

E-02

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A. CHARACTERISTICS

Eucor is a trade name of a corundum-baddeleyite material or rather products made of this material. These castings are manufactured by melting suitable raw materials, pouring the melt into moulds and cooling. These products are mainly distinguished for high abrasion resistance, chemical resistance and high temperature resistance. In general, Eucor products are used when products from cast basalt are no longer sufficient when it comes to requirements for technical parameters and service life. The basic raw material for Eucor products are crushed blocks from linings of glass furnaces from global manufacturers of these materials, which are known worldwide under the AZS designation. Due to the fact that it is a natural material and the melt is formed only by melting the basic raw material, the resulting products may show minor changes compared to the declared values and parameters. These minor changes do not affect the basic properties and parameters of the products.

After casting into a sand mould, the corundum-baddeleyite material shrinks quite a lot during crystallization and for this reason, shrinkage porosity is formed under the riser on the non-exposed side, and, in case of a thicker product, even shrinkage cavities may appear. It is a side effect of the technology. For this reason, filling is always carried out in a place where these defects do not reduce the service life of the product. If there is a request from a customer to obtain a product without any shrinkage cavities, it is necessary to cast the casting so that it is about 40 % larger and cut the porous part off. However, the price of the product will be increased by additional costs for the performed manufacturing operations.

Basic Eucor product ranges are divided into:

- tiles suitable for paving of extremely loaded technological facilities used for transport, treatment and sorting of highly abrasive materials
- pipes suitable for lining of piping systems used for pneumatic transport of abrasive materials
- special castings (bends, branches, reducers, etc.) suitable for lining of piping systems used for pneumatic transport of abrasive materials
- shaped pieces suitable e.g. for lining of cylindrical and curved shapes of technological units used for transport, treatment and sorting of highly abrasive materials
- blocks thick-walled shaped pieces used for building the upper parts of melting furnaces (e.g. glass furnaces) and for paving the floors of pusher-type furnaces

Evaluation:

Certificate no. 030-055851

issued on 11/12/2017

CO 300 TZÚS Prague (The Technical and Test Institute for Construction

Prague, SOE), branch office in Pilsen (Plzeň)

Annual supervision:

CO 300 TZÚS Prague, branch office in Pilsen



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B. TECHNICAL DATA (AVERAGE VALUES)

1/ Basic properties

Scratch hardness of surface according to Mohs (ČSN EN 101): min. 9th point of the scale

Density (ČSN EN 993-2): 3,750-3,900 kg.m⁻³

Bulk density (ČSN EN 993-1):

min. 3,55 kg.m⁻³

Crushing strength (ČSN EN 993-5):

min. 500 MPa

Modulus of rupture (ČSN EN 993-6):

min. 50 MPa

True porosity (ČSN EN 993-1):

max. 10 % by volume

Linear thermal expansion (ČSN EN ISO 10545-8):

see Chart on page 4

Solubility in sulphuric acid (ČSN EN 993-16): Insolubility in sodium hydroxide (ČSN 72 5122): max. 0.75 % by weight min. 98.5 % by weight

Resistance to deep abrasion (ČSN EN ISO 10545-6):

max. loss of 30 mm³

2/ Other properties

Apparent porosity (ČSN EN 993-1):

max. 5 % by volume

Thermal conductivity (ČSN EN 993-14):

see Chart on page 4

3/ Chemical composition (usual values)

 SiO_2

12 to 17 %

 Al_2O_3

41 to 50 %

 ZrO_2

33 to 42 %

Fe₂O₃ TiO₂ ~ 0.1 to 0.2 %

CaO

 $\sim 0.1~\%$

 $Na_2O + K_2O$

~ 0.2 % ~ 1 to 4 %

4/ Mineralogical composition (usual values)

corundum

41 to 50 %

baddeleyite

33 to 42 %

glassy phase

12 to 17 %



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5/ Temperature resistance

EUCOR is resistant to heat deformation at a load of 0.2 MPa and a temperature of 1,700 °C. With standard dimensions, it has relatively good resistance to thermal shocks and it can be safely used as an abrasion-resistant material up to a temperature of 1,000 °C, for short periods even up to 1,100 °C.

Due to thermal stress or due to extreme thermal shocks (large temperature differences or very frequent thermal shocks, in the case of a combination of large temperature differences and frequent thermal shocks), hairline cracks may occur in the Eucor lining during the actual operation. If the Eucor lining is thoroughly glued on or filled with a suitable grouting, the resulting hairline crack will practically create an expansion joint, which has no negative effect on the operating conditions or on the planned service life of the product.

6/ Chemical resistance

EUCOR is completely resistant to all organic solvents, petroleum products and acids. It is also well resistant to alkaline solutions, including inorganic ones, and very well resistant to all inorganic acids except hydrofluoric acid, which reacts, especially at high temperatures, with the silicon dioxide present. It always depends greatly on the concentration of the active medium and especially on temperature, with the increase of which the chemical resistance of EUCOR decreases. Different mixtures of the individual reagents also have an effect. Therefore, for non-standard use, we recommend carrying out at least an indicative laboratory test.

Comparison of basic properties of EUCOR with some other materials

Property	Unit	Ceramic tiles	Cast basalt	EUCOR
Bulk density	kg.m ⁻³	1,900 ~ 2,500	2,900 ~ 3,000	3,55
Crushing strength	MPa	100 ~ 190	300 ~ 450	min. 500
Modulus of rupture	MPa	30 ~ 60	45	50
Resistance to deep abrasion	mm ³	140 ~ 200	max. 110	max. 30
Resistance to thermal shocks		Not specified	Average	Good
Application temperature	°C	200	400	1,000

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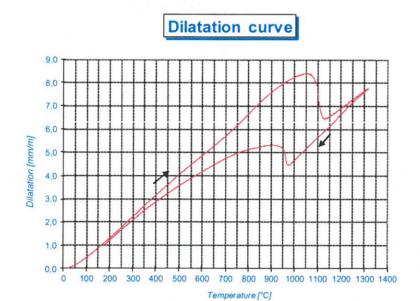
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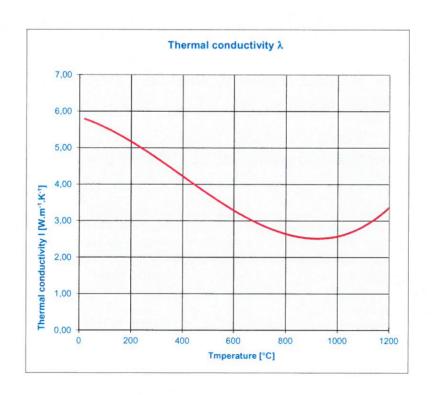
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C. SUPPLIER AND BUSINESS DATA

The manufacturer guarantees basic technical data according to this catalogue sheet. If necessary, additional testing according to the relevant standards can be agreed in return for payment.

Ordering:

The order usually contains:

- a) designation of the manufacturer
- b) type and dimensions of the product; for more complex shapes, a drawing documentation must be attached
- c) quantity (in pcs)
- d) application
- e) delivery time

Packaging:

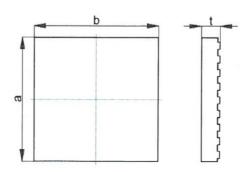
The products are usually transported on pallets and in wooden crates (strapped, in foil) or as consignments in bulk in covered means of transport. As protective intermediate layers, polystyrene, paper, sawn timber or other suitable materials are used.

D. Types of Eucor products

1. Tiles

Tiles are supplied by the manufacturer in rectangular, hexagonal, irregular and special shapes. Indication of rectangular tiles:

 $\underline{a / b / t (R)}$ – a – length, b – width, t – wall thickness including grooving (that is on the back side of the tile)





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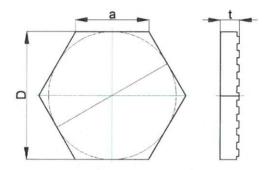
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Indication of hexagonal tiles:

 $\underline{6hr \ D / t \ (R)} - 6hr$ general indication of a tile, D-diameter of the inscribed circle, t-wall thickness including grooving (that is on the non-exposed side)



Dimensional tolerances:

length dimensions $\pm 2 \text{ mm}$

tile thickness $\pm 2 \text{ mm}$

Tiles are supplied in dimensions according to the customer's wishes and technological possibilities of production.

General conditions:

- As a standard, the thickness of tiles is 30 mm. At customer's request and according to an individual price calculation, it is possible, within the technological possibilities of production, to adjust the thickness of the tiles and, if necessary, to tighten the permitted tolerances.
- The weight of the product is determined by a theoretical value and is calculated from the dimensions of the product at a bulk density of 3,55 kg.m⁻³. This weight may differ from the actual one within the permitted dimensional tolerances. The calculation of the theoretical weight of the product shall be rounded up to one decimal place.
- The Eucor tiles must not have any cracks, they must not have any defects that could affect their function in the intended use. Minor corrugation of the surface, minor surface unevenness (bubbles), minor deformations of the surface and edges are not considered defects. Cracks in the Eucor products are identified by tapping with a hammer (weight approx. 0.3 kg) the product without any cracks must produce a clear sound.
- The quality of the tile surface is determined by the nature of the material and by the method of casting into sand moulds. A small amount of sand residues from the mould is allowed.
- At least 95 % of products must not have visible defects that could affect surface quality of the tiles (refer to ČSN EN ISO 10545-2) and must meet requirements for sampling (for principles, refer to ČSN EN ISO 10545-1).

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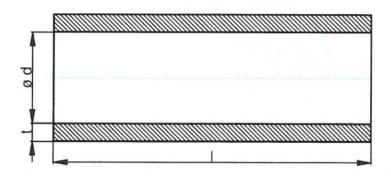
2. Pipes

The pipes are used as abrasion-resistant or chemically resistant inserts for lining of steel pipes, especially for pneumatic transport up to 1,000 °C.

The Eucor pipes are manufactured with inside diameters from 25 mm up to 700 mm.

Basic indication of pipes:

d / t / l - d inside diameter, t wall thickness, l pipe length



Dimensional tolerances:

length $\pm 2 \text{ mm}$

inside diameter ± 2 mm up to a diameter of 300 mm

inside diameter ± 3 mm above a diameter of 300 mm

inside diameter \pm 1 % above a diameter of 590 mm

wall thickness $\pm 2 \text{ mm}$

front face flatness ± 1.5 mm outside diameter it is just an indicative dimension; it is a result of the respective dimensions

and their tolerances (inside diameter, wall thickness and ovality)

Ovality: up to a diameter of 300 mm 4 mm

Over a diameter of 300 mm 6 mm

Over a diameter of 600mm 1,5 % of nominal diameter

(The difference between the largest and the smallest measured diameter)



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General conditions:

- As a standard, the thickness of pipes is 25 mm. Lengths are dependent on the inside diameter: usually, up to Ø 70 mm, the length of pipes is 250 mm; from Ø 70 up to Ø 303 mm, the length of pipes is 500 mm and above Ø 350 mm, the length of pipes is 200, 250 up to 333 mm. At customer's request and according to an individual price calculation, it is possible, within the technological possibilities of production, to adjust the wall thickness and pipe length and, if necessary, to tighten the permitted tolerances.
- The weight of the product is determined by a theoretical value and is calculated from the dimensions of the product at a bulk density of 3,55 kg.m⁻³. This weight may differ from the actual one within the permitted dimensional tolerances. The calculation of the theoretical weight of the product shall be rounded up to one decimal place.
- The Eucor pipes must not have any cracks, they must not have any defects that could affect their function in the intended use. Minor corrugation of the surface, minor surface unevenness (bubbles), minor deformations of the surface and edges are not considered defects. Cracks in the Eucor products are identified by tapping with a hammer (weight approx. 0.3 kg) the product without any cracks must produce a clear sound.
- The quality of the pipe surface is determined by the nature of the material and by the method of casting into sand moulds. A small amount of sand residues from the mould is allowed.
- At least 95 % of products must not have visible defects that could affect surface quality of the tiles (refer to ČSN EN ISO 10545-2) and must meet requirements for sampling (for principles, refer to ČSN EN ISO 10545-1).



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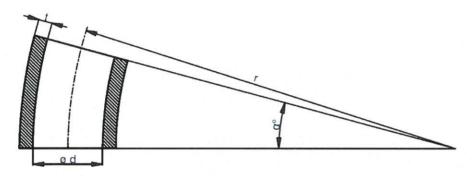
3. Bends, reducing (transition) pieces, branch pipes

a) Bends

The Eucor bends are manufactured with inside diameters from 25 mm up to 700 mm.

Basic indication of bends:

 $\underline{d/r/\alpha/t}$ – d-inside diameter, r-radius, α - angle, t-wall thickness



Dimensional tolerances:

inside diameter $\pm 3 \text{ mm}$

inside diameter above 590 mm $$ \pm 1 %

wall thickness $\pm 2 \text{ mm}$ radius $\pm 1 \%$

angle ± 4 mm (the maximum length along the bend is measured)

front face flatness $\pm 1.5 \text{ mm}$

outside diameter it is just an indicative dimension; it is a result of the respective

dimensions and their tolerances (inside diameter, wall thickness

and ovality)

Ovality:

up to a diameter of 300 mm

4 mm

Over a diameter of 300 mm

6 mm

Over a diameter of 600mm

1,5 % of nominal diameter

(The difference between the largest and the smallest measured diameter)



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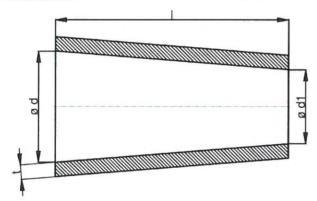
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b) Reducers (transition pieces)

Transition pieces or reducers are produced by casting into sand moulds in a single piece or composed of several pieces.

Basic indication of transition pieces (reducers):

d / d1 / 1 / t - d-inside diameter - larger, d1-inside diameter - smaller, l-length, t-wall thickness



Dimensional tolerances:

inside diameter $\pm 3 \text{ mm}$ inside diameter above 590 mm $\pm 1 \%$ wall thickness $\pm 2 \text{ mm}$ $\pm 3 \text{ mm}$ length front face flatness $\pm 1.5 \text{ mm}$

outside diameter it is just an indicative dimension; it is a result of the respective

dimensions and their tolerances (inside diameter, wall thickness

and ovality)

Ovality: up to a diameter of 300 mm 4 mm Over a diameter of 300 mm

6 mm

Over a diameter of 600mm 1,5 % of nominal diameter

(The difference between the largest and the smallest measured diameter)

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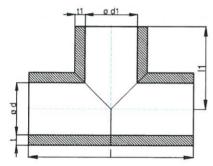
EUTIT	E U C O R Catalogue Sheet		
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c) Branch pieces

Branch pieces are produced by casting into sand moulds in a single piece or composed of several pieces.

Basic indication of branches:

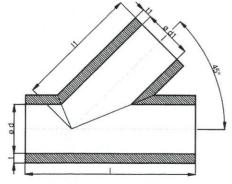
the "T-piece" type of branch with the angle of 90 ° $\frac{d/d1/l/l}{d-l}$ – d-inside diameter of the straight part, dl-inside diameter of a branch, l-length of the straight part, ll-the length of a branch from the axis of the straight part



branch with the angle of > 45 °

 $\frac{d / d1 / 45 \circ / 1 / 11}{d1}$ – *d* – *inside diameter of the straight part,* d1 – *inside diameter of a branch,* $45 \circ$ – *the angle of a branch axis to the axis of the straight part,*

l– length of the straight part, *l1*– length of a branch from the axis of the straight part

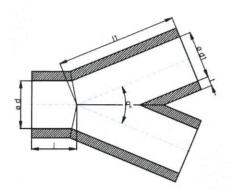




the "Y-piece" type of branch

 $\frac{d / d1 / \alpha / 1 / 11}{d}$ – d-inside diameter of the straight part, d1-inside diameter of a branch, α - the angle of the two branch axes,

l-length of the straight part, *l1*-length of a branch from the axis of the straight part



Dimensional tolerances:

 $\begin{array}{lll} \text{length} & \pm 2 \text{ mm} \\ \text{inside diameter} & \pm 3 \text{ mm} \\ \text{inside diameter above 590 mm} & \pm 1 \% \\ \text{wall thickness} & \pm 2 \text{ mm} \\ \text{angle} & \pm 4 \text{ mm} \\ \text{front face flatness} & \pm 1.5 \text{ mm} \end{array}$

outside diameter it is just an indicative dimension; it is a result of the respective

dimensions and their tolerances (inside diameter, wall thickness

and ovality)

Ovality: up to a diam

up to a diameter of 300 mm

4 mm

Over a diameter of 300 mm

6 mm

Over a diameter of 600mm

1,5 % of nominal diameter

(The difference between the largest and the smallest measured diameter)

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General conditions:

- As a standard, the thickness of bends, transition pieces (reducers) and branches is 25 mm. At customer's request and according to an individual price calculation, it is possible, within the technological possibilities of production, to adjust the wall thickness, or to produce different thicknesses of "the exposed and the non-exposed" sides and, if necessary, to tighten the permitted tolerances.
- The weight of the product is determined by a theoretical value and is calculated from the dimensions of the product at a bulk density of 3,55 kg.m⁻³. This weight may differ from the actual one within the permitted dimensional tolerances. The calculation of the theoretical weight of the product shall be rounded up to one decimal place.
- The Eucor bends, transition pieces (reducers) and branches must not have any cracks, they must not have any defects that could affect their function in the intended use. Minor corrugation of the surface, minor surface unevenness (bubbles), minor deformations (pressure marks) of the surface and edges are not considered defects. Cracks in the Eucor products are identified by tapping with a hammer (weight approx. 0.3 kg) the product without any cracks must produce a clear sound.
- The quality of surface of bends, transition pieces (reducers) and branches is determined by the nature of the material and by the method of casting into sand moulds. A small amount of sand residues from the mould is allowed.
- At least 95 % of products must not have visible defects that could affect surface quality of the tiles (refer to ČSN EN ISO 10545-2) and must meet requirements for sampling (for principles, refer to ČSN EN ISO 10545-1).

4/ Shaped pieces

The denomination "shaped pieces" refers to a wide range of different radial tiles, rings, transitions, nozzles, cyclones and other shapes.

Basic indication of radial shaped pieces:

<u>**R** - **r** / α / **l** / **t** - **R**- radial piece, **r**- lining radius, α -- angle, **l**- shaped piece length, **t**- thickness</u>

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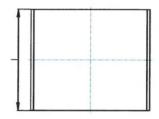
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Dimensional tolerances:

length dimensions (up to the size of a shaped piece of 300 x 300) \pm 2 mm

length dimensions (above the size of a shaped piece of 300 x 300). The tolerance, based on the complexity of the product, will be given in the offer.

thickness of shaped pieces (up to the size of a shaped piece of 300 x 300) \pm 2 mm

thickness of shaped pieces of more complex and larger shapes

The tolerance, based on the complexity of the product, will be given in the offer.

General conditions:

- As a standard, the thickness of shaped pieces is 30 mm. At customer's request and according to an individual price calculation, it is possible, within the technological possibilities of production, to adjust the wall thickness and, if necessary, to tighten the permitted tolerances. If the dimensional tolerances specified for tiles, pipes and bends (flat and hollow shaped pieces) can be applied to shaped pieces, these tolerances shall be taken into account. The permitted tolerances are always agreed in advance with the customer.
- The weight of the product is determined by a theoretical value and is calculated from the dimensions of the product at a bulk density of 3,55 kg.m³. This weight may differ from the actual one within the permitted dimensional tolerances. The calculation of the theoretical weight of the product shall be rounded up to one decimal place.
- The Eucor shaped pieces must not have any cracks, they must not have any defects that could affect their function in the intended use. Minor corrugation of the surface, minor surface unevenness (bubbles), minor deformations (pressure marks) of the surface and edges are not considered defects. Cracks in the Eucor products are identified by tapping with a hammer (weight approx. 0.3 kg) - the product without any cracks must produce a clear sound.
- The quality of surface of shaped pieces is determined by the nature of the material and by the method of casting into sand moulds. A small amount of sand residues from the mould is allowed.



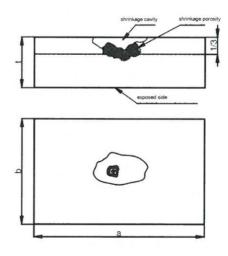
At least 95 % of products must not have visible defects that could affect surface quality of the tiles (refer to ČSN EN ISO 10545-2) and must meet requirements for sampling (for principles, refer to ČSN EN ISO 10545-1).

5. Blocks

Blocks are thick-walled shaped pieces used for lining of the upper parts of melting furnaces (e.g. glass furnaces) and for paving the floors of pusher-type furnaces

Basic indication of blocks:

a) the Eucor block – according to size or according to a drawing (with an oriented shrinkage cavity and shrinkage porosity)



b) the Eucor block – according to size or according to a drawing, without shrinkage cavity with partial shrinkage porosity



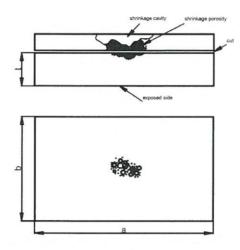
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Dimensional tolerances:

Side dimensions +0 mm, -8 mm

Deflection of individual surfaces $\pm 3 \text{ mm}$

General conditions:

As a standard, the Eucor blocks are produced with an oriented shrinkage cavity on the non-exposed side. If customers require blocks free of shrinkage cavities, this fact must be stated in the order. At customer's request and according to an individual price calculation, it is possible, within the technological possibilities of production, to tighten the permitted tolerances.

Permitted tolerances must always be agreed in advance.

- The weight of the product is determined by a theoretical value and is calculated from the dimensions of the product at a bulk density of 3,55 kg.m⁻³. This weight may differ from the actual one within the permitted dimensional tolerances. The calculation of the theoretical weight of the product shall be rounded up to one decimal place.
- The Eucor blocks must not have any cracks through the entire wall thickness, they must not have any defects that could affect their function in the intended use. Minor corrugation of the surface, minor surface unevenness (bubbles), minor deformations (pressure marks) of the surface and edges are not considered defects.
- The quality of the product surface is determined by the nature of the material and by the method of casting into sand moulds. A small amount of sand residues from the mould is allowed.
- Individual acceptance conditions which are based on the agreement of both parties can be created with a customer.
- At least 95 % of products must not have visible defects that could affect surface quality (refer to ČSN EN ISO 10545-2) and must meet requirements for sampling (in general refer to ČSN EN ISO 10545-1).

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Updated on:

01/08/2022

Responsible person: quality manager

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