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## 1 Revision key

Index	Date	Description	Editor
00	25.01.2013	First draft	Hoppe, Patrick
01	14.02.2013	Symbols/marking added	Hoppe, Patrick
02	27.02.2013	Various changes	Hoppe, Patrick
03	01.08.2017	General porosity requirement added in section 6, removed remark in section 5.6	Hoppe, Patrick
04	13.10.2017	Blocking notice added, transition to revised specification template	Hoppe, Patrick

## 2 Blocking notice

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am: 25.01.2013 von: P. Hoppe	am: 18.10.2017 von: Lepperhof, Markus	am: 18.10.2017 von: Hoppe, Patrick	BT-Sp-003 Porosity EN
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### 3 Scope

This factory standard is valid for machined surfaces of parts manufactured in gravity die casting and continuous casting made of copper and copper-based alloys.

### 4 Connected references and standards

- DIN EN ISO 8062-1
- DIN EN ISO 8785
- DIN EN ISO 10135
- BDG-Guideline VDG P211

### 5 Purpose

The aim of this standard is to uniform binding quality requirements for permissible porosities of machined surfaces according to their functional impact. This guideline does not refer any other kind of surfaces damages only porosity. Such cases must be agreed separately. Other flaws such as sink marks, cold flow marks, segregations, burrs and others not part of this guideline.

Furthermore a coding of related porosity classes for the marking in drawings (finished parts) will be defined.

### 6 Definitions

To apply this document to its purpose the terms according to DIN EN ISO 8062-1, DIN EN ISO 8785 and DIN EN ISO 10135 are valid.

#### 6.1 Porosity class:

The coding of porosity classes includes certain parameters that will be defined in the following paragraphs 4.3 to 4.7 (on the basis of BDG-guideline VDG P211 for copper and copper-based alloys).

#### 6.2 Reference surface:

The marking of a uniform reference surface in finished part drawings result from the symbols set in this factory standard, according to the marking in drawings described in paragraph 6 (as a general rule, functional surfaces are limited by edge transitions such as broken edges, chamfers or roundings).

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### 6.3 Pore diameter/extent of a pore [ $\emptyset$ ]:

The designation of the maximum pore diameter is served in mm. Following definitions are valid:

Maximum allowed pore diameter (related to round pores, i.e. blow holes) or maximum allowed extent of a pore (related to stretched pores, figure 1 idealised, i.e. shrinkage pore)

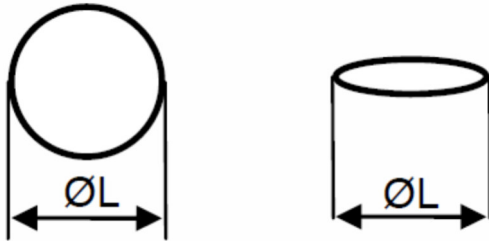


figure 1: Illustration of equivalent pore diameters and extent of pores

If shrinkage pores occur branched, interconnected, rugged, oval or generally as a non-idealized round geometry, the maximum extent of the pore (equivalent pore diameter) will have to be chosen at the discretion of each worker according to figure 2.

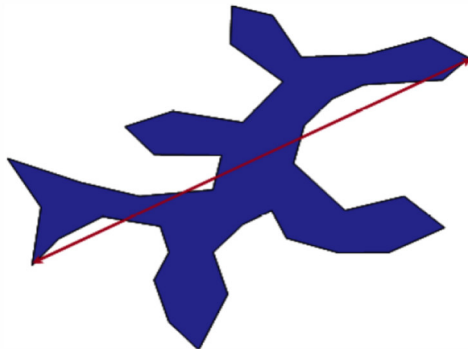


figure 2: Required choice of equivalent pore diameter

### 6.4 Number of pores [Z]:

The integer value [Z] provides the maximum allowed number of separately occurring pores on a reference surface. Here accumulations of pores are equal to single pores, as long as their boundaries are not separated from each other.

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### 6.5 Accumulation of pores [H]:

An accumulation of pores will be existent, if the edge spacing between two neighbouring pores is lower than the diameter of the smaller pore. Accumulations of pores are impermissible in general.

### 6.6 Edge spacing between pores [A]:

This parameter provides the minimum boundary distance between two neighbouring pores according to figure 3. The designation of the boundary distance refers to the pore diameter ( $\varnothing$ ) of the smaller of two pores nearby multiplied by an integer value. This value or an explicitly specified minimum distance between two pore boundaries (only minimum distance valid) can be taken from the related porosity class. The same distances apply to combinations of pore boundaries and the edges of the corresponding reference surface.

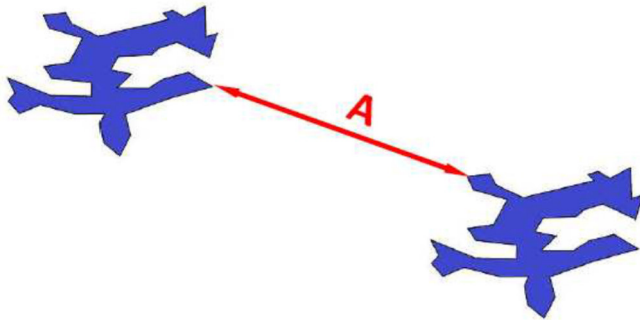


figure 3 Required choice of minimum edge spacing between pores

### 6.7 Ignored pores [U]:

The value of [U] provides the maximum diameter of pores that will remain disregarded during the assessment of a reference surface. In the context of this factory standard this applies to micro pores in all porosity classes, i.e. for pores, the shape and size with the sighted human eye cannot be assessed reliably. They range up to a maximum extent of 0.5 mm in diameter.

## 7 BT-porosity classes

Depending on the functional requirements the permissible degree of porosity is given by the following customizable pore coding:

**BTP- [parameter 1][value] / [parameter 2][value] /.../ [parameter n][value]**

For common functional surfaces pre-defined BT-porosity classes should be preferred according to table 1. For customized functional surfaces the valid porosity class will have to be referenced as given in the porosity coding, if there are requirements different from the pre-defined BT-porosity classes. In case functional surfaces are not indicated by a certain porosity class, BT porosity class D according to table 1 is automatically applied to surfaces.

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BT-porosity class	Porosity coding	Reference surface limited by edge transitions				
		Extent of a pore	Number of pores	Accumulation of pores	Edge spacing between pores	Ignored pores
Short symbol of parameter:		ØL	Z	H <sup>1)</sup>	A <sup>2)</sup>	U
Valid range:		≤	≤	(A>1)	(≥)	(ØL<U)
Unit of measurement:		[mm]	[1]	[0/1]	[1/mm]	[mm]
<b>A</b>	<b>BTP-ØL2/Z5/H0/A5/U0,5</b>	2	5	0	-/5	0,5
<b>B</b>	<b>BTP-ØL2/Z2/H0/A5/U0,5</b>	2	2	0	-/5	0,5
<b>C</b>	<b>BTP-ØL1/Z5/H0/A1/U0,5</b>	1	5	0	-/1	0,5
<b>D</b>	<b>BTP-Z0/H0/U0,5</b>	-	0	0	-	0,5

table 1: defined BT-porosity classes

- 1) 0: inadmissible 1: valid  
2) A [mm] = value \* ØL(smaller pore) / explicit value

## 8 Recording in drawings

The designation of the specification is stated on the drawing above the title block as follows:

„Porosity classes according to [document-ID]“

### 8.1 Symbols/markings

To mark functional surfaces with allowed porosities the symbol provided according to DIN EN ISO 10135 has to be taken. The graphical symbol for porosity is to be entered on the reference line, followed by the indication of a defined porosity class (see figure 4). Requirements differing from the pre-defined requirements have to follow explicitly using the given porosity coding (see figure 5).

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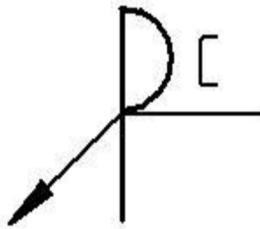


figure 4 Symbol for marking BT-porosity class C in drawings

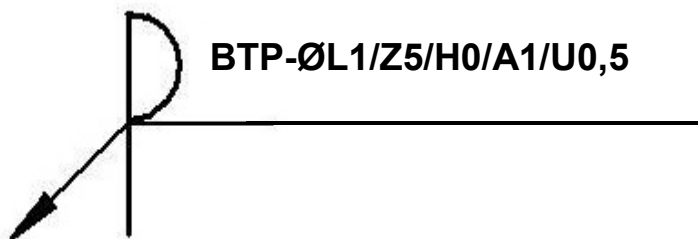


figure 5 Symbol for explicitly marking BT-porosity class C in drawings according to porosity coding

## 8.2 Marking rules

- Surface in the viewing direction: Connecting line ends with arrow (filled)
- Surface perpendicular to the viewing direction: Connecting line ends of the point (filled)
- Restricted surface: mark with wide dot-dash line including dimensions (see ISO 10135)

## 9 Further definitions

In single cases may be very difficult to meet the right decision. In these cases the quality departments of supplier and customer have to be involved.

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