





POROZNI METALNI MATERIJALI od sferične bronce su specifični proizvodi metalurgije praha koji svojim povezanim sistemom kapilara zadržavaju svaku vrstu čestica. Pravilan izbor polaznih prahova obezbeđuje izradu filtera sa ravnometrično definisanim veličinom pora od oko 0,003 do 1,14 mm. Time se omogućava da se u pogledu poroznosti prečnika pora i otpora proticanja zadovolje svi postavljeni uslovi.

Sinterovanje

Sinterovanje vec spremljenih komada se vrši u specijalnim pecima sa kontrolisanom zastitnom atmosferom ili u vakuumskim pecima, zagrevanjem dok se poslednji delic praha na površini istopi i sjedini. Zrna praha se dovode na tacnu odredjenu temperaturu na kojoj se samo površine cestica tope i sjednjiju, a ne prelaze u tecno stanje (odlivak). Kroz ovakav proces rekristalizacije stvara se od pulverizovanog materijala jedan jako cvrst sinterovani oblikovani deo. Prilikom sinterovanja legiranih prahova razlicitih tacaka topanja govorimo o "tecnoj fazi sinterovanja". Glavne karakteristike ovog procesa su niža temperatura sinterovanja, relativno brzo skupljanje i homogenizacija i velika gustina dobijenog materijala.

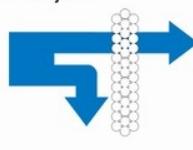
PRIMENA

Filtriranje i separacija fluida

1. Filtriranje tečnosti od čvrstih nečistoća kao i odvajanje nemešajućih tečnosti na bazi različitog površinskog napona.
2. Filtriranje gasova od čvrstih i tekućih čestica u svim uslovima (visoki i niski pritisci i temperature) te odvajanje gasova na bazi različite brzine difuzije. Sušenje gasova kroz patronе od sinter bronze ispunjene silikagelom.
3. Filtriranje rastopljenih plastičnih masa.

Umirivanje toka

Prolazom kroz filter nemirni i nepravilni tok se usmerava i umiruje.



POROUS METAL materials made of spherical bronze are specific PM products which, with their inter-connected system of capillaries, work as a trap for all sorts of particles. Right choice of starting powders enables production of filters with uniformly defined pore size, ranging from 0.003 to 0.14 mm, making possible for these filters to satisfy all requirements regarding porosity, pore diameter and flow resistance.

SINTERING

Molded pieces are being made in special furnaces with controlled protective atmosphere or vacuum furnaces by heating to the temperature at which last bit of powder on the surface melt and merge. Bronze powder grains are brought to a specific temperature at which only the surface particles melt and merge but do not exceed to the liquid state – casting.

Through these process, very solid sintered parts are being created out of pulverized materials by process of so called re-crystallization. The main characteristics of this process are lower sintering temperatures, a relatively rapid homogenization and high density of final product. This process is different from sintering of alloy powders with different melting points, which is liquid phase sintering.

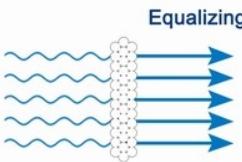
APPLICATION

Filtriranje i separacija fluida

1. Filtering liquids from solid impurities and separation of non-mixing liquids, based on different surface electricity.
2. Filtering of gases from solid and liquid particles in different conditions (high and low pressure and temperature) and gases separation based on different diffusion speed. Gas drying through cartridges of sinter bronze filled with silica gel.
3. Filtering of melted plastics.

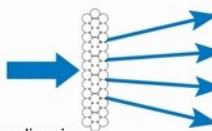
Fluidizacija (disperzija)

Visoko porozni bronzani filteri sa velikim brojem površinskih pora mogu disperzovati vazduh ili gas, a mogu se oristiti i za fizičko-hemijsku izmenu između gase i tečnosti. Podjednaka raspodela vazduha preko sinter metalne strukture omogućava fluidizaciju prahova ili granulometričkog materijala kod silosa, sušara, uređaja za podizanje tereta, pneumatskih rashladnih uređaja itd.



Fluidization (dispersion)

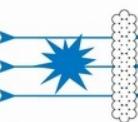
By passing through the filters irregular flows become regular and directed.



Highly porous bronze filters with large number of surface pores can disperse air or gas. Equal distribution of air through numerous pores of filter allows fluidization of powders or granule like materials in silos, kilns, equipments for heavy loads lifting or compressed air cooling devices, etc.

Zaštita od povratnog plamena

U tehnici gasnog zavarivanja bronzani filteri imaju mogućnost sprečavanja povratka slučajno zapaljenih gasova zahvaljujući kapilarnom sistemu para.

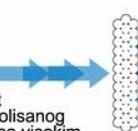


Protection of the return fire

Bronze filters have the ability to prevent accidentally burned gases during the process of gas welding, based on its steam capillary system.

Prigušivanje

Poroznost bronzanih sinter filtera daje visoku efikasnost primene u pneumatskoj tehnici, jer ima mogućnost kontrolisanog odbijanja i absorpcije zvuka. Primjenjuje se u sistemima sa visokim brzinama i turbulentnim kretanjem fluida.



Trottling and dampening

Porosity of bronze sinter filters provides their highly efficient application in pneumatics, because of filters ability of sound rejection and absorption.
Applies to systems with high speed and turbulent fluid motion.

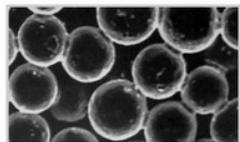


Svojstva

- niska gustoča, visok stepen poroznosti od 30 – 50%, te tavnometerna raspodela veličine pora praktično istog oblika i veličine (od 5 do 200 mikrona) koja zavisi od veličine zrna bronce (od 0.040 do 1.000 mm)
- visoka čvrstoća i stabilan oblik (zatezna čvrstoća > 50 N/mm²)
- visoka termička i korozivna otpornost (u oksidacionoj atmosferi .. do 180 C , u redukcionoj atmosferi .. do 400C)
- hemijska otpornost na benzine , kiseline alkalije i soli
- pouzdanost eksplatacije pri visokim i udarnim pritiscima i raznim protočnim medima
- mogućnost osiguranja niskog pada pritiska
- mogućnost spajanja lepljenjem, mekim i tvrdim lemljenjem i zaštitnim zavarivanjem
- mogućnost izrade navoja na filteru
- mogućnost čišćenja i regeneracije
- visoka ekonomičnost

Granulacija Filtera od sinter bronze

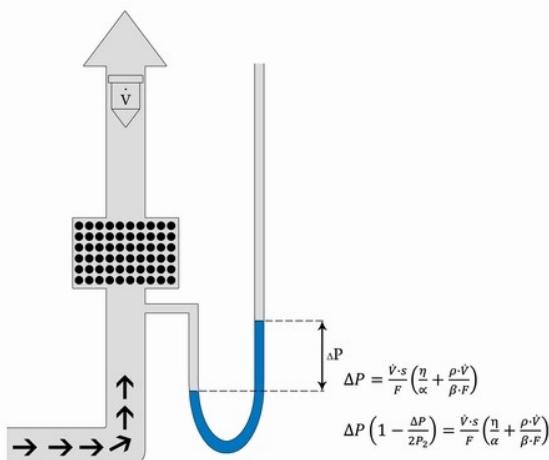
Proces filtriranja održava se na dva mesta. Na samoj površini filtera odvajaju se one čestice filtracionog fluida koje su veće od veličine pora. Međutim u dubini filtera zaustavljaju se na unutrašnjim zidovima i dobar deo čestica čije su veličine manje od veličine pora , pa se na kraju filtera propusti samo neznatni deo čestica.Efikasnost filtriranja zavisi o čitavom nizu faktora (viskozitet fluida , obliku filtera , temperaturi, brzini toka itd.) i nemože se dati čvrsta vrednost.Ipak, jasno je da će veća efikasnost filtriranja proizći korišćenjem finijeg zrna filtera, ali zato na uštrbu protočne moći.



Protočnost

Sinter filteri od bronce imaju veću poroznost i tanje zidove od većinedugih poroznih materijala.Ovo znači da će pad pritiska kod sinter filtera od bronce biti vrlo nizak.

Sledeći diagram omogućava očitavanje vrednosti pada pritiska za bronzone filtere debljine 2.5mm na temelju poznate protočnosti za vazduh (viskozitet 183 mikropoasa) na temperaturi od 20 C.



$\Delta P [N/m^2]$ – pad pritiska ($p_1 - p_2$) / pressure drop ($p_1 - p_2$)

$\dot{V} [m^3/s]$ – protok fluida / flow rate in relation to pressure

$\rho [Ns^2/m^4]$ – gustina medija / density of the medium

$S [m]$ – debљina zida filtera / filter wall thickness

$F [m^2]$ – filtraciona površina / filter surface area

$\eta [Nm^2]$ – dinamicki viskozitet media / dynamic viscosity of the medium

$p_1 [N/m^2]$ – apsolutni pritisak pre filtera / absolute pressure before the filter

$p_2 [N/m^2]$ – apsolutni pritisak posle filtera / absolute pressure after the filter

$\alpha, \beta [m^2]$ – osobine filtera(koeficijent propusnosti) / properties of the filter(permability coefficient)

Properties

- Low-density, high porosity (30-50%) and equal distribution of pores with particularly same shape and size (from 5 to 200 micrones). Pour size depends on size of bronze powder grain size (gain size varies from 0.04 to 1000mm)
- Stable form and high strength (tensile strength ≥ 50N/mm²)
- High thermal and corrosion resistance (in oxidation atmosphere up to 180 C , in reduction atmosphere up to 400C)
- Chemical resistance to gasoline, acidic, alkalines and salts
- Reliable at high pressure and various flow substances
- Possibility of protection of low pressure drop
- Possibility of merging of particles by glueing, soft and hard soldering and protective welding
- Possibility of making vents on the filters
- Possibility of cleansing and re-use
- Highly economic

Granulation

Bronze type	Kern size (mm)	Porosity (%)	Fineness of filter (mn)	Hear strenght (N/mm ²)
B 8	0,04 - 0,08	20 - 35%	15	130
B 12	0,063 - 0,09	20 - 35%	20	120
B 20	0,08 - 0,16	20 - 35%	38	110
B 30	0,1 - 0,2	20 - 35%	52	100
B 45	0,18 - 0,315	20 - 35%	80	90
B 60	0,2 - 0,315	20 - 35%	100	90
B 80	0,315 - 0,4	20 - 35%	135	80
B 100	0,315 - 0,63	20 - 35%	150	70
B 150	0,5 - 0,71	20 - 35%	217	40
B 200	0,63 - 1,0	20 - 35%	267	30

Tabela granulacije sinter bronze koju koristi firma Soliton

Table granulation sinter bronze used by the company Soliton

Filtering process takes place in two places. On the very surface of the filter particles that are larger of pore size are being separated while in the depths of the filter , on its inner wall, a part of the particles whose sizes are less than pore size are being separated. At the end of the filtering process only a few particles remains.

Filteration efficiency depends on whole series of factors (viscosity of the fluid, filter shape, temperature, flow rate, etc

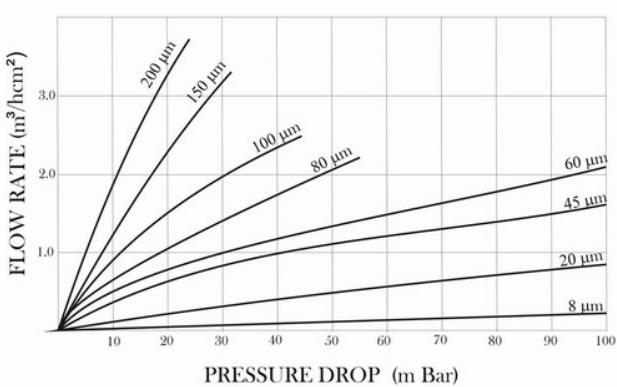
Exact value of filtering efficiency can not be given, nevertheless, it is clear that greater efficiency filtering result using finer grain filter, but at the cost of power flow.

Flow

Sinter bronze filters have higher porosity and thinner walls than most of other porous materials.

This enables the pressure drop in these filter to be very low.

The following diagram represents readings of pressure drop values for 2.5 mm thick bronze powder filter based on known air flow (viscosity of 183 micro pro asa) at the temperature of 20c

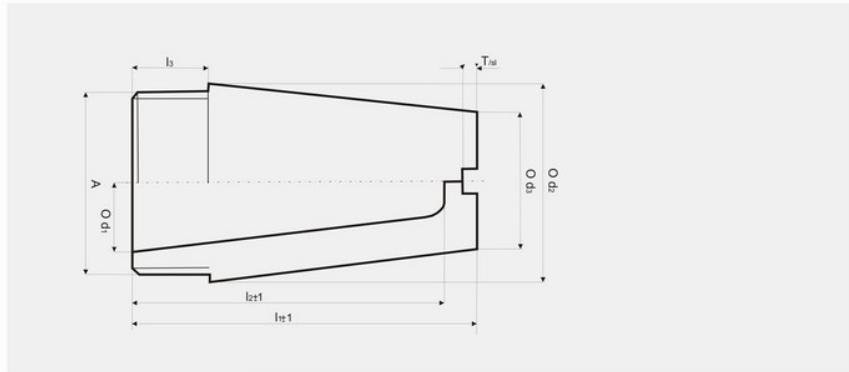


PRESSURE DROP (m Bar)



Prigušník od sinterovane bronze
sa šíľcom
*Silencer made of sintered bronze
with a slot*
Material : CuSn11

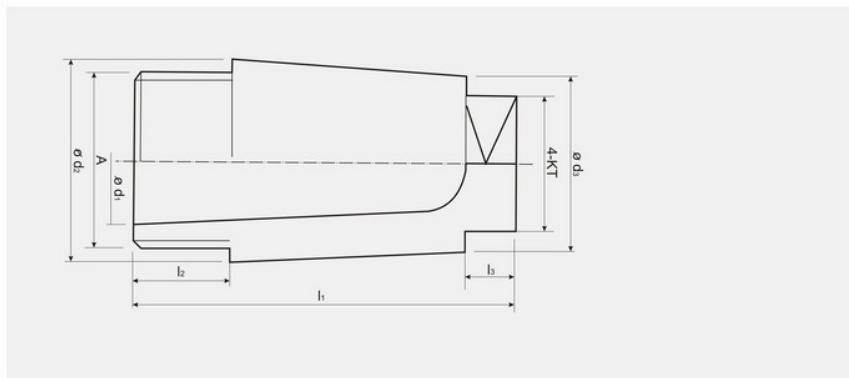
A mm	E d ₁ mm	E d ₂ mm	E d ₃ mm	l ₁ mm	l ₂ mm	l ₃ mm	B mm	T sl
G 1/8"	4	11	8	21	17	5,5	1,5	2
G 1/4"	6	14	10	27	20	8,5	1,5	2
G 3/8"	10	18	15	36	30	11	2	2
G 1/2"	11	24	19	44	37	11	2	3
G 3/4"	17	29	20	65	53	12	2	3,5
G 1"	22	25	26	75	66	15	3,5	4
NPT	E d ₁ mm	E d ₂ mm	E d ₃ mm	l ₁ mm	l ₂ mm	l ₃ mm	B mm	T sl
G 1/8"	4	11	8	25,5	21,5	10	1,5	2
G 1/4"	6	14	10	33,6	26,6	15,1	1,5	2
G 3/8"	10	18	15	40,3	34,3	15,3	2	2
G 1/2"	11	24	19	52,9	45,9	19,9	2	3
G 3/4"	17	29	20	73,2	61,2	20,2	2	3,5
G 1"	22	35	26	85	76	25	3,5	4
G 1 1/4"	32,3	42	34	90	81	25,6	3,5	4
G 1 1/2"	38,4	50	42	100	90	26	3,5	4
G 2"	48	68	60	110	100	26,9	3,5	4



Prigušník od sinterovane bronze sa
četvrtkrom
*Silencer made of sintered bronze
with a square slot*
Material : CuSn11

A mm	E d ₁ mm	E d ₂ mm	E d ₃ mm	l ₁ mm	l ₂ mm	l ₃ mm	4-KT sq
G 1/8"	5	12	8,5	22	5,5	4,5	7
G 1/4"	6,2	14	11,5	27	7	4,5	9
G 3/8"	9	18	15,5	35	9	6	13
G 1/2"	13	24	20,5	43	10	7	17
G 3/4"	20	30	25	55	14	7	19
G 1"	25	38	30	69	15	8	24

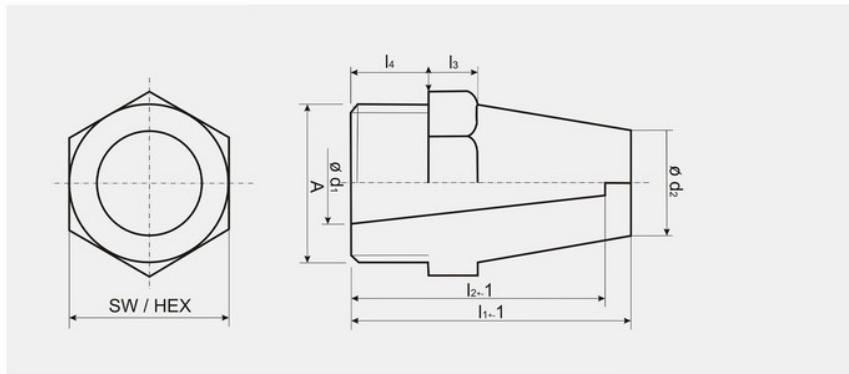
A mm	E d ₁ mm	E d ₂ mm	E d ₃ mm	l ₁ mm	l ₂ mm	l ₃ mm	4-KT sq
M 10 x 1	5	12	8,5	22	5,5	4,5	7
M 12 x 1,5	6,2	14	11,5	27	7	4,5	9
M 14 x 1,5	6,2	16	11,5	27	7	4,5	9
M 16 x 1,5	9	18	15,5	35	9	6	13
M 22 x 1,5	13	24	20,5	43	10	7	17
M 27 x 2	20	30	25	55	14	7	19
M 33 x 2	25	38	30	69	15	8	24





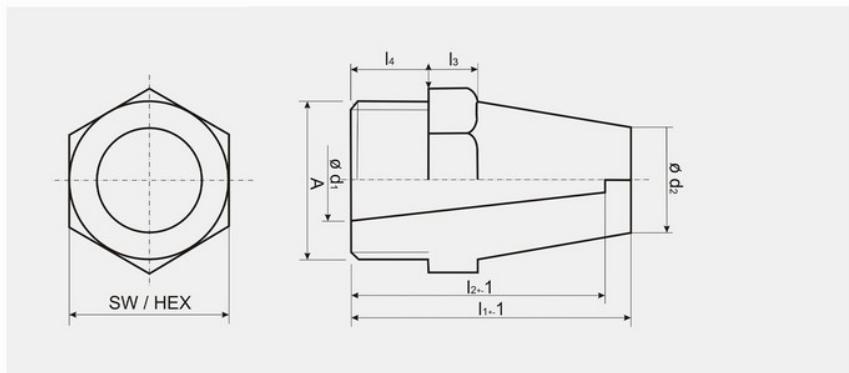
Prigušník sa šesticon MS
 Silencer made with a solid brass hexagon
 Material : CuSn11 + MS58

A mm	E d ₁ mm	E d ₂ mm	l ₁ mm	l ₂ mm	l ₃ mm	l ₄ mm	SW HEX
G 1/8"	4	8	28	24	4	6	13
G 1/4"	6	12	34	30	4	8	17
G 3/8"	9	15	36	32	5	10	22
G 1/2"	12	19	44	40	7	12	27
G 1/2"	12	17	65	60	7	12	22
G 3/4"	16	22	54	48	10	14	32
G 1"	22	18	66	60	10	16	41
G 2"	48	50	75	68	10	16	70



Prigušník sa šesticon
 Silencer made with a hexagon
 Material : CuSn11

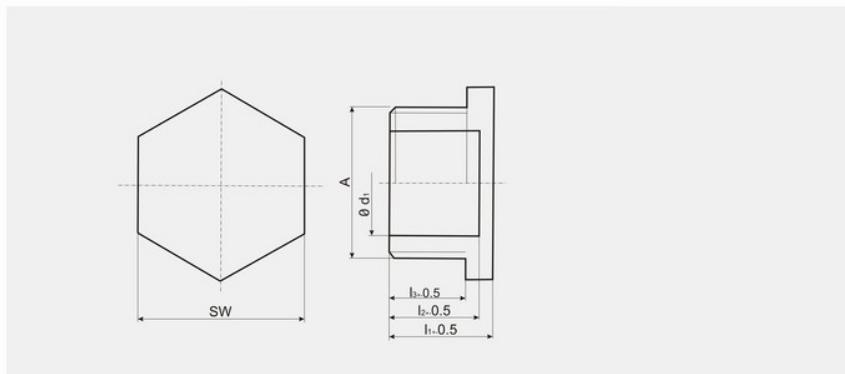
A mm	E d ₁ mm	E d ₂ mm	l ₁ mm	l ₂ mm	l ₃ mm	l ₄ mm	SW HEX
G 1/8"	4	8	28	24	4	6	13
G 1/4"	6	12	34	30	4	8	17
G 3/8"	9	15	36	32	5	10	22
G 1/2"	12	19	44	40	7	12	27
G 1/2"	12	17	65	60	7	12	22
G 3/4"	16	22	54	48	10	14	32
G 1"	22	18	66	60	10	16	41
G 2"	48	50	75	68	10	16	70



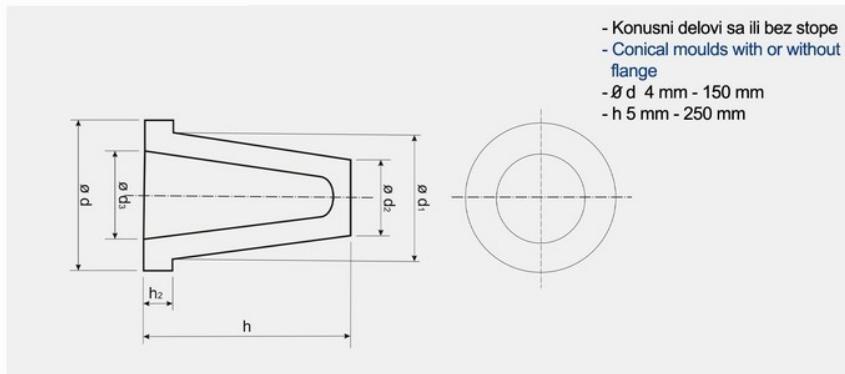


Zatvarač za ozračivanje
 Vent plug
 Material : CuSn11

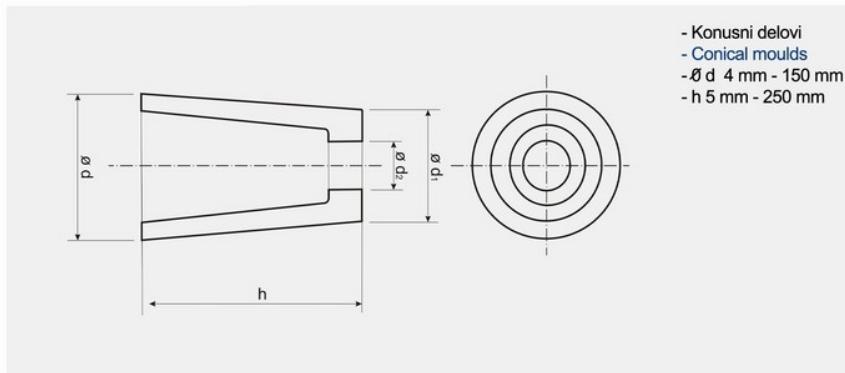
A	O d ₁ mm	l ₁ mm	l ₂ mm	l ₃ mm	SW HEX
G 1/8"	15,2	8,4	4,7	5,3	11
G 1/4"	7	12	9	8,5	15
G 3/8"	9	15	12,5	11	19
G 1/2"	13	15	12,5	11	22
G 3/4"	16	17	14	13	29
G 1"	22	19	16	15	36



Konusni delovi sa ili
 bez stope
 Conical moulds with or
 without flange



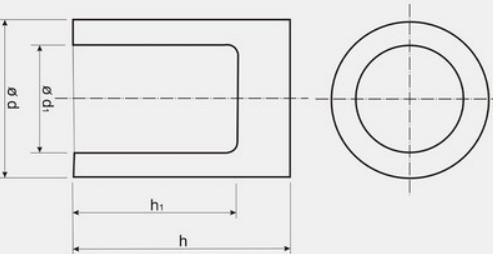
Konusni delovi
 Conical moulds



- Konusni delovi
 - Conical moulds
 - Ø d 4 mm - 150 mm
 - h 5 mm - 250 mm



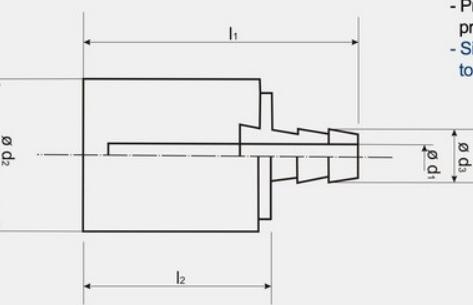
Kape od sinter bronze
Moulds of sintered bronze



- Kape od sinter bronze
- Moulds of sintered bronze
- d 4 mm - 300 mm
- h 2 mm - 1000 mm



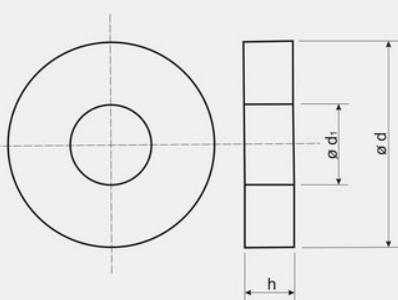
Prigušnici od sinter bronze
Silencers made of sinter bronze



- Prigušnici od sinter bronze sa bakarnim priključkom
- Silencers made of sinter bronze, sintered together with a solid brass fitting



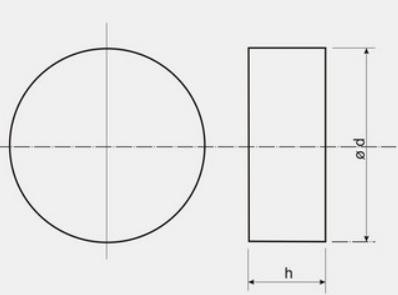
Prstenovi od sinterovane
bronze
Sintered bronze rings



- Prstenovi od sinterovane bronze
- Sintered bronze rings
- d 4 mm - 600 mm
- h 1 mm - 100 mm



Pločice i zapušači od
sinterovane bronze
Discs & plugs of sintered bronze



- Pločice i zapušači od sinterovane bronze
- Discs & plugs of sintered bronze
- d 1 mm - 500 mm
- h 1 mm - 100 mm



Ploče / Plates



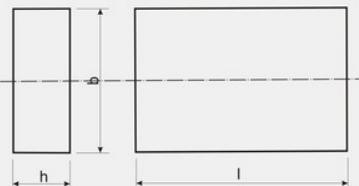
Sinter cevi - Hollow cylinder



Specijalni oblici - Special forms

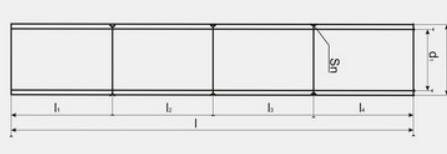


Filteri od aktivnog uglja
Filter dryers



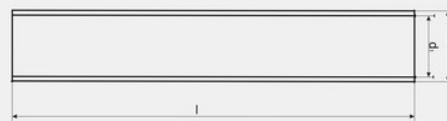
- Ploče od sinterovane bronce
- Plates made of sintered bronze
- l max = 500 mm
- b max = 250 mm
- h max = 60 mm

Po želji kupca veće ploče se rade iz segmenata spajanjem kalajem.
Larger dimensions can be velded (Sn) from section.



Max dužina h=1050 mm bez šava.
Mogućnost spajanja kalajem do l-max po želji kupca.

Mogućnost zatvaranja krajeva ili sinterovanja priključka sa colovnim ili metričkim navojem.



Maximum seamless length h = 1050mm . The possibility of tin soldering l-max to the customer's request.
There is possibility to be made with close ends, or to be sintered on attachments with imperial or metric thread.

- SPECIJALNI OBLOCI SA ILI BEZ DORADE PO ŽELJI KUPCA
SPECIAL FORMS, WITH OR WITHOUT ADDITIONAL MACHINING BY THE CUSTOMER'S REQUEST

- Proizvodi se do maksimalne širine Ø 600 mm maksimalna visina h=1050 mm
- Mogu se izradivati u kombinaciji sa čvrstim već unapred pripremljenim delovima od mesinga, bakra ili bronce.
- Sam spoj vrši se sinterovanjem.

- Production goes up to : maximum width of OD Ø 600mm maximum height h = 1050mm
- Can be combined with already prepared parts made of brass, copper or bronze.
- Connection (soldering) is done by sintering.

FILTERI OD AKTIVNOG UGLJA

-Koriste se zatvorenim instalacijama u filtriranju vazduha i vode.
Zbog svoje kompaktnosti i čvrstine se lako i brzo izmenjuju.

FILTERS OF ACTIVE CHARCOAL

are used in closed installations in air and water filtering.
Because of its compactness and firmness it can be easily and quickly changed.

FILTER-SUŠAČI – namenjeni su sušenju rashladnih fluida u rashladnim i klima uređajima kapaciteta preko 94000 kJ/h. Patronе se umetaju u kućišta koje su ugradene u instalaciju. Kompaktnost i mehanička otpornost omogućavaju brzu i laku zamenu. Kvalitet i tehničke osobine proverio institut za Fizičku Hemiju fakulteta u Beogradu.

FILTER-DRYERS - are designed to be used to dry cooling fluid in chillers and air conditioners. Capacity is over 94,000 kJ/h. Cartridges are inserted into the housing that are built in the installation. Compactness and mechanical resistance enables fast and easy replacement. Quality and technical characteristics verified by Institute of Physical Chemistry, University of Belgrade.



ŽELEZNI SINTER LEŽAJEV

Širok spektar veličina do spoljnog prečnika Ø 50.

Isporučuju se suvi ili impregnirani uljem.
 Poseduju veliku preciznost
 (mogućnost držanja tolerancije do 0.0025 mm).

Gotovi komadi mogu biti mašinski doradivani ili se može izvršiti površinska zaštita.

STEEL SINTERED BEARINGS

Wide range of sizes up to the OD Ø 50.

Supplied dry or impregnated with oil. They are made in high accuracy (possibility to keep tolerances up to 0.0025 mm).

Finished parts can be remachined or could be perform surface protection.

PRECIZNI SINTER DELOVI

- Izrađuje se po želji kupca od raznih prahova metala i legura. Delovi poseduju visoku preciznost (zadržavaju tolerancije do 0.0025 mm).
- Proizvode se od najprostijih do kompleksnih oblika.
- Tehnologija proizvodnje omogućava veliku ekonomičnost u seriskoj proizvodnji.
- Gotovi komadi mogu se naknadno mašinski doradivati kao i vršiti površinska zaštita.

PRECISION SINTER PARTS

- Made of various metals powders and alloys by customers request. This are high precision parts (tolerance is 0.0025mm).

- Shape variety goes from simple to the very complex one.
- Production technology allows an economical mass production.
- Finished parts can be remachined or could be perform surface treat (hardening etc.)

BRONZANI SINTER LEŽAJEV

- Veliki izbor dimenzija do maksimalnog spoljnog diametra Ø 50 mm i maksimalne visine h=50 mm.
- Materijal poseduje veoma dobre antifričione osobine, čvrstinu i izdržljivost pri zahtevnoj primeni.
- Primenjuje se u slučajevima gde podmazivanje nije dozvoljeno.

BRONZE SINTER BEARINGS

- Large selection of sizes up to a maximum OD Ø50mm and maximum height h = 50mm.
- Material has a very good frictionless properties, toughness and durability in demanding application.
- Applicable in cases where lubrication is not allowed.

PRIPREMNE GRUPE

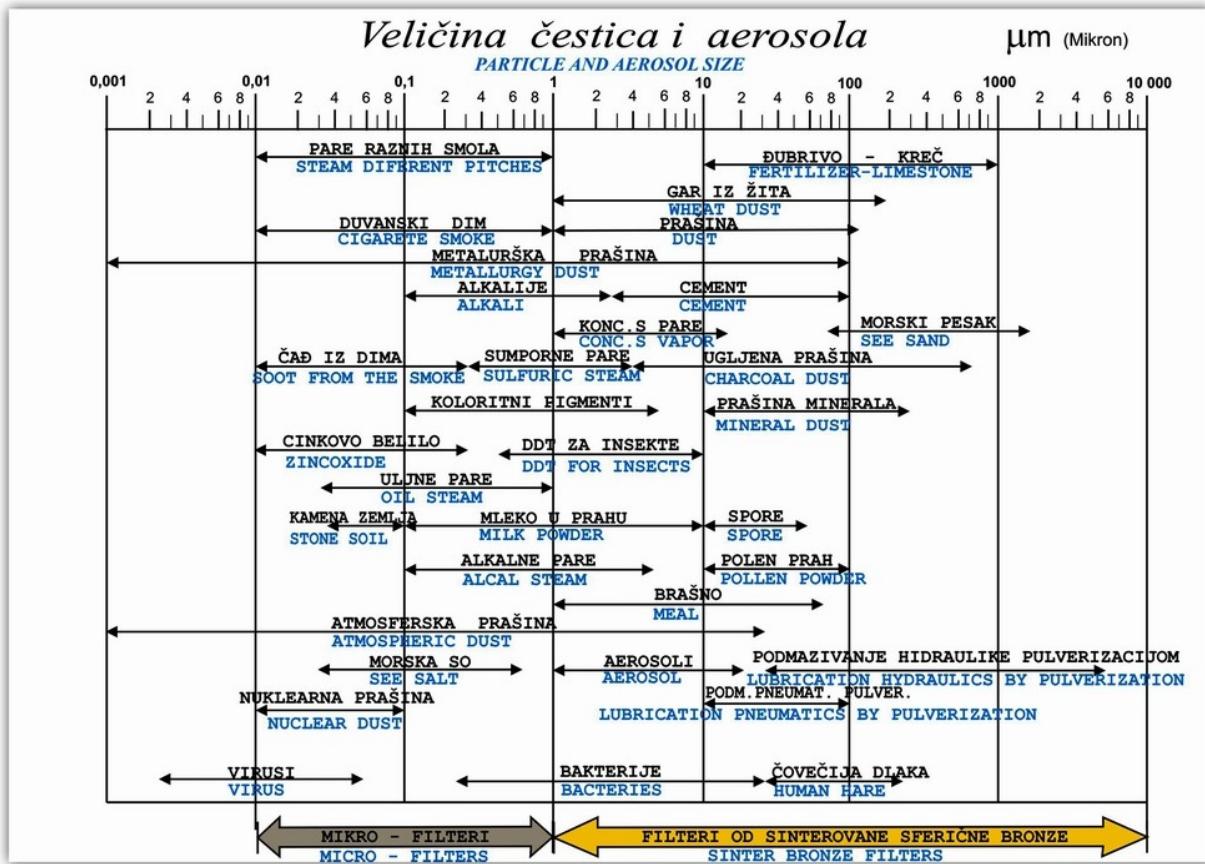
Kompletne pripremne grupe izradjuju se u više varijanti, aluminijumska, plastična ili prohromska kućišta za više vrsta priključaka od $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1".
 Filter ulošci su brzo izmenjivi i mogu biti u više različitih tipova i kombinacija.
 Pred filter, grubi filter, mikrofilter, odvajač kondenzatora ili isušivač.



PREPARATORY GROUP

Complete preparatory groups are made in several variations, aluminum, plastic or Stainless steel housing for different types of connectors from $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1".

Filter inserts are quickly Interchangeable and can be made in many different types and combinations. Pre filter, rough filter, micro filter, condensed steam separator or dryer.





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