INTERNATIONAL STANDARD

**ISO 15786**

First edition
2008-10-01

# Technical drawings — Simplified representation and dimensioning of holes

*Dessins techniques — Représentation et cotation simplifiées des trous*

Reference number
ISO 15786:2008(E)

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# Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15786 was prepared by Technical Committee ISO/TC 10, *Technical product documentation*, Subcommittee SC 6, *Mechanical engineering documentation*.

# Introduction

This International Standard has been established to specify the simplified representation and dimensioning of holes.

The rules established by this International Standard determine, unambiguously, methods for the representation — both complete and simplified — and the dimensioning of holes, as well as the structure and sequence of the descriptive elements for the simplified representation of holes.

# Technical drawings — Simplified representation and dimensioning of holes

## 1 Scope

This International Standard specifies rules for the simplified representation, dimensioning and tolerancing of holes, counterbores, internal threads and chamfers on drawings.

Where there could be misinterpretation using simplified representation, the complete representation and dimensioning by cuts, sections or elements on a larger scale apply, according to ISO 128-30, ISO 128-34, ISO 128-40, ISO 128-44, ISO 128-50, ISO 129-1 and ISO 406.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 128-22, *Technical drawings — General principles of presentation — Part 22: Basic conventions and applications for leader lines and reference lines*

ISO 128-30, *Technical drawings — General principles of presentation — Part 30: Basic conventions for views*

ISO 128-34, *Technical drawings — General principles of presentation — Part 34: Views on mechanical engineering drawings*

ISO 128-40, *Technical drawings — General principles of presentation — Part 40: Basic conventions for cuts and sections*

ISO 128-44, *Technical drawings — General principles of presentation — Part 44: Sections on mechanical engineering drawings*

ISO 128-50, *Technical drawings — General principles of presentation — Part 50: Basic conventions for representing areas on cuts and sections*

ISO 129-1, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

ISO 406, *Technical drawings — Tolerancing of linear and angular dimensions*

ISO 1101, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 5458, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Positional tolerancing*

ISO 6410-3:1993, *Technical drawings — Screw threads and threaded parts — Part 3: Simplified representation*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**complete representation of holes**
representation of holes in accordance with generally valid rules and projection methods for technical drawings

**3.2**
**simplified representation of holes**
representation of holes, drawn either true to scale or not, with a symbolic representation of the features

**3.3**
**complete dimensioning of holes**
dimensioning of holes using dimension lines and extension lines

**3.4**
**simplified dimensioning of holes**
dimensioning of holes using leader lines and reference lines

## 4 Methods of representation and dimensioning of holes

### 4.1 Complete representation and complete dimensioning of holes

The complete representation and dimensioning of holes according to ISO 128-30, ISO 128-34, ISO 128-40, ISO 128-44, ISO 128-50 and ISO 129-1 applies in all cases where a simplified representation of holes and dimensioning could lead to misinterpretation of the drawing (see Table 1).

### 4.2 Complete representation and simplified dimensioning of holes

Representation and dimensioning of holes in the sections is preferred. For dimensioning in the sections, the leader line is directed towards the point of intersections of the visible edge of the part and the centre line of the hole, ending with an arrowhead on the centre line of the hole. For dimensioning in the view from above, the leader line is directed towards the centre of the hole, ending with an arrowhead on the outline of the hole (see Table 1). For rules relative to the use of leader lines and reference lines, see ISO 128-22.

### 4.3 Simplified representation and simplified dimensioning of holes

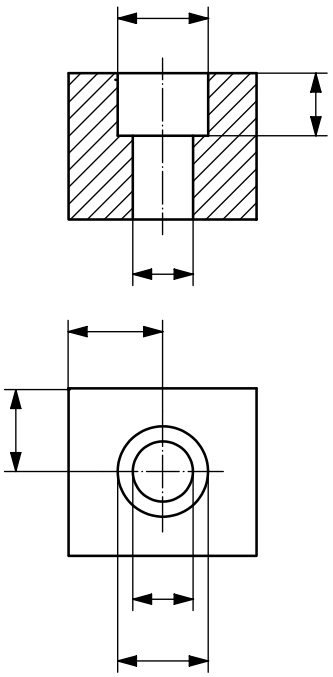
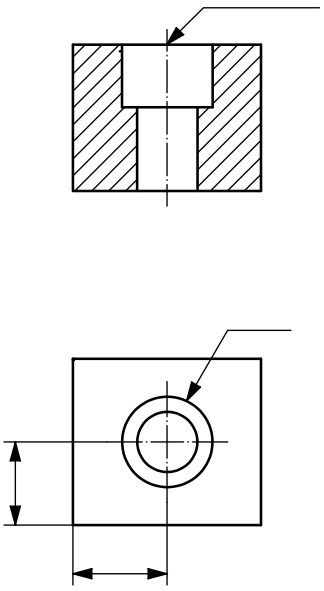
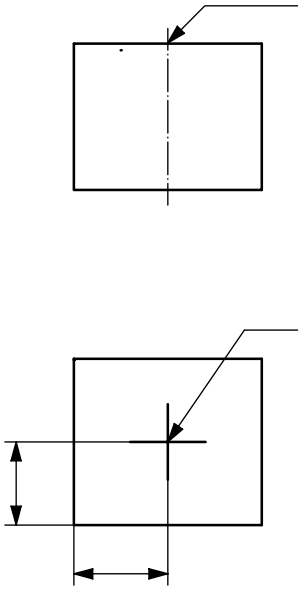
For simplified representation and simplified dimensioning of holes, only the centre lines of the holes are shown. In the case of the view from above, the location of the centre of the hole is represented by a cross using continuous wide lines (according to ISO 128-24:1999, type 01.2). The location of holes represented parallel to the plane of projection is shown by a long-dashed dotted narrow line (according to ISO 128-24:1999, type 04.1).

In the case of simplified dimensioning, the leader line ends with an arrowhead at the centre of the hole or at the point of intersection of the visible edge of the part and the centre line of the hole. The arrowhead points to the surface of the part from which the features are indicated (direction of manufacture; exception, see 5.3) (see Table 1).

### 4.4 Representation of holes on the same drawing

It is suggested that holes should be drawn and represented using only one of the methods of Table 1 to avoid causing confusion on the same drawing.

**Table 1 — Comparison of methods for representation and dimensioning of holes**

| Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning |
|---|---|---|
|  |  |  |

## 5 Structure of dimensioning of holes

### 5.1 Structure and sequence of descriptive elements for simplified dimensioning of holes

The structure of the simplified dimensioning of holes is composed of continuous enumeration and denominations of features used.

This means that the graphical symbols (e.g. ∅) and the dimensions (e.g. diameter, hole depths, tolerances) are shown one below the other. The feature with the largest dimension shall be shown in the first line.

The data shall be marked in characters of the same size, with the exception of the indication of surface texture (see 5.8).

The necessary data for each feature, several identical features or several groups of identical features are indicated on one line of the simplified dimensioning.

Structure and sequence of data is explained in Figure 1.

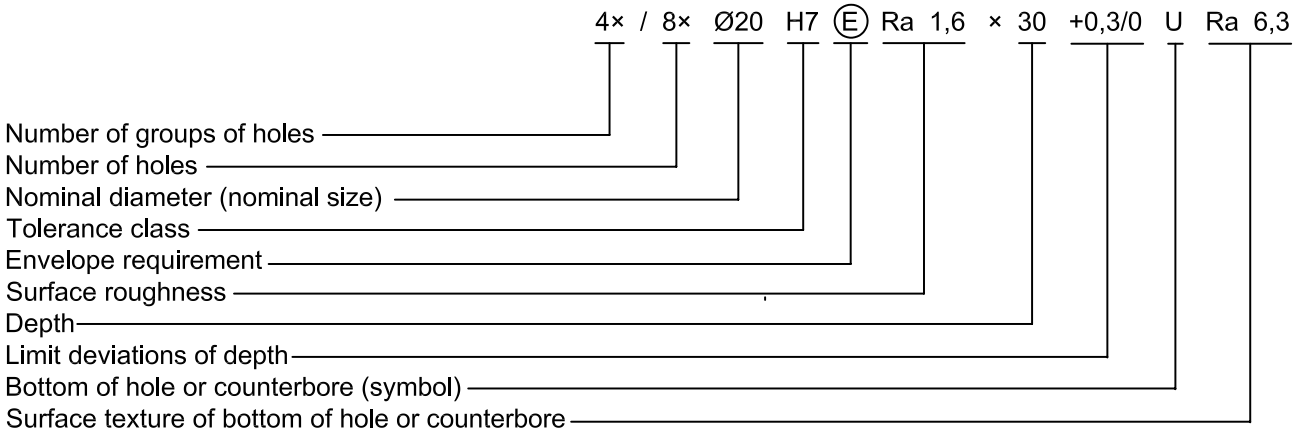



**Figure 1 — Structure and sequence of descriptive elements**

4× / 8× ⌀20H7Ⓔ Ra 1,6 × 30+0,3/0U Ra 6,3

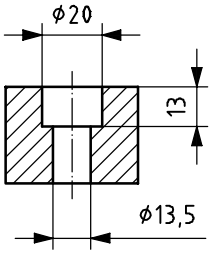
**Figure 2 — Indication on a drawing**

## 5.2 Graphical symbols

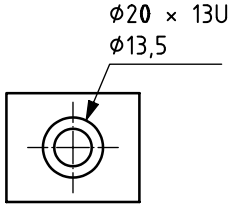
See Table 2.

**Table 2 — Symbols**

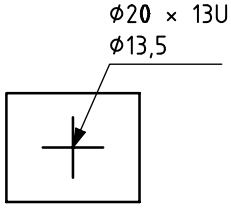
| No. | Symbol | Term | Example | Figure |
|---|---|---|---|---|
| 1 | ∅ | Diameter (ISO 129-1) | ∅10 | 4, 5, 6, 7, 8 |
| 2 | □ | Square (ISO 129-1) | □20 | Table A.1, No. 6 |
| 3 | × | Sign between nominal size and depth or angle dimensions, number of features and of groups of features | M10 × 25 | 4, 5, 7, 8, 14 |
| 4 | / | Sign between depth dimensions or between number of groups and number of features, e.g. thread length and bottom hole depth | M10 × 25/30 | 9, 12 |
| 5 | U | Cylindrical counterbore, flat hole bottom | ∅10 × 25U | 3, 4 |
| 6 | V | Material-dependent bit (point angle of hole bottom) | ∅10 × 25V | 6 |
| 7 | W | Indexable insert bit (hole bottom) | ∅10 × 25W | 5 |
| 8 | Y | Dimension indicated up to bit | ∅10 × 28Y | 8 |




a) Complete representation and complete dimensioning

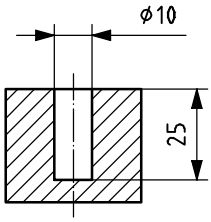



b) Complete representation and simplified dimensioning

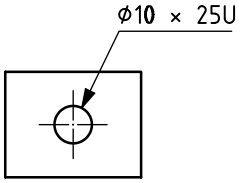



c) Simplified representation and simplified dimensioning

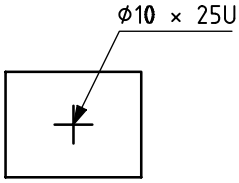
**Figure 3 — Hole with counterbore**




a) Complete representation and complete dimensioning

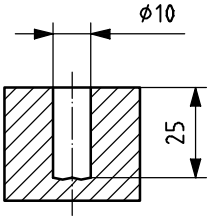



b) Complete representation and simplified dimensioning

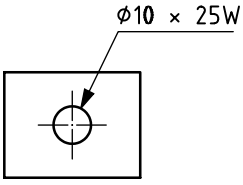



c) Simplified representation and simplified dimensioning

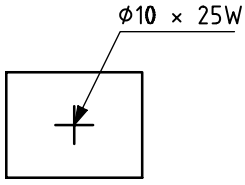
**Figure 4 — Hole with flat hole bottom**




a) Complete representation and complete dimensioning

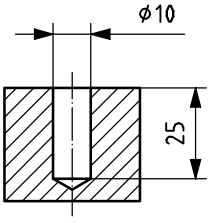



b) Complete representation and simplified dimensioning

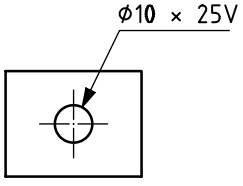



c) Simplified representation and simplified dimensioning

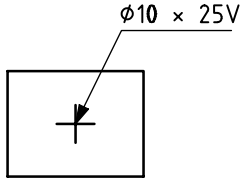
**Figure 5 — Hole with bottom produced using indexable insert**




a) Complete representation and complete dimensioning

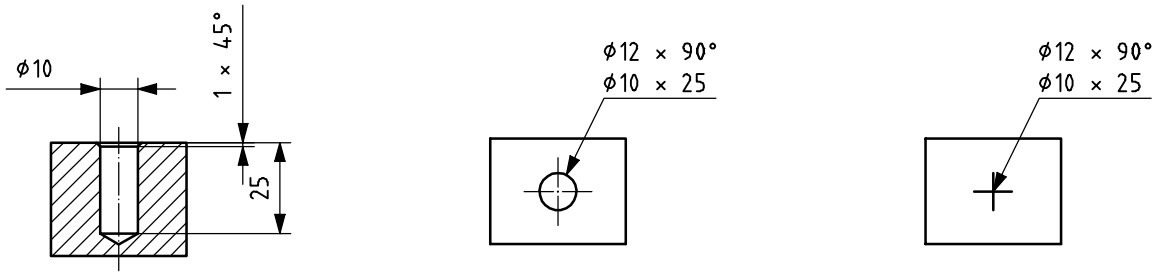



b) Complete representation and simplified dimensioning



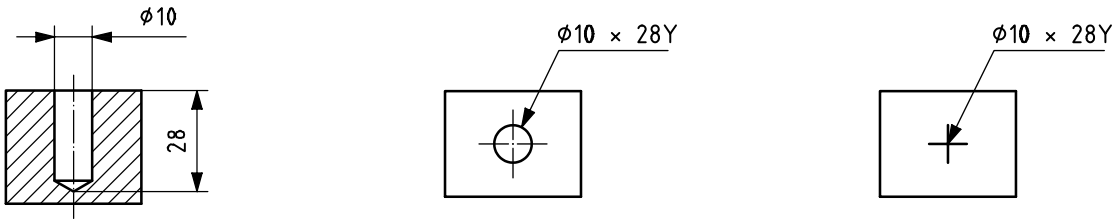

c) Simplified representation and simplified dimensioning

**Figure 6 — Hole with dimension to point angle of hole bottom**




**a) Complete representation and complete dimensioning** | **b) Complete representation and simplified dimensioning** | **c) Simplified representation and simplified dimensioning**

**Figure 7 — Chamfered hole (hole bottom not specified)**




**a) Complete representation and complete dimensioning** | **b) Complete representation and simplified dimensioning** | **c) Simplified representation and simplified dimensioning**

**Figure 8 — Hole with dimension indicated up to bit**

## 5.3 Number of groups of holes and number of holes in a group

Groups of identical holes (counterbores and bores) shall be dimensioned and toleranced with a single instruction. For the repeated groups of holes, only those dimensions necessary to identify their location shall be indicated. The number of groups of holes and number of holes in each group shall precede the largest diameter of profile.

The number of groups of holes in a group shall precede, and be separated from, the data by the sign "×", e.g. 5 × ∅10 or 6 × M10.

The number of holes in a group shall precede, and be separated from, the number of holes in each group by the sign "×" and a slash "/", e.g. 3×/ 5× ∅10 or 4×/ 6 × M10 (see Figure 9).

Where ambiguity could occur, group and element description in words may be used, e.g. 3 groups/5 holes ∅10 or 4 groups/6 threads M10. Text descriptions shall not be used in drawings subject to automated data transfer.

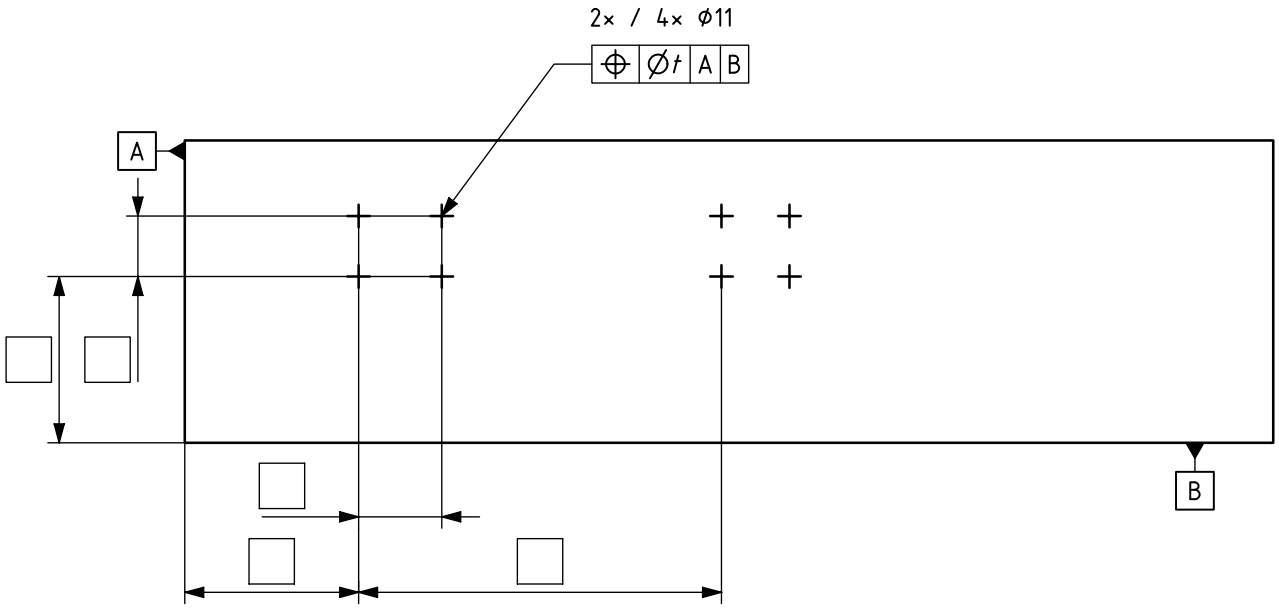
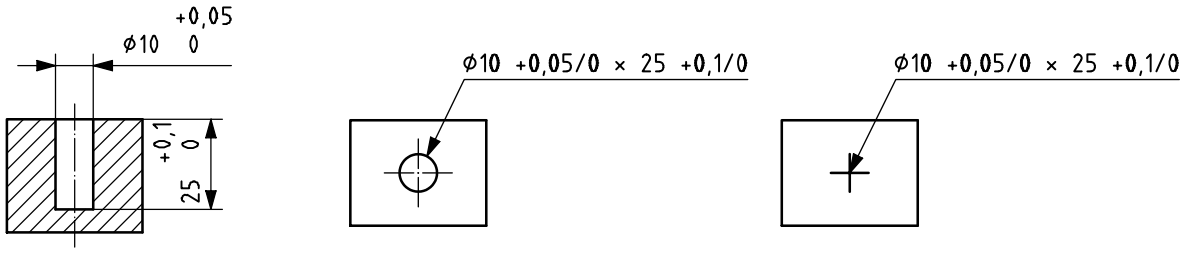



**Figure 9 — Simplified representation of two groups with four holes in each group**

## 5.4 Indication of tolerances

The indicated dimensions shall be toleranced, either by directly related tolerances or by general dimensional tolerances, for example by ISO 2768-1 (see Figures 10 and 11).




**a) Complete representation and complete dimensioning**

**b) Complete representation and simplified dimensioning**

**c) Simplified representation and simplified dimensioning**

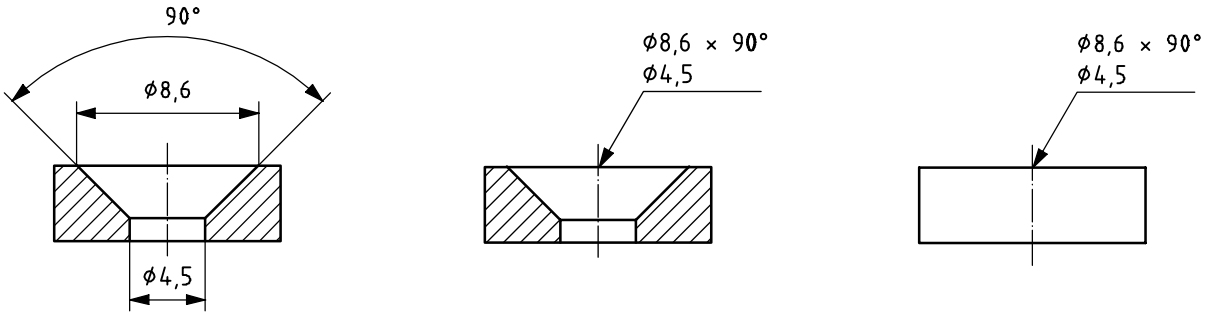
**Figure 10 — Hole with tolerance indication (hole bottom not specified)**

## 5.5 Hole bottom

The form of the hole bottom is represented by the graphic symbols “V”, “U” or “W” (see Table 2). If indications on the form of the hole bottom are not available, the form may be at the discretion of the manufacturer.

## 5.6 Countersinks and chamfers

In the case of simplified dimensioning, chamfers and countersinks shall be treated in the same way. The dimensions are shown by indicating the largest diameter and the countersinking angle separated by the sign “×” (see Figure 11).




**a) Complete representation and complete dimensioning**

**b) Complete representation and simplified dimensioning**

**c) Simplified representation and simplified dimensioning**

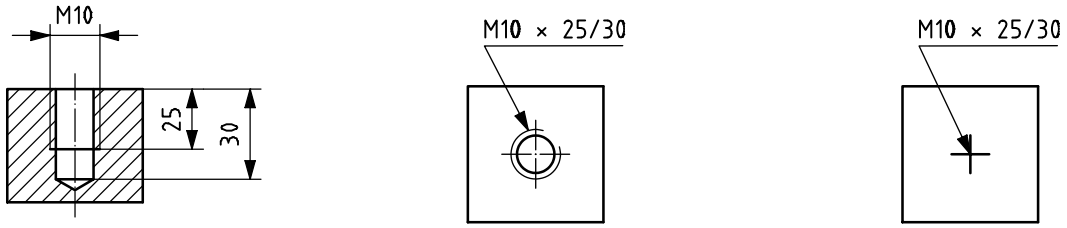
**Figure 11 — Chamfer**

## 5.7 Depth dimensions

The depth of hole and threads is indicated by the sign "×" as a division sign (see ISO 6410-3).

In the case of thread indications, the threaded length is separated from the cored hole depth by a slash "/", e.g. M10×25/30 (see Figure 12). Holes without depth indications are bored through.

If, in addition to the thread indications, the cored hole diameter is required, this is shown as a second feature (see Figure 13). If no indications are made on the cored hole depth for threads, the cored hole is bored through (see Figure 14). In the case of tolerance holes, e.g. ∅8H7 (see Table A.1, No. 3), the depth indication is separated by a slash "/" as well.




**a) Complete representation and complete dimensioning**

**b) Complete representation and simplified dimensioning**

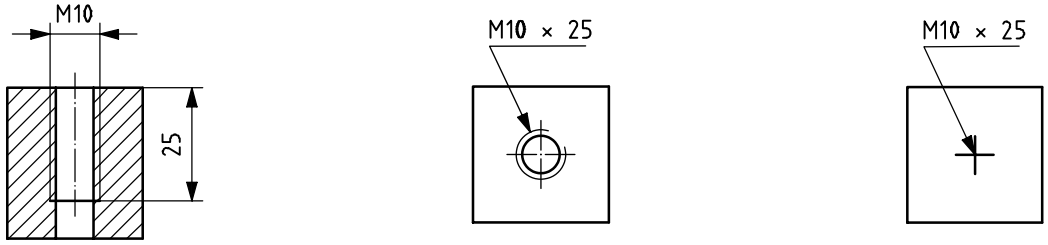
**c) Simplified representation and simplified dimensioning**

**Figure 12 — Threaded hole with indication of thread length and cored hole depth (hole bottom not specified)**


**a) Complete representation and simplified dimensioning**

**b) Simplified representation and simplified dimensioning**

**Figure 13 — Threaded hole with indication of cored hole diameter (hole bottom not specified)**



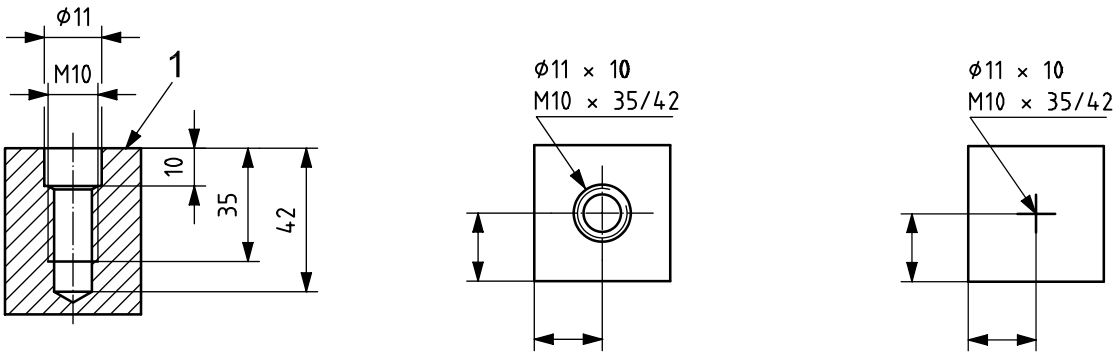

**a) Complete representation and complete dimensioning**

**b) Complete representation and simplified dimensioning**

**c) Simplified representation and simplified dimensioning**

**Figure 14 — Threaded hole with indication of thread length (core hole bored through)**

In the case of two or more features on one axis, the hole depths shall always be indicated from the same starting plane (see Figure 15). The starting plane of the entire hole is the plane where the largest feature begins (see Figure 16).




**a) Complete representation and complete dimensioning**

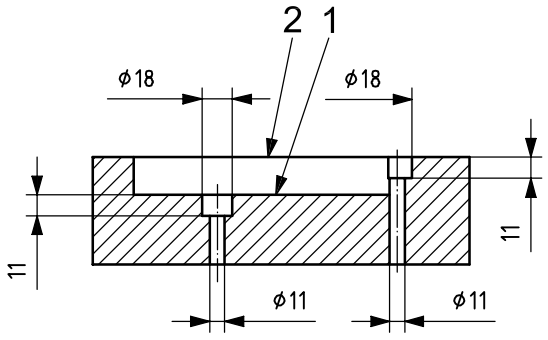
**b) Complete representation and simplified dimensioning**

**c) Simplified representation and simplified dimensioning**

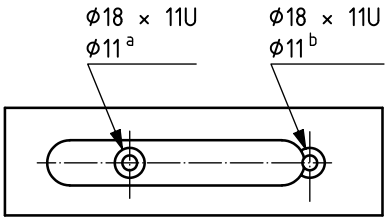
**Key**

1 base plane

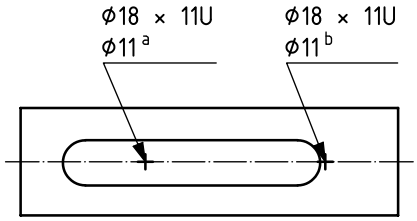
**Figure 15 — Complex threaded countersunk hole with indication of thread length and cored hole depth (hole bottom not specified)**




**a) Complete representation and complete dimensioning**




**b) Complete representation and simplified dimensioning**




**c) Simplified representation and simplified dimensioning**

**Key**

1 base plane 1

2 base plane 2

[a] Hole 1.

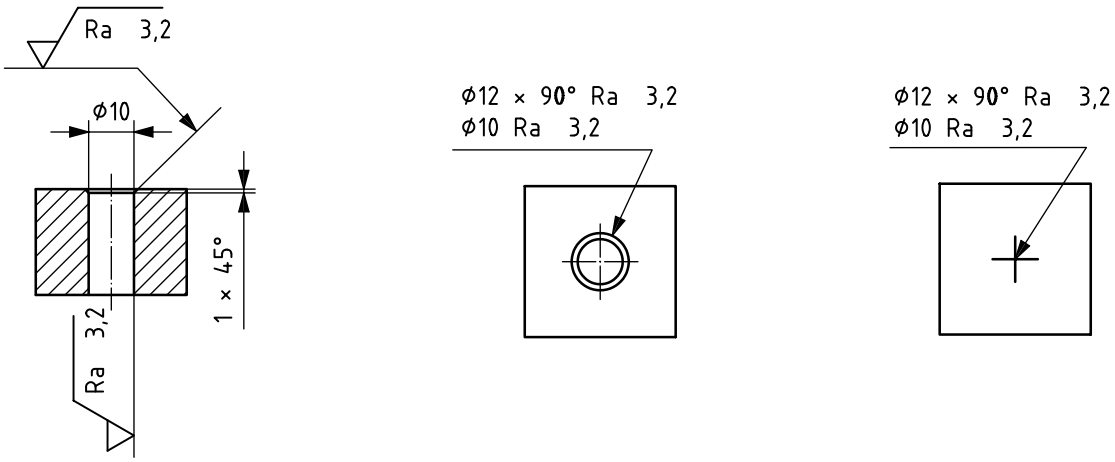
[b] Hole 2.

**Figure 16 — Two holes with counterbore and different hole depths**

## 5.8 Indication of surface texture

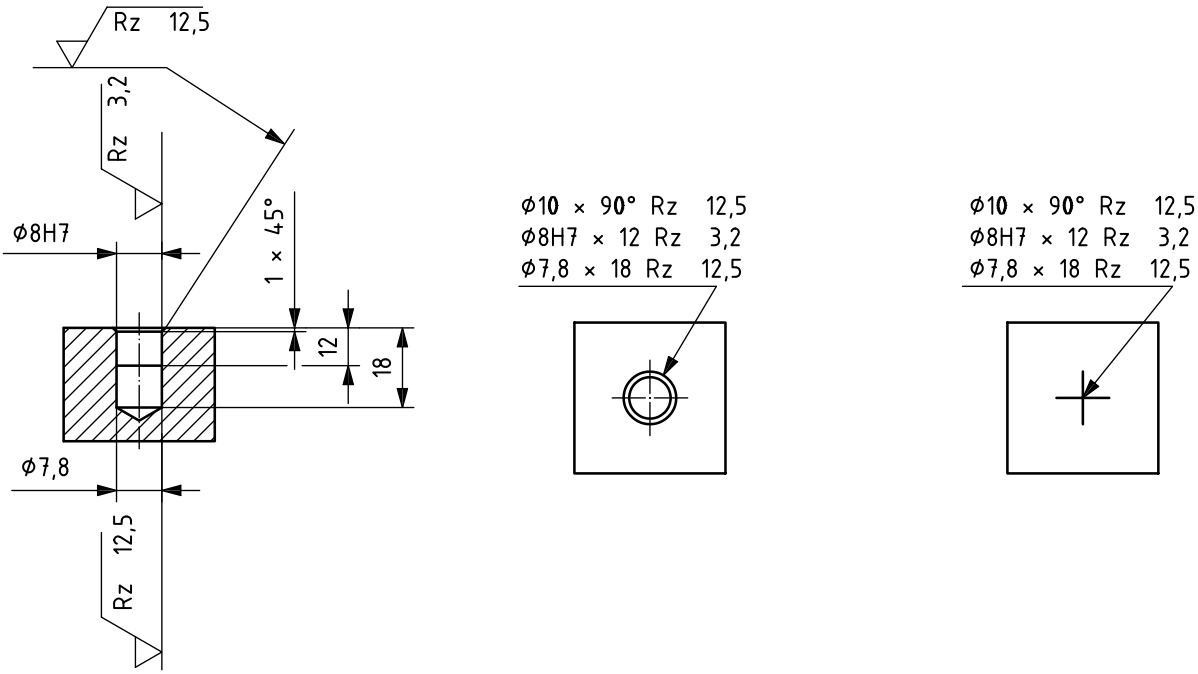
In order to be able to identify the surface texture conditions, it is necessary, to indicate the corresponding roughness values, even for code designations, according to ISO 1302 (see Figures 17 and 18).

The surface texture is indicated without a “complete graphical symbol”. This implies in principle that the hole is manufactured by machining and the default definitions according to ISO 1302 apply. The complete representation and complete dimensioning shall be used if the default definitions are not applicable.




**a) Complete representation and complete dimensioning** **b) Complete representation and simplified dimensioning** **c) Simplified representation and simplified dimensioning**

**Figure 17 — Chamfered hole with surface roughness indication**




**a) Complete representation and complete dimensioning** **b) Complete representation and simplified dimensioning** **c) Simplified representation and simplified dimensioning**

**Figure 18 — Complex chamfered hole with surface roughness indications (hole bottom not specified)**

## 5.9 Indication of dimensions on geometrical tolerances

The hole shall be shown above the tolerance frame if geometrical tolerances in accordance with ISO 1101 and ISO 5458 are indicated (see Figure 19).

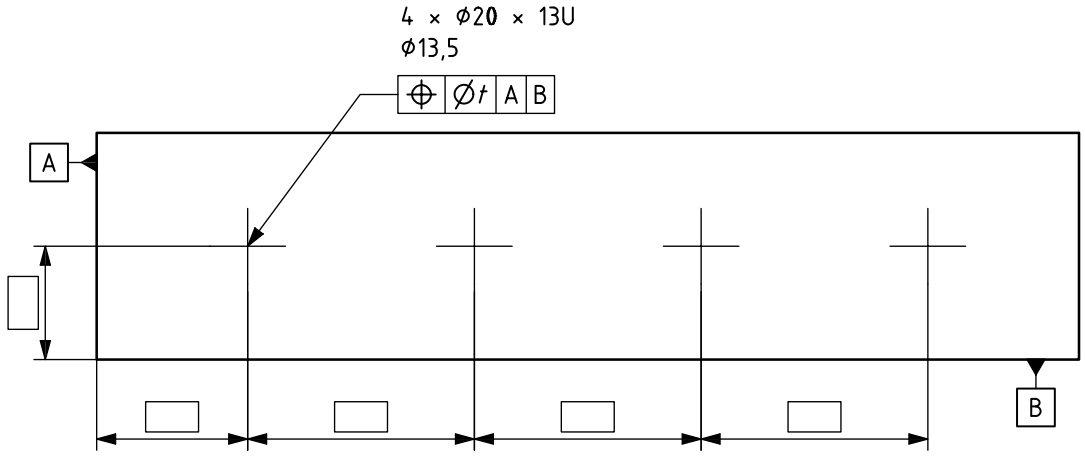



**Figure 19 — Simplified representation of group of four holes with counterbore using tolerance frame**

# Annex A
(informative)

# Examples for representation and dimensioning of holes, counterbores and internal threads

**Table A.1 — Examples for representation and dimensioning of holes, counterbores and internal threads**

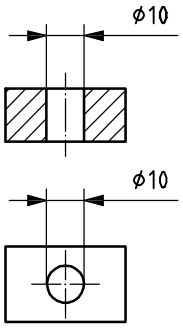
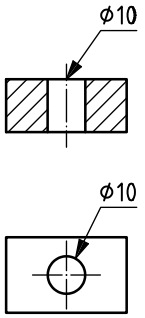
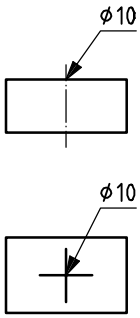
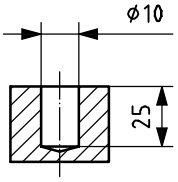
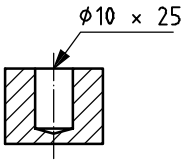
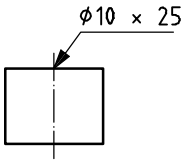
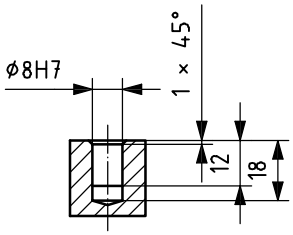
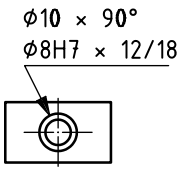
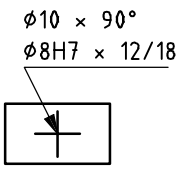
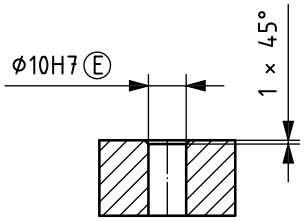
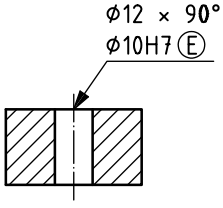
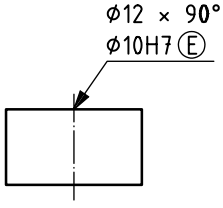
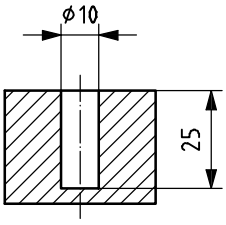
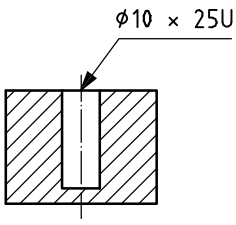
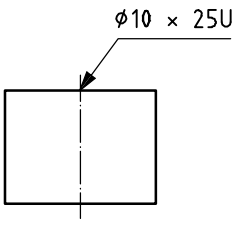
| No. | Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning | Explanation |
|---|---|---|---|---|
| 1 |  |  |  | Through-hole ∅10 |
| 2 |  |  |  | Bottom hole ∅10, 25 deep (hole bottom not specified) |
| 3 |  |  |  | Reamed bottom ∅8H7, 12 deep bore depth 18, with chamfer 1 × 45° (hole bottom not specified) |
| 4 |  |  |  | Reamed hole ∅10H7 passing through with chamfer 1 × 45° |
| 5 |  |  |  | Bottom hole ∅10, 25 deep with flat hole bottom |

**Table A.1** (*continued*)

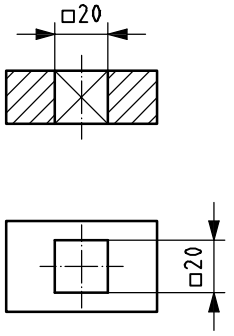
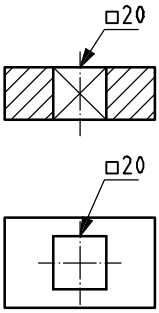
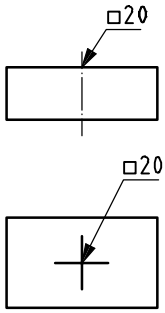
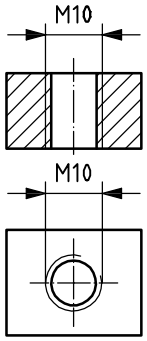
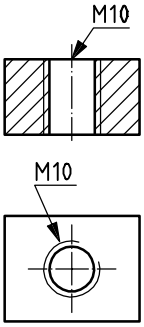
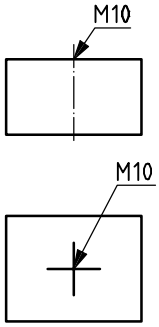
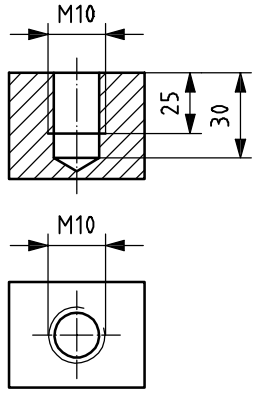
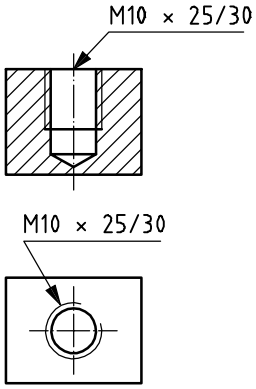
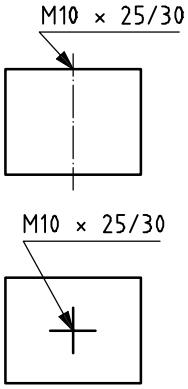
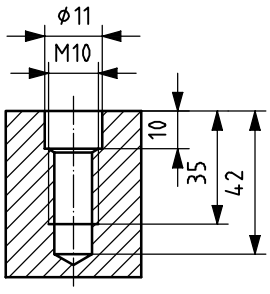
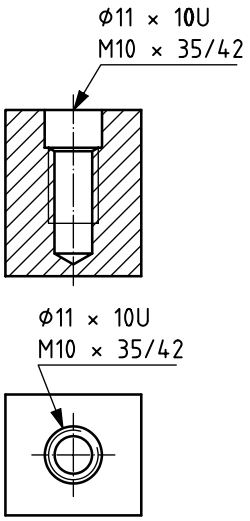
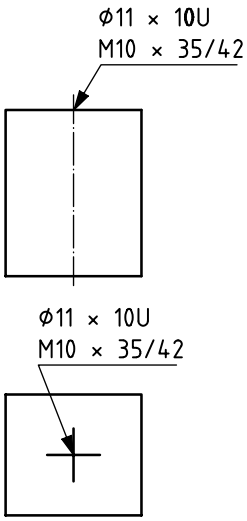
| No. | Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning | Explanation |
|---|---|---|---|---|
| 6 |  |  |  | Square through-hole 20×20 |
| 7 |  |  |  | Through-thread M10 |
| 8 |  |  |  | Thread M10 with threaded length 25, cored hole depth 30 |
| 9 |  |  |  | Thread M10 with free counterbore ∅11, 10 depth, threaded depth 35 and cored hole depth 42 (measured from base plane) |

**Table A.1** (*continued*)

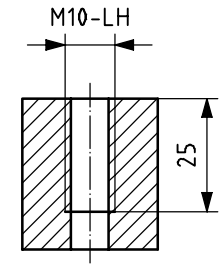
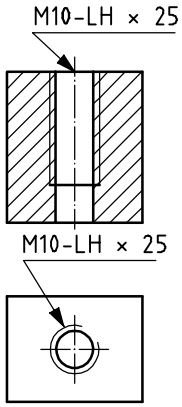
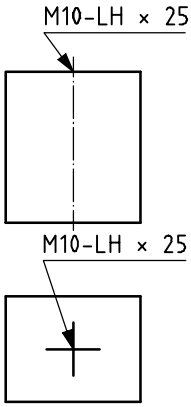
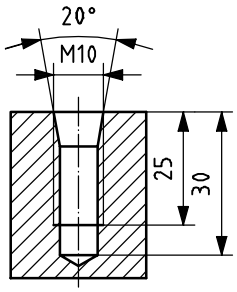
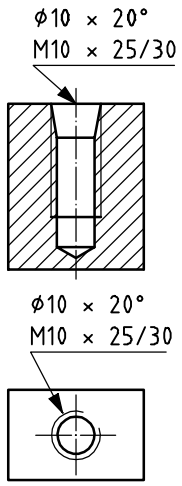
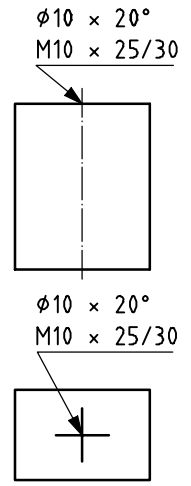
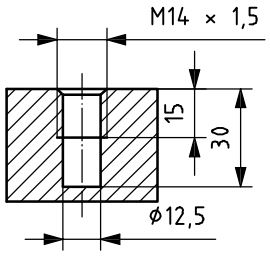
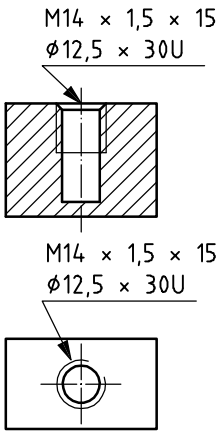
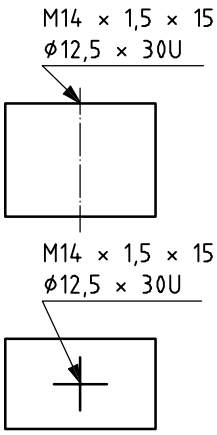
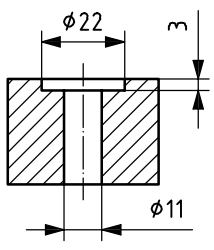
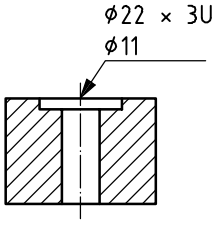
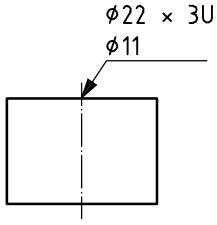
| No. | Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning | Explanation |
|---|---|---|---|---|
| 10 |  |  |  | Left-hand thread M10 with threaded length 25, cored hole bored through |
| 11 |  |  |  | Thread M10 with 20° countersink up to cored hole diameter, threaded length 25 and cored hole depth 30 |
| 12 |  |  |  | Fine taphole M14×1,5 with depth of thread 15 and cored hole diameter 12,5, cored hole depth 30 with flat hole bottom |
| 13 |  |  |  | Through-hole ∅11 with flat counterbore ∅22, counterbore depth 3 |

**Table A.1** (*continued*)

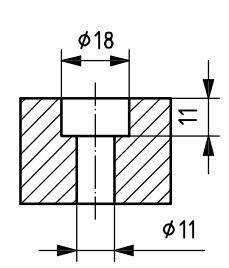
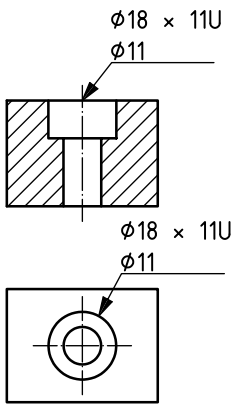
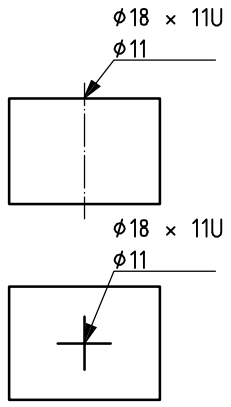
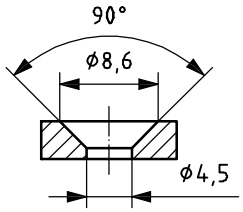
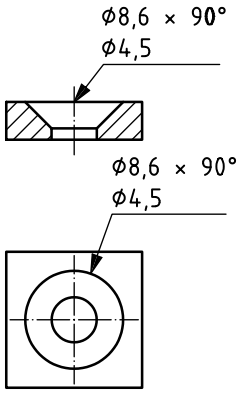
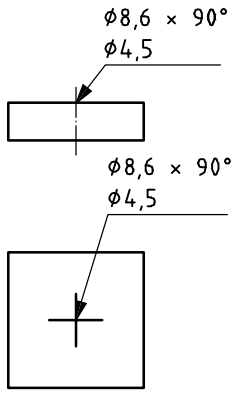
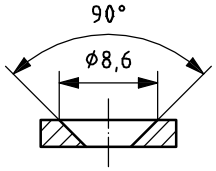
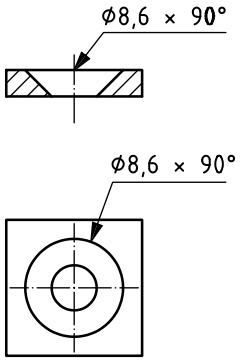
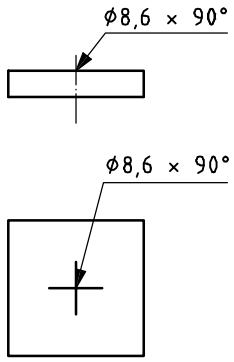
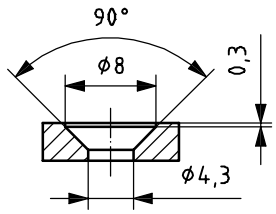
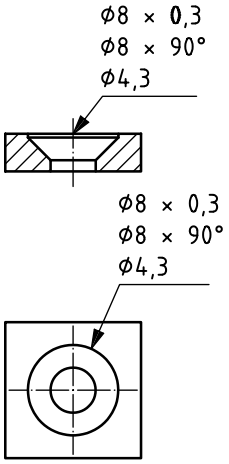
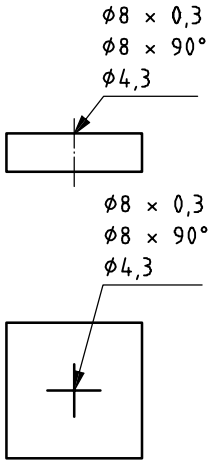
| No. | Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning | Explanation |
|---|---|---|---|---|
| 14 |  |  |  | Counterbore for cheese head screw M10, counterbore diameter ∅18, with flat hole bottom counterbore depth 11, through-hole ∅11 |
| 15 |  |  |  | Through-hole ∅4,5 with countersink of 90° and countersink diameter ∅8,6 |
| 16 |  |  |  | Conical countersink of 90° and countersink diameter ∅8,6 |

**Table A.1** (*continued*)

| No. | Complete representation and complete dimensioning according to ISO 129-1 | Complete representation and simplified dimensioning | Simplified representation and simplified dimensioning | Explanation |
|---|---|---|---|---|
| 17 |  |  |  | Cylindrical counterbore ∅8 with counterbore depth 0,3, through-hole ∅4,3 with conical countersink of 90° and countersink diameter ∅8 |

# Bibliography

[1] ISO 128-20:1996, *Technical drawings — General principles of presentation — Part 20: Basic conventions for lines*

[2] ISO 128-24, *Technical drawings — General principles of presentation — Part 24: Lines on mechanical engineering drawings*

[3] ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

[4] ISO 8015:1985, *Technical drawings — Fundamental tolerancing principle*

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