do not disassemble the product or make any modifications, including additional machining.

Doing so may cause human injury and/or an accident.

#### 3. Check if PTFE can be used in the application.

PTFE powder (Polytetrafluoroethylene resin) is included in the sealant. Confirm that the use of it will not cause any adverse effect on the system.

### Caution

#### 1. Keep the connection part of fittings and tubing from rotating or oscillating movement. Use rotary One-touch fittings (KS or KX series) in these cases.

The fittings may be damaged if they are used in the above manner.

#### 2. The tubing bending radius in the vicinity of the fitting should be at least the minimum bending radius of the tubing.

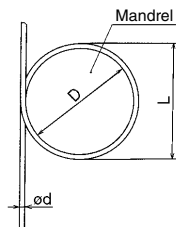
If the bending radius is less than the minimum value, fittings may be damaged, and tubing may crack or be crushed. The minimum bending radius of the FR soft nylon tubing (TRS series), FR double layer tubing (TRB series), antistatic soft nylon tubing (TAS series), polyolefin tubing (TPH series), and soft polyolefin tubing (TPS series) is measured as following in accordance with JIS B 8381.

The tubing deformation ratio at the minimum bending radius is obtained through the following formula, based on tubing diameter and mandrel diameter by winding the same radius mandrel tube.

$$\eta = \left(1 - \frac{L - D}{2d}\right) \times 100$$

Tube deformation ratio at the minimum bending radius

Here,  $\eta$  : Deformation ratio [%]  
d : Tubing diameter [mm]  
L : Measured length [mm]  
D : Mandrel diameter [mm]  
(Twice against the minimum bending radius)  
Test temperature: 20 ±5°C  
Relative humidity: 65 ±5%



#### 3. Do not use fluids other than those listed on the specifications.

Applicable fluids are air and water. Please consult with SMC if using other fluids.

#### 4. When used with water, the fittings or tubing may be damaged depending on the surge pressure.

#### 5. Depending on the storage or operating environment and the period of storage or use, the surface of the brass (C3604) may blacken. If the discoloration of the brass is a problem, we recommend selecting electroless nickel-plated brass instead.

Example) KQ2H06-01 NS

## Mounting / Piping

### Warning

#### 1. Operation manual

Install the products and operate them only after reading the operation manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.

#### 2. Maintenance space

Allow sufficient space for maintenance and inspection.

#### 3. Adhere to the thread tightening method.

Refer to the "Connection Thread Tightening Method" when mounting the product.

#### 4. There may be cases in which the tubing detaches from the fitting and thrashes around uncontrollably due to tubing degradation or fitting breakage.

To prevent the situation from becoming uncontrollable, fit the tubing with a protective cover or secure it in place.

### Caution

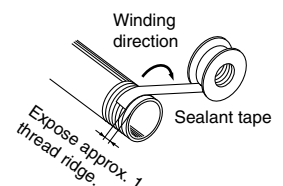
#### 1. Preparation before piping

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

#### 2. Winding of sealant tape

When screwing together pipes, fittings, etc., be certain that chips from the pipe threads and sealant do not get inside the pipe.

Also, if sealant tape is used, leave approx. 1 thread ridge exposed at the end of the threads.



#### 3. Check the model, type, and size before installation. Also, confirm that there are no scratches, gouges, or cracks on the product.

#### 4. When connecting the tubing, take pressure and possible changes to the tubing length into account, and allow a sufficient margin.

Failure to do so may result in fitting breakage or the detachment of the tubing. Refer to the recommended piping conditions.

#### 5. Do not apply unnecessary forces, such as twisting, pulling, moment loads, vibration, impact, etc., on fittings or tubing.

This will cause damage to fittings and will crush, burst, or release tubing.

#### 6. Tubing, with the exception of coiled tubing, requires stationary installation. Do not use standard tubing (non-coiled) in applications where tubing is required to travel inside the flexible protection tube. Tubing that travels may sustain abrasion, extension, or severance due to tensile force. The removal of tubing from the fitting may also occur. Use caution prior to use in an application.

#### 7. To install the fitting, screw the fitting into the hexagonal face of the body, and tighten with a suitable wrench.

Affix the wrench at the base of the thread. If the size of the hexagonal face and wrench do not match, or tightening takes place near the tube side, it may cause the collapse or deformation of the hexagonal face, or damage to the equipment. After installing, confirm that there is no damage to the fitting, etc.



# Fittings & Tubing Precautions 2

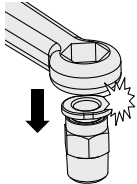
Be sure to read this before handling products.

## Mounting / Piping

### Caution

#### 8. Interference in oval type release buttons

The following models cannot be used if a box wrench or socket wrench is used.



#### KQ2 Series

Model	Applicable tubing	Connection thread	Part number
Male connector	ø3.2	M3 x 0.5	KQ2H23-M3G1
	ø3.2	M5 x 0.8	KQ2H23-M5□1
	ø4	M3 x 0.5	KQ2H04-M3G1
	ø4	M5 x 0.8	KQ2H04-M5□1
	ø6	M6 x 1.0	KQ2H04-M6□1
	ø6	M5 x 0.8	KQ2H06-M5□1
	ø6	M6 x 1.0	KQ2H06-M6□1
	ø6	R1/8	KQ2H06-01□S1
	ø1/8	10-32UNF	KQ2H01-32□1
	ø5/32	10-32UNF	KQ2H03-32□1
	ø3/16	10-32UNF	KQ2H05-32□1
	ø5/32	NPT1/16	KQ2H03-33□S1
	ø1/8	M5 x 0.8	KQ2H01-M5□1
	ø3/16	M5 x 0.8	KQ2H05-M5□1
Female connector	ø4	M3 x 0.5	KQ2F04-M3□1
	ø4	M5 x 0.8	KQ2F04-M5□1
	ø6	M5 x 0.8	KQ2F06-M5□1
	ø1/8	10-32UNF	KQ2F01-32□1
	ø5/32	10-32UNF	KQ2F03-32□1
	ø1/8	M3 x 0.5	KQ2F23-M3□1
	ø1/8	M5 x 0.8	KQ2F23-M5□1

□: A (Brass), N (Brass + Electroless nickel plating)

#### KQ2-G Stainless Steel Series

Model	Applicable tubing	Connection thread	Part number
Male connector	ø4	M5 x 0.8	KQ2H04-M5G1
	ø6	M5 x 0.8	KQ2H06-M5G1
	ø6	R1/8	KQ2H06-01GS1

## Air Supply

### Warning

#### 1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

Regarding products for general fluids, please contact SMC concerning applicable fluids.

#### 2. When there is a large amount of drainage

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

#### 3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes the malfunction of pneumatic equipment.

If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to the Best Pneumatics No. 6 catalog.

#### 4. Use clean air.

Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

## Air Supply

### Caution

#### 1. Install an air filter.

Install an air filter on the upstream side of the valve.

Select an air filter with a filtration size of 5 µm or smaller.

#### 2. Install an aftercooler, air dryer, water separator, etc.

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.

#### 3. Ensure that the fluid and ambient temperatures are within the specified range.

If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals or equipment malfunction. Therefore, take appropriate measures to prevent freezing.

For compressed air quality, refer to the Best Pneumatics No. 6 catalog.

## Operating Environment

### Warning

#### 1. Do not use in an atmosphere where corrosive gases, chemicals, sea water, water, or water steam are present. Do not use in cases where there is direct contact with any of the above.

Refer to each construction drawing for information on the materials of fittings and tubing.

#### 2. Do not expose the product to direct sunlight for an extended period of time.

#### 3. Do not use in a place subject to heavy vibration and/or impact.

#### 4. Do not mount the product in locations where it is exposed to radiant heat.

#### 5. Do not use ordinary fittings and tubing in locations where static electricity would be problematic.

This may result in system failure or other problems. In such places, the use of antistatic fittings (KA series) and antistatic tubing (TA series) is recommended.

#### 6. Do not use ordinary fittings and tubing in locations where spatter is generated.

Spattering may result in a fire hazard. In such places, the use of flame resistant fittings (KR/KRM series) and flame resistant tubing (TRS/TRB/TRBU/TRTU series) is recommended.

#### 7. Do not use in an environment where the product is directly exposed to cutting oil, lubricant, coolant oil, etc.

Please contact SMC if using in an environment exposed to cutting oil, lubricant, coolant oil, etc.

#### 8. Take caution when nylon tubing and soft nylon tubing are used in a clean room.

The antioxidant on the surface of the tubing may come off, thereby lowering the cleanliness level.

#### 9. Do not use in environments where foreign matter may stick to the product or get mixed in the product's interior.

This may cause leakage or the disconnection of the tubing.



# Fittings & Tubing Precautions 3

Be sure to read this before handling products.

## Maintenance

### Warning

#### 1. Perform maintenance and inspections according to the procedures indicated in the operation manual.

If handled improperly, malfunction or damage of machinery and equipment may occur.

#### 2. Maintenance work

If handled improperly, compressed air can be dangerous. The assembly, handling, repair, and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

#### 3. Drain flushing

Remove drainage from air filters regularly.

#### 4. Removal of equipment and supply/exhaust of compressed air

Before components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

When the equipment is restarted, proceed with caution after confirming that appropriate measures are in place to prevent sudden movement.

### Caution

#### 1. Be certain to wear safety glasses at all times during periodical inspections.

#### 2. Replace fittings or tubing having the following problems.

- 1) Cracks, gouges, wearing, corrosion
- 2) Air leakage
- 3) Twists or crushing of tubing
- 4) Hardening, deterioration, softening of tubing

#### 3. When replacing tubes or fittings, do not try to mend or repair and then reuse them.

## One-touch Fittings

### Mounting / Piping

### Caution

#### 1. Installation and removal of tubing for One-touch fittings

##### 1) Installation of tubing

(1) Cut the tubing perpendicularly, being careful not to damage the outside surface. Use an SMC tube cutter TK-1, 2, 3, 5, or 6. Do not cut the tubing with pliers, nippers, scissors, etc., otherwise the tubing will be deformed and problems may result.

(2) The outside diameter of the polyurethane tubing swells when internal pressure is applied to it. Therefore, it may be impossible to re-insert the tubing into the One-touch fitting. Check the tubing outside diameter, and when the accuracy of the outside diameter is +0.07 mm or larger for  $\phi 2$ , +0.15 mm or larger for other sizes, re-insert it into the One-touch fitting without cutting the tubing. When the tubing is re-inserted into the One-touch fitting, confirm that the tubing goes through the release button smoothly.

## One-touch Fittings

### Mounting / Piping

### Caution

(3) Grasp the tubing, and slowly push it straight (0 to 5°) into the One-touch fitting until it comes to a stop.

(4) Pull the tubing back gently to make sure it has a positive seal. Insufficient installation may cause air to leak or the tubing to release.

As a guide for checking if the tubing is pulled out or not, refer to the following table.

Tubing size	Tensile force of tubing [N]
$\phi 2$ , 3.2, 1/8"	5
$\phi 4$ , 5/32", 3/16"	8
$\phi 6$ , 1/4"	12
$\phi 8$ , 5/16"	20
$\phi 10$ , 3/8"	30
$\phi 12$ , 1/2"	35
$\phi 16$	50

#### 2) Removal of tubing

(1) Push the release button flange evenly and sufficiently to release the tube. Do not push in the tubing before pressing the release button.

(2) Pull out the tubing while keeping the release button depressed. If the release button is not held down sufficiently, the tubing cannot be withdrawn.

(3) To reuse the tubing, remove the previously lodged portion of the tubing. If the lodged portion is left on without being removed, it may result in air leakage and make the removal of the tubing difficult.

#### 2. Connecting products with metal rods

Products with metal rods (KC series, previous KQ series, KN series, KM series, etc.) cannot be connected to KQ2 series One-touch fittings. If connected, the metal rod cannot be retained by the chuck of the One-touch fitting, and products with metal rods may project during pressurization, causing serious personal injury or accident.

Even when products with metal rods can be connected to other One-touch fittings, do not use any tube, resin plug, or reducer after connection. This may cause releasing.

For details about One-touch fittings that can connect to products with metal rods, contact SMC.



# Fittings & Tubing Precautions 4

Be sure to read this before handling products.

## Connection Thread Tightening Method

### 1. Connection thread: M3

First, tighten by hand, then use a suitable wrench to tighten the hexagonal portion of the body an additional 1/4 turn. The reference value for the tightening torque is 0.4 to 0.5 N·m.

### 2. Connection thread: M5 and 10-32UNF

First, tighten by hand, then use a suitable wrench to tighten the hexagonal portion of the body an additional 1/6 to 1/4 turn. The reference value for the tightening torque is 1 to 1.5 N·m.

### 3. Connection thread: M6

First, tighten by hand, then use a suitable wrench to tighten the hexagonal portion of the body an additional 1/6 to 1/4 turn.

\* Excessive tightening may damage the thread portion or deform the gasket and cause air leakage. Insufficient tightening may loosen the threads or cause air leakage.

### 4. Fittings with sealant: R, NPT

1) First, tighten the fitting by hand, then use a suitable wrench to tighten the hexagonal portion of the body a further two or three turns.

To find the appropriate tightening torque, see the table below.

Connection thread size (R, NPT)	Tightening torque [N·m]
1/16, 1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

2) If the fitting is tightened with excessive torque, a large amount of sealant will seep out. Remove the excess sealant.

3) Insufficient tightening may cause seal failure or loosen the threads.

4) For reuse

(1) Normally, fittings with a sealant can be reused up to 2 to 3 times.

(2) To prevent air leakage through the sealant, remove any loose sealant stuck to the fitting by blowing air over the threaded portion.

(3) If the sealant no longer provides effective sealing, wind sealant tape over the sealant before reusing. Do not use any form other than the tape type of sealant.

(4) Once the fitting has been tightened, backing it out to its original position often causes the sealant to become defective. Air leakage will occur.

### 5. Face seal fittings: R, NPT, G

1) Tighten fittings with sealant using the proper tightening torques in the table below.

Connection thread size (R, NPT, G)	Proper tightening torque [N·m]
1/16, 1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

2) Insufficient tightening may cause seal failure or loosen the threads.

3) For reuse

(1) Normally, fittings with a sealant can be reused up to 6 to 10 times.

(2) The seal ring cannot be replaced.

### 6. Uni thread fittings

1) First, tighten the threaded portion by hand, then use a suitable wrench to tighten the hexagonal portion of the body further at the appropriate wrench tightening angle shown below. For the reference value for the tightening torque, refer to the table below.

#### Connection Female Thread: Rc, NPT, NPTF

Uni thread size	Wrench tightening angle after hand-tightening [deg]	Tightening torque [N·m]
1/8	30 to 60	3 to 5
1/4	30 to 60	8 to 12
3/8	15 to 45	14 to 16
1/2	15 to 30	20 to 22

#### Connection Female Thread: G

Uni thread size	Wrench tightening angle after hand-tightening [deg]	Tightening torque [N·m]
1/8	30 to 45	3 to 4
1/4	15 to 30	4 to 5
3/8	15 to 30	8 to 9
1/2	15 to 30	14 to 15

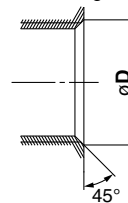
2) The gasket can be reused up to 6 to 10 times. It can be replaced easily when it has sustained damage. A broken gasket can be removed by holding it and then turning it in the same direction as loosening the thread. If the gasket is difficult to remove, cut it with nippers, etc. In such a case, use caution not to scratch the seat face because the seat face of the fitting's 45° gasket is the sealing face.

## Chamfer Dimensions for Female Threads

### Caution

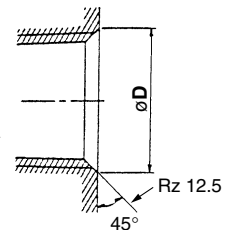
#### 1. Chamfer dimensions for female connection threads M3, M5, 10-32UNF

In compliance with ISO 16030 Standards (air pressure fluid dynamics – connection – ports and stud ends), the chamfer dimensions shown below are recommended. By chamfering as shown in the following table, machining of threads is easier and effective for burr prevention.



Connection thread size	Chamfer dimension øD (Recommended value) [mm]
M3	3.1 to 3.4
M5	5.1 to 5.4
10-32UNF	5.0 to 5.3

#### 2. Chamfer dimensions of R and NPT threads with sealant, and Uni threads



Connection thread size	Chamfer dimension øD (Recommended value)		
	G	Rc	NPT, NPTF
1/16	—	—	8.2 to 8.4
1/8	10.2 to 10.6	10.2 to 10.4	10.5 to 10.7
1/4	13.6 to 14.0	13.6 to 13.8	14.1 to 14.3
3/8	17.1 to 17.5	17.1 to 17.3	17.4 to 17.6
1/2	21.4 to 21.8	21.4 to 21.6	21.7 to 21.9

\* For Uni threads, Rz 12.5 is necessary for sealing at the chamfered part.



# Fittings & Tubing Precautions 5

Be sure to read this before handling products.

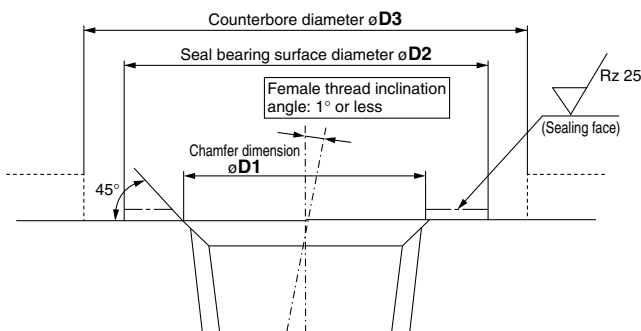
## Chamfer Dimensions for Female Threads

### ⚠ Caution

#### 3. Chamfer dimensions for female threads of face seal fittings (R, NPT, G)

- 1) Surface roughness of bearing surface: Rz 25 or less
- 2) Chamfer dimension:  $\phi D1$ , Seal bearing surface diameter:  $\phi D2$  (Refer to the table below.)
- 3) Female thread inclination angle:  $1^\circ$  or less
- 4) Counterbore diameter when the female thread is counterbored:  $\phi D3$ 
  - Models with hexagonal flats: Body width across flats x 1.1 or more
  - Models other than hexagon (Hexagon socket head male connector, etc.): Body dimensions + 0.2 mm or more
  - \* The width across flats and the body dimensions differ depending on the model even when the same thread size is used. Refer to the dimensions in the catalog.
- 5) If oil content or sealant is sticking to the female thread, this may cause damage to the product. Remove it before piping.

Connection thread size	Chamfer dimension $\phi D1$ [mm]	Seal bearing surface diameter $\phi D2$ [mm]
R1/8	10.2 to 10.4	12 or more
R1/4	13.6 to 13.8	17 or more
R3/8	17.1 to 17.3	21 or more
R1/2	21.4 to 21.6	27 or more
NPT1/16	8.2 to 8.4	11.11 or more
NPT1/8	10.5 to 10.7	12.7 or more
NPT1/4	14.1 to 14.3	17.46 or more
NPT3/8	17.4 to 17.6	22 or more
NPT1/2	21.7 to 21.9	28.7 or more
G1/8	10.2 to 10.6	12 or more
G1/4	13.6 to 14.0	17 or more
G3/8	17.1 to 17.5	21 or more
G1/2	21.4 to 21.8	27 or more



## Recommended Piping Conditions

1. When connecting piping to the One-touch fitting, use a pipe length with sufficient margin, in accordance with the piping conditions shown in Fig. 1.

Also, when using a tying band, etc., to bind the piping together, make sure that external force does not come to bear on the fitting. (See Fig. 2.)

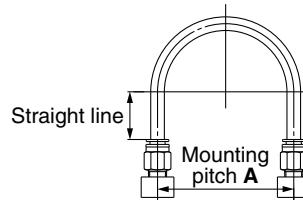
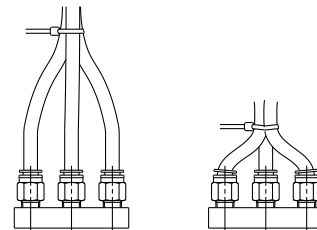


Fig. 1 Recommended piping

Unit: [mm]

Tubing size	Mounting pitch A			Straight line length
	Nylon tubing	Soft nylon tubing	Polyurethane tubing	
$\phi 2$	—	—	13 or more	10 or more
$\phi 3.2, 1/8"$	44 or more	35 or more	25 or more	16 or more
$\phi 4, 5/32"$	56 or more	44 or more	26 or more	20 or more
$\phi 3/16"$	67 or more	52 or more	38 or more	24 or more
$\phi 6$	84 or more	66 or more	39 or more	30 or more
$\phi 1/4"$	89 or more	70 or more	57 or more	32 or more
$\phi 8, 5/16"$	112 or more	88 or more	52 or more	40 or more
$\phi 10$	140 or more	110 or more	69 or more	50 or more
$\phi 3/8"$	134 or more	105 or more	69 or more	48 or more
$\phi 12$	168 or more	132 or more	88 or more	60 or more
$\phi 1/2"$	178 or more	140 or more	93 or more	64 or more
$\phi 16$	224 or more	176 or more	114 or more	80 or more



Recommended Not recommended

Fig. 2 When using a tying band to bind the piping together

## Tubing Design / Selection

### ⚠ Caution

1. When using tubing from a manufacturer other than SMC, be careful of the tolerance of the tubing O.D. and tubing material.

- 1) Nylon tubing Within  $\pm 0.1$  mm
- 2) Soft nylon tubing Within  $\pm 0.1$  mm
- 3) Polyurethane tubing Within  $+0.15$  mm, Within  $-0.2$  mm

Do not use tubing which does not satisfy the specified tubing O.D. accuracy, or tubing with an I.D., material, hardness, or surface roughness that differs from SMC's tubing. Please consult SMC if anything is unclear. It may cause difficulty in connecting the tubing, leakage, disconnection of the tubing, or fitting damage.

When used with tubing other than those from SMC, due to their properties, the products listed below are not subject to warranty.

KQG2, KQB2, KFG2, KF,  $\phi 2$ MM

2. When using fittings other than those from SMC, be certain to confirm that the operating conditions are such that no problems will arise.