# INTERNATIONAL STANDARD

**ISO 7440-1**

Second edition
1991-12-01

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# Road vehicles — Fuel injection equipment testing —

## Part 1:
Calibrating nozzle and holder assemblies

*Véhicules routiers — Essai des équipements d'injection de combustible —*

*Partie 1: Ensembles porte-injecteur et injecteur de calibration*

Reference number
ISO 7440-1:1991(E)

## 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.

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.

International Standard ISO 7440-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Sub-Committee SC 7, *Injection equipment and filters for use on road vehicles*.

This second edition cancels and replaces the first edition (ISO 7440-1:1985), of which 3.2.3 and figures 5 and 6 have been technically revised; clause 5 and table 1 (1985 edition) have been deleted.

ISO 7440 consists of the following parts, under the general title *Road vehicles — Fuel injection equipment testing*:

— *Part 1: Calibrating nozzle and holder assemblies*

— *Part 2: Orifice plate flow-measurement*

Setting and maintenance requirements for fuel injection equipment are specified in ISO 4008-3:1987, *Road vehicles — Fuel injection pump testing — Part 3: Application and test procedures*.

Annex A of this part of ISO 7440 is for information only.

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## Introduction

The calibrating nozzle and holder assemblies are intended to simulate closely the function of the nozzle and holder assemblies in the fuel injection system of a compression-ignition (diesel) engine. They are flow gauges and require careful handling and maintenance.

The manufacturer of the injection equipment and/or the manufacturer of the engine will need to specify the type of calibrating nozzle and holder assembly, the appropriate single hole orifice plate size or pintle nozzle (as applicable), high pressure pipes, exact limits, etc. to be used.

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# Road vehicles — Fuel injection equipment testing —

# Part 1:
Calibrating nozzle and holder assemblies

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## 1 Scope

This part of ISO 7440 specifies two types of calibrating nozzle and holder assemblies intended for the testing and setting of diesel fuel injection pumps on test benches.

It applies to

a) a calibrating nozzle and holder assembly with a single hole orifice plate;

b) a calibrating nozzle and holder assembly with a delay pintle type nozzle.

The approximate range of the calibrating nozzle and holder assembly is up to

— 300 $mm^3$/stroke with the single hole orifice plate

— 150 $mm^3$/stroke with the delay pintle type nozzle.

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 7440. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7440 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4010:1977, *Road vehicles — Calibrating nozzle, delay pintle type.*

## 3 Requirements

### 3.1 Calibrating nozzle and holder assemblies

#### 3.1.1 With single hole orifice plate

The two alternative designs of the calibrating nozzle and holder assembly with a single hole orifice plate are shown in figure 1.

#### 3.1.2 With delay pintle type nozzle

The two alternative designs of the calibrating nozzle and holder assembly with the delay pintle type nozzle specified in ISO 4010 are shown in figure 2.

### 3.2 Components

The calibrating nozzle and holder assemblies consist of the components specified in 3.2.1 to 3.2.8 with their functionally critical dimensions.

#### 3.2.1 Holder body

The holder body is shown in figure 3. It may have two different executions: with and without vent.

#### 3.2.2 Spring

The spring is shown in figure 4.

#### 3.2.3 Inlet stud with edge filter

The inlet stud with edge filter is shown in figure 5. It may be flow-tested as shown diagrammatically in figure 6. The outlet of the fixture (within the dotted lines) shall be at ambient pressure.

Dimensions in millimetres

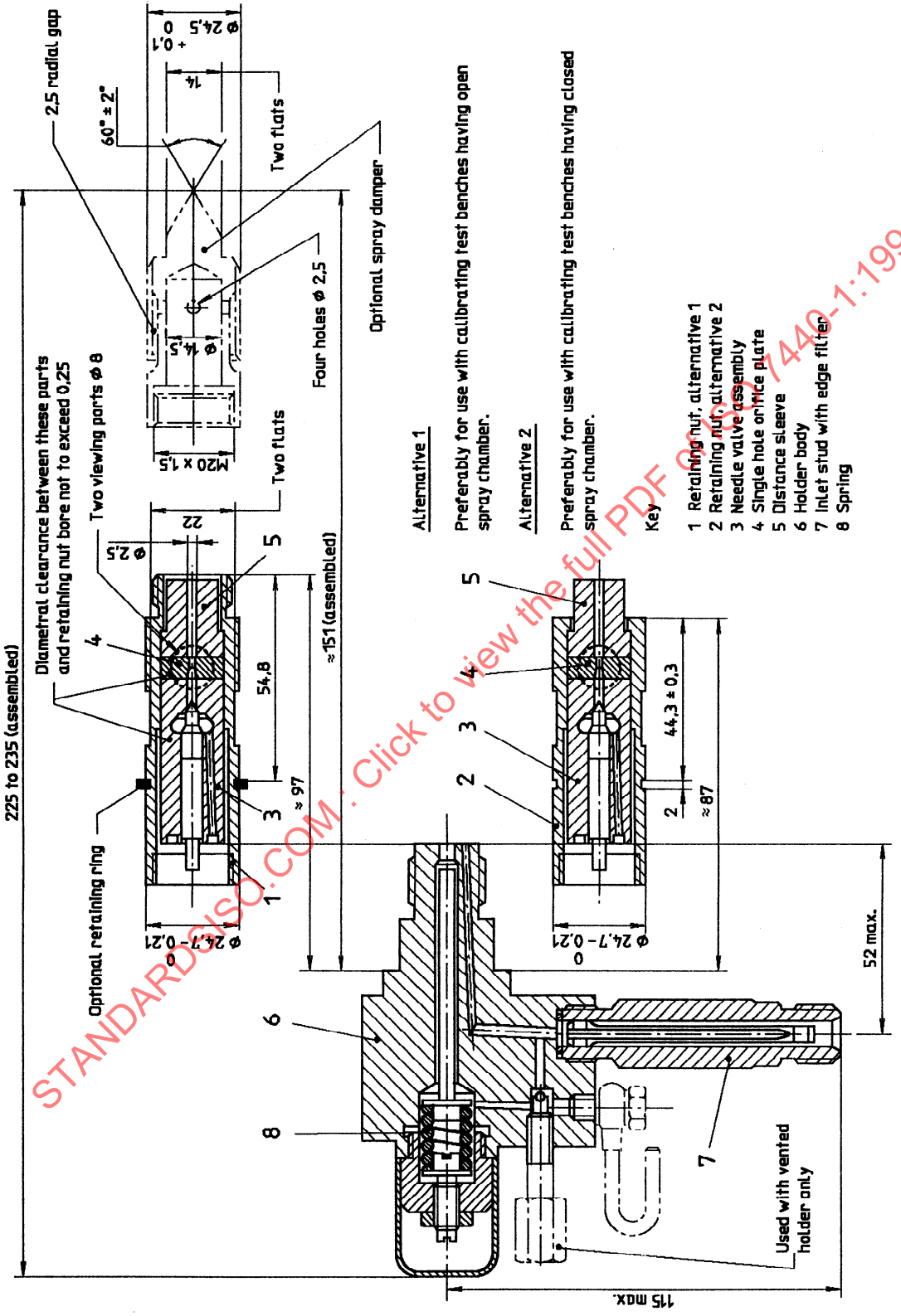


**Figure 1 — Calibrating nozzle and holder assembly with single hole orifice code**

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Dimensions in millimetres

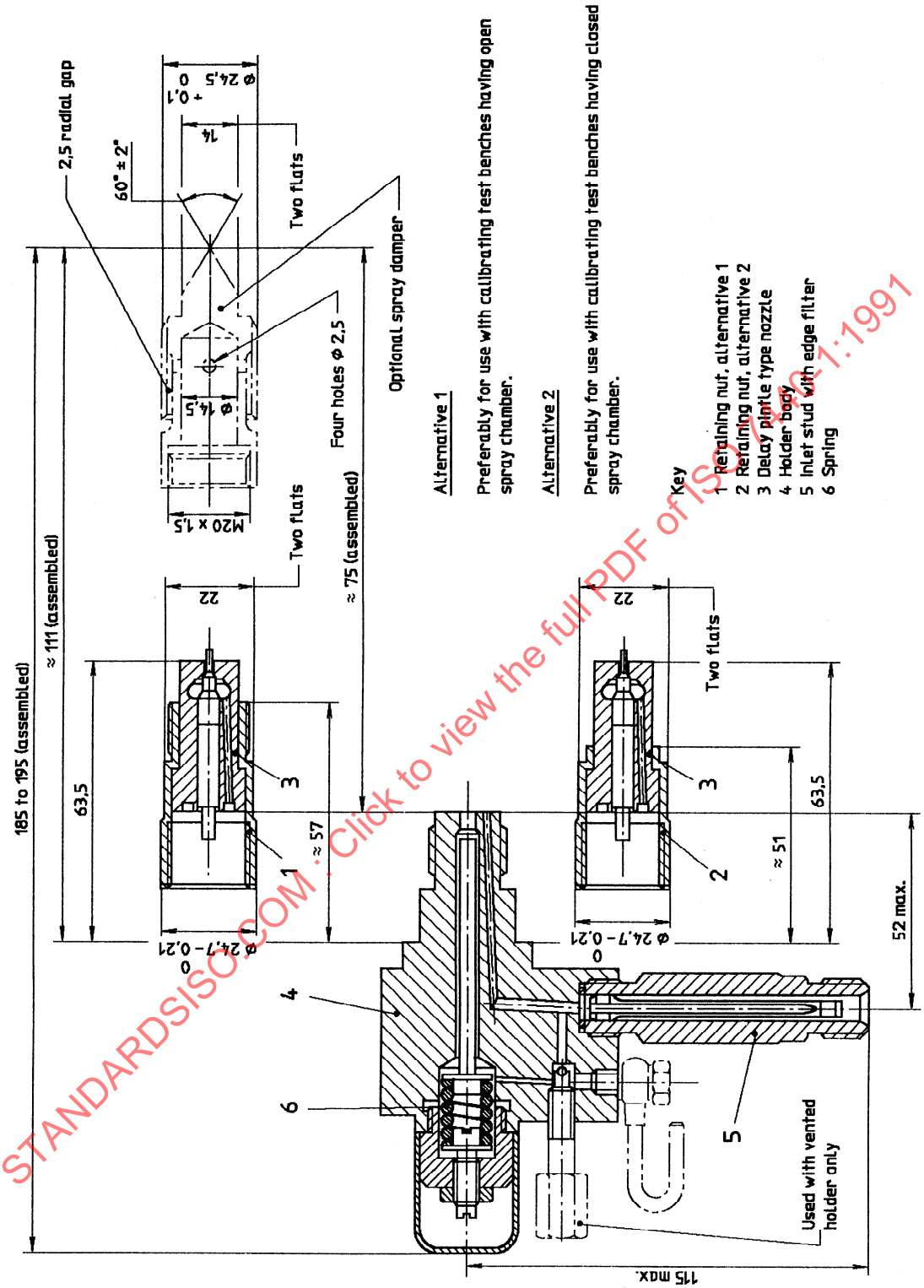


**Figure 2 — Calibrating nozzle and holder assembly with delay pintle type nozzle**

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Dimensions in millimetres

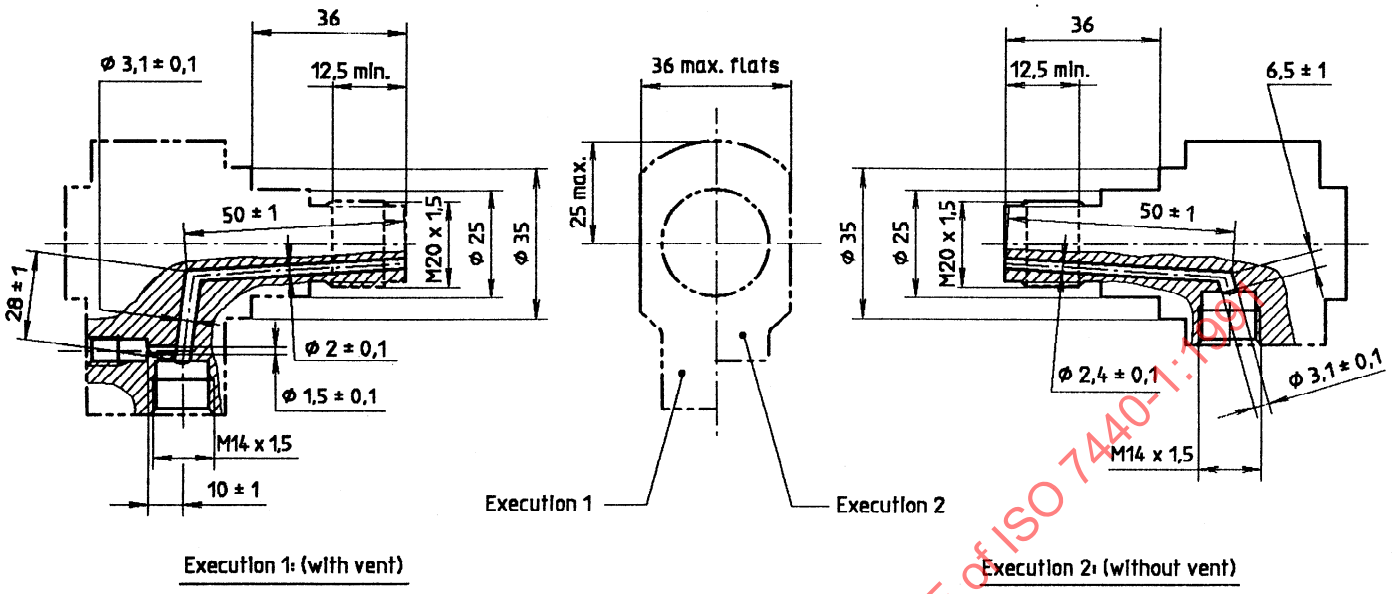


**Figure 3 — Holder body**

Dimensions in millimetres

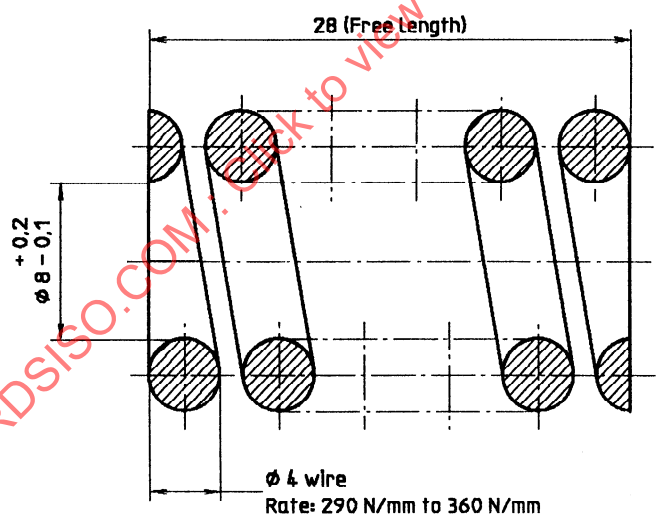


**Figure 4 — Spring**

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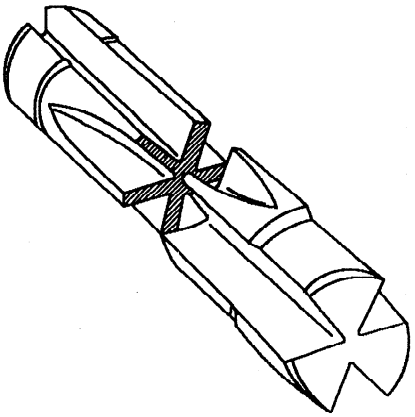
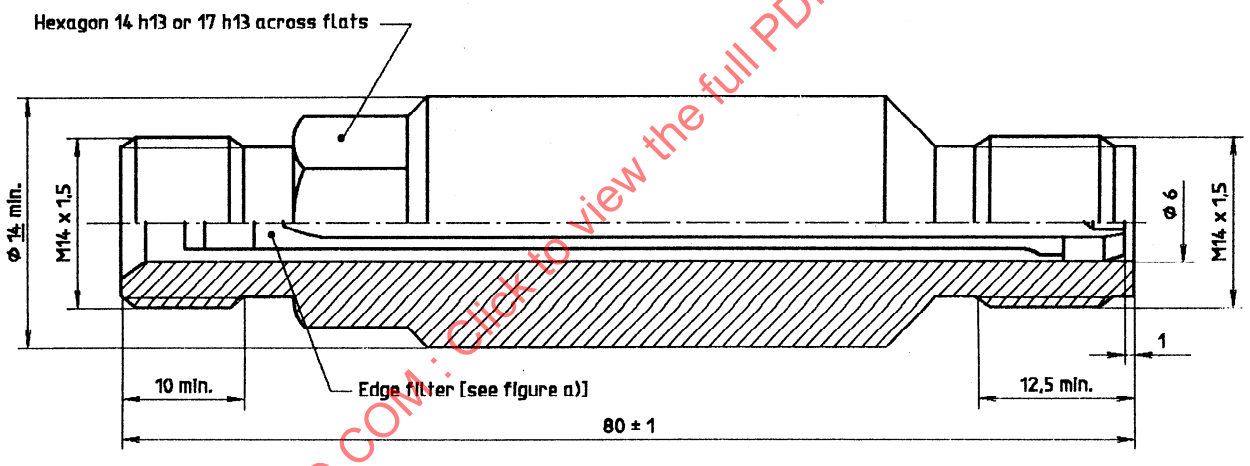
Dimensions in millimetres



a) Edge filter with flutes (schematic)




b) Inlet stud with edge filter

| Characteristic | Value |
|---|---|
| Filter clearance (radial) | 0,02 mm to 0,033 mm |
| Filter clearance area | 7,3 $mm^2$ min. |
| Flow area for three flutes [see figure 5a)] | 7,5 $mm^2$ min. |
| Internal volume | 1 450 $mm^3$ ± 40 $mm^3$ |
| Filter flow at 0,3 MPa (3 bar) pressure[1)] | 4 750 $cm^3$/min to 6 500 $cm^3$/min |
| Minimum flow of assembled holder body with inlet stud and edge filter at 0,3 MPa (3 bar) pressure[1)] | 2 000 $cm^3$/min |

1) These tests shall be made using calibration fluid as specified in ISO 4113 at 40 °C ± 1 °C and the tolerance of the supply pressure shall be ± 0,03 MPa (0,3 bar).

**Figure 5 — Characteristic dimensions and values of inlet stud with edge filter**

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Dimensions in millimetres

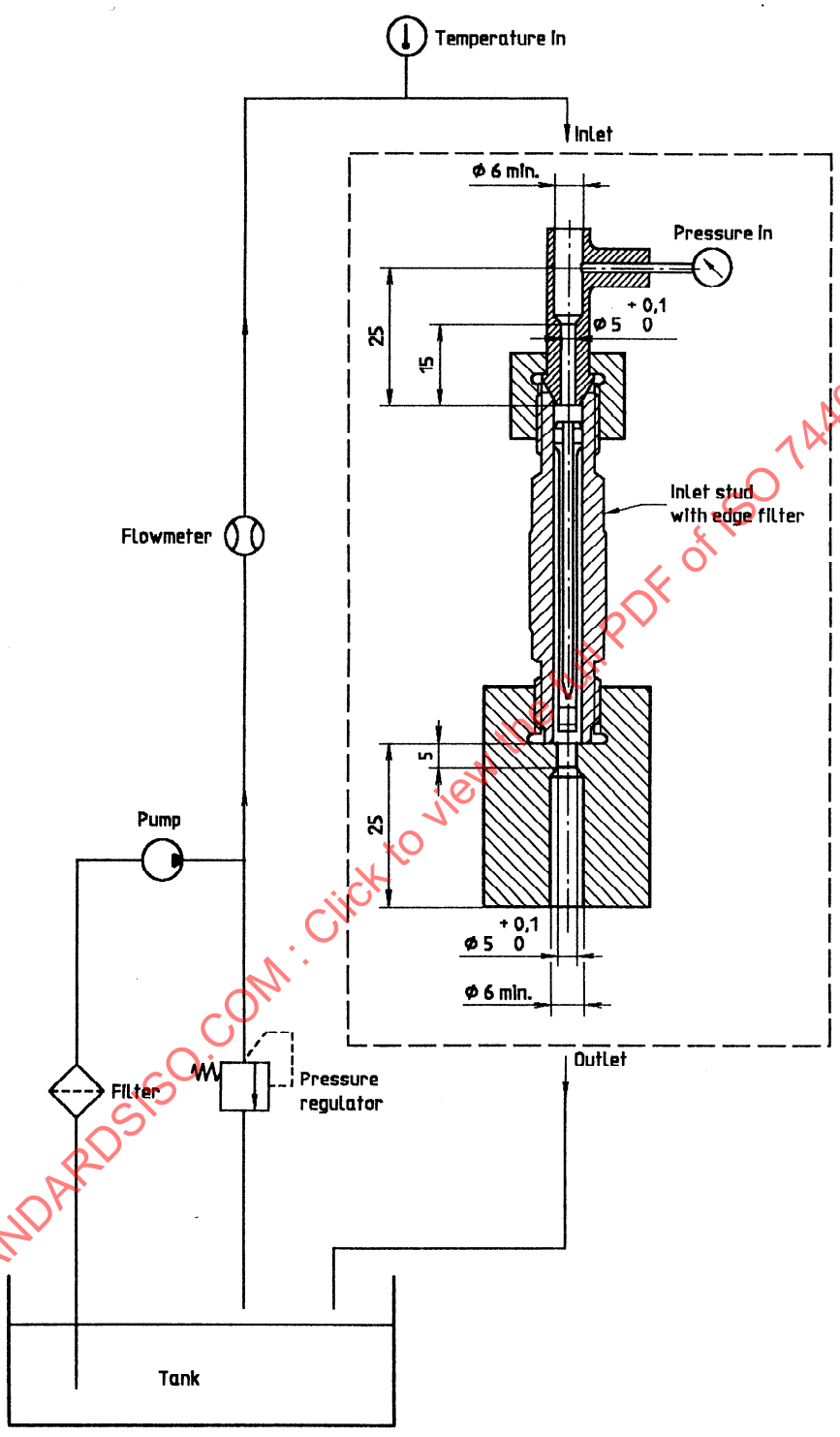


**Figure 6 — Inlet stud flow measuring system**

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### 3.2.4 Needle valve assembly

The needle valve assembly is shown in figure 7.

Dimensions in millimetres

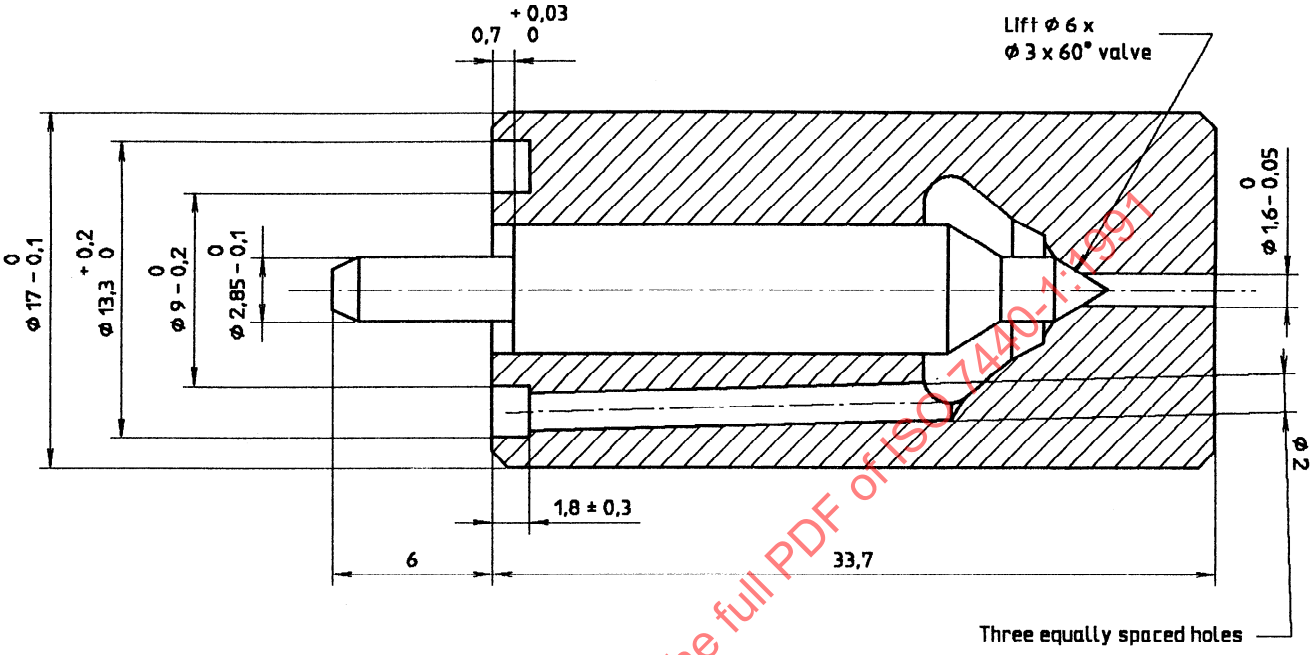


**Figure 7 — Needle valve assembly**

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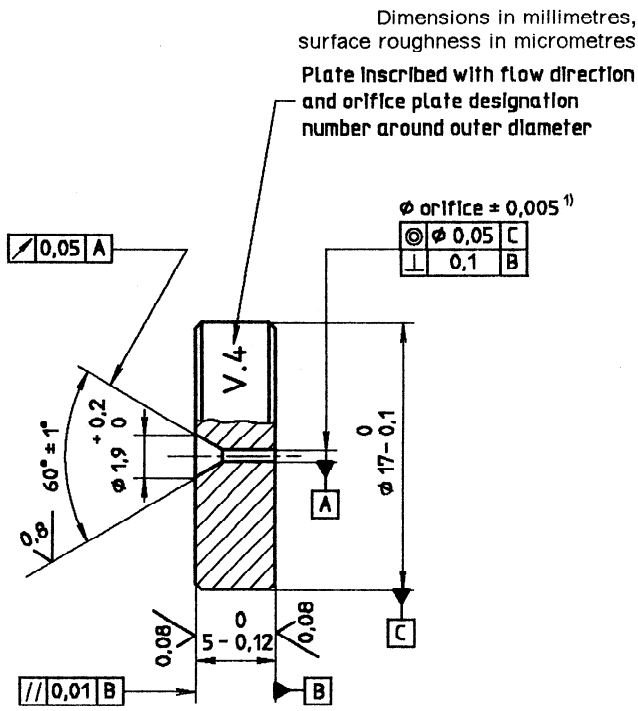
### 3.2.5 Single hole orifice plate

The orifice plate(s) and flow range(s) are shown in figure 8.




1) Tolerance of orifice hole is only a guide for manufacturing. Its purpose is to assist in meeting the final static flow limits specified in the table when flow-tested under the test conditions described in ISO 7440-2.

| Orifice plate No. | | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| Orifice diameter, mm | | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 |
| Flow, $cm^3/min$ | min. | 964 | 1 528 | 2 190 | 3 024 | 3 948 |
| | max. | 1 014 | 1 606 | 2 302 | 3 180 | 4 150 |

**Figure 8 — Single hole orifice plate**

### 3.2.6 Delay pintle type nozzle

The delay pintle type nozzle is specified in ISO 4010.

### 3.2.7 Distance sleeve

The distance sleeve is shown in figure 9.

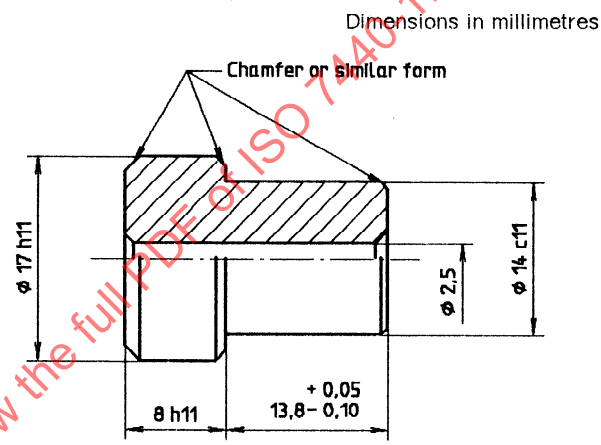



**Figure 9 — Distance sleeve**

### 3.2.8 Retaining nuts

The design of the different types of retaining nuts is shown in figures 10 and 11.

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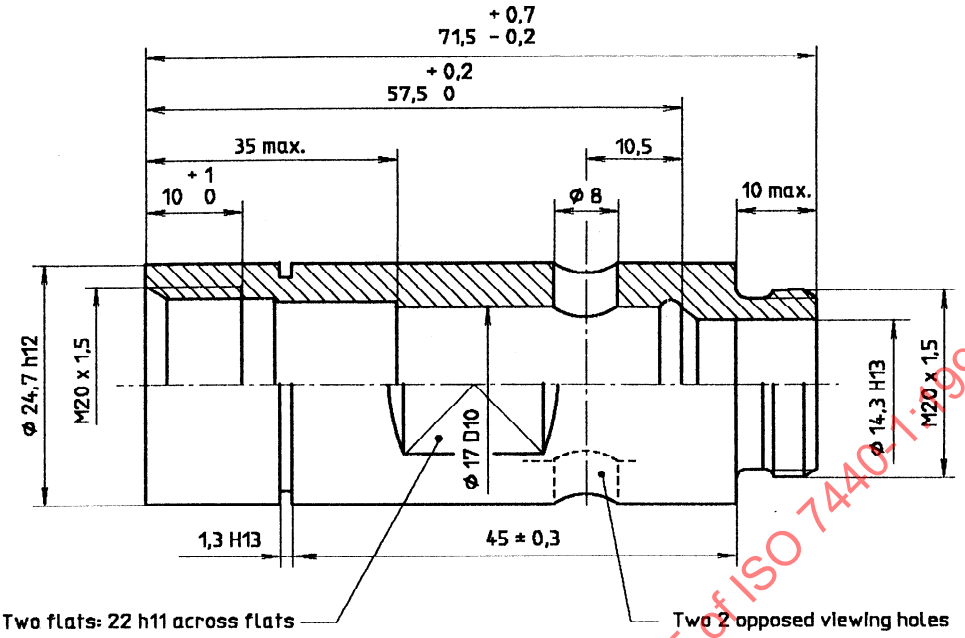
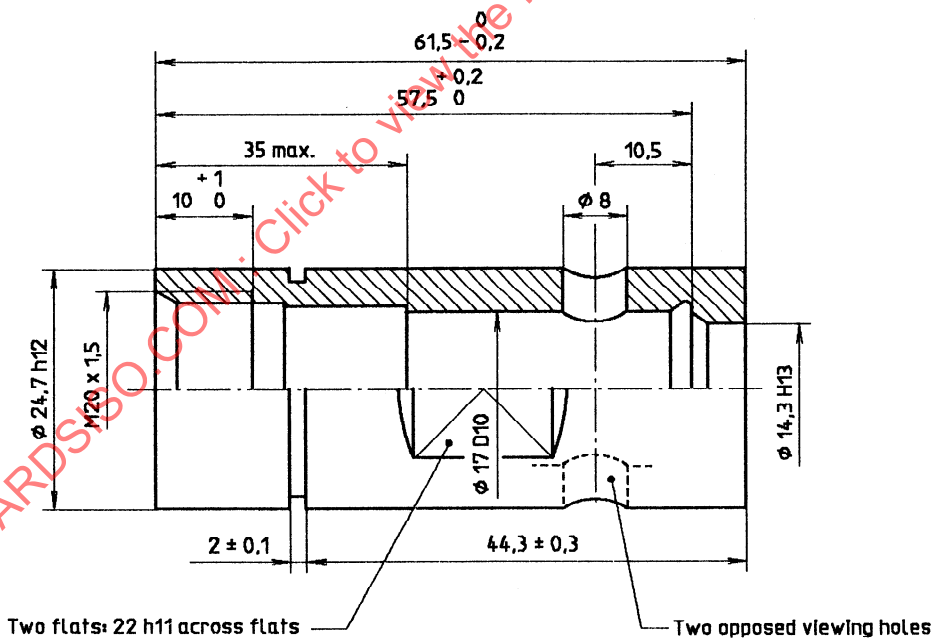
Dimensions in millimetres




a) Alternative 1 (for use with open spray chamber)




b) Alternative 2 (for use with closed spray chamber)

**Figure 10 — Retaining nuts (capnuts) for calibrating nozzle and holder assembly with single hole orifice plate**

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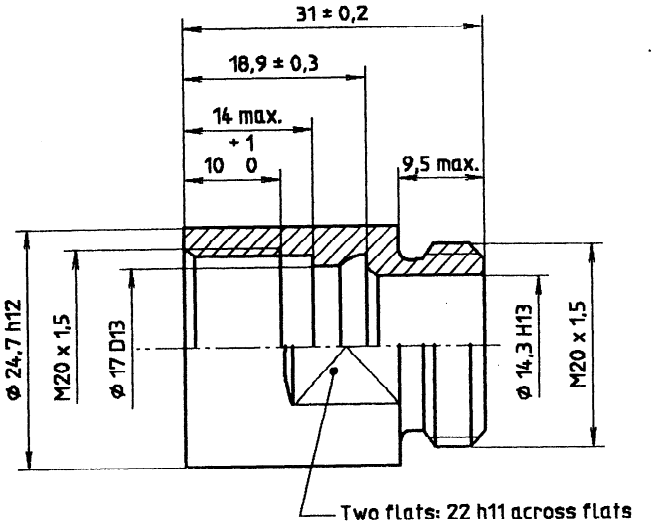
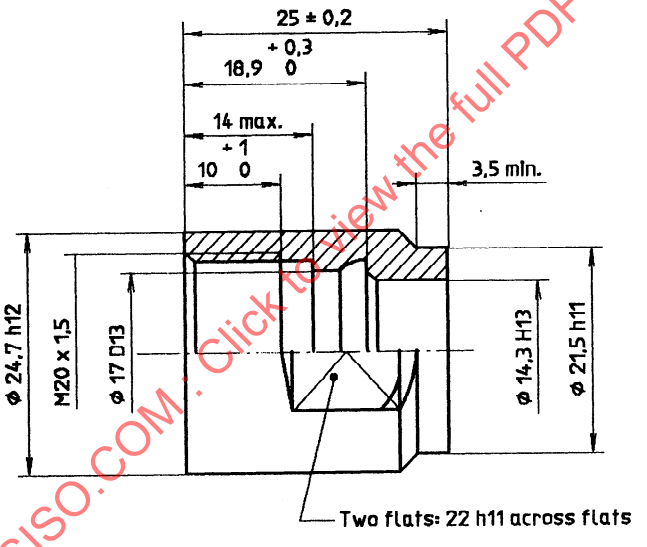
Dimensions in millimetres




a) Alternative 1 (for use with open spray chamber)




b) Alternative 2 (for use with closed spray chamber)[1)]

1) Retaining nut as specified in ISO 2699 (nozzle holder type 2) and in ISO 2697 (dimensions and tolerances of the nozzle capnut).

**Figure 11 — Retaining nuts (capnuts) for calibrating nozzle and holder assembly with delay pintle type nozzle**

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## 4 Designation

### 4.1 General example

The various alternatives of nozzle, nozzle holder, nozzle retaining nut and nozzle opening pressure result in many possible combinations of component content and adjustment. To facilitate concise specification of any particular form of calibrating nozzle and holder assembly,

a) required by the injection pump test schedule, or

b) requiring purchase, either in whole or in part, by the operator,

the range of calibrating nozzle and holder assemblies shall be designated in code form as given by the following example:

**ISO 7440 A13 - 170**

## 4.2 Explanation of designation

The designation comprises the four elements in 4.2.1 to 4.2.4, the two last being separated by a hyphen.

### 4.2.1 1st element: ISO code

This specifies the ISO International Standard number where the calibrating nozzle and holder assemblies are defined.

In the example: ISO 7440

### 4.2.2 2nd element: letter code

In the example: A

This single letter code allows extension of the present A code system if and when all the possibilities of the code tables (see 4.3) are filled by new or modified orifice plates, nozzle types and/or holder bodies; then the letter "A" shall be changed to "B", etc.

This presupposes that additional "B" code tables will be put together.

In the "B" system the meaning of either one of the digits may, however, retain the same meaning as in the "A" code but this shall be duplicated in the "B" code tables.

### 4.2.3 3rd element: component content

This two-digit code defines the component content as specified in 4.3.

In this example: 13 specifies:

1- (Tens-digit code): delay pintle type nozzle as specified in ISO 4010.

-3 (Units-digit code): vented holder body, as specified in figure 3 (execution 1), with a closed spray chamber nozzle retaining nut, alternative 2 (see figures 1 and 2).

### 4.2.4 4th element: nozzle opening pressure

These three digits define the nozzle opening pressure setting in $10^5$ Pa (bar).

In the example: 170 specifies 170 bar nozzle opening pressure

## 4.3 Structure of component content code (3rd element)

The logic structure of the code defining the combination of components of the various calibrating nozzle and holder assemblies as specified in this part of ISO 7440 is given in table 1 for the tens and table 2 for the units digit.

**Table 1 — Tens-digit for A code**

| Code | Type of nozzle or orifice plate |
|---|---|
| 0- | not fitted |
| 1- | nozzle type: ISO 4010 |
| 2- | —* |
| 3- | —* |
| 4- | orifice plate No.: 4 |
| 5- | orifice plate No.: 5 |
| 6- | orifice plate No.: 6 |
| 7- | orifice plate No.: 7 |
| 8- | orifice plate No.: 8 |
| 9- | —* |

NOTES

1 The orifice plate numbers are as defined in figure 8.

2 The codes where spaces are marked with an asterisk (*) are at present undefined and are available for future definitions.

3 Code 0- refers to a nozzle holder suitable for accepting either type of nozzle.

4 Codes 4-, 5-, 6-, 7- and 8- refer to orifice plates only.

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**Table 2 — Units-digit for A code**

| Code | Type of nozzle holder assembly | |
|---|---|---|
| | Holder body with vent | Nozzle retaining nut for spray chamber: |
| -0 | —* | |
| -1 | not specified | not specified |
| -2 | yes | not specified |
| -3 | yes | closed |
| -4 | yes | open |
| -5 | —* | —* |
| -6 | no | not specified |
| -7 | no | closed |
| -8 | no | open |
| -9 | —* | —* |

NOTES

1 Execution 1 (figure 3) illustrates a nozzle holder body with a vent. Execution 2 (figure 3) illustrates a nozzle holder body without a vent.

2 Alternative nozzle retaining nuts are as shown in figures 1, 2, 10 and 11.

3 The codes where spaces are marked with an asterisk (*) are at present undefined and are available for future definitions.

4 This unit digit does not identify the difference between a retaining nut for an orifice plate and a delay pintle nozzle.

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