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**Hydraulic fluid power — Two-, three-  
and four-port screw-in cartridge  
valves — Cavities with ISO 725 (UN  
and UNF) threads**

*Transmissions hydrauliques — Distributeurs à cartouche à visser à deux,  
trois et quatre orifices — Logements avec filetage ISO 725 (UN et UNF)*



Reference number  
ISO/TR 17209:2013(E)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. [www.iso.org/directives](http://www.iso.org/directives)

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. [www.iso.org/patents](http://www.iso.org/patents)

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

## 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 of liquids in the enclosed circuit.

Screw-in cartridge valves are becoming increasingly popular in hydraulic fluid power applications worldwide. The number of manufacturers of these products has grown substantially in recent years. The application of these products requires the use of a valve cavity prepared by machining. The specifications for the machined cavity can come from a source other than the manufacturer of the cartridge valve to be used. An ISO document for these cavities was needed to ensure interchangeability.

In recognition of this need, an International Standard, ISO 7789:1998, for screw-in cartridge valve cavities with metric threads was developed. The aim of ISO 7789 was a new range of cavities for which a full range of valve functions and sizes are not yet available.

The purpose of this ISO Technical Report is to provide a series of cavities and sizes with ISO 725 UN and UNF threads and sizes that match the fit requirements of the majority of cartridge valves produced and applied worldwide today.

It is not proposed that this Technical Report replace ISO 7789. It is needed to enhance uniform interchangeability in the use of existing products which use ports with UN and UNF (inch) threads, are in worldwide use today and continue to be produced in ever-increasing quantities and valve functions. This Technical Report uses the port form and thread in the existing ISO 11926-1.

This Technical Report fulfils the following five points, which are the priorities agreed upon by ISO/TC 131.

- The Technical Report is needed to ensure functionality in fluid power applications of cartridge valves. Currently, the user has no assurance that a cartridge valve of the same basic size actually fits properly into a cavity of the same basic size if it was made to a different manufacturer's specification.
- The ability of screw-in cartridge valves to fit into customized applications is an important factor in choosing fluid power over other means of motion control.
- A Technical Report for the screw-in cartridge valve cavities currently in use allows users to make performance comparisons in selecting valves.
- A Technical Report for the screw-in cartridge valve cavities currently in use simplifies selection and application of valves.
- A Technical Report for the screw-in cartridge valve cavities currently in use can result in less variety of non-standard cavities. It can also simplify tooling selection in the manufacture of manifold systems.

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# Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities with ISO 725 (UN and UNF) threads

## 1 Scope

This Technical Report specifies the dimensions and provides other data relating to cavities with ISO 725 UN and UNF threads in which two-, three-, and four-port screw-in cartridge valves are mounted, in order to ensure dimensional interchangeability.

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

## 2 Normative references

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

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

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

ISO 5598, *Fluid power systems and components — Vocabulary*

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

ISO 9461, *Hydraulic fluid power — Identification of valve ports, subplates, control devices and solenoids*

ISO 11926-1, *Connections for general use and fluid power — Ports and stud ends with ISO 263 UN and UNF threads and O-ring sealing — Part 1: Ports with truncated housing for O-ring seal*

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

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 apply.

## 4 Dimensions

The dimensions of cavities for hydraulic screw-in cartridge valves with two, three and four ports are shown in [Figures 1](#) through [4](#) and given in [Tables 1](#) through [4](#).

## 5 Tolerances

5.1 Tolerance values for all dimensions and surface roughness are given in [Figures 1](#) through [4](#) and [Tables 1](#) through [4](#) and are expressed in accordance with ISO 1101 and ISO 1302.

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

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

NOTE All figures in this Technical Report indicate tolerance requirements using the ISO code “ISO 2768-mK” as described in ISO 2768-1 and ISO 2768-2.

## 6 Cavity usage and identification and marking of valve function

### 6.1 General

This Technical Report provides features and dimensions for cavities which allow for dimensional interchangeability of cartridge valves that can have different functions (directional control, pressure control, non-return [check], etc.)

### 6.2 Current and past cavity usage

This Technical Report provides features and dimensions for cavities that allow for dimensional interchangeability of many of the cartridge valves that existed at the time of publication of this Technical Report.

**CAUTION — Any cavity might be able to accept cartridge valves with different functions.**

### 6.3 Identification and marking of valve function

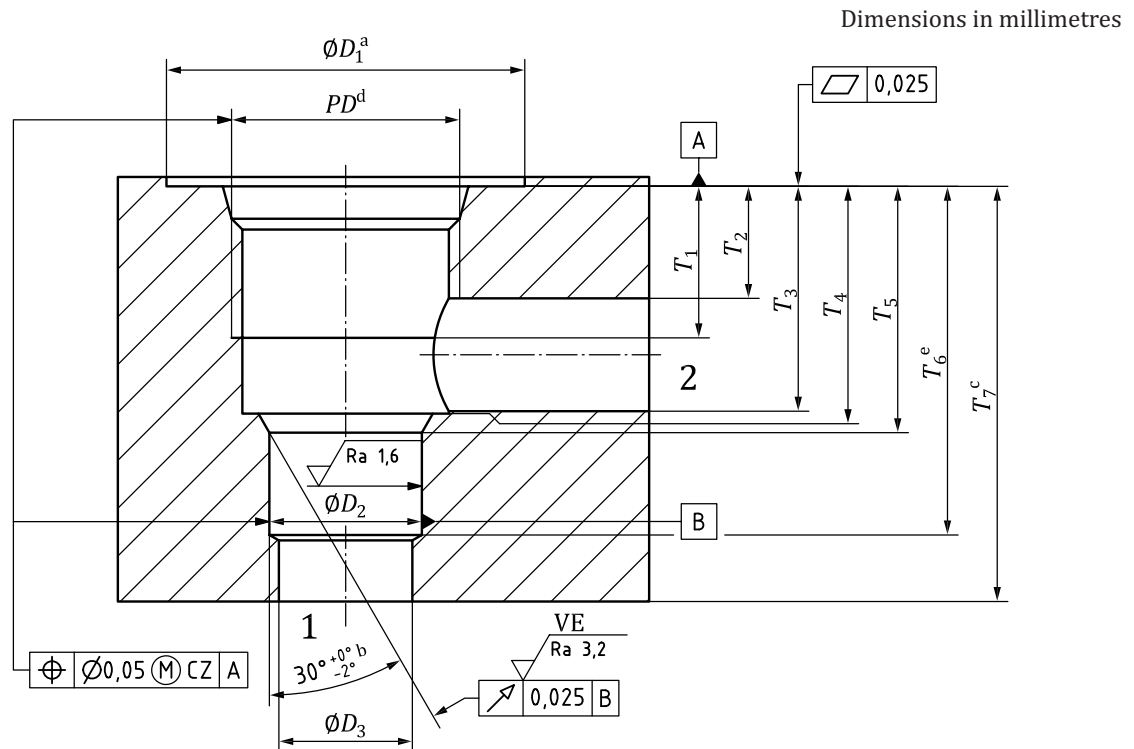
The functions of cartridge valves used in cavities that conform to this Technical Report and are part of a manifold shall be identified in accordance with ISO 9461 and marked on the manifold in accordance with ISO 16874.

## 7 Identification statement (reference to this Technical Report)

It is strongly recommended that manufacturers use the following statement in test reports, catalogues and sales literature when electing to comply with this Technical Report.

“Hydraulic cartridge valve cavities are in accordance with ISO/TR 17209, *Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities with ISO 725 (UN and UNF) threads.*”





**Key**

1, 2 ports

*PD* (thread) pitch diameter

VE visual examination

a 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 cavities of similar size.

Connectors on electrically operated valves and adjustment features on other cartridge valves may exceed this space dimension, and allowance shall be made for fitting and removing such connectors and cartridge valves.

b The lead-in angle and other data of cavity form are 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.

c Suggested pre-machining depth to obtain appropriate diameter tolerance for dimension  $T_6$ . For some valve types, the valve manufacturer specifies additional pilot drill dimensions to provide clearance for an extension to the valve or to allow for minimum fluid flow path in this area.

d The port is in accordance with ISO 11926-1.

e Dimension  $T_6$  is the minimum finished length required for the sealing diameter on the cartridge valve.

NOTE ISO 8015, ISO 2768-mK

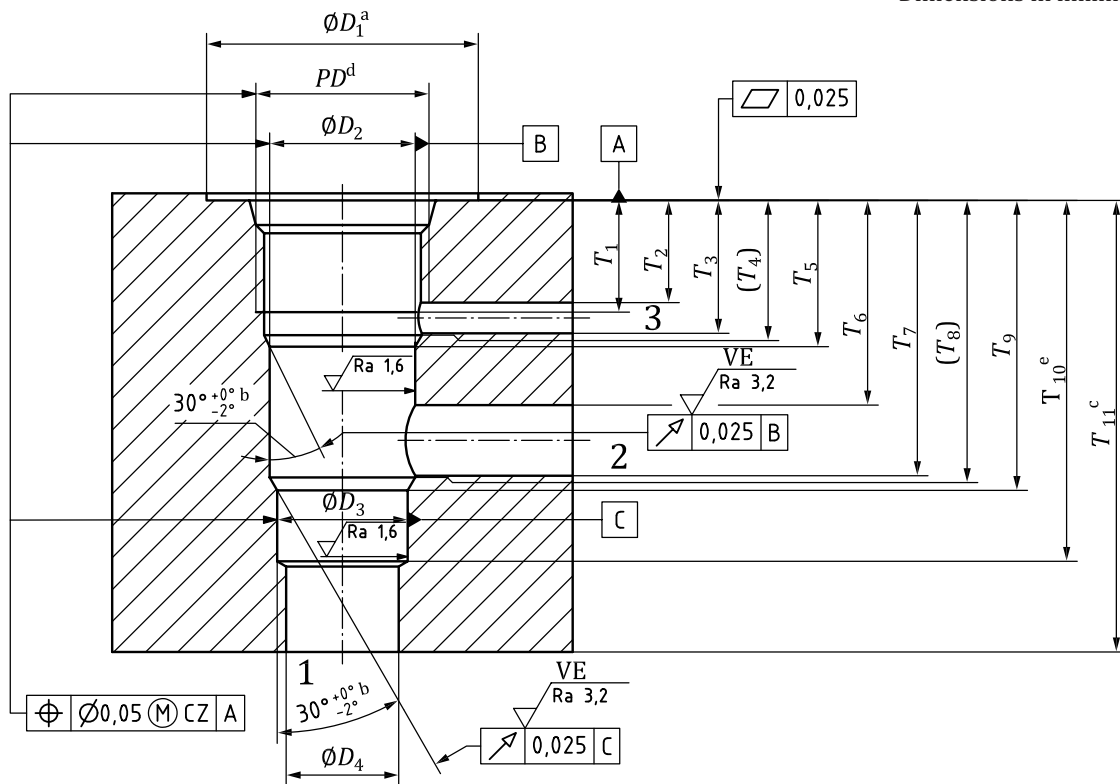
**Figure 1 — Cavity for two-port cartridge valves**

**Table 1 — Dimensions of cavities for two-port cartridge valves**

Dimensions in millimetres

Dimension		Dimension by codification <sup>a</sup>					
	tol.	3/4-01-0-13	7/8-01-0-13	1 1/16-01-0-13	1 1/16-01-1-13	1 5/16-01-0-13	1 5/8-01-0-13
Thread <sup>b</sup>		3/4-16 UNF-2B	7/8-14 UNF-2B	1 1/16-12 UN-2B	1 1/16-12 UN-2B	1 5/16-12 UN-2B	1 5/8-12 UN-2B
$D_1$	min	30,00	34,00	41,00	41,00	49,00	58,00
$D_2$	+0,05 -0	12,70	15,87	22,22	23,82	28,60	36,52
$D_3$	max	12,70	15,87	22,22	23,82	28,60	36,52
$T_1$	min	14,30	16,00	20,60	20,60	22,50	20,60
$T_2$	min	9,50	12,30	17,00	17,00	15,00	18,00
$T_3$	max	18,95	23,60	35,40	35,40	34,10	44,30
$T_4$	+0,4 -0	19,05	23,70	35,50	35,50	34,20	44,40
$T_5$	+0,4 -0	20,63	25,30	37,10	37,10	35,80	46,00
$T_6$	min	28,60	33,33	47,00	47,00	47,00	58,70
$T_7$		—	—	—	—	—	—
<sup>a</sup> Codification is in accordance with ISO 5783. <sup>b</sup> In accordance with ISO 11926-1.							

Dimensions in millimetres



**Key**

1, 2, 3 ports

*PD* (thread) pitch diameter

VE visual examination

- a 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 cavities of similar size  
Connectors on electrically operated valves and adjustment features on other cartridge valves may exceed this space dimension, and allowance shall be made for fitting and removing such connectors and cartridge valves.
- b The lead-in angle and other data of cavity form are 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.
- c Suggested pre-machining depth to obtain appropriate diameter tolerance for dimension  $T_{10}$ . For some valve types, the valve manufacturer specifies additional pilot drill dimensions to provide clearance for an extension to the valve or to allow for minimum fluid flow path in this area.
- d The port is in accordance with ISO 11926-1.
- e Dimension  $T_{10}$  is the minimum finished length required for the sealing diameter on the cartridge valve.

NOTE ISO 8015, ISO 2768-mK

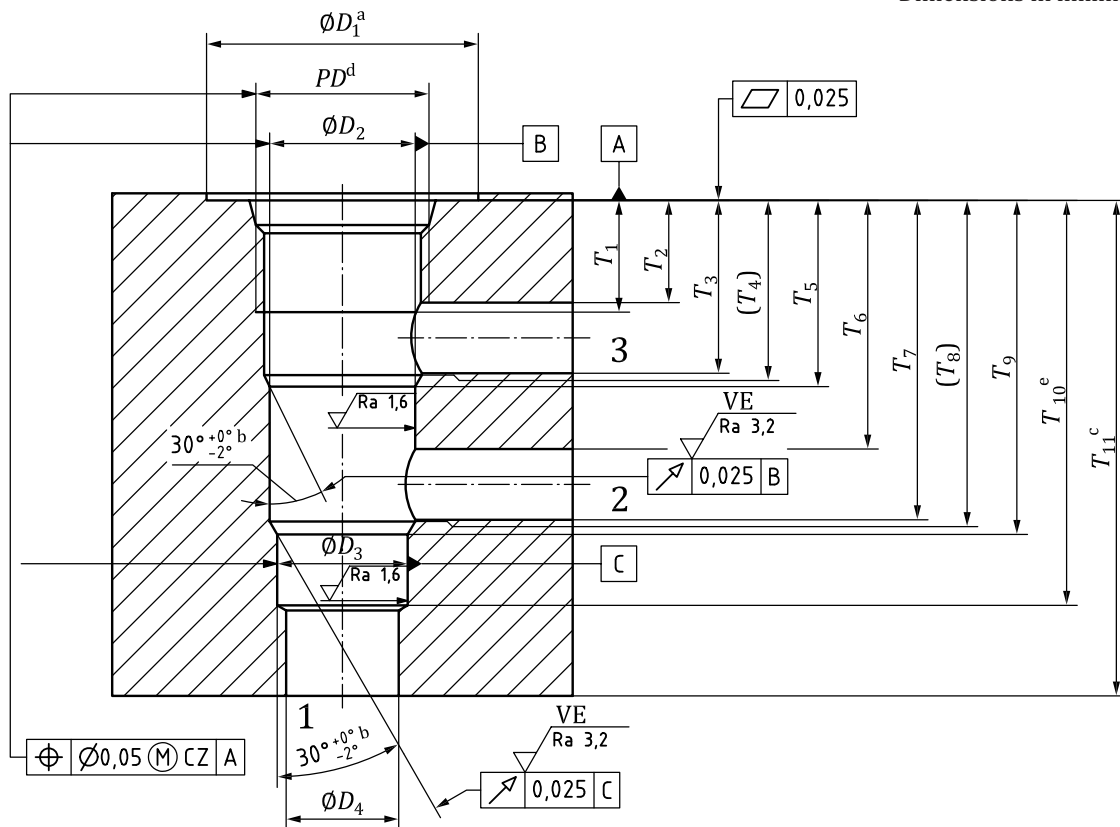
**Figure 2 — Cavity for three-port cartridge valves with two main flow ports and one pilot/vent port**

**Table 2 — Dimensions of cavities for three-port cartridge valves with two main flow ports and one pilot/vent port**

Dimensions in millimetres

Dimension		Dimension by codification <sup>a</sup>				
	tol.	3/4-02-0-13	7/8-02-0-13	1 1/16-02-0-13	1 5/16-02-0-13	1 5/8-02-0-13
Thread <sup>b</sup>		3/4-16 UNF-2B	7/8-14 UNF-2B	1 1/16-12 UN-2B	1 5/16-12 UN-2B	1 5/8-12 UN-2B
$D_1$	min	30,00	34,00	41,00	49,00	58,00
$D_2$	+0,05 -0	15,87	19,05	23,80	28,60	36,52
$D_3$	+0,05 -0	14,27	17,47	22,22	25,42	33,35
$D_4$	max	14,27	17,47	22,22	25,42	33,35
$T_1$	min	12,50	14,20	22,20	17,50	20,60
$T_2$	min	11,00	12,00	21,00	13,50	16,50
$T_3$	max	14,50	16,40	26,90	20,40	23,60
( $T_4$ )		14,60	16,50	27,00	20,50	23,70
$T_5$	+0,4 -0	16,00	17,75	28,00	22,10	25,40
$T_6$	min	22,50	24,20	37,50	29,20	37,30
$T_7$	max	32,26	38,20	51,50	44,65	63,40
( $T_8$ )		32,38	38,30	51,60	44,75	63,50
$T_9$	+0,4 -0	33,65	39,70	53,00	47,60	66,15
$T_{10}$	min	42,00	47,60	62,00	55,60	77,80
$T_{11}$		—	—	—	—	—
<sup>a</sup> Codification is in accordance with ISO 5783. <sup>b</sup> In accordance with ISO 11926-1.						

Dimensions in millimetres

**Key**

1, 2, 3 ports

*PD* (thread) pitch diameter

VE visual examination

a 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 cavities of similar size.

Connectors on electrically operated valves and adjustment features on other cartridge valves may exceed this space dimension, and allowance shall be made for fitting and removing such connectors and cartridge valves.

b The lead-in angle and other data of cavity form are 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.

c Suggested pre-machining depth to obtain appropriate diameter tolerance for dimension  $T_{10}$ . For some valve types, the valve manufacturer specifies additional pilot drill dimensions to provide clearance for an extension to the valve or to allow for minimum fluid flow path in this area.

d The port is in accordance with ISO 11926-1.

e Dimension  $T_{10}$  is the minimum finished length required for the sealing diameter on the cartridge valve.

NOTE ISO 8015, ISO 2768-mK

**Figure 3 — Cavity for three-port cartridge valves with three main flow ports**

**Table 3 — Dimensions of cavities for three-port cartridge valves with three main flow ports**

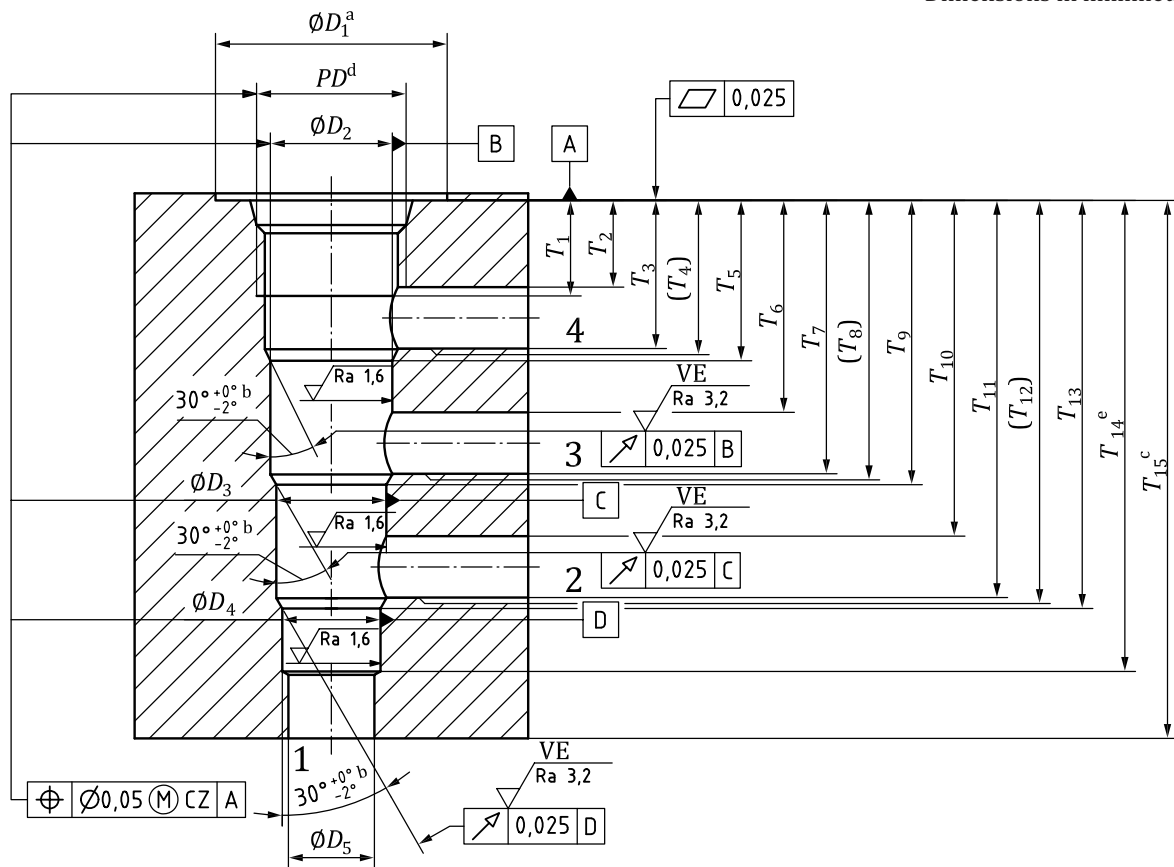
Dimensions in millimetres

Dimension		Dimension by codification <sup>a</sup>				
	tol.	3/4-03-0-13	7/8-03-0-13	1 1/16-03-0-13	1 5/16-03-0-13	1 5/8-03-0-13
Thread <sup>b</sup>		3/4-16 UNF-2B	7/8-14 UNF-2B	1 1/16-12 UN-2B	1 5/16-12 UN-2B	1 5/8-12 UN-2B
$D_1$	min	30,00	31,00	41,00	49,00	58,00
$D_2$	+0,05 -0	15,87	17,47	23,80	28,60	36,52
$D_3$	+0,05 -0	14,27	15,87	22,22	27,00	33,35
$D_4$	max	14,27	15,87	22,22	27,00	33,35
$T_1$	min	14,30	15,90	22,20	22,50	20,60
$T_2$	min	10,50	13,50	22,00	16,60	17,80
$T_3$	max	17,50	21,90	35,50	33,70	44,30
( $T_4$ )		17,60	22,00	35,60	33,80	44,40
$T_5$	+0,4 -0	19,05	23,40	36,62	35,40	46,00
$T_6$	min	25,75	30,70	46,70	45,20	58,90
$T_7$	max	31,70	37,70	60,10	62,40	84,20
( $T_8$ )		31,80	37,80	60,20	62,50	84,30
$T_9$	+0,4 -0	33,24	39,24	61,60	63,94	87,16
$T_{10}$	min	43,26	47,60	73,40	75,40	100,00
$T_{11}$		—	—	—	—	—

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

<sup>b</sup> In accordance with ISO 11926-1.

Dimensions in millimetres

**Key**

1, 2, 3, 4 ports

*PD* (thread) pitch diameter

VE visual examination

a 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 cavities of similar size.

Connectors on electrically operated valves and adjustment features on other cartridge valves may exceed this space dimension, and allowance shall be made for fitting and removing such connectors and cartridge valves.

b The lead-in angle and other data of cavity form are 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.

c Suggested pre-machining depth to obtain appropriate diameter tolerance for dimension  $T_{14}$ . For some valve types, the valve manufacturer specifies additional pilot drill dimensions to provide clearance for an extension to the valve or to allow for minimum fluid flow path in this area.

d The port is in accordance with ISO 11926-1.

e Dimension  $T_{14}$  is the minimum finished length required for the sealing diameter on the cartridge valve.

NOTE ISO 8015, ISO 2768-mK

**Figure 4 — Cavity for four-port cartridge valves with four main flow ports**

**Table 4 — Dimensions of cavities for four-port cartridge valves with four main flow ports**

Dimensions in millimetres

Dimension		Dimension by codification <sup>a</sup>				
	tol.	3/4-04-0-13	7/8-04-0-13	1 1/16-04-0-13	1 5/16-04-0-13	1 5/8-04-0-13
Thread <sup>b</sup>		3/4-16 UNF-2B	7/8-14 UNF-2B	1 1/16-12 UN-2B	1 5/16-12 UN-2B	1 5/8-12 UN-2B
$D_1$	min	30,00	31,00	41,00	49,00	58,00
$D_2$	+0,05 -0	15,87	19,05	23,80	28,60	36,52
$D_3$	+0,05 -0	14,27	17,47	22,22	27,00	33,35
$D_4$	+0,05 -0	12,70	15,87	20,62	25,42	31,75
$D_5$	max	12,70	15,87	20,62	25,42	31,75
$T_1$	min	14,30	15,87	22,20	22,50	20,60
$T_2$	min	10,50	13,50	22,00	16,60	17,80
$T_3$	max	17,50	21,90	35,50	33,70	44,30
( $T_4$ )		17,60	22,00	35,60	33,80	44,40
$T_5$	+0,4 -0	19,05	23,40	36,62	35,20	46,00
$T_6$	min	25,75	30,70	46,70	45,20	58,90
$T_7$	max	31,70	37,70	60,10	62,40	84,20
( $T_8$ )		31,80	37,80	60,20	62,50	84,30
$T_9$	+0,4 -0	33,24	39,24	61,60	63,94	87,16
$T_{10}$	min	40,00	46,60	71,30	73,90	100,00
$T_{11}$	max	45,90	53,50	84,50	91,10	126,50
( $T_{12}$ )		46,00	53,60	84,60	91,20	126,60
$T_{13}$	+0,4 -0	47,44	55,04	86,00	92,60	128,00
$T_{14}$	min	56,13	63,50	98,00	104,00	141,28
$T_{15}$		—	—	—	—	—

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

<sup>b</sup> In accordance with ISO 11926-1.



## **Annex A**

### **(informative)**

## **Block mounting**

The installation of cartridge valves in control manifolds also requires identification of the piping connections on the manifold. The identification method usually used in hydraulic systems uses letters and is applied in accordance with ISO 9461. When more than one of the same type of port is present in the manifold, these ports may be identified by indexation: A<sub>1</sub>, A<sub>2</sub>, etc. Also see ISO 16874.

## Bibliography

- [1] ISO 129-1, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*
- [2] ISO 725, *ISO inch screw threads — Basic dimensions*
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- [4] ISO 7789, *Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities*
- [5] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*



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