

POROUS FILTERS



Well-known brand name for high performance porous sintered metal filters, in stainless steel, bronze or nickel alloys, for liquid or gas filtration.



PORAL® products are manufactured by compaction and sintering of metal powders. Pore size is defined by the powder granulometry and classified as PORAL® grade.

MAIN ADVANTAGES OF SINTERED METAL FILTERS

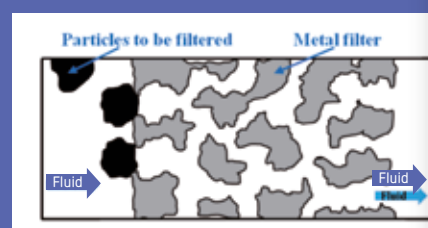
- **High temperature resistance**, stability over a wide temperature range from cryogenic ($\approx -150^{\circ}\text{C}$) to 900°C .
- **High corrosion resistance**, chemical stability.
- **High mechanical strength, high differential pressure capability, resistance to vibration and abrasion.**
- **Easy cleaning** for significant operational cost savings by reverse flushing with a clean fluid, by appropriate solvents, chemical reagents, ultrasonic washing or calcining.
- **Easy to implement** in any installation design.

Filtration capacity

There are two possible operating modes using PORAL® Filters:

Barrier or surface filtration

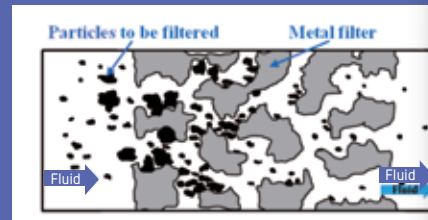
When pore size is smaller than particle size, all particles are retained on the filter surface. In this configuration, back flush cleaning is readily performed.



In-Depth Filtration

When particles size is smaller than pore size, particles tend to penetrate in the sinuous porosity of the filter media. Particles meet a lot of obstacles, and a large proportion are then retained on the pore walls.

In this configuration, the filtration capacity is given by the filtration efficiency but depends of many parameters as fluid viscosity, flow rate, PORAL® thickness etc.



Material Selection

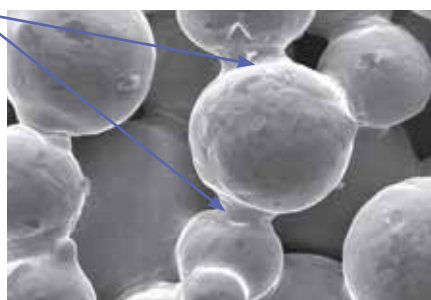
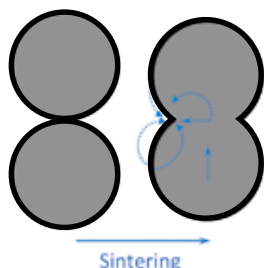
Alloy grades	Advantages	Max. T°C under oxidizing atmosphere	Max. T°C under reducing atmosphere
Bronze / Copper alloy			
Bronze	<ul style="list-style-type: none"> Good corrosion resistance in sea water. Compatible with oxygen, hot / cold freshwater or with diluted non-oxidizing acids (without air). Typically used for hydraulic and pneumatic applications. 	250	300
Stainless Steel			
SS 316 L	<ul style="list-style-type: none"> Common usage for food application. 	400	500
SS 304 L	<ul style="list-style-type: none"> Often used in oxidizing conditions, with nitric or organic acids (except formic and oxalic), with sulphuric, phosphoric or hydrochloric acids. Heat resistant. 	500	600
Ni alloys			
Inconel 600	<ul style="list-style-type: none"> Good resistance to corrosion and heat. Good resistance to oxidizing conditions at high temperature. Resists to oxidizing in corrosive solutions and to sulfur compounds. Typically used in nuclear, chemical and heat-treating industry for its strength and corrosion resistance. 	600	800
Monel 400	<ul style="list-style-type: none"> Resists to anhydrous hydrofluoric acid, to chlorine derivatives, fluorine, H₂SO₄, NaOH. 	500	500
Hastelloy X	<ul style="list-style-type: none"> High resistance under high temperature oxidizing atmosphere. 	800	900
Hastelloy C276	<ul style="list-style-type: none"> Good resistance to HF, HNO₃. 	650	650

Other alloys on request.

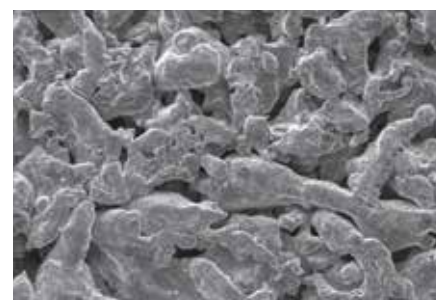
Typical microstructure of sintered metal filters

Sintering neck formed by solid state diffusion

Schematic representation of sintering mechanisms :



Microstructure of Bronze PORAL® filters after sintering.
Gr. 15- x 250



Microstructure of Stainless steel & Ni alloys PORAL® filters after sintering.
Gr. 15- x 100

Filtration efficiency

The efficiency values below are given for air and water at a given flow rate.

Bronze

PORAL® Grade	Filtration efficiency			
	GASES		LIQUIDS	
	98% of particles stopped (µm)	99,9% of particles stopped (µm)	98% of particles stopped (µm)	99,9% of particles stopped (µm)
03	0,7	1	3,8	5
05	2,3	3	17	22
07	3,4	5	23	30
10	4,6	7,5	29	39
15	6,2	12	45	60
20	7	14	73	97
30	8,5	20	102	135
40	10,5	26	140	185
60	13	35	190	270

Stainless Steel And Ni Alloys

PORAL® Grade	Filtration efficiency			
	GASES		LIQUIDS	
	98% of particles stopped (µm)	99,9% of particles stopped (µm)	98% of particles stopped (µm)	99,9% of particles stopped (µm)
03	0,2	0,5	3,2	4,5
05	0,4	1,2	5,9	9
07	0,7	2,3	12	16
10	1,2	3,6	16	24
15	2	6	26	37
20	3,2	8,6	40	58
30	5	13	60	90
40	8	20	90	130

Standards : ISO 12500-3 in gas = air and ASTM F795 in liquid = water

Permeability and Pressure drop calculation (ISO 4022)

The fluid permeability of a sintered metal filter is defined by two permeability coefficients: a friction-dependent permeability coefficient α and an inertia-dependant permeability coefficient β .

In a laminar flow, the pressure drop increases linearly proportionally to the flow rate. In that case, all the energy losses are due to the viscosity of the fluid only, following Darcy's law:

$$\frac{\Delta P}{e} = \alpha \times \eta \times \frac{Q_v}{S} = \frac{1}{P_0} \times \eta \times \frac{Q_v}{S}$$

In case of a turbulent flow (only significant at high flow), several other mechanisms are involved. The equation above, completed by Forchheimer, becomes:

$$\frac{\Delta P}{e} = \alpha \times \eta \times \frac{Q_v}{S} + \beta \times \rho \times \left(\frac{Q_v}{S}\right)^2$$

P., α and β coefficients, average values:

PORAL® Grade		03	05	07	10	15	20	30	40	60
Stainless steel & Ni Alloys	α ($\times 10^{10}$) [m^{-2}]	455	111	57	31	18	11,5	6,5	3,5	-
	β ($\times 10^5$) [m^{-1}]	13	9	7	6	5	4	3,5	3	-
Bronze	α ($\times 10^{10}$) [m^{-2}]	207	51	25,5	12,5	7	3,5	2,1	1,2	0,6
	β ($\times 10^5$) [m^{-1}]	15,5	5,5	3	2	1,2	0,8	0,5	0,4	0,3

ΔP = Pressure drop at the filter [Pa]
 e = Wall thickness of the filter [m]

$\alpha = 1/P_0$ = Viscous permeability coefficient [m^{-2}]
 η = Dynamic viscosity of the fluid [Pa.s]

Q_v = Volume flow rate of the fluid [m^3/s]
 S = Filtration Effective Surface [m^2]

β = Inertia permeability coefficient [m^{-1}]
 ρ = Fluid density [kg/m^3]

Functional controls

PORAL® production process is under control to ensure the highest quality to our products. Final products are controlled according to international standards. Control reports as described in EN 10204 can be provided on demand.

Our 3.1 report can include the following tests.

Bubble-point test (EN ISO 4003)

The bubble test provides a simple method to determine the size of the "largest pore" of the part tested.

The porous element is submerged in ethanol and we measure the pressure needed to get the first bubble of gas that passes through the widest pore. The first bubble of gas will form at the pore having the greatest throat, the throat being the narrowest section of this pore.



Fluid permeability test (EN ISO 4022)

The test consists in measuring the pressure loss of an air flow through the porous media to determine the viscous and inertia permeability coefficient.

Mechanical resistance

The sintering process gives the mechanical properties to the porous material.

Tensile strength Rt

Consists in half-pipe traction test.

Mechanical resistance Rm

Evaluated through burst or collapse pressure test consists in measuring the maximum differential pressure sustained by a porous tube from inside to outside (burst) or from outside to inside (collapse).

Bending strength Rf

Evaluated through 3-points bending test on flat sheets. It consists in applying a load F at the midpoint between 2 supports till breakage.

Fatigue resistance

Performed on candles or cartridges to evaluate the expected lifetime in automatic systems, where PORAL® products are subject to many filtration / back flush cycles.

Permeability in a gas flow

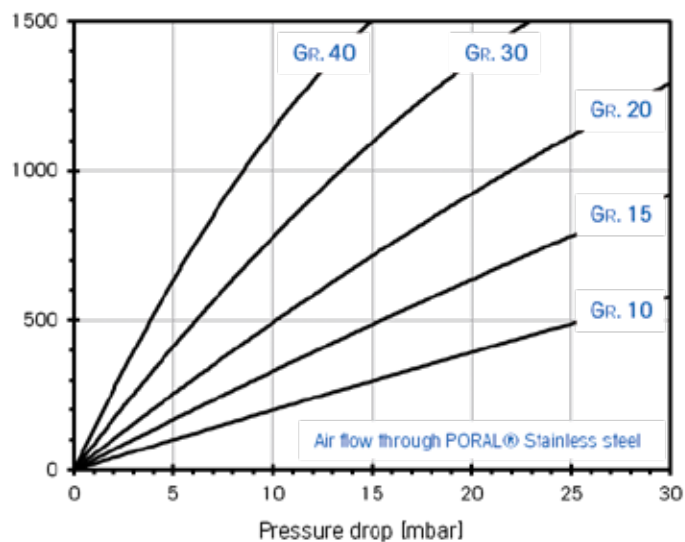
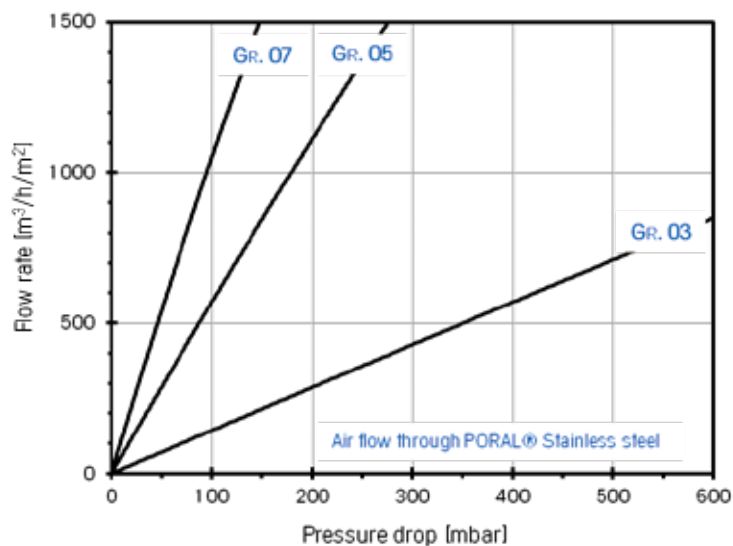
Mean Value Characteristic lines of Permeability corresponding to an air flow, in accordance with DIN ISO 4022

Conditions:

Material: Stainless steel type 316L

Wall thickness: 3 mm

Air at 20°C and 4 bars

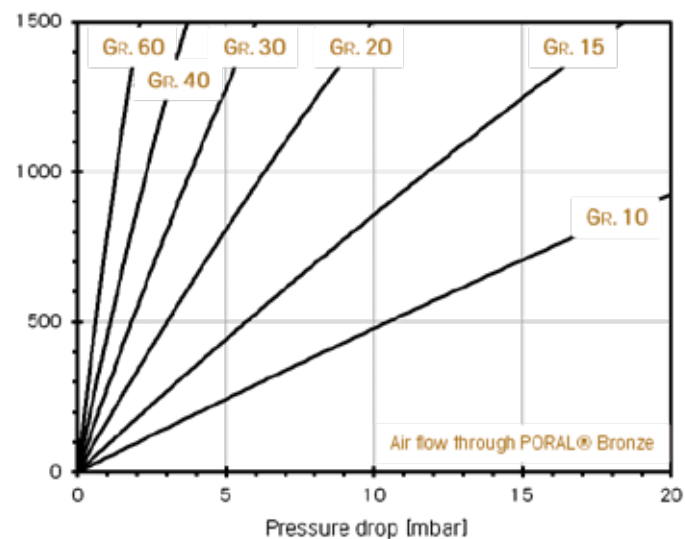
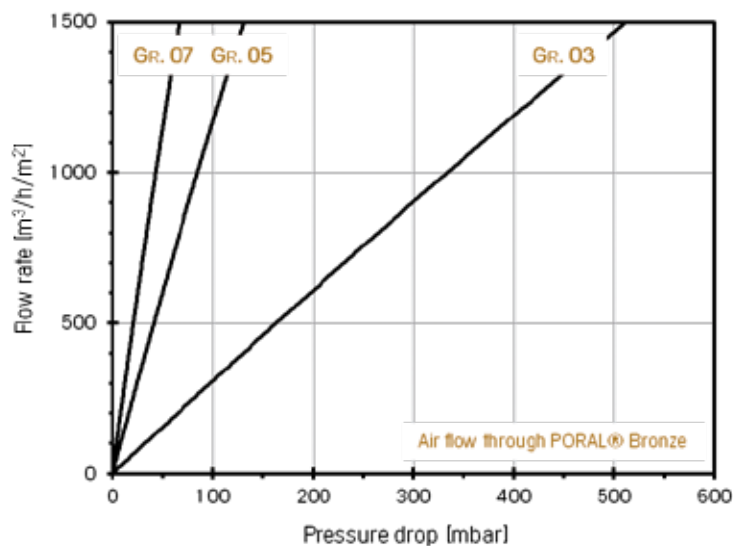


Conditions:

Material: bronze

Wall thickness: 3 mm

Air at 20°C and 4 bars



Permeability in a liquid flow

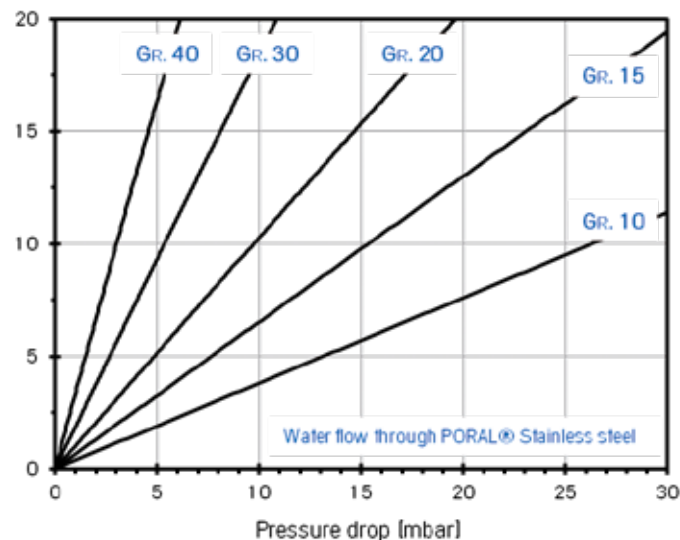
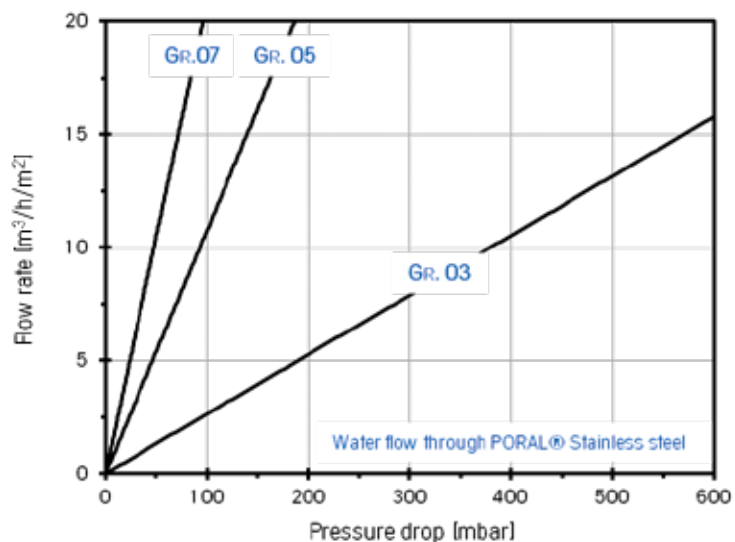
Mean Value Characteristic lines of Permeability corresponding to a water flow, in accordance with DIN ISO 4022

Conditions:

Material: Stainless steel type 316L

Wall thickness: 3 mm

Water at 20°C

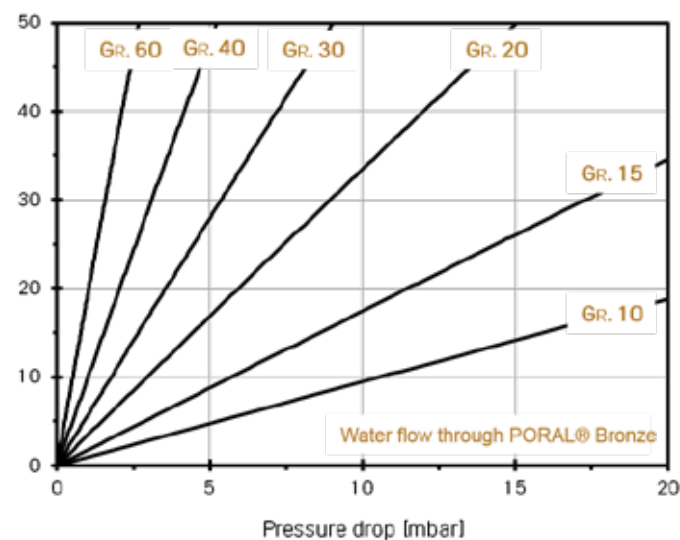
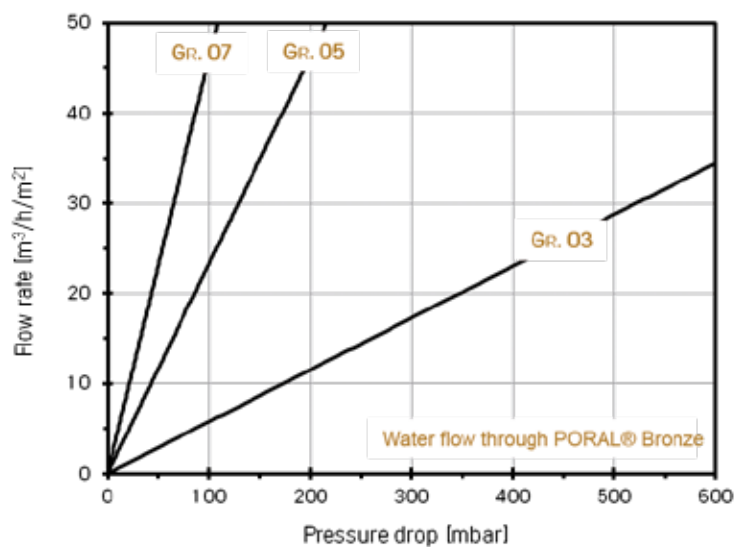


Conditions:

Material: Bronze

Wall thickness: 3 mm

Water at 20°C



Spargers - diffusers

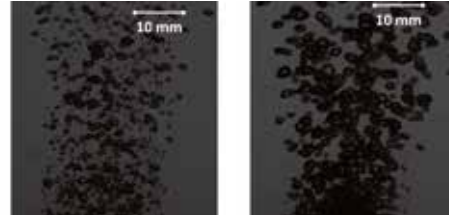
For injection of gas into a liquid: wine or beer production, water treatment, fermentation for example

Two main operating configurations can be:

- **Static diffusers:** usually used in batch tank productions and/or for lower quantity of liquid. Diffusers are generally placed in the bottom of tanks and could be mounted in different ways using single or multiple elements, clamped on the outside tank wall.
- **Dynamic diffusers:** gas is directly injected in a pipeline through a porous PORAL® filter. Using the velocity and turbulence of the flowing liquid, this configuration is the most efficient diffuser system since it results in fine bubbles, for superior performance.



Effect of flow rate on bubble size (PORAL® Grade 05), Static configuration



Beyond a certain flow rate, the bubble size reaches a maximum value, independently of the grade. This observation could be explained by coalescence phenomena.

As small bubbles transfer gases more efficiently, bubble size is an important criteria to consider

According to the evolution of bubble size vs. flow rate in static configuration, Stainless steel PORAL® filters can be divided into two groups:

Grades 03 to 10:

$QV < 3 \text{ L/h/cm}^2$: bubble size increases with the flow rate from 0.4 to 1.4 mm on average.

$QV > 3 \text{ L/h/cm}^2$: stabilization of bubble size around 1.4 mm independently of the grade.

Grades 15 to 40:

$QV < 2 \text{ L/h/cm}^2$: bubble size varies differently from one grade to another, but rapidly reaches millimeter values.

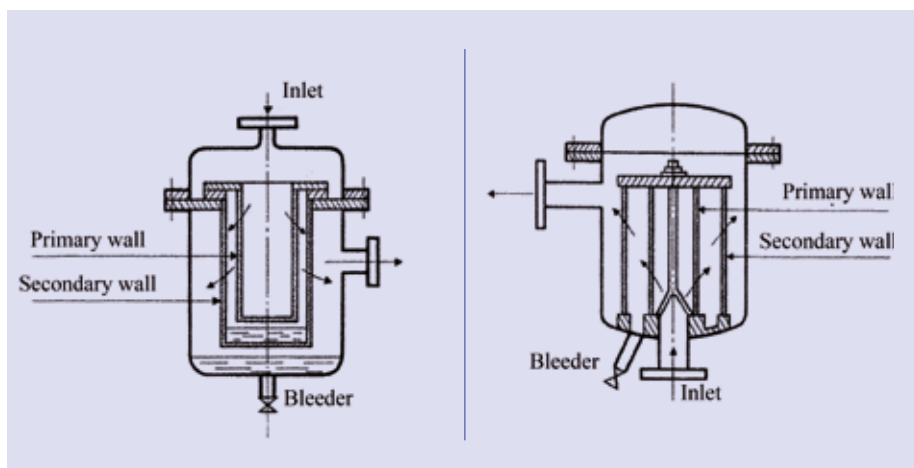
$QV > 2 \text{ L/h/cm}^2$: stabilization of bubble size around 1.4 mm whatever the grade.

Liquid-gas filtration

The PORAL® microstructure allows the separation of liquid vesicles conveyed:

- By entrapping liquid vesicles in the thickness of the filter if the pollution of the gas is low.
- By coalescence of liquid vesicles into droplets easier to remove in case of dense fogs.

Examples of double-walled filters used to eliminate liquid impurities in a gas flow:



The primary wall acts as a coalescer; vesicles or aerosols are trapped inside and combined in a continuous liquid phase.

The secondary wall is a safety; its role is to retain droplets of relatively large dimensions which could be thrown out to the outlet.

The PORAL® filters could also be used as safety filters or genlock. In that case, the filter is sized to allow the gas flow under a low pressure drop but to oppose, to an accidental crossing of a liquid mass, a sufficient pressure drop to stop completely any flow of liquid in the pipeline.

Fluidization

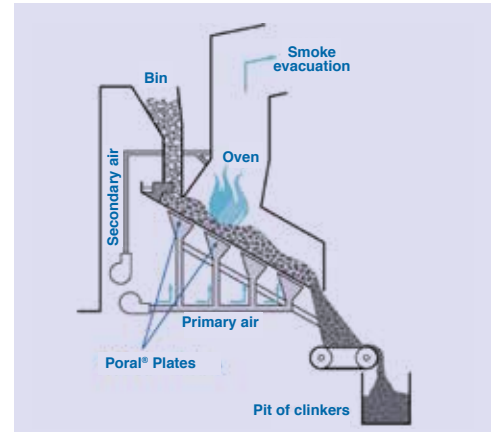
The advantage of the fluidized state is that the solids particles have similar flow properties to those of a liquid phase. The fluidized state begins when the gas velocity is sufficient to be able to carry the powdery material (bed of solid particles).

This fluidized state could be reached blowing through PORAL® sintered metal products, for:

• Transport by gravity force

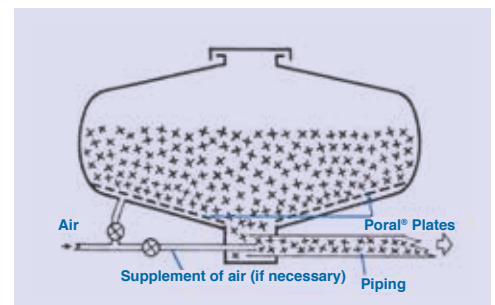
Allowing bulk material carriage on PORAL® airstides.

PORAL® products are appreciated in the cement industry for example because of their heat, abrasion and vibration resistance.



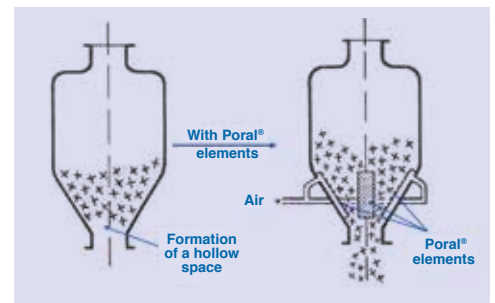
• Transport under pressure (bulk carrying)

To allow the carriage of powdery materials when transport by gravity force is not sufficient, especially when the distance to be covered is ascending or sinuous.



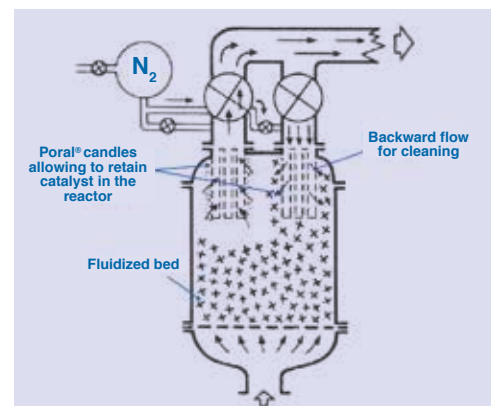
• In Silo-flows

Fluidization is used in these cases to ensure the flow of powdery materials by gravity force at the bottom of silos without any arching or dead zones.



• In fluidized bed reactor

Many types of reactions could occur in fluidized bed reactors as catalytic reactions, polymerization, etc... offering a uniform particle mixing.



Implementation and assembly

**PORAL® standard filters exist in different shapes such as tubes, plates, discs, cones...
In addition, we also can offer custom versions based on following operations:**

- Welded to fitting / ending. Electrical or laser welding are possible, depending of the application.
- Welded together to reach higher plate or tube dimensions.
- Brazed in an assembly.
- Laser, water or wire cutted to a final specific dimension.
- Machined or drilled using conventional machining tools. Take care: machining will close the surface open porosity.
- Threaded.
- Glued in an assembly.
- Rolled, unrolled or stamped.
- Clamped (cartridges or cones) using a joint.

The choice of the best assembly method will depend of the environment.



Cleaning of PORAL® sintered filters

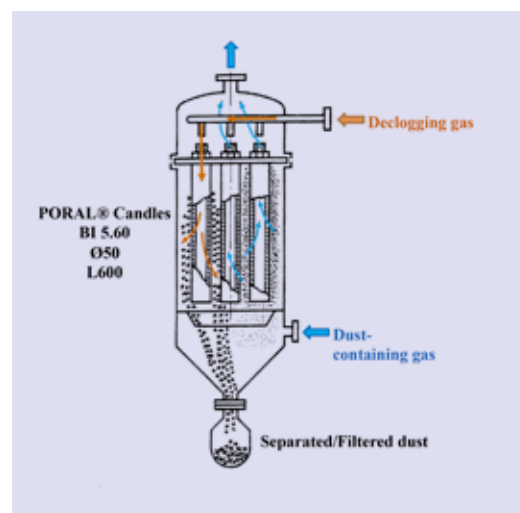
A significant advantage of porous sintered filters is to be cleanable and reusable over a long period of time.

Cleaning is mainly operated in situ, in automatic systems when blowback or backflush is automatically generated at a given max pressure drop level. It can be manually operated as well, even outside from the systems.

Specific cleaning procedures can be developed depending on the type of pollution (inorganic or organic); most of which will consist on one or a combination of the following methods:

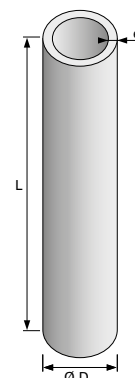
- **Backwash cleaning.**
- **Chemical cleaning** using acids, solvents, detergent solutions...
- **Calcining or heat treatment** in an oven.
- **Ultrasonic cleaning**, mainly for chemically inert materials.

The effectiveness of the unclogging could be assessed by testing the filters using bubble test and pressure drop measurement.



Porous Stainless Steel Isostatic Tubes (IS)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 14 to 110 mm
- **Length:** to 1 000 mm

Material

Type 316 L construction per default.
304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Basic shape for standard candles (BI) or cartridges (CRI, CFI and DOE).

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

8 PORAL® grades available - see PORAL® grades definition table for detailed information.
In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).
In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

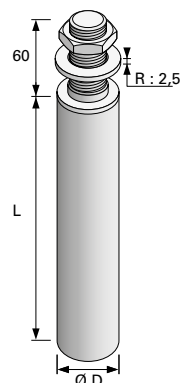
ISOSTATIC TUBES				
TYPE	"Ø D" Outer diameter [mm]	"L" Length [mm]	"e" Wall thickness [mm]	"S" Filtration area [cm²]
IS 14.250	14	250	2,0	110
IS 17.600	17	600	2,0	320
IS 20.600	20	600	2,0	434
IS 30.600	30	600	2,5	565
IS 35.600	35	600	2,5	660
IS 40.600	40	600	2,5	754
IS 50.600	50	600	2,5	942
IS 60.600	60	600	2,5	1131
IS 80.600	80	600	3,0	1508
IS 100.600	100	600	3,0	1885
IS 17.900	17	900	2,5	481
IS 23.1000	23	1000	2,5	723
IS 30.1000	30	1000	2,5	942
IS 35.1000	35	1000	2,5	1100
IS 40.1000	40	1000	2,5	1257
IS 50.1000	50	1000	2,5	1571
IS 60.1000	60	1000	2,5	1885
IS 80.1000	80	1000	3,0	2513
IS 100.1000	100	1000	3,0	3142

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: IS diameter.length.grade Ex IS 30.600.05

Porous Stainless Steel Candles (BI)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 14 to 50 mm
- **Length:** 100 to 900 mm

Material

Type 316 L construction per default,
304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Candles to be screwed under a filter plate in a filtration vessel or at the end of a piping.
Standard thread M20x150 - Ø16 opening on one end + closed ending on the other end.
Other fitting on request : NPT, BSP or others.

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

8 PORAL® grades available - see PORAL® grades definition table for detailed information.
In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).
In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

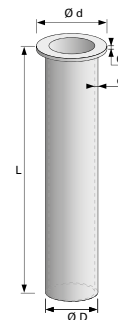
CANDLES				
TYPE	"Ø D" Outer diameter [mm]	"L" Porous length [mm]	Adaptator type	"S" Filtration area [cm²]
BI 2.10	20	100	M12	70
BI 4.12	40	125	M20	150
BI 4.25	40	250	M20	300
BI 5.30	50	300	M20	450
BI 5.60	50	600	M20	900

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: BI type.grade Ex BI 4.25.05

Porous Stainless Steel Cartridges (CRI)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 30 up to 100mm
- **Length:** 250 up to 1000mm

Material

Type 316 L construction per default,
 304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Cartridges to be clamped on a filter plate in a filtration vessel or on a tank wall.
Standard flange ØC / thickness 8mm on one end + closed ending on the other end.
Other flange on request.

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

8 PORAL® grades available - see PORAL® grades definition table for detailed information.
 In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).
 In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

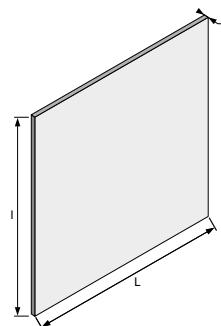
CARTRIDGES					
TYPE	"Ø D" Outer diameter [mm]	"L" Porous length [mm]	"Ø d" Flange diameter [mm]	"e" Wall thickness [mm]	"S" Filtration area [cm²]
CRI 3.25	30	250	48	2 to 3 (according to grade)	200
CRI 3.50	30	500	48	2 to 3 (according to grade)	400
CRI 4.25	40	250	60	2 to 3 (according to grade)	300
CRI 4.50	40	500	60	2 to 3 (according to grade)	600
CRI 5.30	50	300	70	2 to 3 (according to grade)	450
CRI 5.60	50	600	70	2 to 3 (according to grade)	900
CRI 5.90	50	900	70	2 to 3 (according to grade)	1350
CRI 6.30	60	300	80	2 to 3 (according to grade)	550
CRI 6.60	60	600	80	2 to 3 (according to grade)	1100
CRI 6.90	60	900	80	2 to 3 (according to grade)	1650
CRI 8.50	80	500	100	2 to 3 (according to grade)	1200
CRI 8.60	80	600	100	2 to 3 (according to grade)	1450
CRI 8.100	80	1000	100	2 to 3 (according to grade)	2400
CRI 10.60	100	600	120	2 to 3 (according to grade)	1800
CRI 10.90	100	900	120	2 to 3 (according to grade)	2700

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: CRI type.grade Ex CRI 5.60.05

Porous Stainless Steel Plates (IK)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Max Dimensions:**
600 x 300 mm
Higher dimensions possible
by welding plates together.
- **Thickness:** 3 or 5 mm

Material

Type 316 L construction per default,
304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Typical application: fluidized bed plate.

Plates IK16 can be offered in different thicknesses from 2 to 10 mm.

Other plates offered only in 3 or 5 mm thicknesses.

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

8 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).

In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

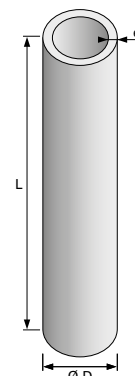
PLATES				
TYPE	"L" Length [mm]	"I" Width [mm]	"e" Wall thickness [mm]	"S" Filtration area [cm²]
IK 5.30	600	300	3	1800
IK 5.50	600	300	5	1800
IK 8.30	500	250	3	1250
IK 8.50	500	250	5	1250
IK 10.30	300	300	3	900
IK 10.50	300	300	5	900
IK 16.30	250	250	3	625
IK 16.50	250	250	5	625

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: IK type.thickness x 10,grade Ex IK 10.30.10

Porous Stainless Steel Uniaxial Tubes (IP)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 8 to 50mm
- **Length:** 20 up to 50mm

Material

Type 316 L construction per default,
304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Mainly used as flame arrestors in welding devices.

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

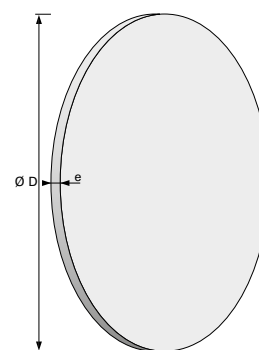
8 PORAL® grades available - see PORAL® grades definition table for detailed information.
In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).
In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

UNIAXIAL TUBES				
TYPE	"Ø D" Outer diameter [mm]	"L" Porous length [mm]	"e" Wall thickness [mm]	"S" filtration area [cm²]
IP 8.20	8	20	2,0	5,0
IP 20.30	20	30	2,0	19,0
IP 30.50	30	50	2,0	47,0
IP 50.40	50	40	2,0	63,0
Customized design available upon request: send your requirement to poral.sales@poral.org				
PORAL standard designation: IP type,grade Ex IP 8.20.10				

Porous Stainless Steel Discs (IC)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Diameter:** up to 160 mm
- **Thickness:** 2 or 3 mm

Material

Type 316 L construction per default,
 304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

8 PORAL® grades available - see PORAL® grades definition table for detailed information.
 In liquids, retention at 98% of solid particles from 3,2 µm (PORAL® grade 03) to 90 µm (PORAL® grade 40).
 In gases, retention at 98% of solid particles from 0,2 µm (PORAL® grade 03) to 8 µm (PORAL® grade 40).

Designation / ordering guide

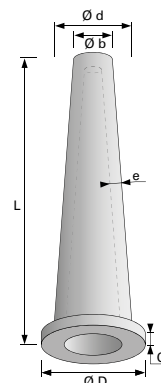
DISCS			
TYPE	"Ø D" Disc diameter [mm]	"e" Thickness [mm]	"S" filtration area [cm²]
IC 10.20	10	2	0,78
IC 10.30		3	
IC 21.20	21	2	3,5
IC 21.30		3	
IC 30.20	30	2	7
IC 30.30		3	
IC 42.20	42	2	14
IC 42.30		3	
IC 60.20	60	2	28
IC 60.30		3	
IC 90.20	90	2	63,5
IC 90.30		3	
IC 114.20	114	2	102
IC 114.30		3	

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - thickness (x10) - grade. Ex.: IC 114.20.05

Porous Stainless Steel Cones (ICN)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Diameter:** 8 to 21 mm
- **Height:** 20 to 60 mm

Material

Type 316 L construction per default,
304 L, Inconel 600, Monel 400 or Hastelloy on request.

Features & Benefits

Mainly used for in-time filtration offering larger filtration surface in small diameters.
To be clamped or inserted in PPL assembly.

Retention rates

2 PORAL® standard grades available: 05 & 20 - see PORAL® grades definition table for detailed information.
In liquids, retention at 98% of solid particles from 5,9 µm (PORAL® grade 05) to 40 µm (PORAL® grade 20).
In gases, retention at 98% of solid particles from 0,4 µm (PORAL® grade 05) to 3,2 µm (PORAL® grade 20).

Designation / ordering guide

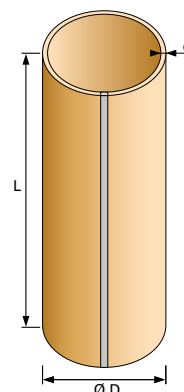
CONES							
TYPE	"Ø d" Base diameter [mm]	"L" Total length [mm]	"Ø D" Flange diameter [mm]	"e" Wall thickness [mm]	"C" Flange thickness [mm]	"Ø b" Apex diameter [mm]	"S" filtration area [cm²]
ICN 8	8	20	13	1,5	2,5	1	1
ICN 12	12	32	17	2	2,5	2	5
ICN 15	15	41	21	2	3	2	10
ICN 21	21	60	27	2,5	3	2,8	20

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - grade. Ex.: ICN 8.20

Porous Bronze Welded Tubes (BT)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 50, 80 or 100 mm
- **Length:** 250 up to 600 mm

Material

Bronze (89% Cu / 11% Sn) construction.

Standard welding in tin (usable till 100°C). Other welding on request.

Features & Benefits

- Good durability against most aggressive fluids,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

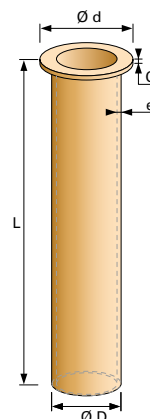
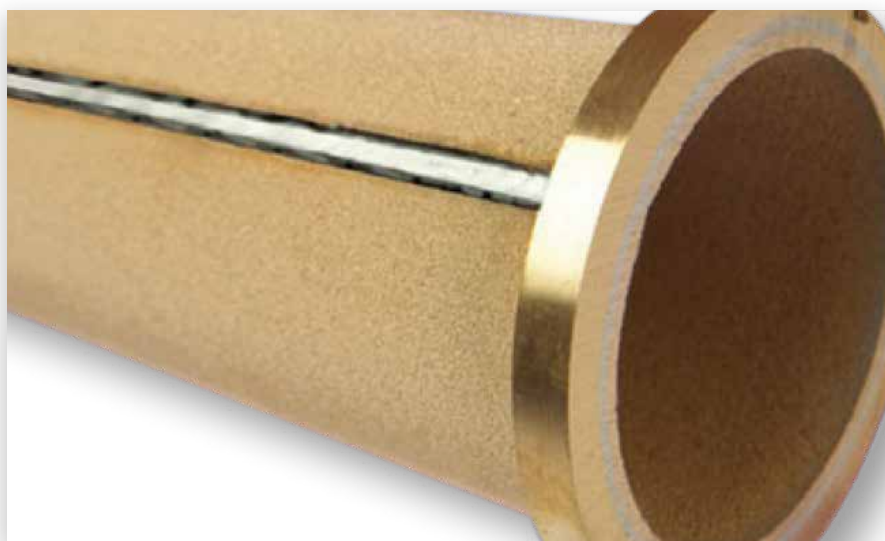
WELDED TUBES				
ITEM	"Ø D" Outer diameter [mm]	"L" Length [mm]	"e" Wall thickness [mm]	"S" filtration area [cm²]
BT 20.5.20	50	300	2	450
BT 20.5.30			3	
BT 10.5.20	50	600	2	900
BT 10.5.30			3	
BT 16.8.20	80	250	2	625
BT 16.8.30			3	
BT 8.8.20	80	500	2	1250
BT 8.8.30			3	
BT 10.10.20	100	300	2	875
BT 10.10.30			3	
BT 5.10.20	100	600	2	1750
BT 5.10.30			3	

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - thickness (x10) - grade. Ex.: BT 8.8.20.10

Porous Bronze Cartridges (CRB)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 32 to 100 mm
- **Length:** 300 up to 1200 mm

Material

Bronze (89% Cu / 11% Sn) construction.

Standard welding in tin (usable till 100°C). Other welding on request.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

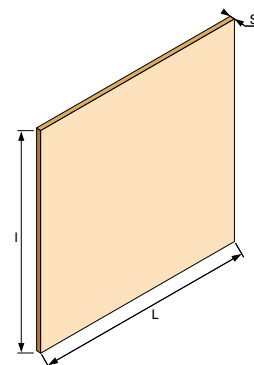
CARTRIDGES						
ITEM	"Ø D" Outer diameter [mm]	"L" Total length [mm]	"Ø d" Flange diameter [mm]	"e" Wall thickness [mm]	"C" Flange thickness [mm]	"S" filtration area [cm²]
CRB 3.50	32	500	48	3	8	400
CRB 5.30	50	300	70	2	8	450
CRB 5.60	50	600	70	2	8	900
CRB 5.90	50	900	70	2	8	1350
CRB 8.50	80	500	100	2/3	10	1250
CRB 8.100	80	1000	100	2/3	10	2500
CRB 10.60	100	600	120	2/3	12	1750
CRB 10.120	100	1200	120	2/3	12	3500

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - grade. Ex.: CRB 5.90.15

Porous Bronze Plates (BK)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



• **Dimensions:** 500 x 500
or 600 x 300 mm
*Higher dimensions possible
by welding plates together.*

Material

Bronze (89% Cu / 11% Sn) construction.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

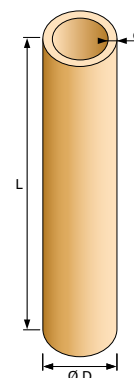
PLATES				
TYPE	"L" Length [mm]	"I" Width [mm]	"e" Wall thickness [mm]	"S" filtration area [cm²]
BK 4.20	500	500	2	2500
BK 4.30			3	
BK 4.50			5	
BK 5.20	600	300	2	1800
BK 5.30			3	
BK 5.50			5	
BK 8.20	500	250	2	1250
BK 8.30			3	
BK 8.50			5	
BK 10.20	300	300	2	900
BK 10.30			3	
BK 10.50			5	
BK 16.20	250	250	2	625
BK 16.30			3	
BK 16.50			5	

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - thick. (x10) - grade. Ex.: BK 10.30.15

Porous Bronze Seamless Tubes (BLR)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Ext. Diameter:** 26 or 32 mm
- **Length:** 48 or 250 mm

Material

Bronze (89% Cu / 11% Sn) construction.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

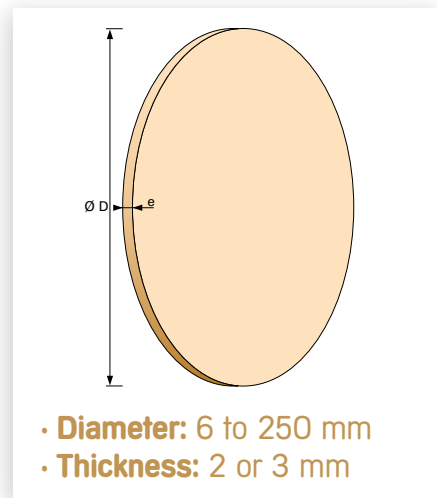
SEAMLESS TUBES				
TYPE	Ø D" Outer diameter [mm]	"L" Length [mm]	"e" Wall thickness [mm]	"S" filtration area [cm²]
BLR 26	26	48	3	39
BLR 32	32	250	3	200

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item – length - grade. Ex.: BLR 26.48.15

Porous Bronze Discs (BC)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



Material

Bronze (89% Cu / 11% Sn) construction.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

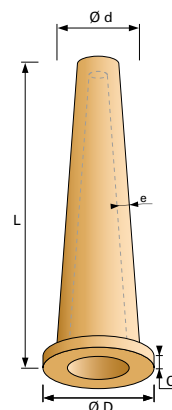
DISCS			
TYPE	"Ø D" Disc diameter [mm]	"e" Wall thickness [mm]	"S" filtration area [cm²]
BC 6.20	6	2	0,3
BC 6.30		3	
BC 13.20	13	2	1,3
BC 13.30		3	
BC 21.20	21	2	3,5
BC 21.30		3	
BC 30.20	30	2	7
BC 30.30		3	
BC 42.20	42	2	14
BC 42.30		3	
BC 60.20	60	2	28
BC 60.30		3	
BC 90.20	90	2	63,5
BC 90.30		3	
BC 114.20	114	2	102
BC 114.30		3	
BC 250.20	250	2	450
BC 250.30		3	

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - thickness (x10) - grade. Ex.: BC 114.20.05

Porous Bronze Cones (BCN)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Diameter:** 8 up to 21 mm
- **Height:** 20 up to 80 mm

Material

Bronze (89% Cu / 11% Sn) construction.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

9 PORAL® grades available - see PORAL® grades definition table for detailed information.

In liquids, retention at 98% of solid particles from 3,8 µm (PORAL® grade 03) to 190 µm (PORAL® grade 60).

In gases, retention at 98% of solid particles from 0,7 µm (PORAL® grade 03) to 13 µm (PORAL® grade 60).

Designation / ordering guide

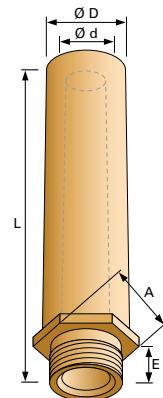
CONES						
ITEM	"Ø d" Base diameter [mm]	"L" Total length [mm]	"Ø D" Flange diameter [mm]	"e" Wall thickness [mm]	"C" Flange thickness [mm]	"S" filtration area [cm²]
BCN 8	8	20	13	1,5	2,5	4
BCN 12	12	40	17	2	2,5	6
BCN 15	15	60	21	2,5	3	8
BCN 21	21	80	27	3	3	10

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - grade. Ex.: BCN 15.05

Porous Bronze Silencers (SMH)

PORAL® standard products are covering a wide range of applications.
Customized design available upon request.



- **Diameter:** 10 to 34 mm
- **Length:** 22,5 to 74 mm

Material

Bronze (89% Cu / 11% Sn) construction.

Features & Benefits

- Good durability against most aggressive fluids,
- Usable over a wide range of temperatures,
- High mechanical resistance,
- Regenerable through backflush, chemical, thermal or ultrasonic treatment.

Retention rates

Available in grade 40 as standard - other grades on demand - see PORAL® grades definition table for detailed information.
In liquids, retention at 98% of solid particles of 140 µm (PORAL® grade 40).
In gases, retention at 98% of solid particles of 10,5 µm (PORAL® grade 40).

Designation / ordering guide

SILENCERS						
ITEM	Thread	"Ø D" Base diameter [mm]	"Ø d" Apex diameter [mm]	"A" Width [mm]	"E" Height [mm]	"L" Total length [mm]
SMH 1	G1/8"	12	11	13	5,5	22,5
SMH 2	G1/4"	17,5	15,8	19	8,5	36,5
SMH 3	G3/8"	21	18,5	22	8,5	46,5
SMH 4	G1/2"	28	24,9	30	11	59
SMH 5	G3/4"	28	24,4	30	11,5	66,5
SMH 6	G1"	34	30	36	14	74

Customized design available upon request: send your requirement to poral.sales@poral.org

PORAL® standard designation: Item - CO (conic gas thread NPT) or CY (cylindric gas thread). Ex.: SMH 3 CO



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