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**Hydraulic fluid power — Two-, three- and  
four-port screw-in cartridge valves —  
Cavities**

*Transmissions hydrauliques — Distributeurs à cartouche à visser à  
deux, trois et quatre orifices — Logements*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 7789 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

This second edition cancels and replaces the first edition (ISO 7789:1998), which has been technically revised. It also incorporates the Technical Corrigendum ISO 7789:1998/Cor.1:1999.

## Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Typical components found in such systems include hydraulic valves. These devices control flow direction, pressure or flow rate liquids in the enclosed circuit.

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# Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities

## 1 Scope

This International Standard specifies the dimensions and provides other data relating to cavities in which two-, three- and four-port, screw-in cartridge valves are mounted in order to ensure interchangeability.

It is applicable to two-, three- and four-port screw-in cartridge valves generally used in industrial and mobile equipment.

## 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 1101:2004, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 1219-1:2006, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 1302:2002, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 2768-1:1989, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 2768-2:1989, *General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications*

ISO 5598:—<sup>1)</sup>, *Fluid power systems and components — Vocabulary*

ISO 5783:1995, *Hydraulic fluid power — Code for identification of valve mounting surfaces and cartridge valve cavities*

ISO 6149-1:2006, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 1: Ports with truncated housing for O-ring seal*

ISO 16874:2004, *Hydraulic fluid power — Identification of manifold assemblies and their components*

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1) To be published. (Revision of ISO 5598:1985)

### 3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 5598 and the graphical symbols given in ISO 1219-1 apply.

### 4 Dimensions

**4.1** The dimensions of cavities for hydraulic screw-in cartridge valves with two-, three- and four-ports shall be selected from the figures and tables specified in 4.2 to 4.10.

**4.2** The dimensions of cavities for two-port valves (excluding pressure-relief valves) with 5 mm to 20,5 mm maximum port diameter are shown in Figure 1 and given in Table 1.

**4.3** The dimensions of cavities for two-port pressure-relief valves with 5 mm to 20,5 mm maximum port diameter and with a flow direction from port 1 to port 2, are shown in Figure 2 and given in Table 3.

**4.4** The dimensions of cavities for two-port pressure-relief valves with 6 mm to 20,5 mm maximum port diameter and with a flow direction from port 2 to port 1, are shown in Figure 3 and given in Table 5.

**4.5** The dimensions of cavities for three-port valves with 6 mm to 20,5 mm maximum port diameter are shown in Figure 4 and given in Table 7.

**4.6** The dimensions of cavities for four-port valves with 6 mm to 20,5 mm maximum port diameter are shown in Figure 5 and given in Table 9.

**4.7** The dimensions of cavities for two-port valves (excluding pressure-relief valves) with 10,5 mm to 20,5 mm maximum main port diameter and one pilot port are shown in Figure 6 and given in Table 11.

**4.8** The dimensions of cavities for two-port pressure-relief valves with 10,5 mm to 20,5 mm maximum main port diameter, one vent or pilot port and with a flow direction from port 1 to port 2 are shown in Figure 7 and given in Table 13.

**4.9** The dimensions of cavities for two-port pressure-relief valves with 10,5 mm to 20,5 mm maximum main port diameter, one vent or pilot port and with a flow direction from port 2 to port 1 are shown in Figure 8 and given in Table 15.

**4.10** The dimensions of cavities for three-port valves with 10,5 mm to 20,5 mm maximum main port diameter and one pilot port are shown in Figure 9 and given in Table 17.

### 5 Tolerances

Tolerances values for all dimensions and surface roughness are given in Figures 1 to 9 and in Tables 1, 3, 5, 7, 9, 11, 13, 15 and 17, in accordance with ISO 1101 and ISO 1302.

Tolerances for linear and angular dimensions shall be in accordance with the designation as described in ISO 2768-1.

Geometrical tolerances shall be in accordance with the designation as described in ISO 2768-2.

**NOTE** All figures in this International Standard indicate tolerance requirements using the ISO code "ISO 2768-mk" as described in ISO 2768-1 and ISO 2768-2.



## 6 Ports usage and identification

**6.1** Interchangeability of cartridge valves in the cavities defined by this International Standard requires uniform identifications and functions of the valve ports. Symbols for the valve types intended for use in each cavity are shown in Tables 2, 4, 6, 8, 10, 12, 14, 16 and 18. Port usage and identification (1, 2, 3 and 4) are shown on the symbols.

**6.2** The tabulated symbols illustrate general types of valves. Variations within each type shall conform to the port usage convention shown for that type.

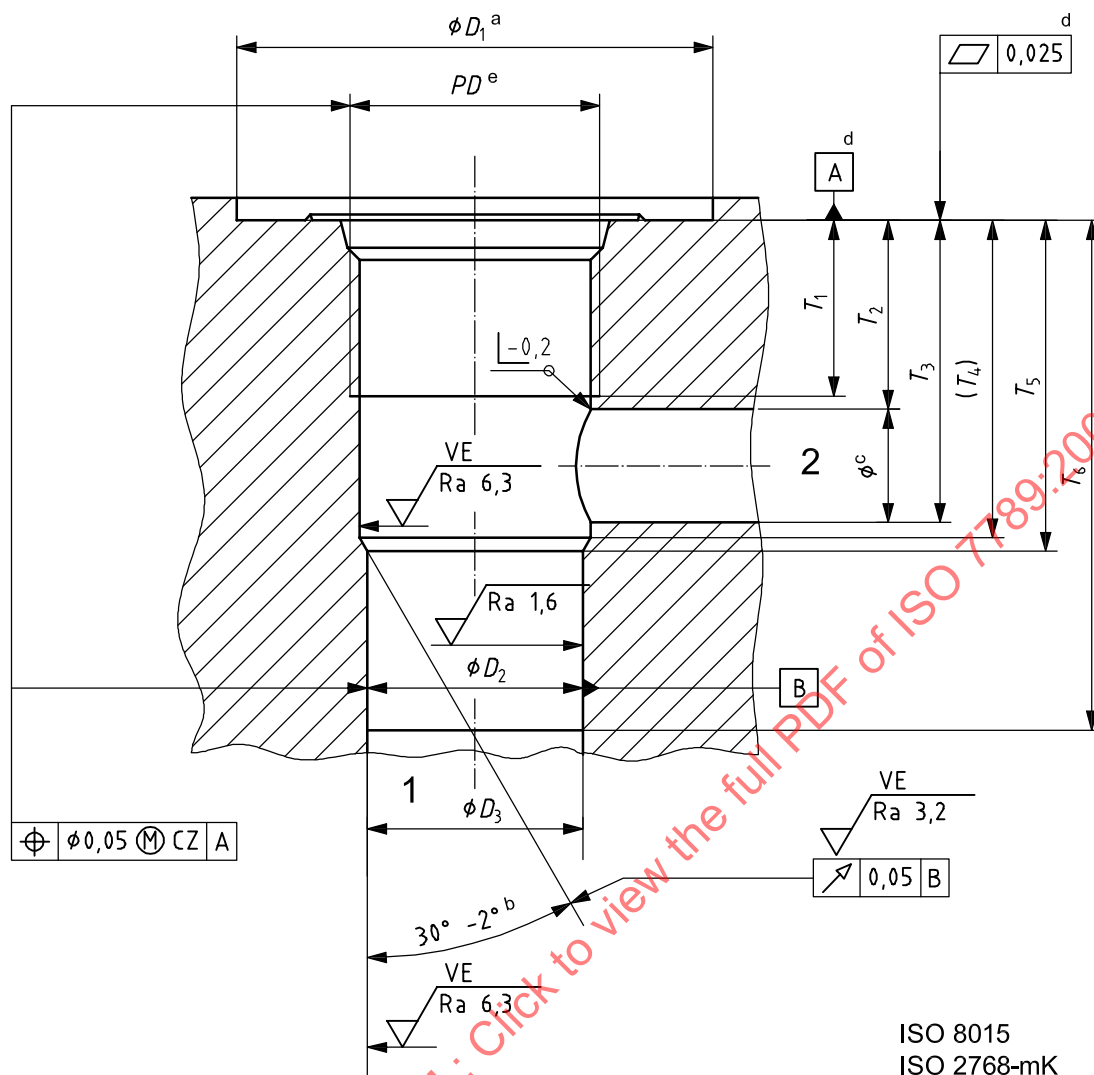
**6.3** Some of the tabulated symbols are commonly combined with other graphic elements to represent a complete valve. For example, the four-port directional control valve shown in Table 10 normally includes operators such as solenoids or springs. Interchangeability of such complete valves requires that the combined symbols, including the added elements, be identical as to port connection in each operator condition.

**6.4** The manifold identification shall be in accordance with ISO 16874.

## 7 Identification statement (Reference to this International Standard)

It is strongly recommended to manufacturers who choose to conform to this International Standard that the following statement be used in test reports, catalogues and sales literature:

“Cavity dimensions and port usage are in accordance with ISO 7789:2007, *Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities.*”

**Key**

1, 2, ports

NOTE The same designations are used in Table 2.

PD (thread) pitch diameter

VE visual examination

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area, the edge must be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

**Figure 1 — Cavities for two-port valves (excluding pressure-relief valves)  
with 5 mm to 20,5 mm maximum port diameter**

**Table 1 — Dimensions for cavities for two-port valves (excluding pressure-relief valves)  
with 5 mm to 20,5 mm maximum port diameter**

Dimensions in millimetres

| Parameter                          | Dimension by codification <sup>a</sup>        |            |            |            |            |            |
|------------------------------------|-----------------------------------------------|------------|------------|------------|------------|------------|
|                                    | 18-01-0-07                                    | 20-01-0-07 | 22-01-0-07 | 27-01-0-07 | 33-01-0-07 | 42-01-0-07 |
| Thread <sup>b</sup>                | M18×1,5                                       | M20×1,5    | M22×1,5    | M27×2      | M33×2      | M42×2      |
| $D_1$ min.                         | 32                                            | 38         | 42         | 48         | 58         | 74         |
| $D_2$ H8                           | 15                                            | 17         | 19         | 23         | 29         | 38         |
| $D_3$                              | 15                                            | 17         | 19         | 23         | 29         | 38         |
| $T_1$ min.                         | 14,5                                          | 14,5       | 15,5       | 19         | 19         | 19,5       |
| $T_2$ min.                         | 14,5                                          | 14,5       | 17         | 22         | 22         | 23         |
| $T_3$ max.                         | 19,5                                          | 20,5       | 27,5       | 35         | 38,5       | 43,5       |
| $(T_4)$                            | 20                                            | 21         | 28         | 35,5       | 39         | 44         |
| $T_5$ <sup>+0,4</sup> <sub>0</sub> | 21,3                                          | 22,3       | 29,3       | 37,2       | 40,7       | 45,7       |
| $T_6$                              | $T_6$ min. <sup>c</sup>                       | 29,5       | 30,5       | 38,5       | 46,5       | 56         |
|                                    | $T_6$ <sup>+1</sup> <sub>0</sub> <sup>d</sup> | 31         | 32         | 40         | 52         | 58         |

<sup>a</sup> Codification is in accordance with ISO 5783.

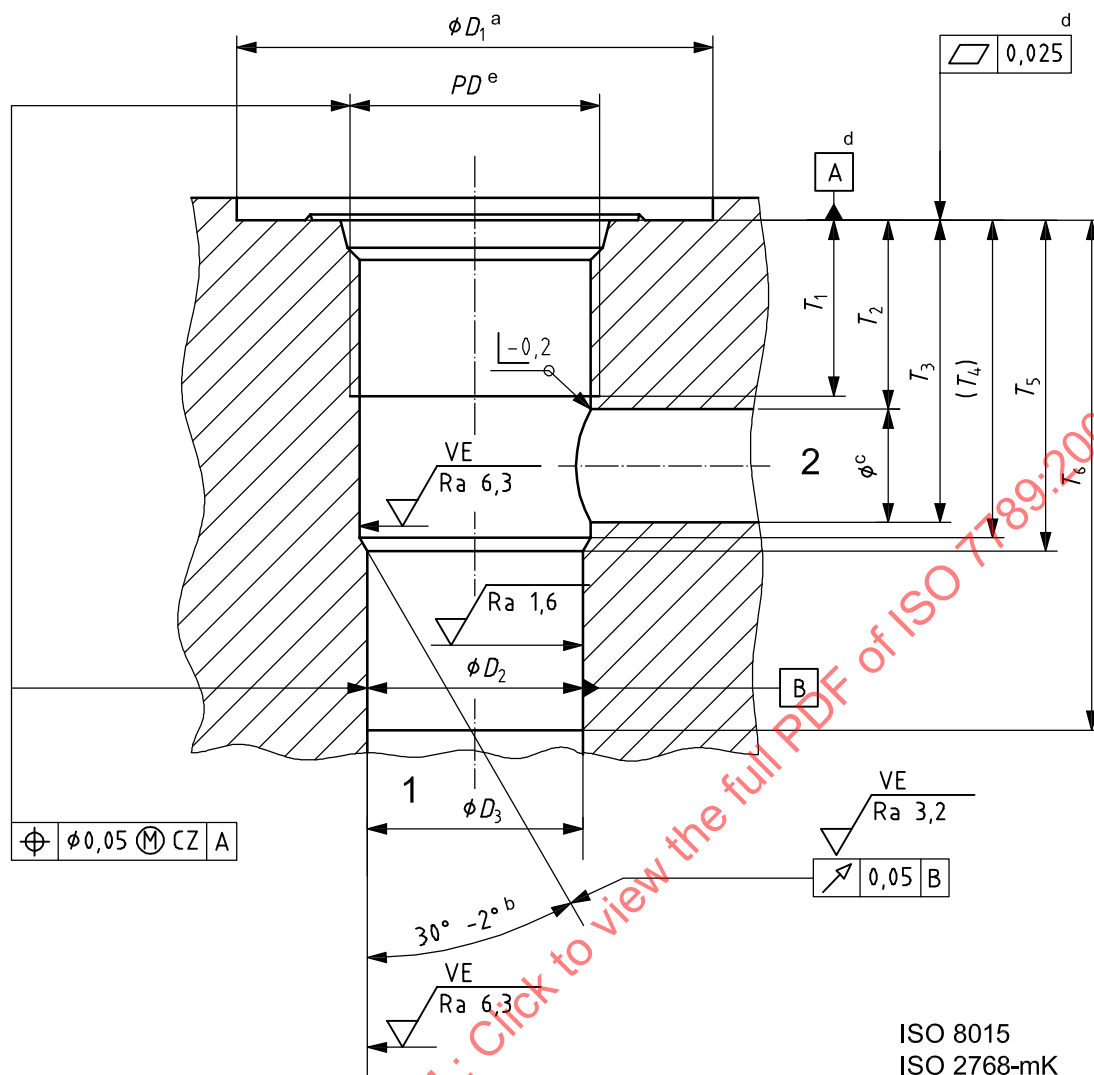
<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this International Standard).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_6$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

**Table 2 — Symbols for valves entering the cavities shown in Figure 1**

| Description                                                         | Symbol | Description                             | Symbol |
|---------------------------------------------------------------------|--------|-----------------------------------------|--------|
| Non-return valve                                                    |        | Throttle non-return valve               |        |
| Flow-control valve with free-flow return check                      |        | Pressure-compensated flow-control valve |        |
| Pressure-compensated flow control valve with free-flow return check |        | Two-port directional control valve      |        |
| Two-port directional control poppet (seat) valve                    |        |                                         |        |

**Key**

1, 2, ports

NOTE The same designations are used in Table 4.

 $PD$  (thread) pitch diameter

VE visual examination

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area; the edge shall be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

**Figure 2 — Cavities for two-port pressure-relief valves with 5 mm to 20,5 mm maximum port diameter and with a flow direction from port 1 to port 2**

**Table 3 — Dimensions for cavities for two-port pressure-relief valves with 5 mm to 20,5 mm maximum port diameter and with a flow direction from port 1 to port 2**

Dimensions in millimetres

| Parameter                          |                                               | Dimension by codification <sup>a</sup> |            |            |            |            |            |
|------------------------------------|-----------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|
|                                    |                                               | 18-02-0-07                             | 20-02-0-07 | 22-02-0-07 | 27-02-0-07 | 33-02-0-07 | 42-02-0-07 |
| Thread <sup>b</sup>                |                                               | M18×1,5                                | M20×1,5    | M22×1,5    | M27×2      | M33×2      | M42×2      |
| $D_1$ min.                         |                                               | 32                                     | 38         | 42         | 48         | 58         | 74         |
| $D_2$ H8                           |                                               | 13,5                                   | 15,5       | 17,5       | 21,5       | 27         | 36         |
| $D_3$                              |                                               | 13,5                                   | 15,5       | 17,5       | 21,5       | 27         | 36         |
| $T_1$ min.                         |                                               | 14,5                                   | 14,5       | 15,5       | 19         | 19         | 19,5       |
| $T_2$ min.                         |                                               | 14,5                                   | 14,5       | 17         | 22         | 22         | 23         |
| $T_3$ max.                         |                                               | 19,5                                   | 20,5       | 27,5       | 35         | 38,5       | 43,5       |
| $(T_4)$                            |                                               | 20                                     | 21         | 28         | 35,5       | 39         | 44         |
| $T_5$ <sup>+0,4</sup> <sub>0</sub> |                                               | 22,6                                   | 23,6       | 30,6       | 38,5       | 42,5       | 47,5       |
| $T_6$                              | $T_6$ min. <sup>c</sup>                       | 30,5                                   | 31,5       | 40         | 48         | 52         | 58         |
|                                    | $T_6$ <sup>+1</sup> <sub>0</sub> <sup>d</sup> | 32                                     | 33         | 41,5       | 49,5       | 54         | 60         |

<sup>a</sup> Codification is in accordance with ISO 5783.

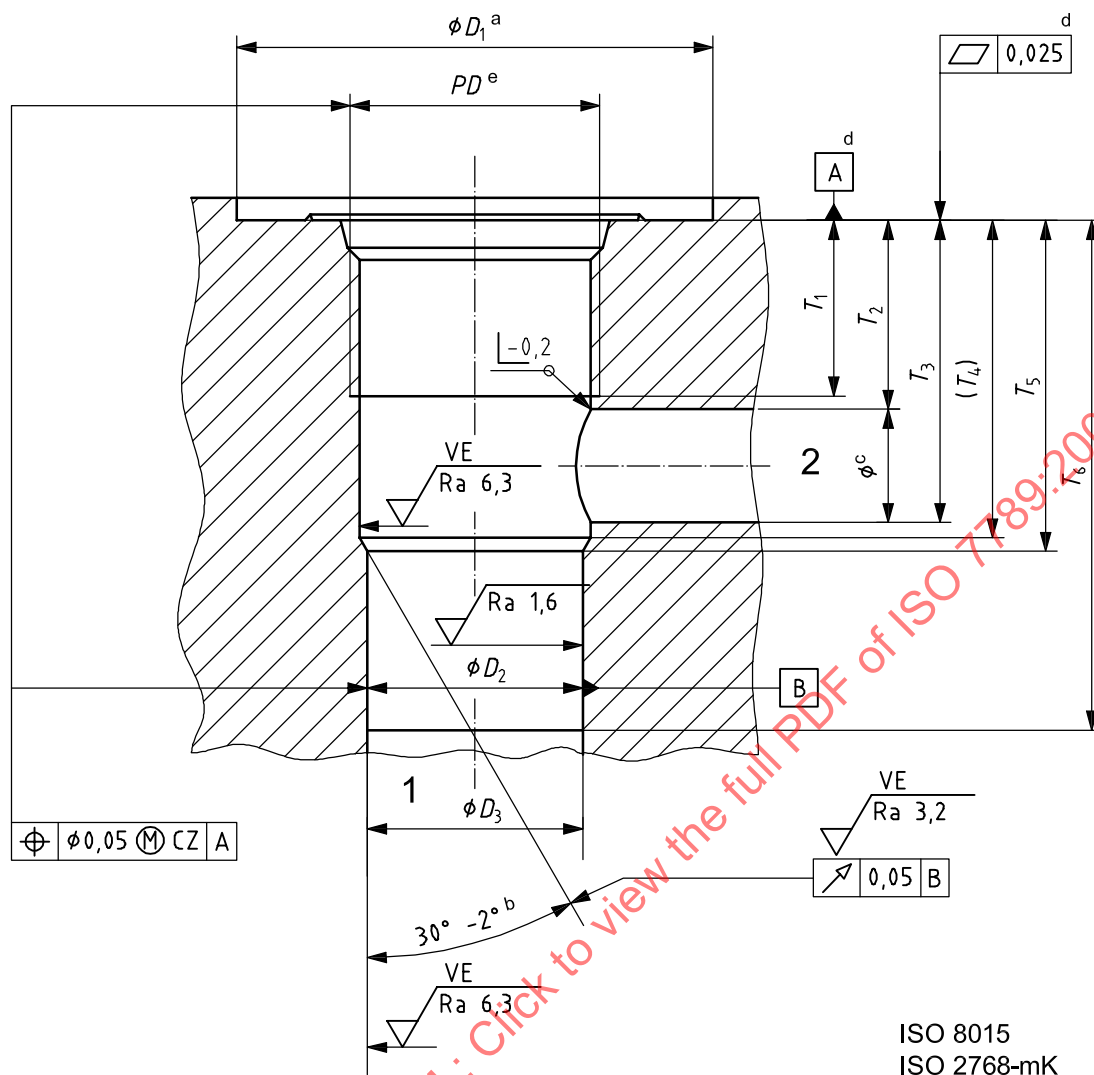
<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this International Standard).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_6$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

**Table 4 — Symbol for valves entering the cavities shown in Figure 2**

| Description                               | Symbol |
|-------------------------------------------|--------|
| Pressure-relief valve,<br>direct operated |        |
| Pressure-relief valve,<br>pilot operated  |        |

**Key**

1, 2, ports

NOTE The same designations are used in Table 6.

 $PD$  (thread) pitch diameter

VE visual examination

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area; the edge shall be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

**Figure 3 — Cavities for two-port pressure-relief valves with 6 mm to 20,5 mm maximum port diameter and with a flow direction from port 2 to port 1**

**Table 5 — Dimensions for cavities for two-port pressure-relief valves with 6 mm to 20,5 mm maximum port diameter and with a flow direction from port 2 to port 1**

Dimensions in millimetres

| Parameter                          |                                               | Dimension by codification <sup>a</sup> |            |            |            |            |
|------------------------------------|-----------------------------------------------|----------------------------------------|------------|------------|------------|------------|
|                                    |                                               | 20-03-0-07                             | 22-03-0-07 | 27-03-0-07 | 33-03-0-07 | 42-03-0-07 |
| Thread <sup>b</sup>                |                                               | M20×1,5                                | M22×1,5    | M27×2      | M33×2      | M42×2      |
| $D_1$ min.                         |                                               | 38                                     | 42         | 48         | 58         | 74         |
| $D_2$ H8                           |                                               | 14                                     | 16         | 20         | 25         | 34         |
| $D_3$                              |                                               | 14                                     | 16         | 20         | 25         | 34         |
| $T_1$ min.                         |                                               | 14,5                                   | 15,5       | 19         | 19         | 19,5       |
| $T_2$ min.                         |                                               | 14,5                                   | 17         | 22         | 22         | 23         |
| $T_3$ max.                         |                                               | 20,5                                   | 27,5       | 35         | 38,5       | 43,5       |
| $(T_4)$                            |                                               | 21                                     | 28         | 35,5       | 39         | 44         |
| $T_5$ <sup>+0,4</sup> <sub>0</sub> |                                               | 24,9                                   | 31,9       | 39,8       | 44,2       | 49,2       |
| $T_6$                              | $T_6$ min. <sup>c</sup>                       | 33                                     | 41         | 49         | 53,5       | 59,5       |
|                                    | $T_6$ <sup>+1</sup> <sub>0</sub> <sup>d</sup> | 34,5                                   | 42,5       | 50,5       | 55,5       | 61,5       |

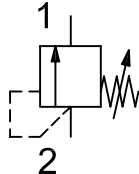
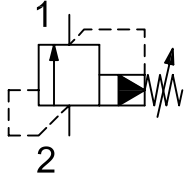
<sup>a</sup> Codification is in accordance with ISO 5783.

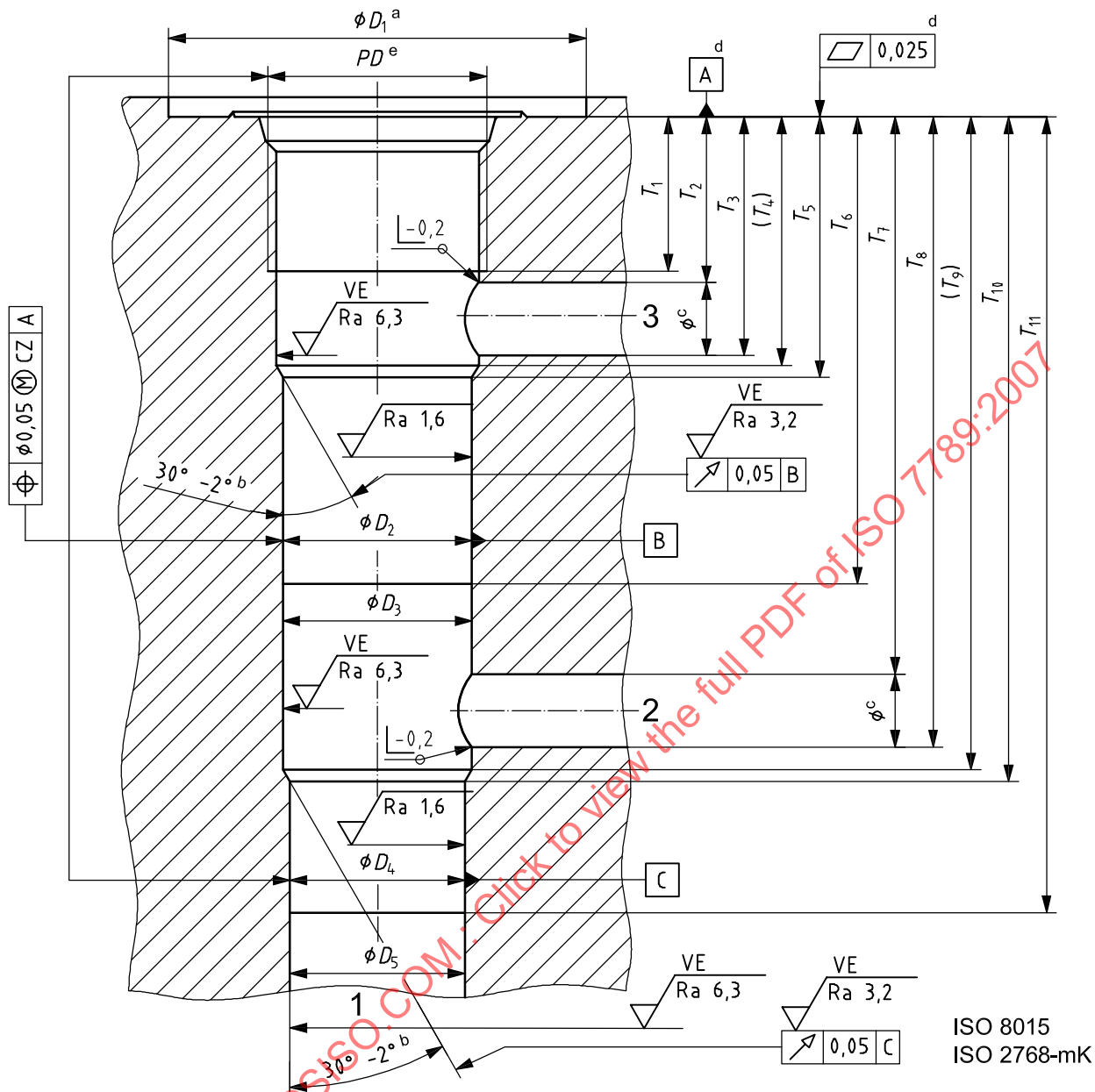
<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this document).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_6$ . For some valve types additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

**Table 6 — Symbol for valves entering the cavities shown in Figure 3**

| Description                            | Symbol                                                                               |
|----------------------------------------|--------------------------------------------------------------------------------------|
| Pressure-relief valve, direct operated |  |
| Pressure-relief valve, pilot operated  |  |

**Key**

1, 2 and 3, ports

 $PD$  (thread) pitch diameter

NOTE The same designations are used in Table 8.

VE visual examination

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area; the edge shall be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

**Figure 4 — Cavities for three-port valves with 6 mm to 20,5 mm maximum port diameter**



Table 7 — Dimensions for cavities for three-port valves with 6 mm to 20,5 mm maximum port diameter

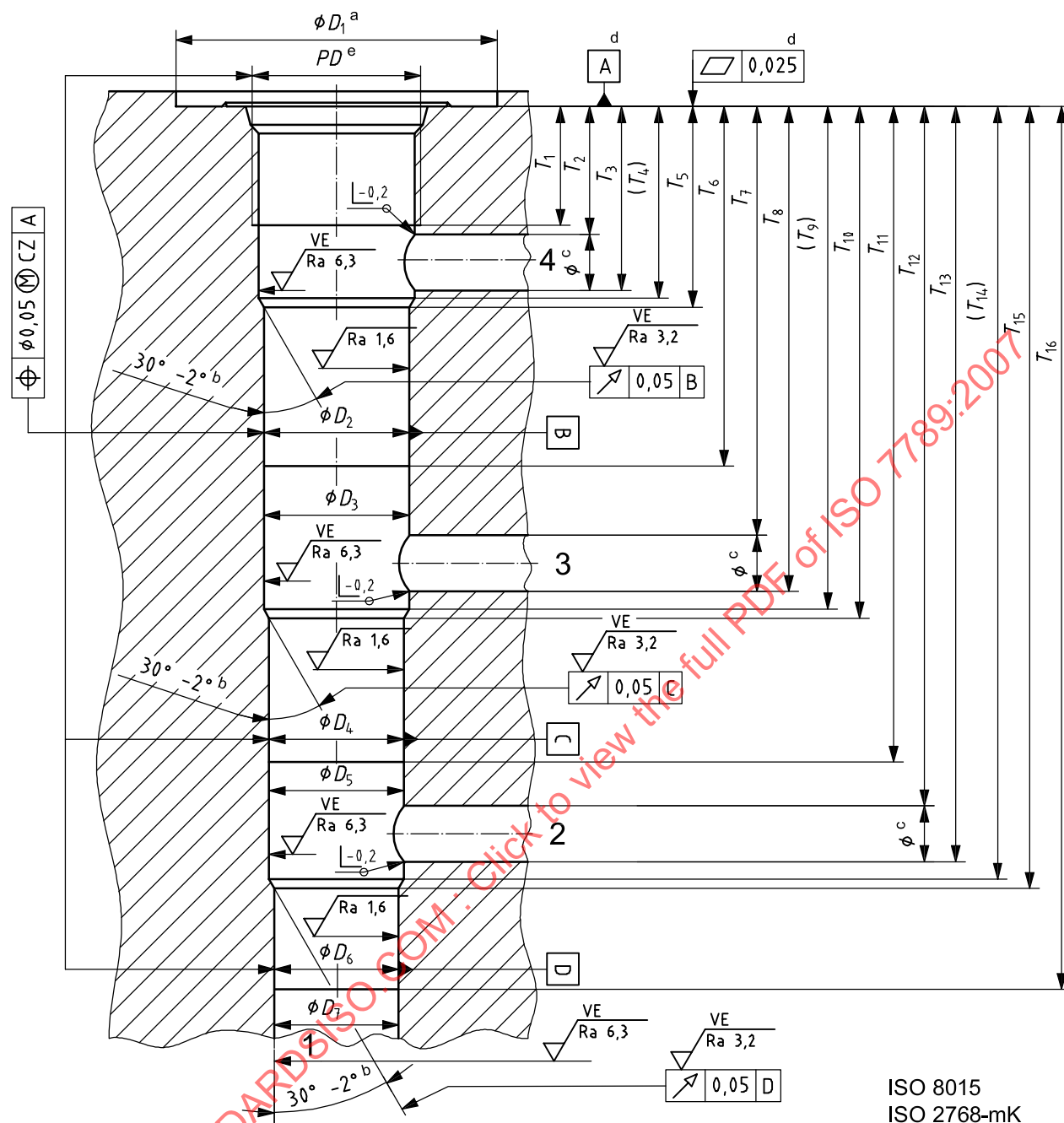
Dimensions in millimetres

| Parameter            | Dimension by codification <sup>a</sup> |            |            |            |            |
|----------------------|----------------------------------------|------------|------------|------------|------------|
|                      | 20-04-0-07                             | 22-04-0-07 | 27-04-0-07 | 33-04-0-07 | 42-04-0-07 |
| Thread <sup>b</sup>  | M20×1,5                                | M22×1,5    | M27×2      | M33×2      | M42×2      |
| $D_1$ min.           | 38                                     | 42         | 48         | 58         | 74         |
| $D_2$ H8             | 17                                     | 19         | 23         | 29         | 38         |
| $D_3$                | 17                                     | 19         | 23         | 29         | 38         |
| $D_4$ H8             | 15,5                                   | 17         | 21         | 27         | 36         |
| $D_5$                | 15,5                                   | 17         | 21         | 27         | 36         |
| $T_1$ min.           | 14,5                                   | 15,5       | 19         | 19         | 19,5       |
| $T_2$ min.           | 14,5                                   | 17         | 22         | 22         | 23         |
| $T_3$ max.           | 20,5                                   | 27,5       | 35         | 38,5       | 43,5       |
| $(T_4)$              | 21                                     | 28         | 35,5       | 39         | 44         |
| $T_5$ $^{+0,4}_0$    | 22,3                                   | 29,3       | 37,2       | 40,7       | 45,7       |
| $T_6$ min.           | 30,3                                   | 37,3       | 45,2       | 48,7       | 53,7       |
| $T_7$ min.           | 30,5                                   | 38,5       | 46,5       | 50         | 56         |
| $T_8$ max.           | 36,5                                   | 49         | 59,5       | 66,5       | 76,5       |
| $(T_9)$              | 37                                     | 49,5       | 60         | 67         | 77         |
| $T_{10}$ $^{+0,4}_0$ | 38,3                                   | 51,2       | 61,7       | 68,7       | 78,7       |
| $T_{11}$             | $T_{11}$ min. <sup>c</sup>             | 46,5       | 60,5       | 78         | 89         |
|                      | $T_{11}$ $^{+1}_0$ <sup>d</sup>        | 48         | 62         | 80         | 91         |

<sup>a</sup> Codification is in accordance with ISO 5783.<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this International Standard).<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_{11}$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

Table 8 — Symbols for valves entering the cavities shown in Figure 4

| Description                                        | Symbol | Description                                          | Symbol |
|----------------------------------------------------|--------|------------------------------------------------------|--------|
| Three-port directional control valve               |        | Three-port directional control valve                 |        |
| Three-port directional control poppet (seat) valve |        | Three-port directional control poppet (seat) valve   |        |
| Shuttle valve                                      |        | Three-port flow control valve                        |        |
| Pressure-reducing valve, direct operated           |        | Pressure-reducing valve with relief, direct operated |        |
| Pressure-reducing valve, pilot operated            |        | Pressure-reducing valve with relief, pilot operated  |        |

**Key**

1, 2 and 3, ports

NOTE The same designations are used in Table 10.

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area; the edge shall be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

 $PD$  (thread) pitch diameter $VE$  visual examinationISO 8015  
ISO 2768-mK**Figure 5 — Cavities for four-port valves with 6 mm to 20,5 mm maximum port diameter**

Table 9 — Dimensions for cavities for four-port valves with 6 mm to 20,5 mm maximum port diameter

Dimensions in millimetres

| Parameter                             | Dimension by codification <sup>a</sup>           |            |            |            |            |
|---------------------------------------|--------------------------------------------------|------------|------------|------------|------------|
|                                       | 20-05-0-07                                       | 22-05-0-07 | 27-05-0-07 | 33-05-0-07 | 42-05-0-07 |
| Thread <sup>b</sup>                   | M20×1,5                                          | M22×1,5    | M27×2      | M33×2      | M42×2      |
| $D_1$ min.                            | 38                                               | 42         | 48         | 58         | 74         |
| $D_2$ H8                              | 17                                               | 19         | 23         | 29         | 38         |
| $D_3$                                 | 17                                               | 19         | 23         | 29         | 38         |
| $D_4$ H8                              | 15,5                                             | 17         | 21         | 27         | 36         |
| $D_5$                                 | 15,5                                             | 17         | 21         | 27         | 36         |
| $D_6$ H8                              | 14                                               | 15         | 19         | 25         | 34         |
| $D_7$                                 | 14                                               | 15         | 19         | 25         | 34         |
| $T_1$ min.                            | 14,5                                             | 15,5       | 19         | 19         | 19,5       |
| $T_2$ min.                            | 14,5                                             | 17         | 22         | 22         | 23         |
| $T_3$ max.                            | 20,5                                             | 27,5       | 35         | 38,5       | 43,5       |
| ( $T_4$ )                             | 21                                               | 28         | 35,5       | 39         | 44         |
| $T_5$ <sup>+0,4</sup> <sub>0</sub>    | 22,3                                             | 29,3       | 37,2       | 40,7       | 45,7       |
| $T_6$ min.                            | 30,3                                             | 37,3       | 45,2       | 48,7       | 53,7       |
| $T_7$ min.                            | 30,5                                             | 38,5       | 46,5       | 50         | 56         |
| $T_8$ max.                            | 36,5                                             | 49         | 59,5       | 66,5       | 76,5       |
| ( $T_9$ )                             | 37                                               | 49,5       | 60         | 67         | 77         |
| $T_{10}$ <sup>+0,4</sup> <sub>0</sub> | 38,3                                             | 51,2       | 61,7       | 68,7       | 78,7       |
| $T_{11}$ min.                         | 46,3                                             | 59,2       | 69,7       | 76,7       | 86,7       |
| $T_{12}$ min.                         | 46,5                                             | 60,5       | 71         | 78         | 89         |
| $T_{13}$ max.                         | 52,5                                             | 71         | 84         | 94,5       | 109,5      |
| ( $T_{14}$ )                          | 53                                               | 71,5       | 84,5       | 95         | 110        |
| $T_{15}$ <sup>+0,4</sup> <sub>0</sub> | 54,3                                             | 73,2       | 86,2       | 96,7       | 111,7      |
| $T_{16}$                              | $T_{16}$ min <sup>c</sup>                        | 62,5       | 82,5       | 95,5       | 106        |
|                                       | $T_{16}$ <sup>+1</sup> <sub>0</sub> <sup>d</sup> | 64         | 84         | 97         | 108        |

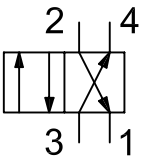
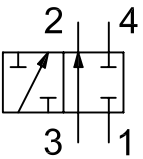
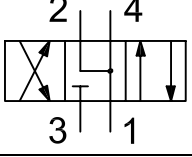
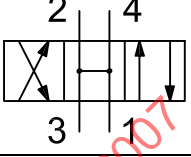
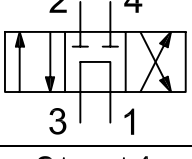
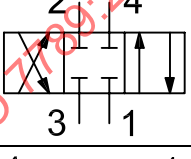
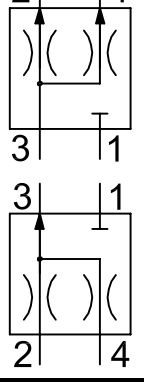
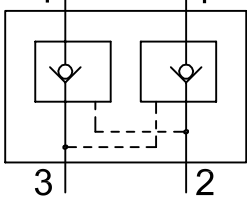
<sup>a</sup> Codification is in accordance with ISO 5783.

<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this International Standard).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

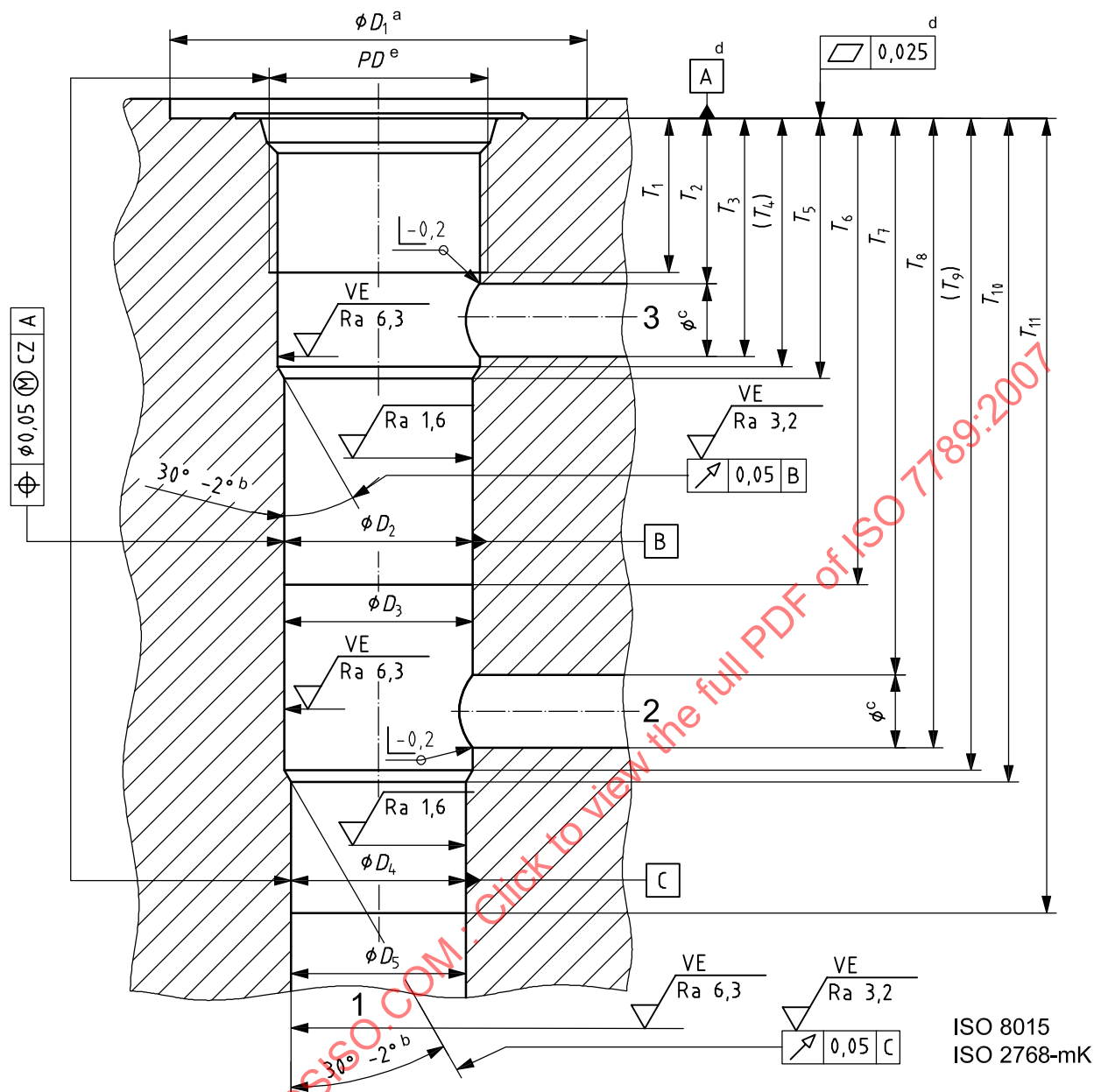
<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_{16}$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

Table 10 — Symbols for valves entering the cavities shown in Figure 5

| Description                                         | Symbol                                                                             | Description                                                | Symbol                                                                               |
|-----------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Four-port directional control valve                 |   | Diverter valve                                             |   |
| Four-port directional control valve<br>Motor Spool  |   | Four-port directional control valve<br>Open centre spool   |   |
| Four-port directional control valve<br>Tandem Spool |   | Four-port directional control valve<br>Closed centre spool |   |
| Divider-combiner valve                              |  | Pilot to open,<br>non-return valve<br>double               |  |

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**Key**

1, 2 and 3, ports

 $PD$  (thread) pitch diameter

NOTE The same designations are used in Table 12.

VE visual examination

<sup>a</sup> The dimensions given are the minimum space required for a screw-in cartridge valve with an allowance for using an axially fitting tool, such as a box spanner, to tighten the cartridge; if it is necessary to use a flat spanner, then adequate clearance should be provided.

This is also the minimum recommended distance between centres of two similarly sized cavities.

Connectors on electrically operated valves may exceed this space dimension and allowance shall be made for fitting and removing any such connectors.

<sup>b</sup> No burrs permitted in this area; the edge shall be rounded.

The cavity geometry is normally produced with an appropriate multi-diameter form tool. Sharp edges should be avoided by rounding to a radius of 0,1 mm to 0,2 mm.

<sup>c</sup> Radial groove optional.

<sup>d</sup> Datum area inside ring nose.

<sup>e</sup> The port is in accordance with ISO 6149-1.

**Figure 6 — Cavities for two-port valves (excluding pressure-relief valves) with 10,5 mm to 20,5 mm maximum main port diameter and one-pilot port**

**Table 11 — Dimensions for cavities for two-port valves (excluding pressure-relief valves) with 10,5 mm to 20,5 mm maximum main port diameter and one-pilot port**

Dimensions in millimetres

| Parameter            | Dimension by codification <sup>a</sup> |            |            |            |
|----------------------|----------------------------------------|------------|------------|------------|
|                      | 22-06-0-07                             | 27-06-0-07 | 33-06-0-07 | 42-06-0-07 |
| Thread <sup>b</sup>  | M22×1,5                                | M27×2      | M33×2      | M42×2      |
| $D_1$ min.           | 42                                     | 48         | 58         | 74         |
| $D_2$ H8             | 19                                     | 23         | 29         | 38         |
| $D_3$                | 19                                     | 23         | 29         | 38         |
| $D_4$ H8             | 17                                     | 21         | 27         | 36         |
| $D_5$                | 17                                     | 21         | 27         | 36         |
| $T_1$ min.           | 15,5                                   | 19         | 19         | 19,5       |
| $T_2$ min.           | 17                                     | 21,5       | 21         | 21,5       |
| $T_3$ max.           | 21,5                                   | 26         | 25,5       | 26         |
| $(T_4)$              | 22                                     | 26,5       | 26         | 26,5       |
| $T_5$ $^{+0,4}_0$    | 23,3                                   | 28,2       | 27,7       | 28,2       |
| $T_6$ min.           | 31,3                                   | 36,2       | 35,7       | 36,2       |
| $T_7$ min.           | 32,5                                   | 37,5       | 37         | 38,5       |
| $T_8$ max.           | 43                                     | 50,5       | 53,5       | 59         |
| $(T_9)$              | 43,5                                   | 51         | 54         | 59,5       |
| $T_{10}$ $^{+0,4}_0$ | 45,2                                   | 52,7       | 55,7       | 61,2       |
| $T_{11}$             | $T_{11}$ min. <sup>c</sup>             | 54,5       | 62         | 65         |
|                      | $T_{11}$ $^{+1}_0$ <sup>d</sup>        | 56         | 63,5       | 67         |
|                      |                                        |            |            |            |
|                      |                                        |            |            |            |

<sup>a</sup> Codification is in accordance with ISO 5783.

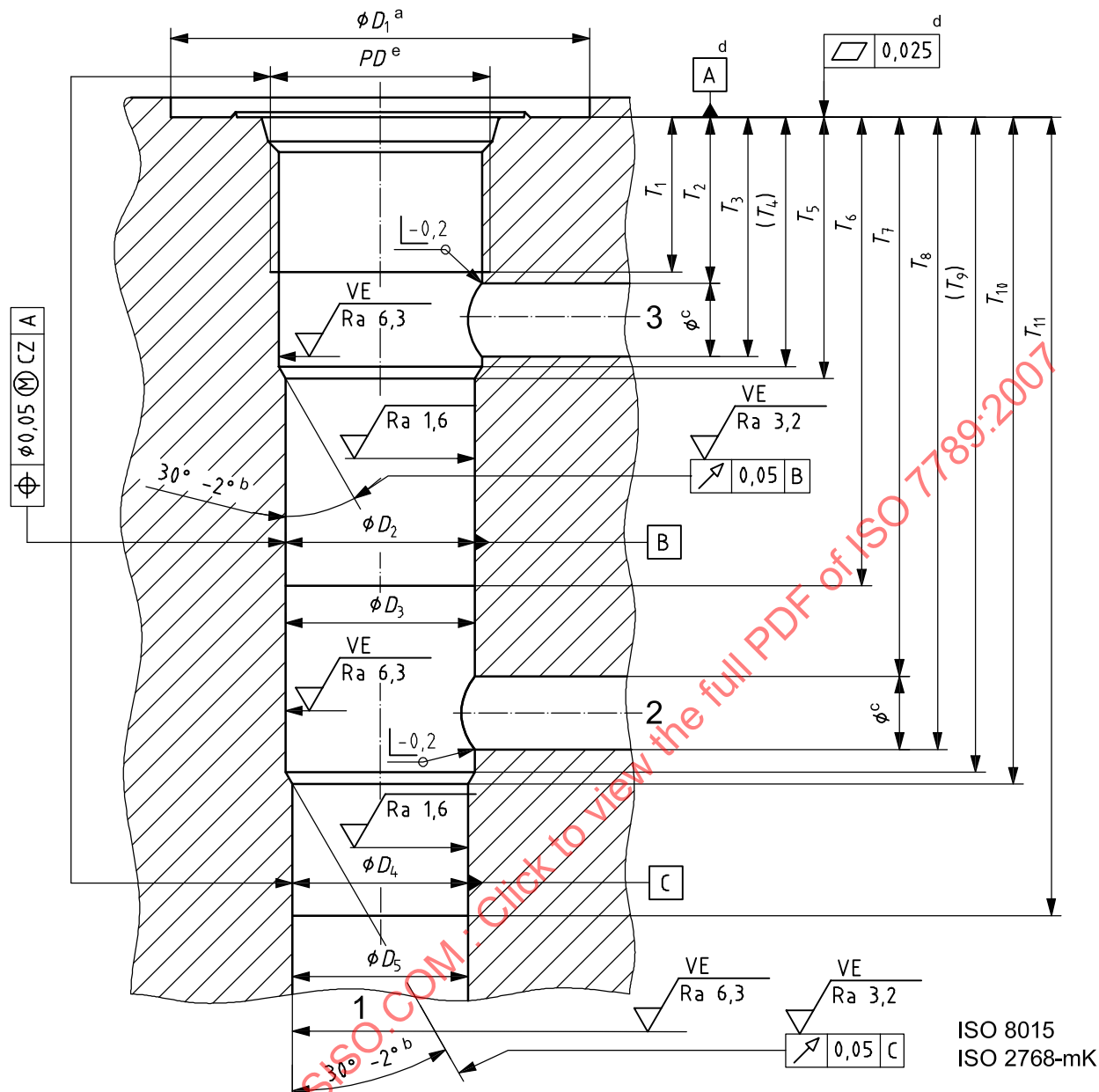
<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this International Standard).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_{11}$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

**Table 12 — Symbols for valves entering the cavities shown in Figure 6**

| Description                                  | Symbol | Description                                 | Symbol |
|----------------------------------------------|--------|---------------------------------------------|--------|
| Sequence valve, direct operated              |        | Sequence valve, pilot operated              |        |
| Accumulator unloading valve, direct operated |        | Accumulator unloading valve, pilot operated |        |
| Pilot to open, non-return valve              |        | Pilot to close, non-return valve            |        |
| Counter balance valve                        |        |                                             |        |



**Figure 7 — Cavities for two-port pressure-relief valves with 10,5 mm to 20,5 mm maximum main port diameter, one vent or pilot port and with a flow direction from port 1 to port 2**



**Table 13 — Dimensions for cavities for two-port pressure-relief valves with 10,5 mm to 20,5 mm maximum main port diameter, one vent or pilot port and with a flow direction from port 1 to port 2**

Dimensions in millimetres

| Parameter            |                                 | Dimension by codification <sup>a</sup> |            |            |            |
|----------------------|---------------------------------|----------------------------------------|------------|------------|------------|
|                      |                                 | 22-07-0-07                             | 27-07-0-07 | 33-07-0-07 | 42-07-0-07 |
| Thread <sup>b</sup>  |                                 | M22×1,5                                | M27×2      | M33×2      | M42×2      |
| $D_1$ min.           |                                 | 42                                     | 48         | 58         | 74         |
| $D_2$ H8             |                                 | 19                                     | 23         | 29         | 38         |
| $D_3$                |                                 | 19                                     | 23         | 29         | 38         |
| $D_4$ H8             |                                 | 15,5                                   | 19,5       | 25         | 34         |
| $D_5$                |                                 | 15,5                                   | 19,5       | 25         | 34         |
| $T_1$ min.           |                                 | 15,5                                   | 19         | 19         | 19,5       |
| $T_2$ min.           |                                 | 17                                     | 21,5       | 21         | 21,5       |
| $T_3$ max.           |                                 | 21,5                                   | 26         | 25,5       | 26         |
| $(T_4)$              |                                 | 22                                     | 26,5       | 26         | 26,5       |
| $T_5$ $^{+0,4}_0$    |                                 | 23,3                                   | 28,2       | 27,7       | 28,2       |
| $T_6$ min.           |                                 | 31,3                                   | 36,2       | 35,7       | 36,2       |
| $T_7$ min.           |                                 | 32,5                                   | 37,5       | 37         | 38,5       |
| $T_8$ max.           |                                 | 43                                     | 50,5       | 53,5       | 59         |
| $(T_9)$              |                                 | 43,5                                   | 51         | 54         | 59,5       |
| $T_{10}$ $^{+0,4}_0$ |                                 | 46,5                                   | 54         | 57,5       | 63         |
| $T_{11}$             | $T_{11}$ min. <sup>c</sup>      | 56                                     | 63,5       | 67         | 73,5       |
|                      | $T_{11}$ $^{+1}_0$ <sup>d</sup> | 57,5                                   | 65         | 69         | 75,5       |

<sup>a</sup> Codification is in accordance with ISO 5783.

<sup>b</sup> The port is in accordance with ISO 6149-1 (relevant for dimensions and tolerances not specified in this document).

<sup>c</sup> This dimension is the minimum finished length required for the sealing diameter on the cartridge.

<sup>d</sup> Suggested pre-machining depth to obtain appropriate diameter tolerance for  $T_{11}$ . For some valve types, additional pilot drill dimensions may be specified by the valve manufacturer to provide clearance for an extension to the valve and/or to allow for minimum fluid flow path in this area.

**Table 14 — Symbol for valves entering the cavities shown in Figure 7**

| Description                                                       | Symbol |
|-------------------------------------------------------------------|--------|
| Pressure-relief valve with ventable or pilot port, pilot operated |        |