

# Sintered Metal Element

***EBKX Series***

**Bronze**

RoHS



Bronze elements

# SMC sintered metal elements are suitable

- High mechanical strength and withstand pressure
- Anti-corrosion
- Suitable for high-accuracy filtration
- Suitable for machining, crimping, brazing, welding, and simultaneous sintering
- Washing allows repeated use

## Specifications

Item	Bronze
Material	CAC403 equivalent
Sintering density (g/cm <sup>3</sup> )	5.0 to 6.5
Void ratio (%)	25 to 43
Operating temperature range (°C) <small>Note 4)</small>	−160 to 200
Thermal expansion coefficient (1/°C)	1.8 × 10 <sup>−5</sup>
Tensile strength (MPa)	9.8 to 83.4
Nominal filtration accuracy (μm)	(1), 2, 5, 10, 20, 40, 70, 100, 120
Typical configurations	Disc, square sheet, cylinder, cylinder with bottom, cone with flange, element with fitting, etc.

Note 1) Sintering density, void ratio, and tensile strength differ according to nominal filtration accuracy.

Note 2) Thermal expansion coefficient applies to bronze material, not to sintered metal elements.

Note 3) Nominal filtration accuracy of 1 μm is an optional value.

Note 4) For operating temperature range of the element with fitting (standard product), refer to page 110.

## Raw material categories and nominal filtration accuracy (μm)

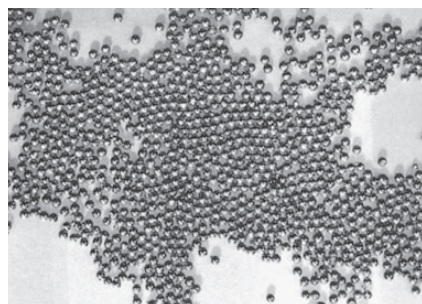
Sieve (mesh)	20	24	32	42	60	80	120	200	250
Opening (μm)	850	710	500	355	250	180	125	75	63
Nominal filtration accuracy (μm)	120	100	70	40	20	10	5	2	

Note 1) Sieve (mesh) and opening values apply to metal mesh separating raw material, not to elements.

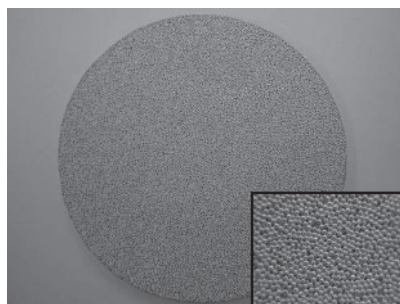
Note 2) Nominal filtration accuracy: Refers to value used to categorize raw material, not to filtration rating.

## Raw Material Powder and Sintered Metal Element

### <Bronze powder>



### <Sintered bronze>



## Applications

A sintered metal element consists of countless interconnected capillary tubes, making it suitable for a wide range of uses. For detailed information on purpose-specific applications, please contact SMC.

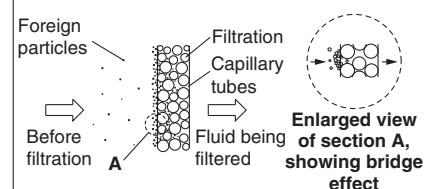
### 1. Filtration

Sintered metal elements are widely used for removing foreign particles from many different kinds of flow media.

Major application fields: General gases, water, various kinds of oils

Normally, filtration makes use of the so-called bridge effect where foreign particles are blocked because they form a bridge-like accumulation.

The size and distribution of particles to be filtered can be controlled through parameters such as the diameter of the capillary tubes. Particles may be blocked completely or selectively.



### 2. High-viscosity filtration

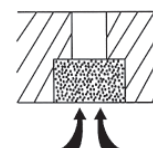
This is used to remove foreign matter or gel from raw materials for fibers or films.

### 3. Sound absorption

The porous quality of sintered metal elements allows them to absorb sound energy, providing a muffling or silencing effect.

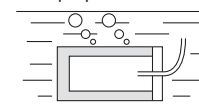
### 4. Gas removal

Sintered metal elements are used for degassing purposes in forming and molding processes.



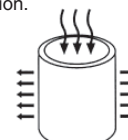
### 5. Foaming

Sintered metal elements positioned in various kinds of fluids are used to introduce gases, for stirring and other purposes.



### 6. Flow control

Because a sintered metal element consists of countless interconnected capillary tubes, it can be used to control the flow of fluids. Cylindrical bronze elements are especially suited for this type of application.

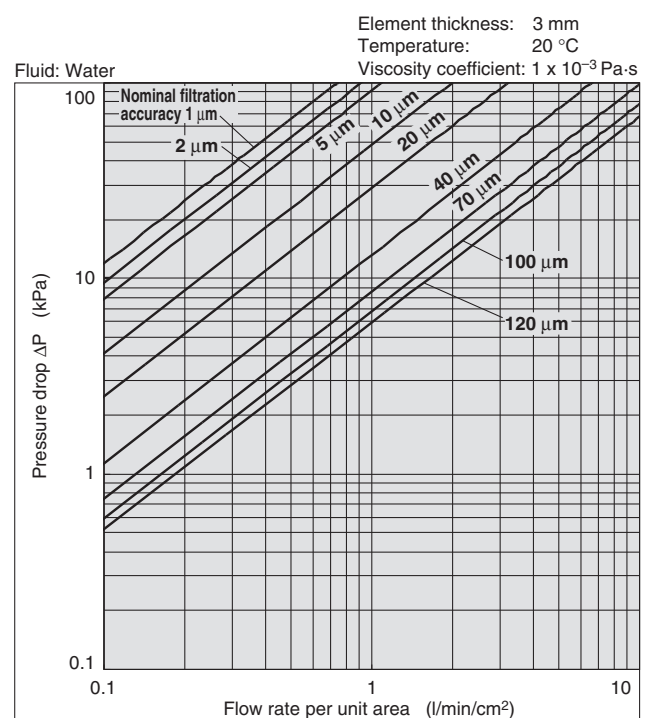
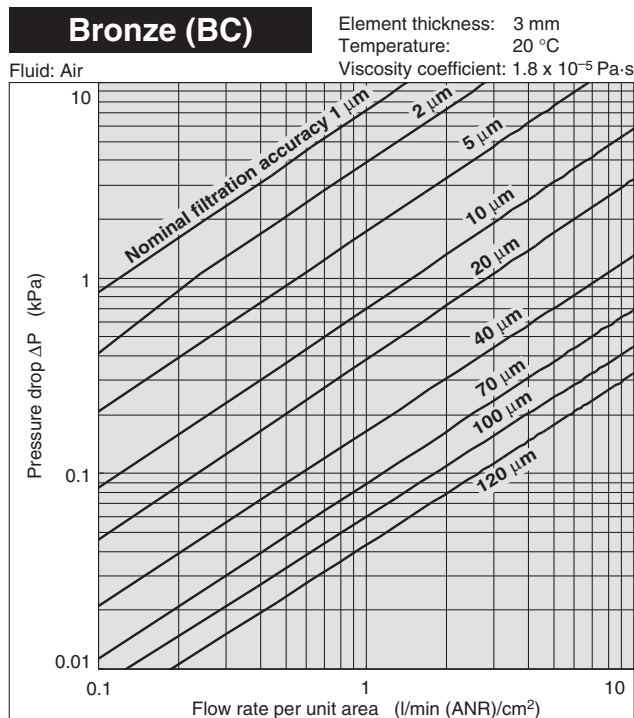


### 7. Other applications

Various other applications make use of the fluid-passing functionality of sintered metal elements.

# for a wide range of industrial applications.

## Flow Rate Characteristics



### <Simplified formula for calculating pressure drop>

The state equation of an ideal gas ( $PV/T = \text{constant}$ ) and the pressure drop are proportional to element thickness and viscosity. Based on this, the pressure drop under conditions that are different from those used in the flow rate characteristics chart can be calculated roughly for reference, using the following simplified procedure.

- (1) Pressure drop  $\Delta P$  kPa when flow medium is air, temperature  $T_1$  °C, pressurization  $P_1$  kPa:

$$\Delta P = \frac{101.3 \times \Delta P_0 \times (273 + T_1)}{293 \times (P_1 + 101.3)}$$

$\Delta P_0$ : Pressure drop kPa obtained from flow rate characteristics chart

- (2) Element thickness dependent pressure drop  $\Delta P$  kPa when flow medium is air and water, element thickness  $t_1$  mm, and element thickness in flow rate characteristics chart differs:

$$\Delta P = \Delta P_0 \times \frac{t_1}{t_0 \text{ (2.3 or 3)}}$$

$\Delta P_0$ : Pressure drop kPa obtained from flow rate characteristics chart or from (1)

$t_0$ : Element thickness in flow rate characteristics chart (BC element = 3 mm)

- (3) Pressure drop  $\Delta P$  kPa when viscosity  $\eta_1$  of flow medium differs from that of air or water:

$$\Delta P = \Delta P_0 \times \frac{\eta_1}{\eta_0}$$

$\Delta P_0$ : Pressure drop kPa obtained from flow rate characteristics chart

$\eta_1$ : Viscosity of flow medium Pa·s

$\eta_0$ : Viscosity of flow rate characteristics chart (air =  $1.8 \times 10^{-5}$  Pa·s, water =  $1 \times 10^{-3}$  Pa·s)

# Sintered Metal Element

## Standard Configurations and Dimensions (Unit: mm)

**Bronze (BC)**

**RoHS**

**5. Element with Fitting (Standard product)**

**EBKX model number**

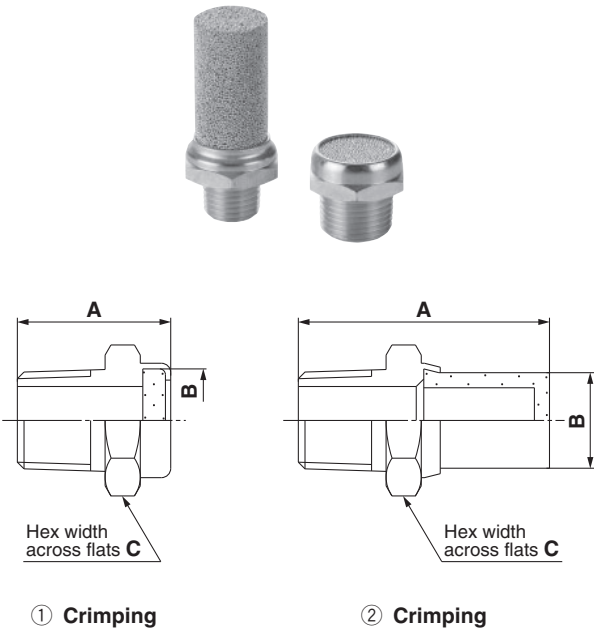
Connection thread	Model number	Dimensions			Configuration
		A	B	C	
M3	EBKX-X9007-□	9.7	8	12	①
M5	EBKX-X9008-□	9.7	8	12	①
R1/8	EBKX-L7004-□	13.5	8	11	①
R1/4	EBKX-J2001-□	47.3	17	21	②
	EBKX-L7005-□	19	19	21	①
R3/8	EBKX-J2002-□	48.3	17	21	②
	EBKX-L7006-□	20	19	21	①
R1/2	EBKX-J2003-□	51.3	17	21	②
	EBKX-L7007-□	23	19	21	①

**Model number suffix □ (nominal filtration accuracy) definition**

symbol	Nominal filtration accuracy
002	2 μm
005	5 μm
010	10 μm
020	20 μm
040	40 μm
070	70 μm
100	100 μm
120	120 μm

Example: Nominal filtration accuracy 2 μm  
EBKX-J2001-002

Operating temperature: -160 to 100 °C





# Sintered Metal Element

## Specific Product Precautions 1

Be sure to read this before handling the products.

### Precautions on Design

#### Caution

##### 1. Strength

The elements are made of porous material with voids inside. Therefore their tensile strength compared to conventional bronze products is lower by a factor of one or two magnitudes. Depending on the application conditions, reinforcing material may be required. Use punched metal or similar for reinforcement.

##### 2. Operating temperature

The operating temperature range given in the specifications (page 106) is the range in which material strength does not deteriorate significantly.

In an oxidizing atmosphere (atmospheric air), the temperature point where oxidization and discoloring begins is 100 °C for bronze elements.

##### 3. Fatigue breakdown

Fatigue breakdown may occur under the following conditions:

- 1) Element is subject to vibrations
- 2) Element is subject to cyclic thermal expansion and contraction

In such cases, use suitable countermeasures such as vibration dampers or punched metal reinforcements to support the element, or employ a construction that absorbs thermal expansion and contraction.

##### 4. End configuration

For information on end configurations of cylinder elements (open or with bottom), check the notes and configuration information on the page for the respective product in this catalogue. When devising applications, make sure that there are no problems such as improper sealing or leaks due to the end configurations.

##### 5. Particle separation

When cutting is performed, particle chipping will occur at edge sections. This is especially noticeable with products rated for high nominal filtration accuracy (µm) values. Particle chipping and other machining problems may also occur at edges of products that are not finished by cutting. Carefully check sealing properties before use.

##### 6. Cleaning

The products of sintered metal elements in the table are cleaned before shipping, but not to clean room standards. Before use in a clean room, elements must be cleaned and flushed by the customer, and application suitability must be verified.

#### Caution

##### 7. Corrosion

Note that corrosion will occur, depending on usage and ambient conditions. Major corrosive substances and corrosion conditions are listed below. Be sure to check this information.

##### Bronze elements

Category	Corrosive substances and corrosion conditions
Acid, alkali	Use in solutions with ferric or cupric ion content or ammonium content not possible, due to corrosion
	Use in nitric acid, sulfur, and hydrochloric acid not possible, due to corrosion
Atmosphere	Corrosion caused by hydrogen sulfide (H <sub>2</sub> S) and sulfurous acid (SO <sub>2</sub> )
Sea water	Products have some resistance but long-term use will cause corrosion
Fresh water	Corrosion caused by presence of carbonic acid (carbonation)

##### 8. Discoloration

- 1) Elements can be discolored by foreign matter deposits, oxidization by flow medium, and other conditions.

In particular, as for the bronze element, a dark red CuO film is formed by the moisture included in the atmosphere and the product may be discolored when unpacked.

However, this does not affect the product characteristics. If the discoloration of the bronze element is pointed out as appearance problem, Ni plating treatment is available. For details, contact SMC.

- 2) A portion that may be seen as black point may rarely occur on the element surface.

This is caused by raw materials included in the raw material powder and does not adversely affect the product performance.



# Sintered Metal Element

## Specific Product Precautions 2

Be sure to read this before handling the products.

### Precautions on Design

#### ⚠ Caution

##### 11. Nominal filtration accuracy

Nominal filtration accuracy of sintered metal elements is a classification rating using the particle size of the raw material. (This is different from the filtration rating with regard to the flow medium.) For reference, particle sizes that can be removed with an efficiency of 95 % (in air and water) at different nominal filtration accuracy ratings are listed below.

##### Nominal filtration accuracy and 95 % removable particle sizes (reference)

Nominal filtration accuracy (μm)	95 % removable particle size (μm)	
	Flow medium: Air	Flow medium: Water
	Bronze (BC)	Bronze (BC)
120	—	244
100	—	177
70	—	104
40	3.6	90
20	2.8	59
10	2.1	32
5	1.5	20
2	1	17

### Installation

#### ⚠ Caution

##### 1. Installation of standard elements with fitting

When the element is held with a tool directly, this may cause damage to the element, resulting in breakage.

- 1) Connection thread M3  
First tighten by hand and then use a suitable wrench on the hex sleeve of the fitting to tighten further by about 1/4 turn.
- 2) Connection thread M5  
First tighten by hand and then use a suitable wrench on the hex sleeve of the fitting to tighten further by about 1/6 turn.
- 3) Connection thread R (pipe taper thread)  
First tighten by hand and then use a suitable wrench on the hex sleeve of the fitting to tighten further.

Connection thread	Suitable tightening torque (N·m)
R1/8	7 to 9
R1/4	12 to 14
R3/8	22 to 24
R1/2	28 to 30

### Operating Environment

#### ⚠ Caution

1. **Discoloration and material degradation may occur if used in a corrosive atmospheric environment.**  
Severe corrosion will cause the product to lose its filtering functionality.
2. **When the product is subject to vibrations or shock, fatigue breakdown may occur. Provide suitable reinforcement to avoid such conditions.**

### Storage

#### ⚠ Caution

1. **Keep the product indoors and in its packing until use.**  
Protect the product from water, humidity, and high temperatures, to avoid discoloration and corrosion.
2. **Do not place any objects on top of the product.**  
Otherwise there is a risk of deformation or breakage.

### Maintenance




#### ⚠ Caution

1. **Pressure drop  $\Delta P$  will change depending on operating conditions.**  
Pressure drop  $\Delta P$  is one of the performance parameters of the element. Establish suitable management standards for this parameter.
2. **Be aware of individual product warranty conditions and exclusions.**  
In the case of sintered metal products, conditions such as filter performance degradation due to clogging and discoloration are not covered by the warranty, even during the warranty period.



## 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) <sup>1)</sup>, and other safety regulations.

-  **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.

- 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.  
etc.

## 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 catalogue 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 catalogue.
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.

## 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.

## 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, whichever is first. <sup>2)</sup> 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 catalogue 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.

## Caution

### SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

## Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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