

Static Electricity **Prevention Equipment**



SMC eliminates a variety of

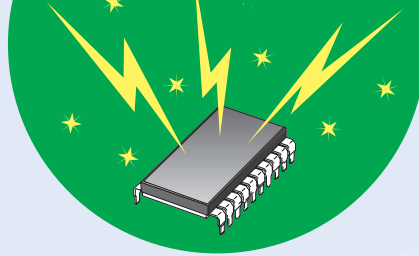


static

**Prevents
adhesion of foreign
materials such as dust.**
(Dust or particle removal)



**Prevents
electrostatic breakdown
of electric parts.**
(ESD)



**Prevents
discomfort due
to static shock.**
(Static shock)

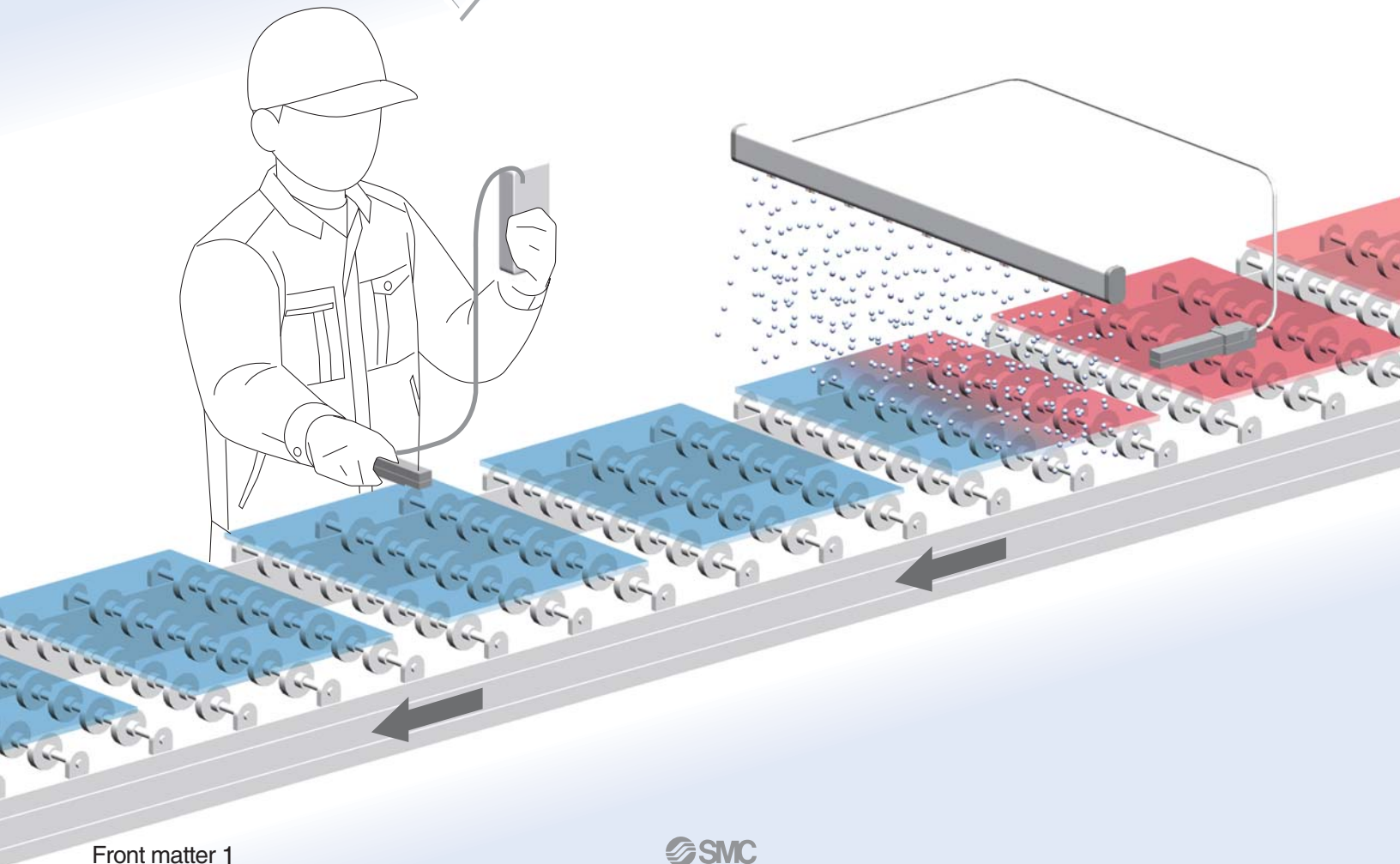


Measurement Equipment (Handheld)

Confirming electrostatic charge
and removal of static electricity

Electrostatic Removal Equipment

Removing static electricity by ionizer



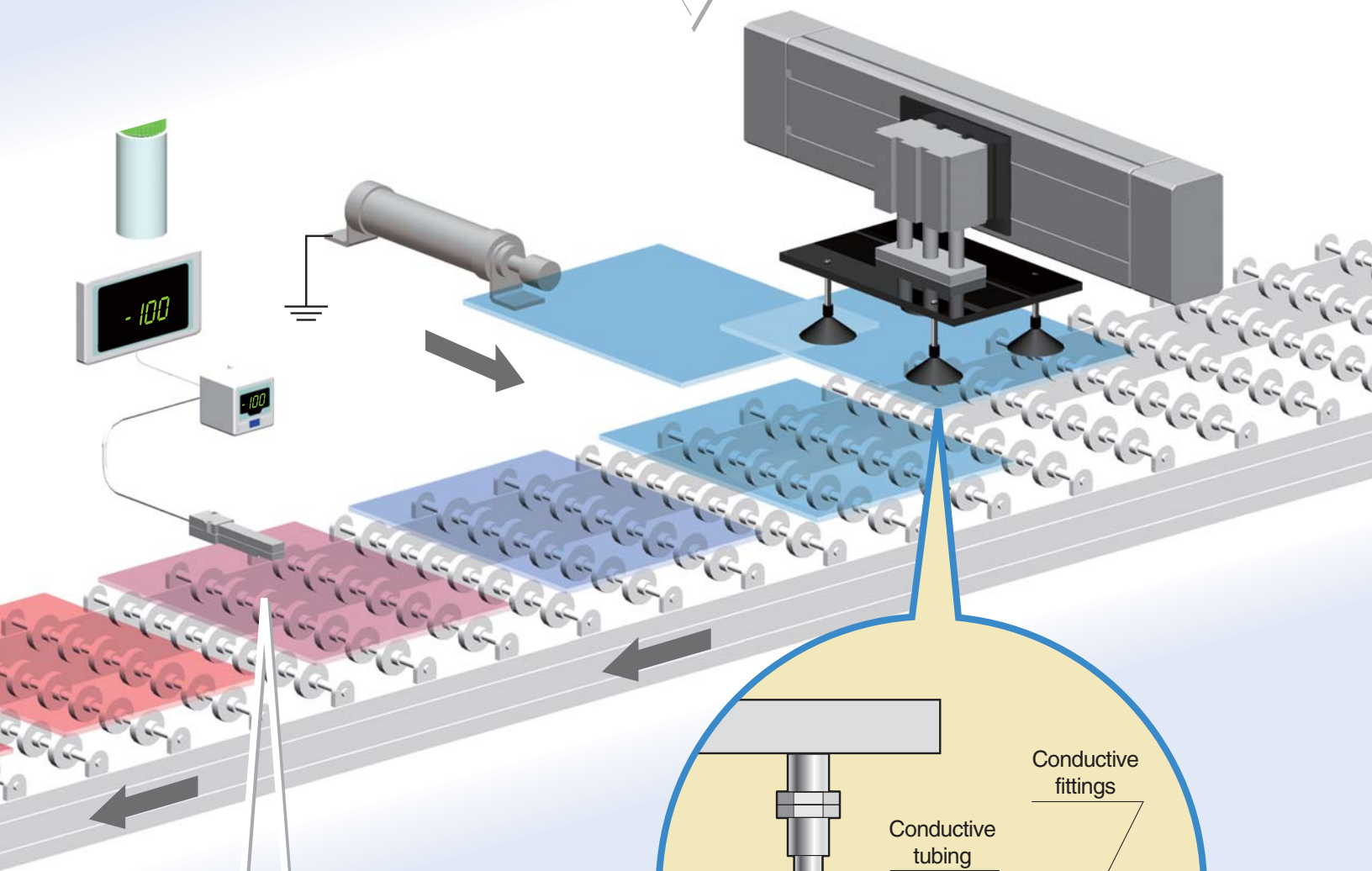
electricity generated problems.

Antistatic Equipment

Fittings P.3
Tubing P.8

Speed Controller
with One-touch Fitting P.10

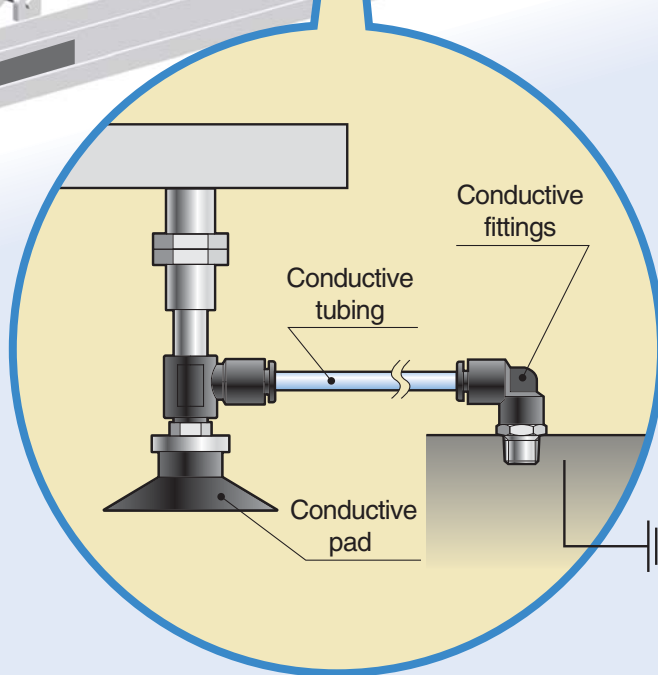
Vacuum Pad P.12
Antistatic Air Cylinder P.17



Measurement Equipment (for FA Devices)

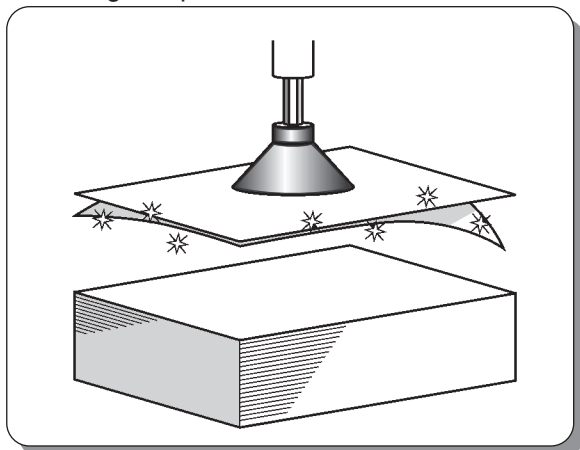
Measuring amount of electrostatic charge of a workpiece.

- Confirming electrostatic condition of a workpiece.
- Checking quality

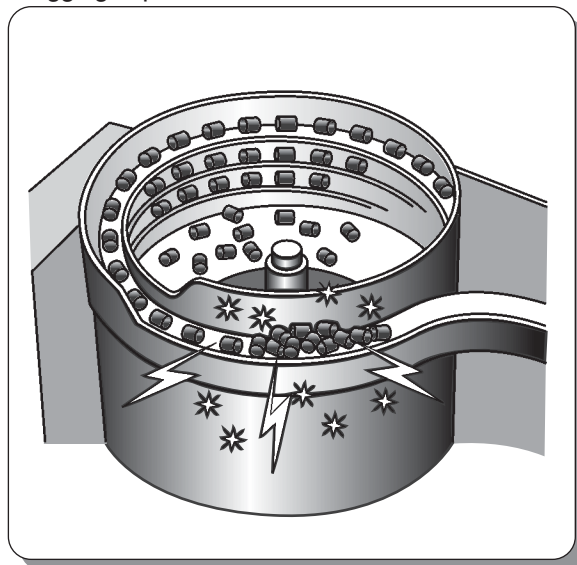


Examples of Static Electricity Generated Problems

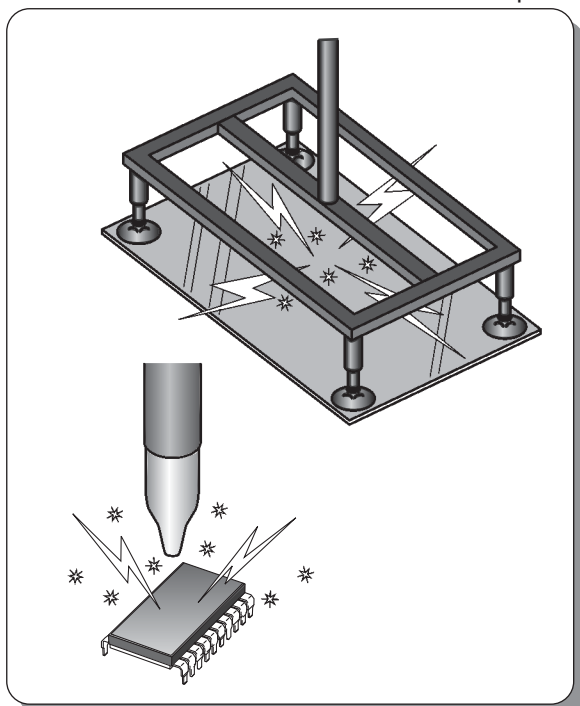
Absorbing multiple sheets



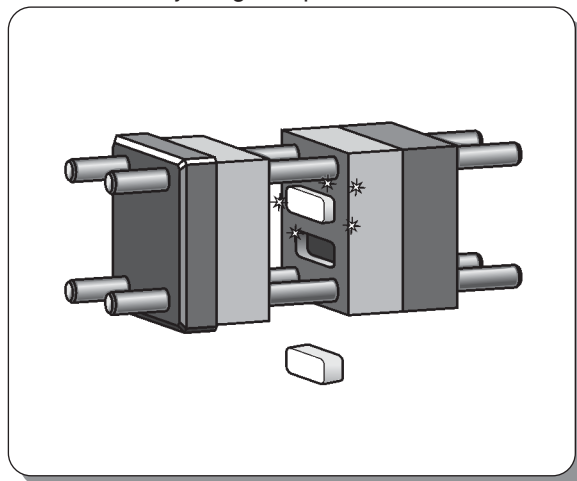
Clogging of parts feeders



Electrostatic breakdown of substrate and IC chips



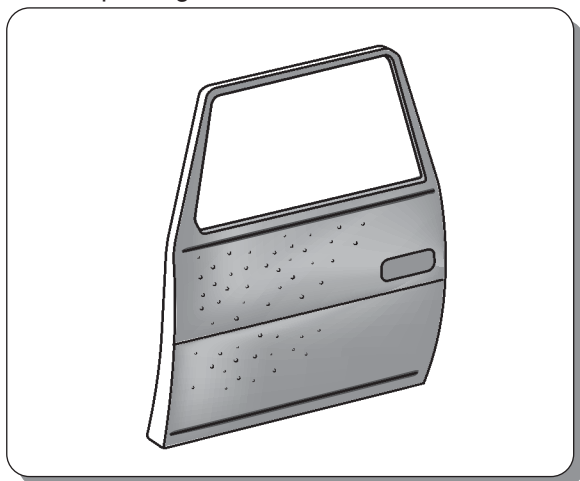
Failures while ejecting workpieces from unloaders



Discomfort due to electrical shocks at workplace



Uneven painting



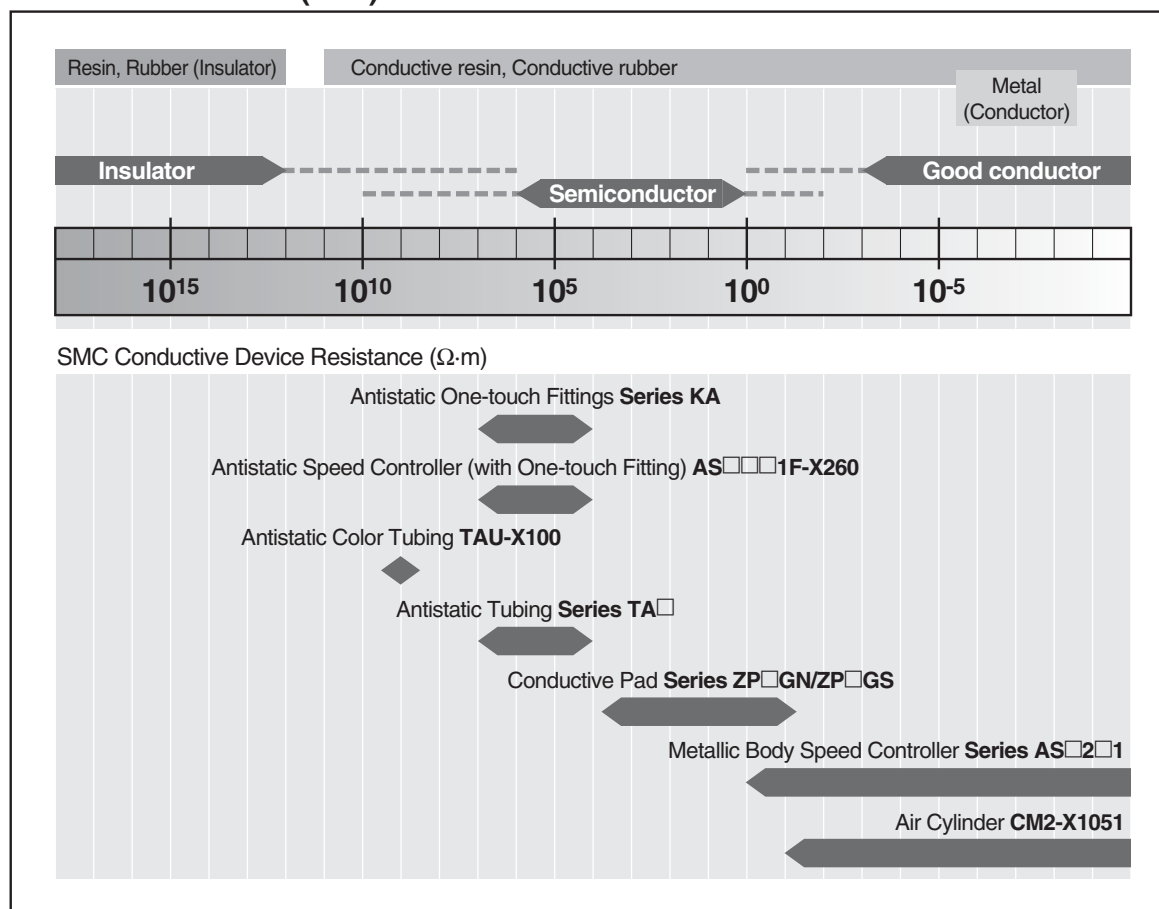
Antistatic Equipment

Lineup of products with conductivity prevention

Friction, contact and detachment cause the build up of static electricity. Static electricity can be instantaneously removed from metals with low volume resistance (conductors) by grounding. Resin and rubber (insulators) which have high volume resistance, however, build up static electricity as it is not eliminated even through grounding. Charged substances cause various problems such as the destruction of devices by electrical discharge, dust adhesion, and the like. Hence, SMC has a lineup of products to which conductive resin and rubber are applied in order to remove static electricity.

SMC's conductive resin and rubber incorporates the following volume resistance materials.

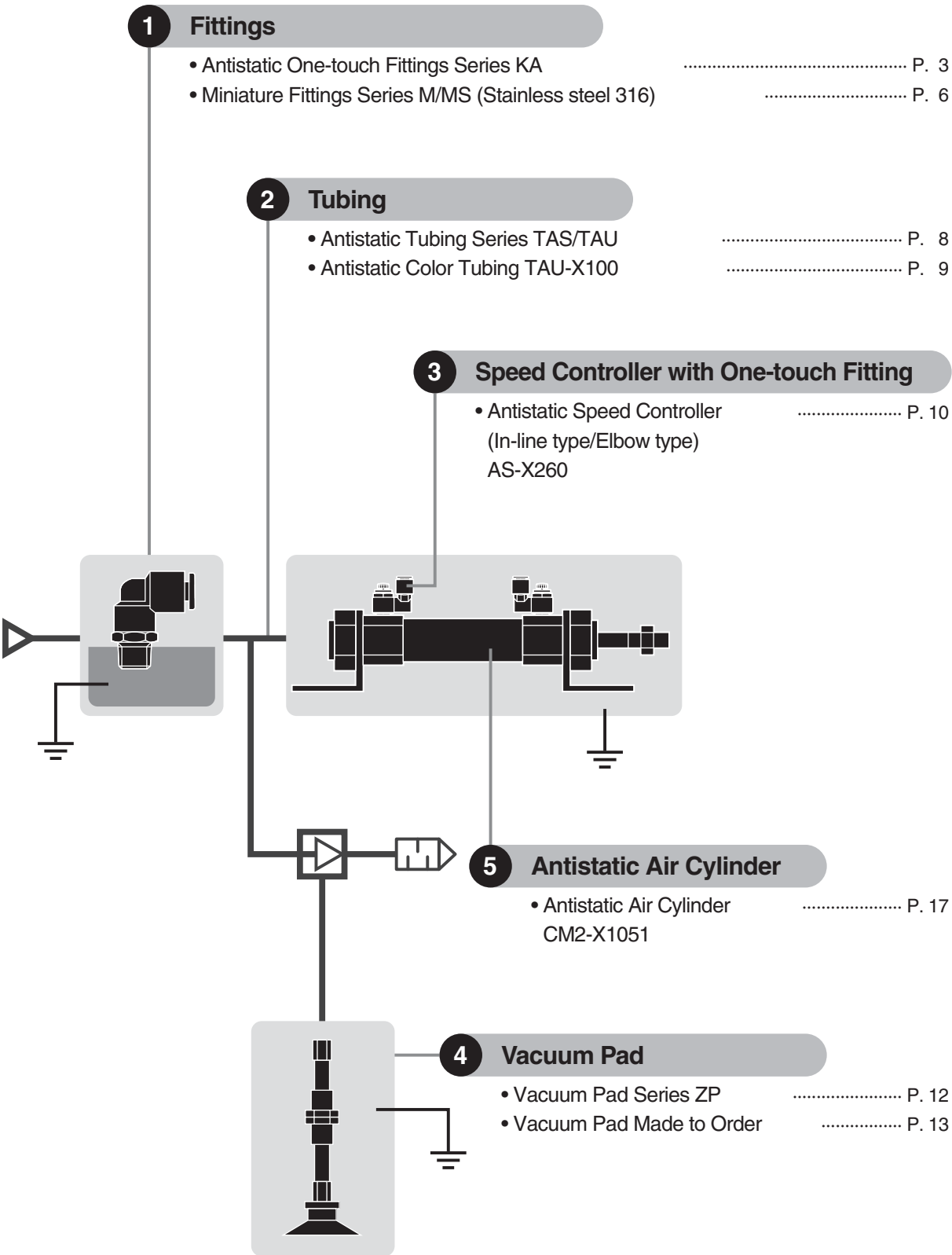
Volume Resistance ($\Omega \cdot m$) for Reference



For reference: The following table shows the electric resistance and characteristics of major materials.

Materials	Electric resistance	Characteristics
Resin, Rubber (Insulator)	10 ¹² to 10 ¹⁸ $\Omega \cdot m$	Some static electricity does not attenuate after charging. Grounding is not useful.
Conductive resin, Conductive rubber	10 ¹¹ $\Omega \cdot m$ or less	It is possible to remove static electricity by seconds after grounding.
Metal (Conductor)	10 ⁰ $\Omega \cdot m$ or less	Static electricity can be instantaneously removed by grounding.

Antistatic Equipment INDEX



Antistatic One-touch Fittings Series KA

- Possible to use from vacuum (–100 kPa)
- Can be used in copper-free application.
- Surface resistance 10^4 to $10^7 \Omega$
- Conductive resin is used for body and seals in fittings and tubing.



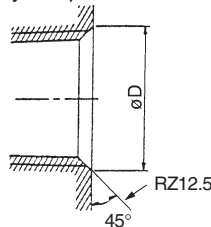
Main Parts Material

Body	C3604BD, PBT
Stud	C3604BD
Chuck	Stainless steel 304
Guide	Stainless steel 304, C3604BD, PBT
Collet, Release button	PBT
Seal, O-ring	NBR

- C3604BD is all electroless nickel plated.
- PBT parts have conductive (10^4 to $10^7 \Omega$) and flame resistant applications. (equivalent to UL Standard V-0)
- Conductive NBR (10^4 to $10^7 \Omega$) is used for seals.

Size of female thread chamfering (Recommended values)

Chamfering in accordance with the following table improves thread workability and prevents the occurrence of burrs.



Female thread size	Chamfering bore ϕD (Recommended value)		
	G	Rc	NPT, NPTF
1/8	10.2 to 11.5	10.2 to 11.8	10.5 to 11.8
1/4	13.6 to 14.5	13.6 to 15.8	14.1 to 15.8
3/8	17.1 to 18.5	17.1 to 19.4	17.4 to 19.4
1/2	21.4 to 22.5	21.4 to 25.1	21.7 to 25.1

Seal

Can be used for a wide range of pressures from low vacuum up to a pressure of 1.0 MPa.

The use of a special profile ensures sealing and reduces resistance when the tube is inserted.

Chuck

Large retaining force

Has large retaining force while holding force is increased by the collet.

Collet

Guide

Body (Black)

O-ring

Stud

Effective when piping in a confined space.

The body and the threaded portion can rotate (to the degree for positioning).

Gasket

UNI Thread

Tube

Release Button (Black)

Light force for removal

When the fitting is removed from the tubing, the check and collet are released, thus preventing them from biting into the tube excessively.

Grounding Method

When UNI thread screws are used metal contact occurs between female and male threads and the fittings do not become electro-statically charged. (With taper threaded screws it is necessary to apply a sealant to the thread, which electrically insulates the fittings causing it to become charged.)

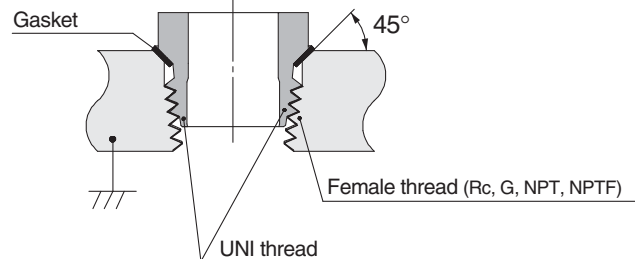


Figure: UNI thread ridge profile

Caution (Chamfer the female thread.)

Applicable Tubing

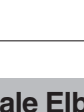
Tubing material	Antistatic soft nylon, Antistatic polyurethane
Tubing O.D.	$\phi 3.2$, $\phi 4$, $\phi 6$, $\phi 8$, $\phi 10$, $\phi 12$

Specifications

Fluid	Air
Operating pressure range	–100 kPa to 1 MPa
Proof pressure	3 MPa
Ambient and fluid temperature	0 to 40°C
Thread	UNI thread JIS B0205, Class 2 (Metric coarse thread)
Seal (Thread portion)	Gasket
Copper-free	Brass parts are all electroless nickel plated.
Surface resistance	10^4 to $10^7 \Omega$

Male Connector**KAH**

Used to pipe in the same direction from female threaded portion
Most common type

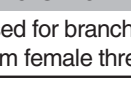
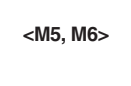
	Applicable tubing O.D. (mm)	Connection thread	Model
	3.2	M5 x 0.8	KAH23-M5
		M6 x 1	-M6
		Uni 1/8	-U01
	4	M5 x 0.8	KAH04-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	6	M5 x 0.8	KAH06-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	8	Uni 3/8	-U03
		Uni 1/8	KAH08-U01
		Uni 1/4	-U02
	10	Uni 3/8	-U03
		Uni 1/8	KAH10-U01
		Uni 1/4	-U02
	12	Uni 3/8	-U03
		Uni 1/2	-U04
		Uni 1/4	KAH12-U02

<M5, M6>

<UNI thread>

Male Branch Tee**KAT**

Used for branching from a female threaded portion at 90° on both sides

	Applicable tubing O.D. (mm)	Connection thread	Model
	3.2	M5 x 0.8	KAT23-M5
		M6 x 1	-M6
		Uni 1/8	-U01
	4	M5 x 0.8	KAT04-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	6	M5 x 0.8	KAT06-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	8	Uni 3/8	-U03
		Uni 1/8	KAT08-U01
		Uni 1/4	-U02
	10	Uni 3/8	-U03
		Uni 1/8	KAT10-U01
		Uni 1/4	-U02
	12	Uni 3/8	-U03
		Uni 1/2	-U04
		Uni 1/4	KAT12-U02

<M5, M6>

<UNI thread>

Male Elbow**KAL**

Used to pipe in the same direction from female threaded portion
Most common type

	Applicable tubing O.D. (mm)	Connection thread	Model
	3.2	M5 x 0.8	KAL23-M5
		M6 x 1	-M6
		Uni 1/8	-U01
	4	M5 x 0.8	KAL04-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	6	M5 x 0.8	KAL06-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	8	Uni 3/8	-U03
		Uni 1/8	KAL08-U01
		Uni 1/4	-U02
	10	Uni 3/8	-U03
		Uni 1/8	KAL10-U01
		Uni 1/4	-U02
	12	Uni 3/8	-U03
		Uni 1/2	-U04
		Uni 1/4	KAL12-U02

<M5, M6>

<UNI thread>

Male Run Tee**KAY**

Used for branching into the same direction and at 90° either from female threaded portion

	Applicable tubing O.D. (mm)	Connection thread	Model
	3.2	M5 x 0.8	KAY23-M5
		M6 x 1	-M6
		Uni 1/8	-U01
	4	M5 x 0.8	KAY04-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	6	M5 x 0.8	KAY06-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	8	Uni 3/8	-U03
		Uni 1/8	KAY08-U01
		Uni 1/4	-U02
	10	Uni 3/8	-U03
		Uni 1/8	KAY10-U01
		Uni 1/4	-U02
	12	Uni 3/8	-U03
		Uni 1/2	-U04
		Uni 1/4	KAY12-U02

<M5, M6>

<UNI thread>

Antistatic Equipment

Antistatic One-touch Fittings Series KA

Male Branch Y

KAU

Used for branching from a female threaded portion into the same direction

	Applicable tubing O.D. (mm)	Connection thread	Model
	3.2	M5 x 0.8	KAU23-M5
<M5, M6>	3.2	M6 x 1	-M6
		Uni 1/8	-U01
	4	M5 x 0.8	KAU04-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
	6	M5 x 0.8	KAU06-M5
		M6 x 1	-M6
		Uni 1/8	-U01
		Uni 1/4	-U02
		Uni 3/8	-U03
	8	Uni 1/8	KAU08-U01
		Uni 1/4	-U02
		Uni 3/8	-U03
	10	Uni 1/4	KAU10-U02
		Uni 3/8	-U03
		Uni 1/2	-U04
<UNI thread>	12	Uni 1/4	KAU12-U02
		Uni 3/8	-U03
		Uni 1/2	-U04

Union Tee

KAT

Used for branch connections of tubes into two directions at 90° on both sides

	Applicable tubing O.D. (mm)	Model
	3.2	KAT23-00
	4	KAT04-00
	6	KAT06-00
	8	KAT08-00
	10	KAT10-00
	12	KAT12-00

Union Y

KAU

Used to branch a tubing in the same direction

	Applicable tubing O.D. (mm)	Model
	3.2	KAU23-00
	4	KAU04-00
	6	KAU06-00
	8	KAU08-00
	10	KAU10-00
	12	KAU12-00

Straight Union

KAH

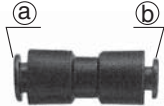
Used to connect tubes in the same direction

	Applicable tubing O.D. (mm)	Model
	3.2	KAH23-00
	4	KAH04-00
	6	KAH06-00
	8	KAH08-00
	10	KAH10-00
	12	KAH12-00

Different Dia. Straight Union

KAH

Used to connect different size tubes

	Applicable tubing O.D. (mm)		Model
	(a)	(b)	
	3.2	4	KAH23-04
	4	6	KAH04-06
	6	8	KAH06-08
	8	10	KAH08-10
	10	12	KAH10-12

Elbow

KAL

Used to connect tubes at right angles

	Applicable tubing O.D. (mm)	Model
	3.2	KAL23-00
	4	KAL04-00
	6	KAL06-00
	8	KAL08-00
	10	KAL10-00
	12	KAL12-00

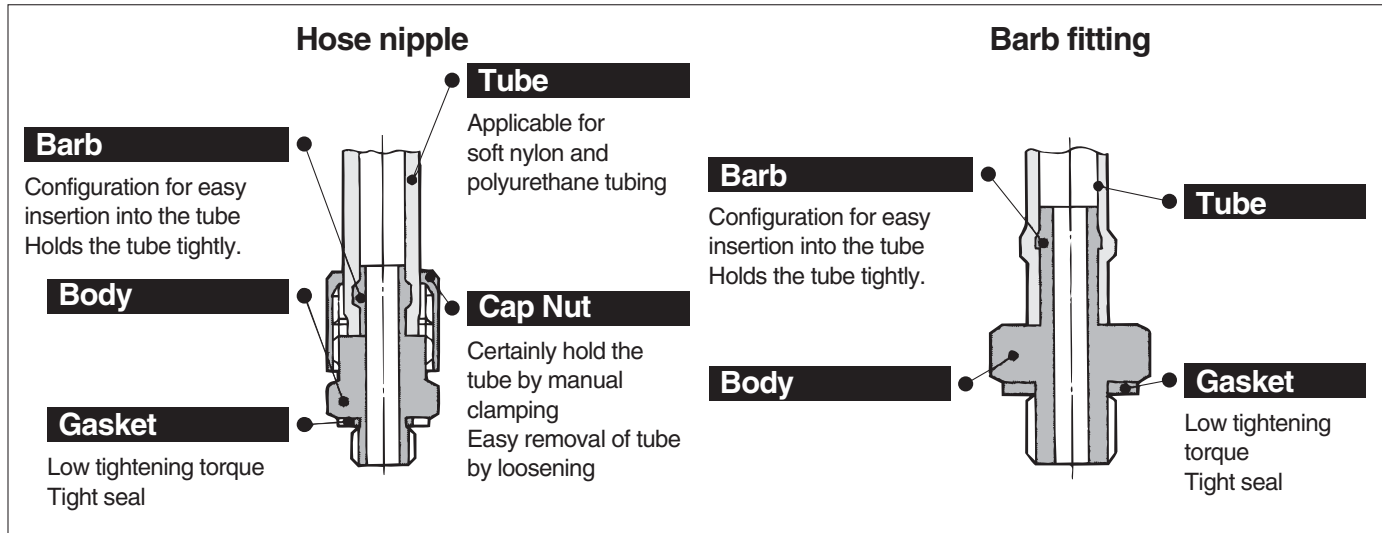
Plug-in Reducer

KAR

Used to change the diameter of one-touch fitting

	Applicable tubing O.D. (mm)	Applicable fitting size	Model
	3.2	4	KAR23-04
		6	KAR04-06
4	4	8	-08
		10	-10
6	6	8	KAR06-08
		10	-10
		12	-12
8	8	10	KAR08-10
		12	-12
10	10	12	KAR10-12

Miniature Fittings Series M/MS (Stainless steel 316)



Compact piping space

Hose nipple tubing connection/disconnection is simple while keeping a large retaining force.

Line up various styles

For air connection in confined areas

Hose nipple, Hose elbow

Applicable for soft nylon and polyurethane tubing

Series M



Specifications

Applicable tubing material		Soft nylon ^{Note1)}		Polyurethane
Applicable tubing	M3	ø3.18/ø2.18	ø4/ø2.5	ø3.18/ø2, ø4/ø2.5, ø2 x ø1.2
	M5-R 1/8		ø4/ø2.5 ø6/ø4	ø3.18/ø2 ø4/ø2.5, ø6/ø4, ø2 x ø1.2
Max. operating pressure (at 20°C)		1 MPa		0.8 MPa
Connection size		M3, M5, R 1/8		
Thread		Metric thread (JIS B0205 Class 2), Pipe thread (JIS B0203)		
Fluid		Air, Water ^{Note 2)}		
Ambient and fluid temperature		-50 to 60°C Water: 0 to 40°C (with no freezing)		

Note 1) Water is not available with soft nylon tubing.

Note 2) Available with hose nipple type only

Main Parts Material

Material	Body	C3604BD (Nipple M-3N, M-5N: Stainless steel 303)
	Gasket	PVC, Stainless steel 304, NBR

Series MS (Stainless steel 316)



Specifications

Applicable tubing material		Soft nylon ^{Note1)}		Polyurethane
Applicable tubing O.D./I.D.		ø3.18/ø2.18	ø4/ø2.5 ø6/ø4	ø3.18/ø2 ø4/ø2.5, ø6/ø4
Max. operating pressure (at 20°C)		1 MPa		0.8 MPa
Connection size		M5 (JIS B0205 Class 2: Metric coarse thread)		
Fluid		Air, Water ^{Note2)}		
Ambient and fluid temperature		-50 to 60°C Water: 0 to 40°C (with no freezing)		

Note 1) Water is not available with soft nylon tubing.

Note 2) Available with hose nipple type only

Main Parts Material

Material	Body	Stainless steel 316
	Gasket	PVC



Caution

Although there are other miniature fittings in the General Catalog, they are not designed for antistatic applications. Only the following are available.

Series M

Series	Model	Description	Application	Note
M3	M-3AU-2	Barb fitting for soft tubing 	For polyurethane tubing	ø2/ø1.2 x M3
	M-3AU-3	Barb fitting for soft tubing	For soft nylon tubing	ø3.18/2.18 x M3
			For polyurethane tubing	ø3.18/2 x M3
	M-3AU-4		For soft nylon and polyurethane tubing	ø4/2.5 x M3
	M-3N	Nipple 	Fitting to workpiece and fitting to fitting connection	M3 male x M3 male
	M-3P	Plug 	Use to plug unused M3 port.	
M5	M-5AU-2	Barb fitting for soft tubing 	For polyurethane tubing	ø2/ø1.2 x M5
	M-5AU-3	Barb fitting for soft tubing 	For soft nylon tubing	ø3.18/2.18 x M5
			For polyurethane tubing	ø3.18/2 x M5
	M-5AU-4		For soft nylon and polyurethane tubing	ø4/2.5 x M5
	M-5AU-6			ø6/4 x M5
	M-5H-4	Hose nipple 	For soft nylon and polyurethane tubing	ø4/2.5 x M5
	M-5H-6			ø6/4 x M5

Series MS

Series	Model	Description	Application	Note
M5	M-5L	Elbow 	One-sided 90° elbow	M5 female x M5 female
	M-5T	Tee 	Both sides allow 90° connection	M5 female x M5 female x M5 female
	M-5J	Extension fitting 	Solid piece moves fitting up from workpiece.	M5 male x M5 female
	M-5N	Nipple 	Fitting to workpiece and fitting to fitting connection	M5 male x M5 male
	M-5UN	Universal nipple	Body rotates at 360° around the stud axis.	M5 male x M5 male PAT.
	M-5E	Bulkhead union 	Panel mount connection	M5 female x M5 female
	M-5ER	Bulkhead reducer 	Reduction from Rc 1/8 to M5 including panel or bracket mounting	Rc 1/8 x M5 female
	M-5M	Manifold 	For reducing Rc 1/8 female be diverted to up to 9, M5 stations, including panel or bracket mounting	Rc 1/8 x M5 female (9 stations)
	M-5P	Plug 	Use to plug unused M5 port.	
	MS-5AU-3	Barb fitting for soft tubing	For soft nylon tubing For polyurethane tubing	ø3.18 x ø2.18 x M5 ø3.18/ø2 x M5
	MS-5AU-4		For soft nylon and polyurethane tubing	ø4/ø2.5 x M5
	MS-5AU-6			ø6/ø4 x M5
	MS-5H-4	Hose nipple	For soft nylon and polyurethane tubing	ø4/ø2.5 x M5
	MS-5H-6			ø6/ø4 x M5
	MS-5P	Plug 	Use to plug unused M5 port.	
	MS-5J	Extension fitting	Solid piece moves fitting up from workpiece.	M5 male x M5 female
	MS-5N	Nipple 	Fitting to workpiece and fitting to fitting connection	M5 male x M5 male
	MS-5UN	Universal nipple	Body rotates at 360° around the stud axis.	M5 male x M5 male PAT.

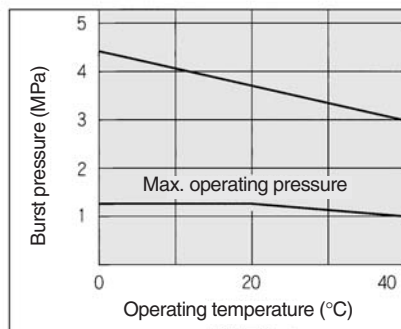
Antistatic Tubing *series TAS/TAU*

Antistatic Soft Nylon Tubing / Series TAS

Flame resistant
(equivalent to UL 94
Standard V-0)
 10^4 to $10^7 \Omega$



**Burst Pressure
Characteristics Curve and
Operating Pressure**



Series

Model	TAS3222	TAS0425	TAS0604	TAS0805	TAS1065	TAS1208
Tubing O.D. (mm)	3.2	4	6	8	10	12
Tubing I.D. (mm)	2.2	2.5	4	5	6.5	8
Black (B)	●	●	●	●	●	●

Specifications

Max. operating pressure (at 20°C)	1.2 MPa					
Burst pressure	Refer to the burst pressure characteristics curve.					
Min. bending radius (mm)	12	12	15	19	27	32
Operating temperature	0 to 40°C					
Material	Conductive nylon + Flame resistant nylon (equivalent to UL 94 Standard V-0)					
Surface resistance	10^4 to $10^7 \Omega$					

How to Order

TAS1065	B	100
Tubing designation	Color	Length per roll
	Symbol Color	Symbol Length
	B Black	20 20 m roll
		100 100 m reel

Made to Order



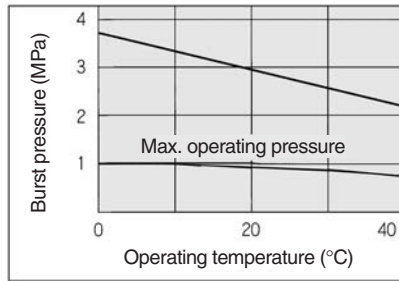
Coil tubing

Antistatic Polyurethane Tubing / Series TAU

Soft type
 10^4 to $10^7 \Omega$



Burst Pressure Characteristics Curve and Operating Pressure



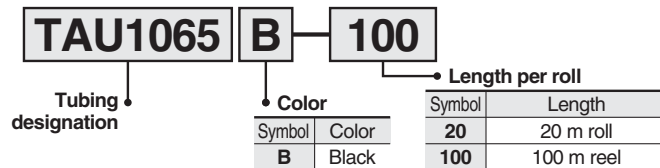
Series

Model	TAU3220	TAU0425	TAU0604	TAU0805	TAU1065	TAU1208
Tubing O.D. (mm)	3.2	4	6	8	10	12
Tubing I.D. (mm)	2	2.5	4	5	6.5	8
Black (B)	●	●	●	●	●	●

Specifications

Max. operating pressure (at 20°C)	0.9 MPa					
Burst pressure	Refer to the burst pressure characteristics curve.					
Min. bending radius (mm)	10	10	15	20	27	35
Operating temperature	0 to 40°C					
Material	Conductive polyurethane					
Surface resistance	10^4 to $10^7 \Omega$					

How to Order



Made to Order



Antistatic Polyurethane Tubing / -X100

Made to Order

- 5 colors
- Surface resistance $10^9 \Omega$

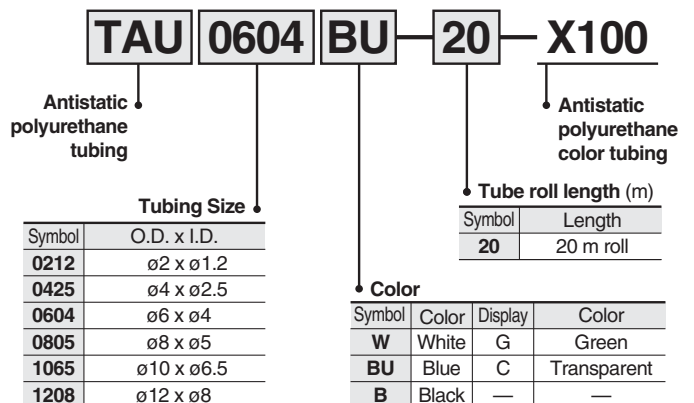
Specifications

Fluid	Air
Max. operating pressure (at 20°C)	0.8 MPa
Ambient and fluid temperature	0 to 40°C
Material	Antistatic polyurethane
Surface resistance	$10^9 \Omega$
Recommended fittings	Antistatic one-touch fittings: Series KA Miniature fittings: Series M/MMS (Note)

Note) Miniature fittings: The following models of the M/MMS series are only available.

Series M	Series MS
M-3AU-2	MS-5AU-4
M-3AU-4	MS-5AU-6
M-5AU-2	MS-5H-4
M-5AU-4	MS-5H-6
M-5AU-6	
M-5H-4	
M-5H-6	

How to Order



Antistatic Speed Controller (In-line type/Elbow type)

AS-X260

Made to Order

Electrostatic prevention measures for semiconductor manufacturing devices, etc.

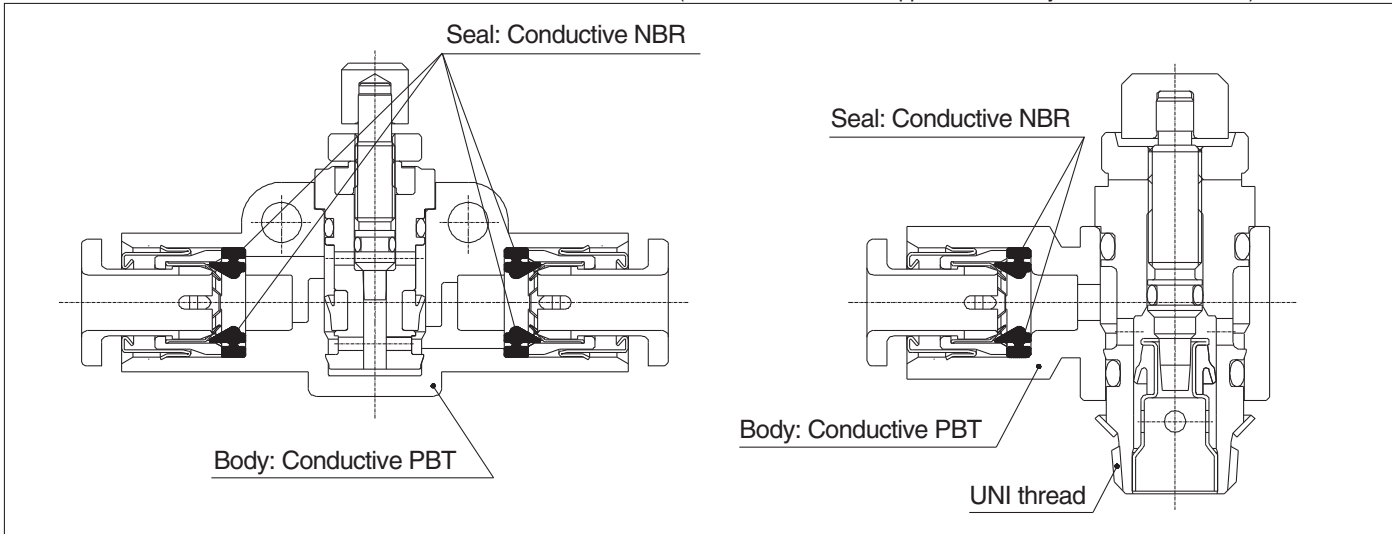
It is possible to prevent products from being electro-statically charged by applying conductive materials (using conductive NBR seal) and grounding UNI thread structure*1) (Gasket seal method).



*1) Ensure that the female thread connected to the speed controller is grounded.
If not grounded, there is a possibility that the controller and tube may remain charged.
Antistatic tubes should also be used.



Feature 1: Surface Resistance 10^4 to $10^7 \Omega$ (Conductive material is applied to the body seal of the controller.)



Features 2: Antistatic UNI Thread Structure (Gasket seal method)

(AS22□1F-□-□-X260 type)

Grounding Method

When UNI thread screws are used metal contact occurs between female and male threads and the controller does not become electro-statically charged. (With taper threaded screws it is necessary to apply a sealant to the thread, which electrically insulates the controller causing it to become charged.)

Specifications

Common Specifications

Type	Elbow	In-line
Model	AS□2□1F-□-□-X260	AS□000F-□-□-X260
Fluid	Air	
Proof pressure	1.5 MPa	1 MPa
Maximum operating pressure	1 MPa	0.7 MPa
Minimum operating pressure	0.1 MPa	
Ambient and fluid temperature	-5 to 60°C (with no freezing)	
Number of needle rotations	10 rotations *2	8 rotations
Applicable tubing material	Antistatic soft nylon tubing (Series TAS) Antistatic polyurethane tubing (Series TAU)	
Surface resistance	10^4 to $10^7 \Omega$	

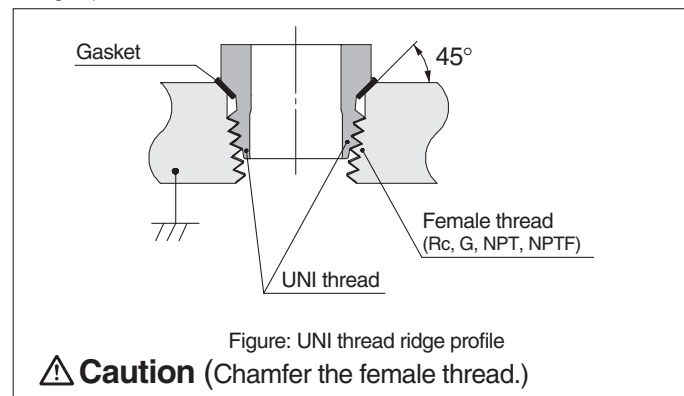
*2) 8 rotations for AS12□1F-M5-04-X260 and AS12□1F-M5-06-X260

Series Variation

Type	Model		Port size	Applicable tubing O.D.				Applicable cylinder bore size (mm)
	Meter-out	Meter-in		4	6	8	10	
Elbow	AS1201F-M5	AS1211F-M5	M5 x 0.8	●	●			6, 10, 16, 20
	AS2201F-U01	AS2211F-U01	Uni1/8	●	●	●	●	20, 25, 32
	AS2201F-U02	AS2211F-U02	Uni1/4	●	●	●	●	20, 25, 32, 40
In-line	AS1000F		—	●	●			6, 10, 16, 20

*3) Contact SMC for models other than the above.

*4) Manufactured upon receipt of order.

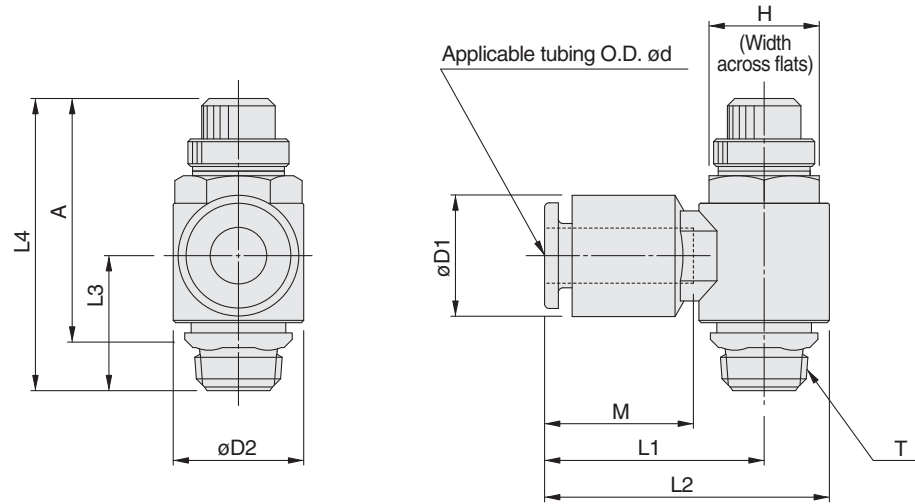


Antistatic Equipment

Antistatic Speed Controller AS-X260

Dimensions

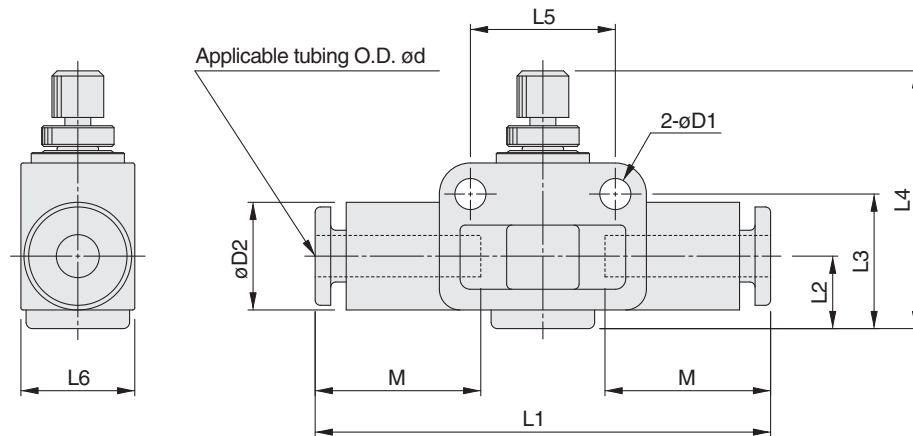
Elbow type



Model		Applicable tubing O.D. ød	T	H	D1	D2	L1	L2	L3	L4		A *)		M
Meter-out	Meter-in									MAX.	MIN.	MAX.	MIN.	
AS1201F-M5-04-X260	AS1211F-M5-04-X260	4	M5	8	10.4	9.6	20.6	25.4	12.2	28.8	26	25.2	22.4	15.8
AS1201F-M5-06-X260	AS1211F-M5-06-X260	6			12.8		21.6	26.4						16.8
AS2201F-U01-04-X260	AS2211F-U01-04-X260	4	Uni1/8	12	11.4	14.2	23.1	30.2	14.3	36.4	31.4	31	26	15.8
AS2201F-U01-06-X260	AS2211F-U01-06-X260	6			13.2		23.9	31						16.8
AS2201F-U01-08-X260	AS2211F-U01-08-X260	8			15.2		25.3	32.4						18.7
AS2201F-U01-10-X260	AS2211F-U01-10-X260	10			18.5		32.1	39.2						20.8
AS2201F-U02-04-X260	AS2211F-U02-04-X260	4	Uni1/4	17	10.4	18.5	25.2	34.4	17.2	39.6	34.6	33	28	15.8
AS2201F-U02-06-X260	AS2211F-U02-06-X260	6			12.8		27.2	36.4						16.8
AS2201F-U02-08-X260	AS2211F-U02-08-X260	8			15.2		35.3	44.5						18.7
AS2201F-U02-10-X260	AS2211F-U02-10-X260	10			18.5									20.8

*) Reference thread dimensions after installation.

In-line type



Model	Applicable tubing O.D. ød	D1	D2	L1	L2	L3	L4		L5	L6	M
							MAX.	MIN.			
AS1000F-04-X260	4	3.2	10.4	44	7	13	25	28	14	11	15.8
AS1000F-06-X260	6		12.8	46		13.5					16.8



For the safe use of the controller, be sure to read "Safety Precautions" in our company's Best Pneumatics General Catalog before handling.

Vacuum Pad *Series ZP*

Pad material

● Conductive NBR (Black with one white mark), Conductive silicon rubber (Black with two white marks)

Pad shape

(Compatible with all models)

Flat (U)



Flat with ribs (C)



Deep (D)



Bellows (B)



Thin flat (UT)
Thin with ribs (CT)



Pad size	2 x 4	3.5 x 7	4 x 10	ø2	ø4	ø6	ø8	ø10	ø13	ø16	ø20	ø25	ø32	ø40	ø50
Flat	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Flat with ribs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Deep	—	—	—	—	—	—	—	●	—	●	—	●	—	●	—
Bellows	—	—	—	—	—	●	●	●	●	●	●	●	●	●	●
Thin flat	—	—	—	—	—	—	—	●	●	●	—	—	—	—	—
Thin with ribs	—	—	—	—	—	—	—	●	●	●	—	—	—	—	—

With buffer

Non-rotating / Rotating
ø2 to 8: stroke 6, 10, 15, 25 mm
ø10 to 32: stroke 10, 20, 30, 40, 50 mm
ø40/50: stroke 10, 20, 30, 50 mm

Model

Without buffer



Series
ZPT

Vertical
vacuum entry

Vacuum entry / Connection

Male
thread

(Common)

VAC



Female
thread

(Common)

VAC

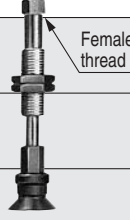


Vacuum entry / Connection

Female
thread

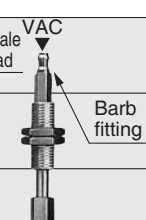
Buffer
body

VAC



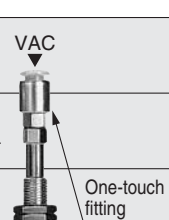
With barb
fitting

Buffer
body



With one-touch
fitting

Buffer
body



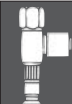
Female
thread

VAC

Barb
fitting

VAC

One-touch
fitting



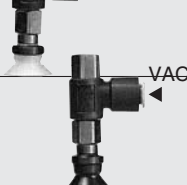
Series
ZPR

Lateral vacuum
entry with
one-touch fitting

With
one-touch
fitting

Male
thread

VAC



With
one-touch
fitting

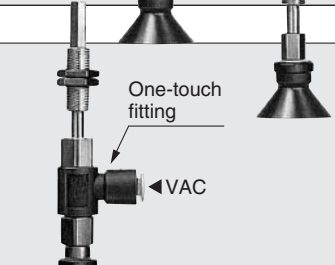
Female
thread

VAC



With
one-touch
fitting

Buffer
body



Series
ZPY

Lateral vacuum
entry with
barb fitting

With barb
fitting

Male
thread

VAC



With barb
fitting

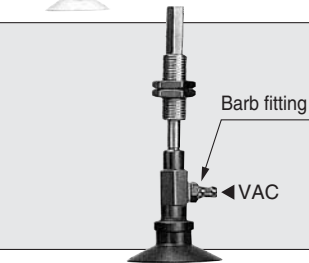
Female
thread

VAC



With barb
fitting

Buffer
body



Barb fitting

VAC

Vacuum Pad Made to Order

Antistatic Pad

With the use of antistatic urethane rubber, the pad can eliminate the static electricity more slowly compared to the conductive rubber.
 10^9 to $10^{11} \Omega\text{-cm}$

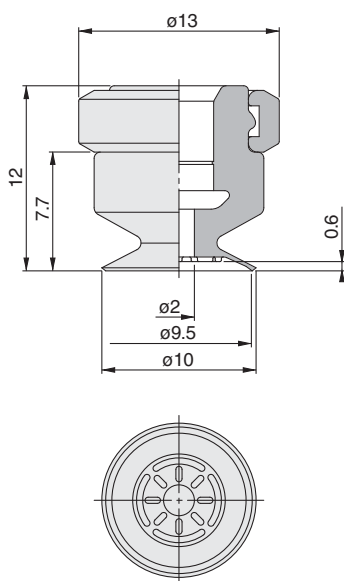
How to Order

INO — 3769 — 1968 — 10 C

Pad diameter	
10	ø10
Pad shape	
C	Flat with ribs
Pad material	
N	NBR
S	Silicon rubber
U	Urethane rubber
U1	Antistatic urethane rubber
F	Fluoro rubber
GN	Conductive NBR
GS	Conductive silicon rubber
Specifications	
G	Pad only
NII	Pad with lock ring

Dimensions

(mm)



* Interchangeable with standard (ø10 to ø16) adapter.

How to Order

INO — 3769 — 1561

Pad Part Number

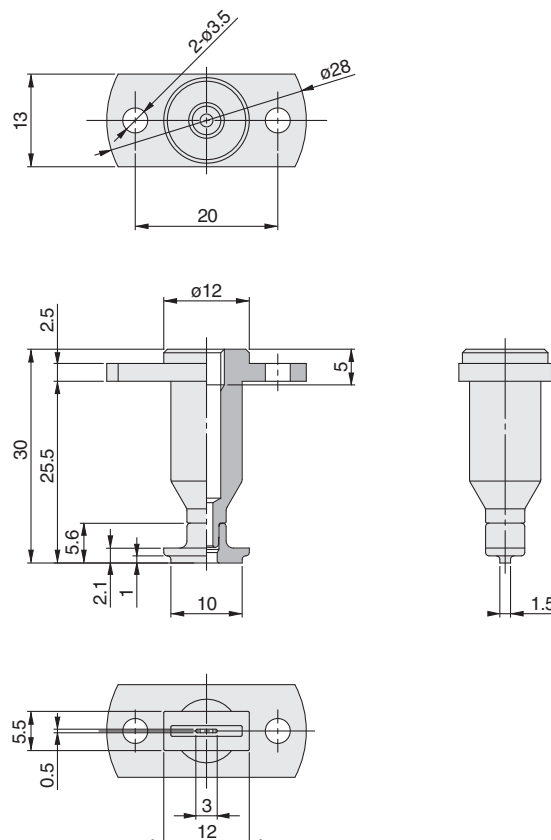
INO — 3769 — 1369 — G

Rubber Specifications

Material	Antistatic urethane rubber
Volume resistivity value	10^9 to $10^{11} \Omega\text{-cm}$
Durometer	80±5

Dimensions

(mm)

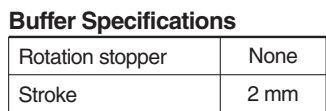


Metal Pad with Buffer

- How to Order**
-
- ZP – A0035XTJAC – DBJ00315**



Dimensions



● When you need buffer only, use the following part numbers to order.

- Buffer part number ①: **ZP-CZZZZ9ZJAC-DBJ00315**

Sponge Pad

-

How to Order

INO-3769-2450-SG 06

Specifications Pad diameter

SG	Sponge	06	ø6
----	--------	----	----

Dimensions



How to Order

INO-3769-2665-SG 10

Specifications Pad diameter

SG	Sponge	10	ø10
----	--------	----	-----

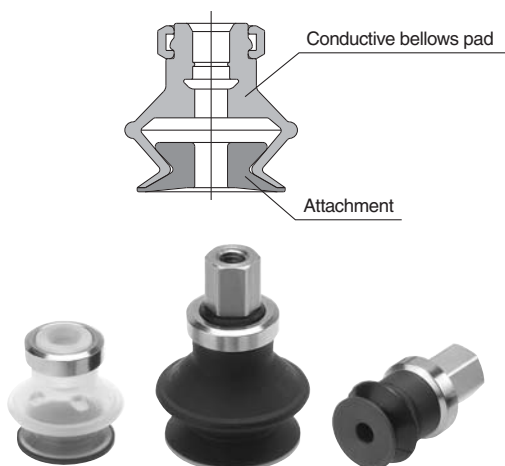
Dimensions



Clean Attachment for Vacuum Pad / ZP-E20□-DBH00142

Made to Order

With the use of conductive PEEK material attachment on the bellows rubber pad, static electricity can be prevented, and oil will not be left on the work.



- Prevent the work from contacting the rubber material, and stop transition of the oil oozing out of the rubber material. (Note: Please consult SMC for details.)
- With combination with bellows pad, scratches on the work can be decreased.
- Applications: Suction process of semiconductor and FPD devices

Variations

Size	ø6, ø8, ø10, ø13, ø16, ø20, ø25, ø32
Material	Conductive PEEK (Volume resistivity: 10^5 to $10^6 \Omega \cdot \text{cm}$)
Applicable pad	Bellows vacuum pad

Attachment



Standard pad diameter	Conductive PEEK
ø6	ZP-E201-DBH00142
ø8	ZP-E202-DBH00142
ø10	ZP-E203-DBH00142
ø13	ZP-E204-DBH00142
ø16	ZP-E205-DBH00142
ø20	ZP-E206-DBH00142
ø25	ZP-E207-DBH00142
ø32	ZP-E208-DBH00142

Note) Part number in above table shows the number for the attachment only. If pad is ordered together, please refer followings.

How to Order (attachment and pad together)

- As shown below, add * for the attachment part number beneath the vacuum pad number. But please note that they are not assembled.
- This attachment can be mounted to SMC standard bellows pad only.
- For conductive PEEK attachment, use the pad made of conductive material.

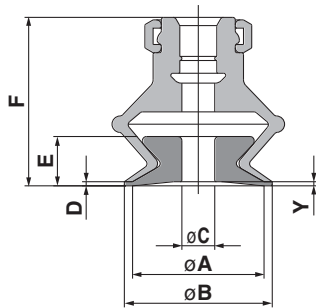
Ex. ZPT06B9NJ10-B5-A8

Vacuum pad part number

*ZP-E201-DBH00142

Attachment part number

Dimensions



(mm)							
Model	A	B	C	D	E	F	Y
ZP06B	6	7	1.6	0.5	3	13.5	0.5
ZP08B	8	9	3		3.5	16.5	
ZP10B	10	12	3.5		5.5	19	
ZP13B	13	15	4		6	20.5	
ZP16B	16	18	8		8.5	24.5	
ZP20B	20	22	10	1	11.5	25	1
ZP25B	25	27				30	
ZP32B	32	34					

<Caution>

- Clean the attachment before usage.

This product is not cleaned after machining. Do not use the attachment out of the package, or residual subject on the attachment is transferred to the work.

Please consult SMC if any question occurs.

Cleaning method (Reference)

- 1) Use vinyl gloves which do not generate particle, and hold the pad except vacuuming part.
- 2) Supply 2-Propanol (isopropyl alcohol) for electronic industry (Purity > 99.5%) to a cloth which does not generate particle.
- 3) Wipe lightly the attachment vacuum surface and the part which may contact with the work.
- 4) Wipe it again with a dry cloth which generates no particle.

- If the contact with hard material becomes a problem, do not use the attachment.

Removing the film covering the contacting foot brackets (anodization), causes the cylinder to become conductive from the piston rod end to the foot brackets.

How to Order

CM2 L 40-150-X1051

Mounting

I	Axial foot
F	Rod end flange
G	Head end flange
C	Single clevis
D	Double clevis
T	Head end trunnion

Cylinder stroke (mm)

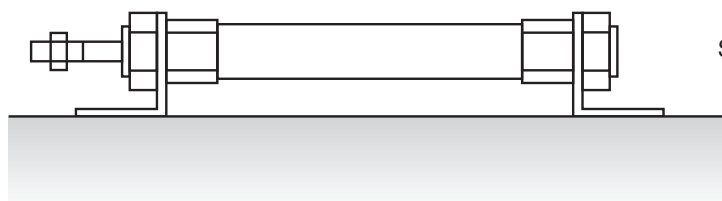
Bore size	Stroke
20	25, 50, 75, 100, 125, 150
25	25, 50, 75, 100, 125, 150
32	25, 50, 75, 100, 125, 150, 200
40	25, 50, 75, 100, 125, 150, 200, 250

Bore size

20	20 mm
25	25 mm
32	32 mm
40	40 mm

Conductive air cylinder

It is possible to eliminate static electricity from the mounted brackets without moving the ground wire attached to the flexible part.



Surface resistance value: $10^{-1} \Omega$ or less

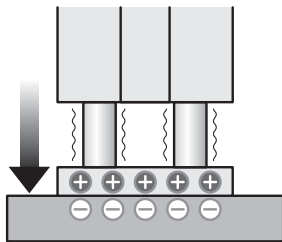
Technical Information

1. Types of Static Electricity Generation

There are various types and names of static electric generation. Basically, static electricity is generated when objects come into contact with one another or when they are separated.

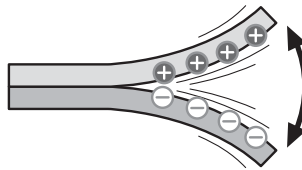
Contact Charging

Static electricity generated when two objects come into contact.



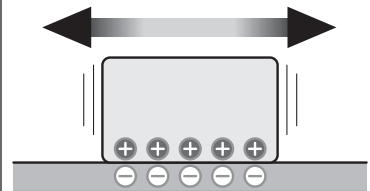
Separation Charging

Static electricity that occurs when two objects that were in contact with each other are separated.



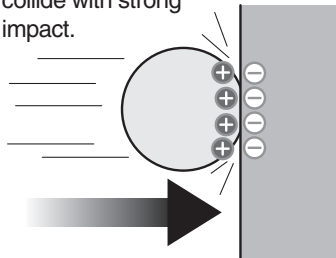
Frictional Charging

Static electricity generates when two objects are rubbed together.



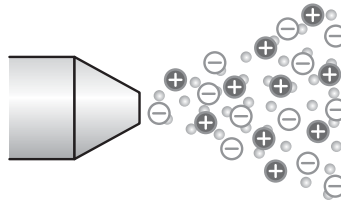
Clash Charging

Static electricity generated when objects (particles or the like) collide with strong impact.



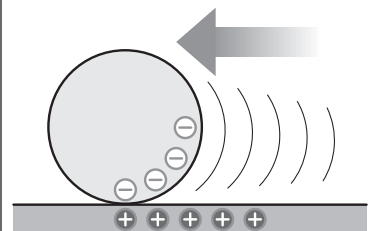
Vapor Charging

Static electricity generates in liquid when water coming out of nozzle becomes misty.



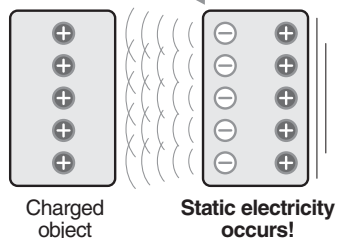
Rolling Charging

Static electricity generated when objects roll over other objects.

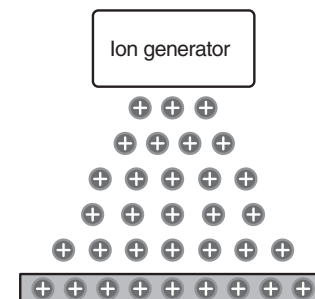


Induction Charging

When an electro-statically charged object approaches another object, static electricity occurs on the opposite side of that object.



Charging from External Ion



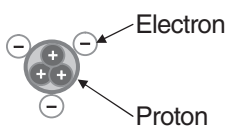
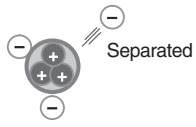
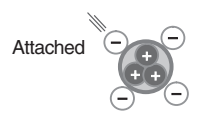
2. Static Electricity

● Why is static electricity generated?

① Principle of static electricity

When looking closely, you can see that all matter is composed of **atoms**. An atom has **protons and electrons that are in electrical balance**. Electrons may become separated from or attached to the atom with a small force.

Disruption of the **balance between protons and electrons leads to static electricity**.

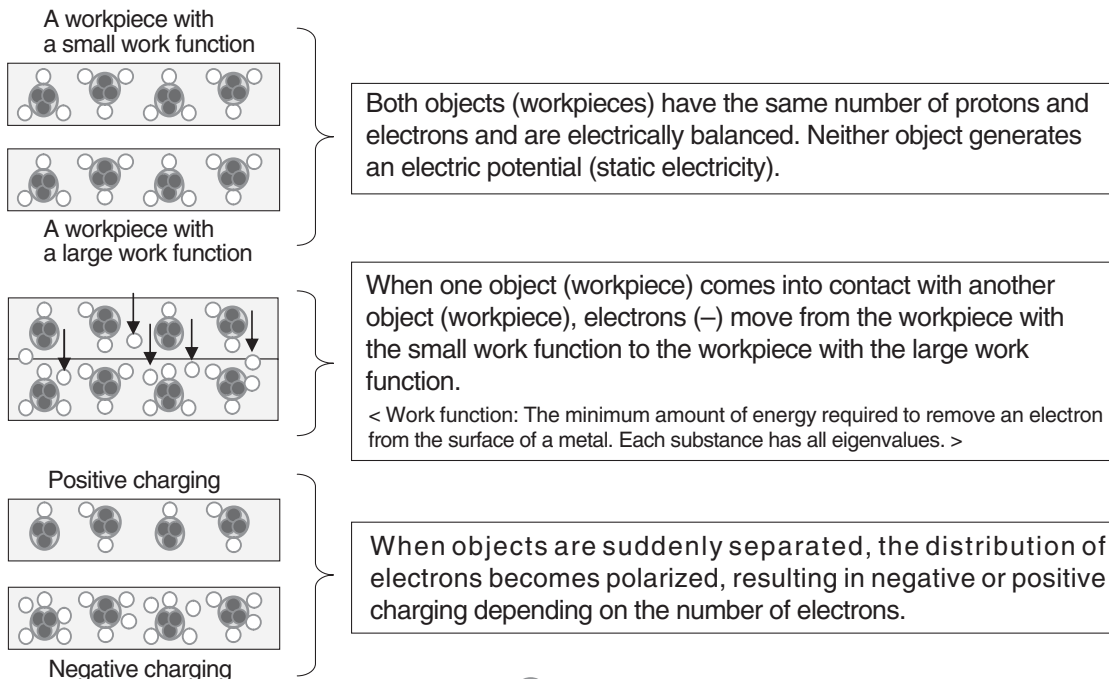
No static electricity (0 V)	Positively charged (+)	Negatively charged (-)
		
Protons (+) and electrons (-) are balanced and no static electricity is generated.	When an electron (-) separates from the atom, the number of protons (+) exceeds the number of electrons (-), resulting in a positively charged state.	When an electron (-) attaches to an atom, the number of electrons (-) exceeds that of protons (+), resulting in a negatively charged state.

Note) 3 electrons are mentioned in the figure, but the number of electrons varies depending on the atom.

● Causes of generating static electricity

① Contact charging

When 2 objects come in contact with each other, electrons can move between the objects. When the objects are suddenly separated under this condition, the atoms are polarized and static electricity is generated.



Electric Polarity and the Amount of Electric Charge

● Triboelectric series

The “electric polarity” and “amount of electric charge” when 2 objects come into contact with each other, are shown in the **triboelectric series**.



Human body
Glass
Mica
Nylon
Wool
Silk
Aluminum
Polyester
Paper
Cotton
Steel
Copper
Rubber
Polyurethane
Polypropylene
Vinyl chloride
Silicon
Fluororesin

How to read the triboelectric series

1: Electric polarity

The materials mentioned in the upper part of the triboelectric series are charged positively and those mentioned in the lower part are charged negatively.

Example 1: Glass (+) Polyester (–)

Example 2: Polyester (+) Fluororesin (–)

2: Electric charge

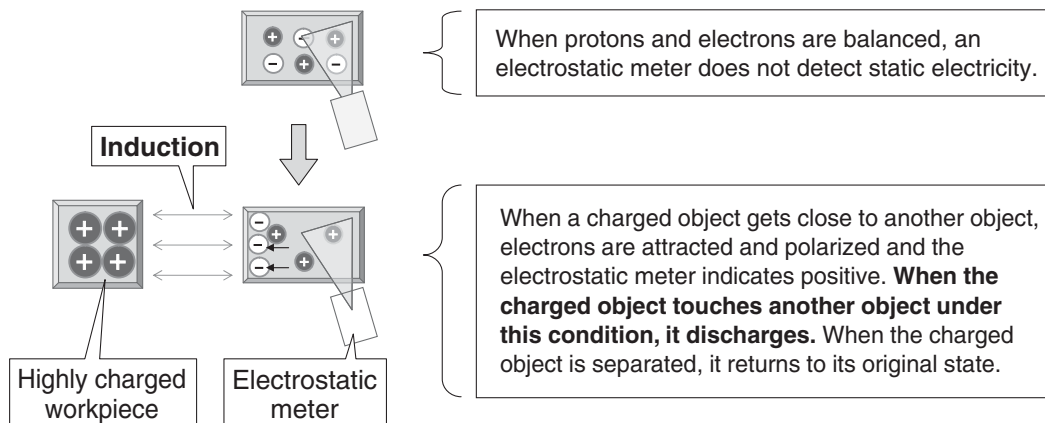
As the distance between 2 materials becomes greater, the amount of charge becomes larger.

Example 1: Amount of charge between the human body and nylon (Small)

Example 2: Amount of charge between the human body and polyurethane (Large)

② Induction charging

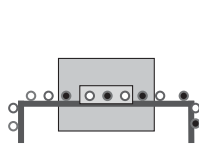
Induction charging is static electricity that is generated when a charged object gets close to another object without contacting it. This static electricity is difficult to detect because the objects do not come into contact with each other.



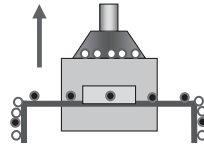
Static Electricity (continue)

Examples of Failures due to Induction Charging

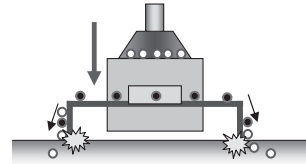
● Device Breakdown 1



1) An uncharged device has no electrical polarization.

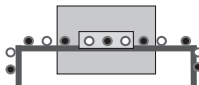


2) When a vacuum pad that has been charged due to repeated operations gets close to the device, static induction occurs. This figure shows that electrons move toward the electrode: the chip and its surroundings are positively charged.

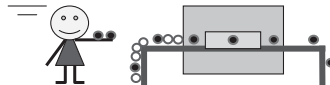


3) When the device is mounted on a circuit board, electrostatic discharge occurs. In this case, a **conductive rubber pad** needs to be used.

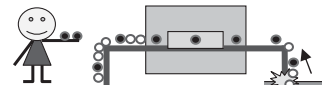
● Device Breakdown 2



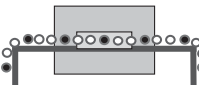
1) An uncharged device has no electrical polarization.



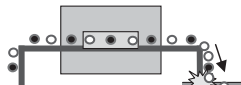
2) When an operator gets close to the device, induction charging occurs. The operator side of the device is negatively charged and the other side is positively charged.



3) When the device is grounded under this condition, static electricity is discharged. Electrons (–) flow into the device from the ground.



4) If the device is insulated, it becomes negatively charged when the operator leaves the device due to the remaining electrons.



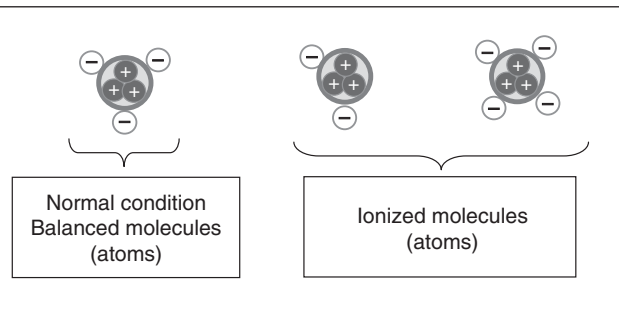
5) When the device is once again grounded, electrostatic discharge occurs again. Electrons (–) flow out.

● Ion charging

Equipment using ultraviolet light etc. may generate ions.
When those ions become attached to workpieces, workpieces become charged.

What is an ion?

- An ion is an electrically charged atom or molecule.
- The ionizer positively or negatively ionizes molecular oxygen (oxygen atoms) and molecular nitrogen (nitrogen atoms) in the air.



3. Countermeasures against Static Electricity

● Prevents static electricity from being generated.

- ① **Proper selection of materials that come into contact with each other (Utilizing the triboelectric series)**
- ② **Reduction of the contact area**
Generation of static electricity increases as the contact area increases. Equipment designs with less contact area are required.
- ③ **Reduction in the frequency with which objects come into contact with each other**
Static electricity accumulates when objects come into contact with each other repeatedly. Reduce the frequency with which objects come into contact with each other to reduce the generation of static electricity.
- ④ **Control of capacitance**
Static electricity voltage fluctuates with capacitance. Capacitance needs to be controlled to prevent static electricity from increasing unnecessarily.

Static electricity voltage and capacitance

● Static electricity voltage

Static electricity voltage can be calculated using the formula below.

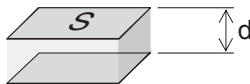
$$\text{Voltage (V)} = \text{Quantity of Electric Charge (Q)} / \text{Capacitance (C)}$$

When the quantity of electric charge is constant, the voltage fluctuates with capacitance.

Example: When capacitance decreases, voltage increases.

● Capacitance (C)

The capacity to store static electricity between two objects. The capacitance between flat plates increases in proportion to the area (S) and decreases when the distance (d) between the flat plates becomes larger.



Example: The static electricity voltage of a workpiece on the table increases when the workpiece is lifted with a lifter because the capacitance becomes smaller.

● Prevent objects from being charged with static electricity.

Even if static electricity is generated, prevent objects from being charged to the extent that problems may result. Appropriate measures need to be taken, depending on the applications.

① Grounding

Grounding is a fundamental countermeasure against static electric. However, grounding is sometimes not complete due to insulation from lubricating oils, and that grounding is not deep enough in the ground, therefore, it is necessary to confirm the grounding.

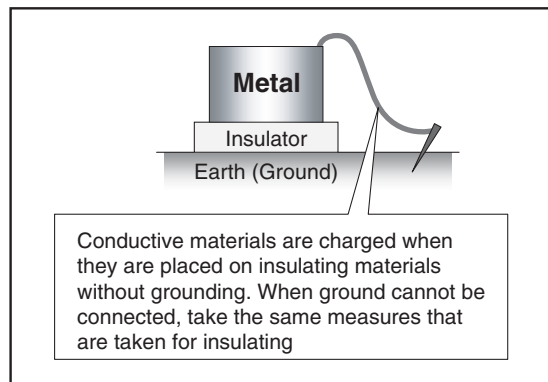
② Humidity control

Humidity is controlled by humidifiers and such.

Caution: Humidifiers may not be effective for devices that obtain a high temperature.

③ Conductive products

Caution: Conductive products cannot discharge static electricity without grounding.



④ Removing static electricity with ionizers, etc.

● Difference in materials

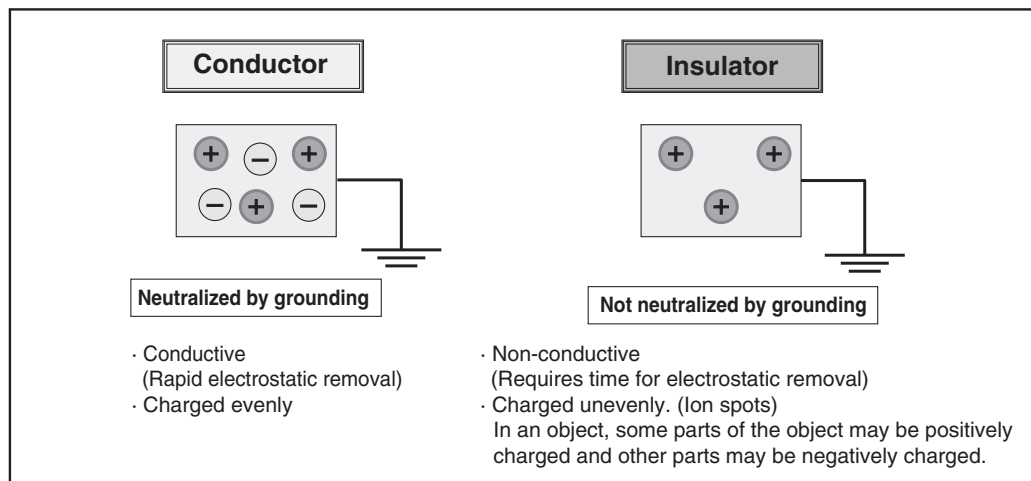
Conductive materials

Conductive materials can discharge static electricity immediately with grounding. When surface treatments such as anodization and the like are applied, conductive materials will become insulated and grounding will be ineffective.

Insulated materials

Insulated materials cannot discharge static electricity even if they are grounded. To discharge static electricity, switch to using conductive materials, use humidity control or a surface active agent, or install an ionizers, etc.

● Electrostatic features of conductive and insulated materials





Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), American National Standards Institute (ANSI)*1) and other safety regulations.

*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.
ANSI/(NFPA) T2.25 R2: Pneumatic fluid power- Systems standard for stationary industrial machinery.
NFPA (Fluid) T2.24.1 R1: Hydraulic fluid power - System standard for stationary industrial machinery.
NFPA 79: Electrical Standard for Industrial Machinery.
ANSI/RIA/ISO 10218 -1: Robots for Industrial Environment -Safety Requirements - Part 1 -Robot.
etc.

- | | |
|--|---|
| | Caution: Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury. |
| | Warning: Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury. |
| | Danger: Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury. |

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary. If anything is unclear, contact your nearest sales branch. (1-800-SMC-SMC1)

Limited Warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited Warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited Warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*** 2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

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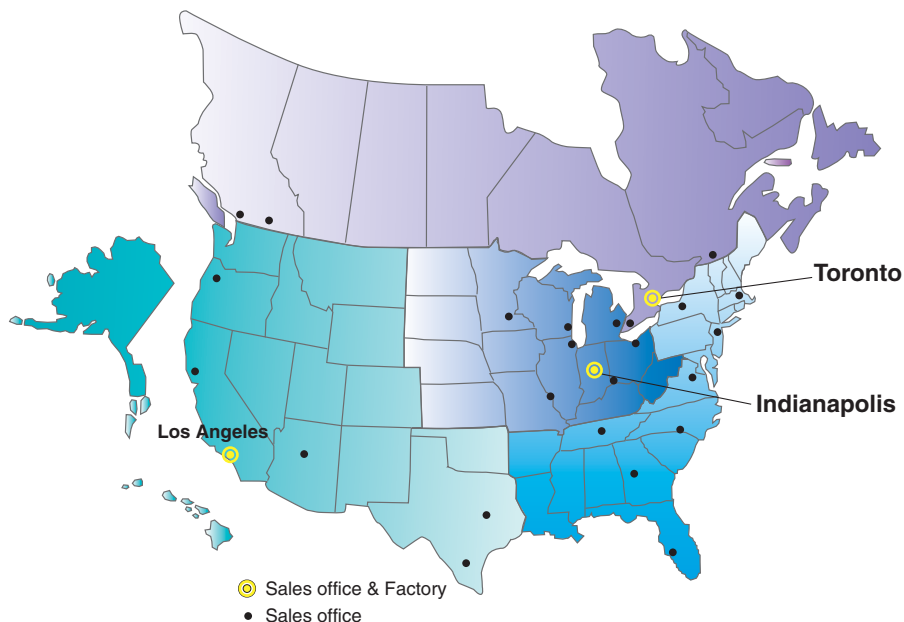
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