
International Standard



7440 / 1

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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

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7440/1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Road vehicles — Fuel injection equipment testing — Part 1 : Calibrating nozzle and holder assemblies

0 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 diesel (compression-ignition) engine. The manufacturer of the injection equipment and/or the manufacturer of the engine shall 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.

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.

2 Field of application

This part of ISO 7440 is applicable 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 mm³/stroke with the single hole orifice plate;
- 150 mm³/stroke with the delay pintle type nozzle.

3 References

ISO 2697, *Road vehicles — Fuel injection nozzles — Size "S"*.

ISO 2699, *Road vehicles — Flange-mounted injection nozzle holders size "S" — Types 2, 3, 4, 5 and 6*.

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

ISO 4093, *Road vehicles — Fuel injection pumps — High pressure pipes for testing*.

ISO 4113, *Road vehicles — Calibration fluid for diesel injection equipment*.

ISO 7440/2, *Road vehicles — Fuel injection equipment testing — Part 2 : Orifice plate flow measurement*.

4 Required characteristics

4.1 Calibrating nozzle and holder assemblies

4.1.1 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.

4.1.2 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.

4.2 Components

The calibrating nozzle and holder assemblies consist of the following components with their functionally critical dimensions.

4.2.1 Holder body

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

4.2.2 Spring

The spring is shown in figure 4.

4.2.3 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.

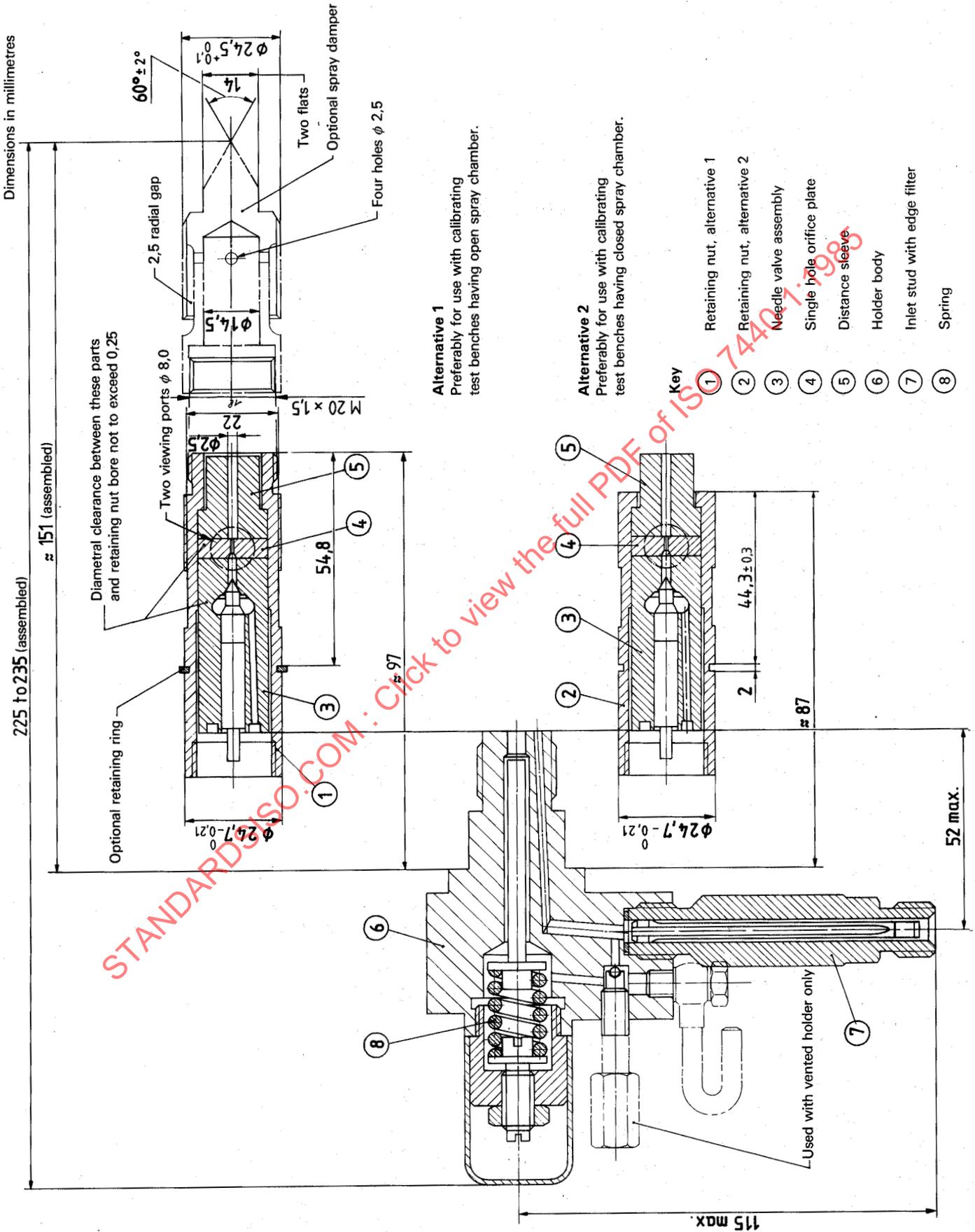


Figure 1 — Calibrating nozzle and holder assembly with single hole orifice plate

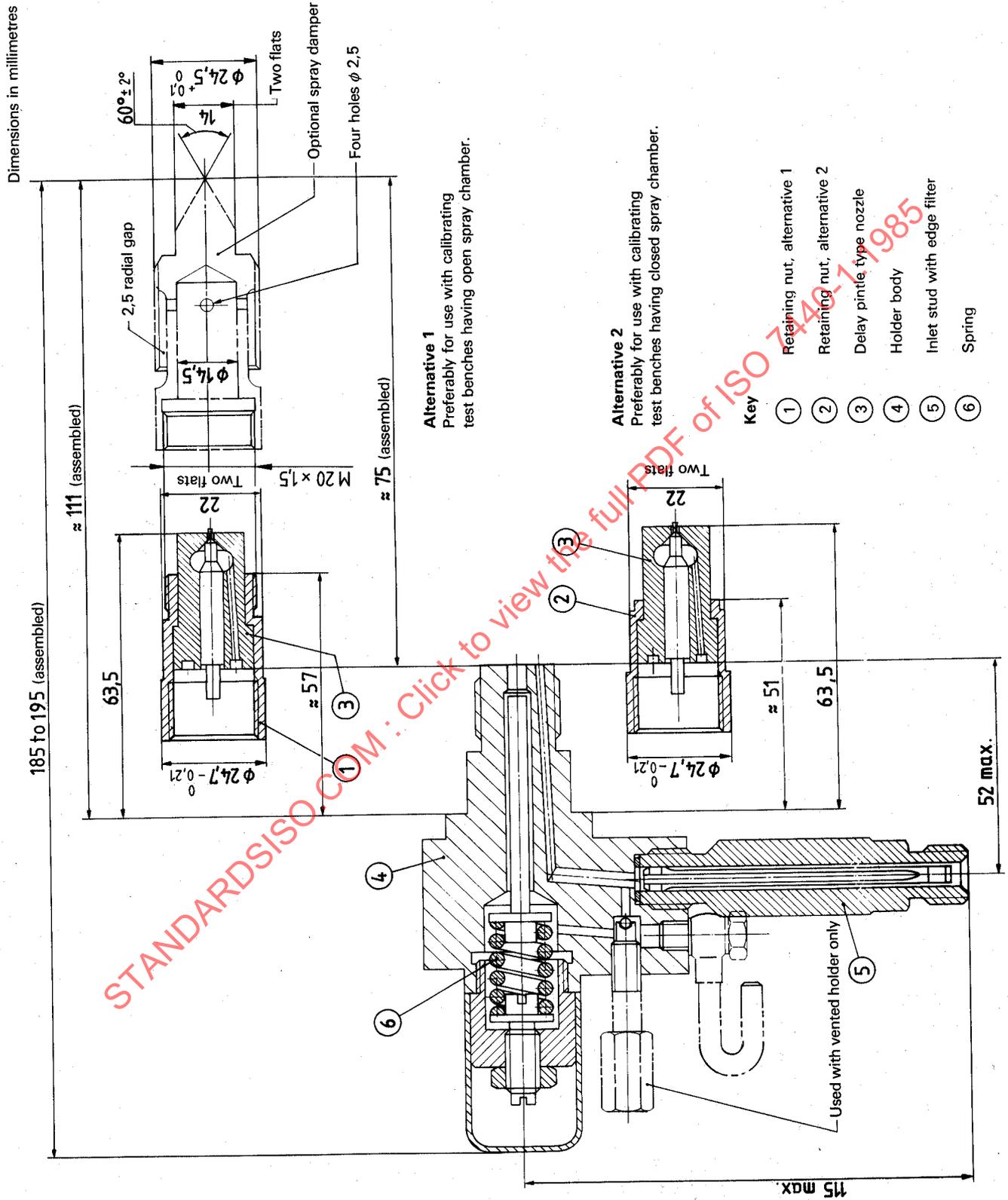
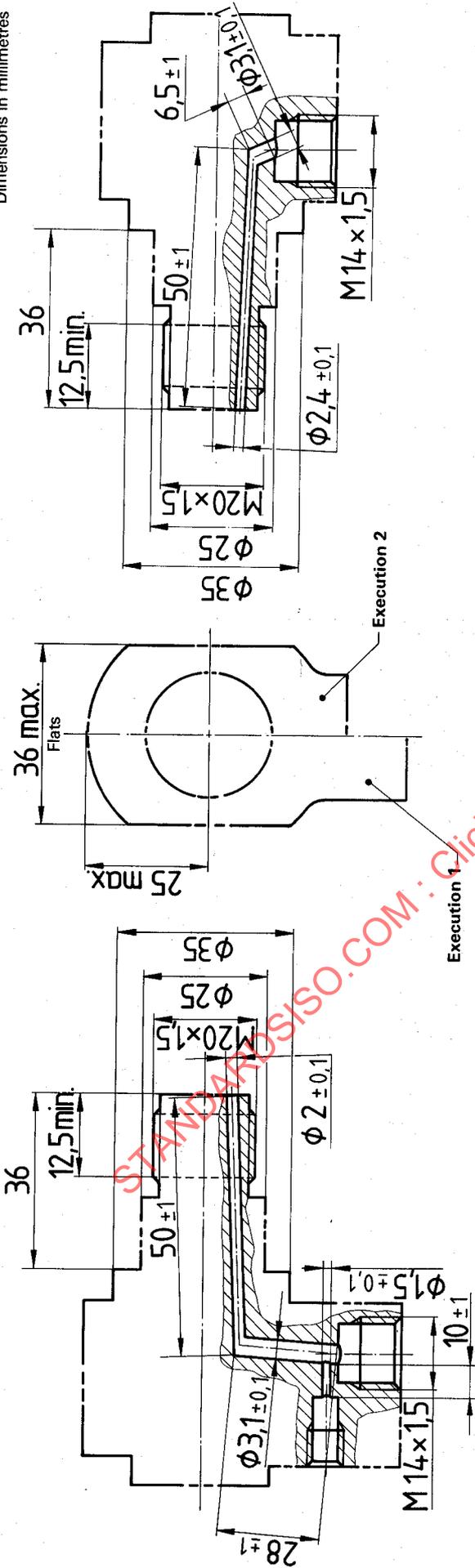


Figure 2 — Calibrating nozzle and holder assembly with delay pintle type nozzle

Dimensions in millimetres



Execution 1 (with vent)

Execution 2 (without vent)

Figure 3 — Holder body

Dimensions in millimetres

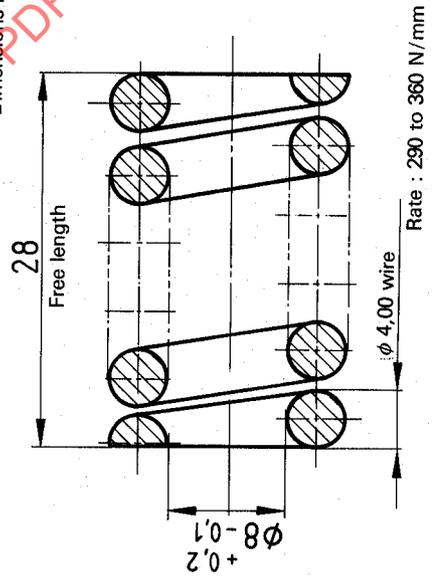
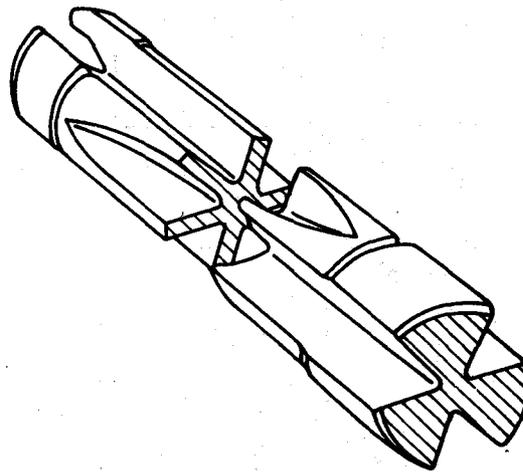
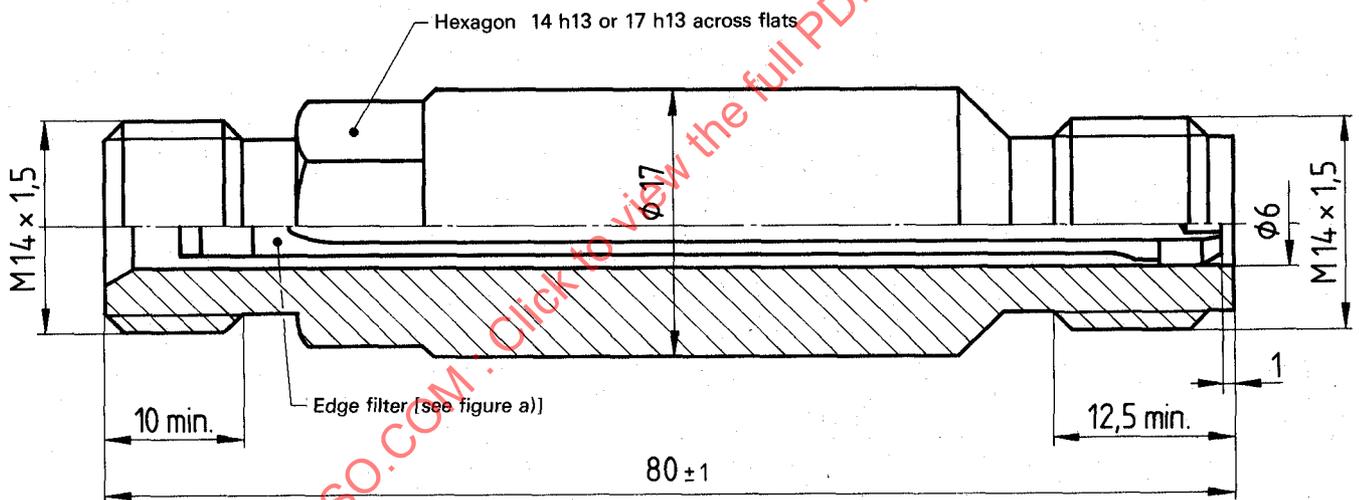


Figure 4 — Spring

Dimensions in millimetres



a) Edge filter with flutes (schematic)



b) Inlet stud with edge filter

Characteristic	Value
Filter clearance (radial)	0,020 to 0,033 mm
Filter clearance area	7,3 mm ² min.
Flow area for three flutes [see figure a)]	7,5 mm ² min.
Internal volume	1 450 ± 40 mm ³
New filter flow at 0,3 MPa (3 bar) pressure*	4 750 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*	2 000 cm ³ /min
Minimum acceptable flow in service of the edge filter (to replace) at 0,3 MPa (3 bar) pressure*	2 500 cm ³ /min

* These tests shall be made using calibration fluid as specified in ISO 4113 at 40 ± 1 °C

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

Dimensions in millimetres

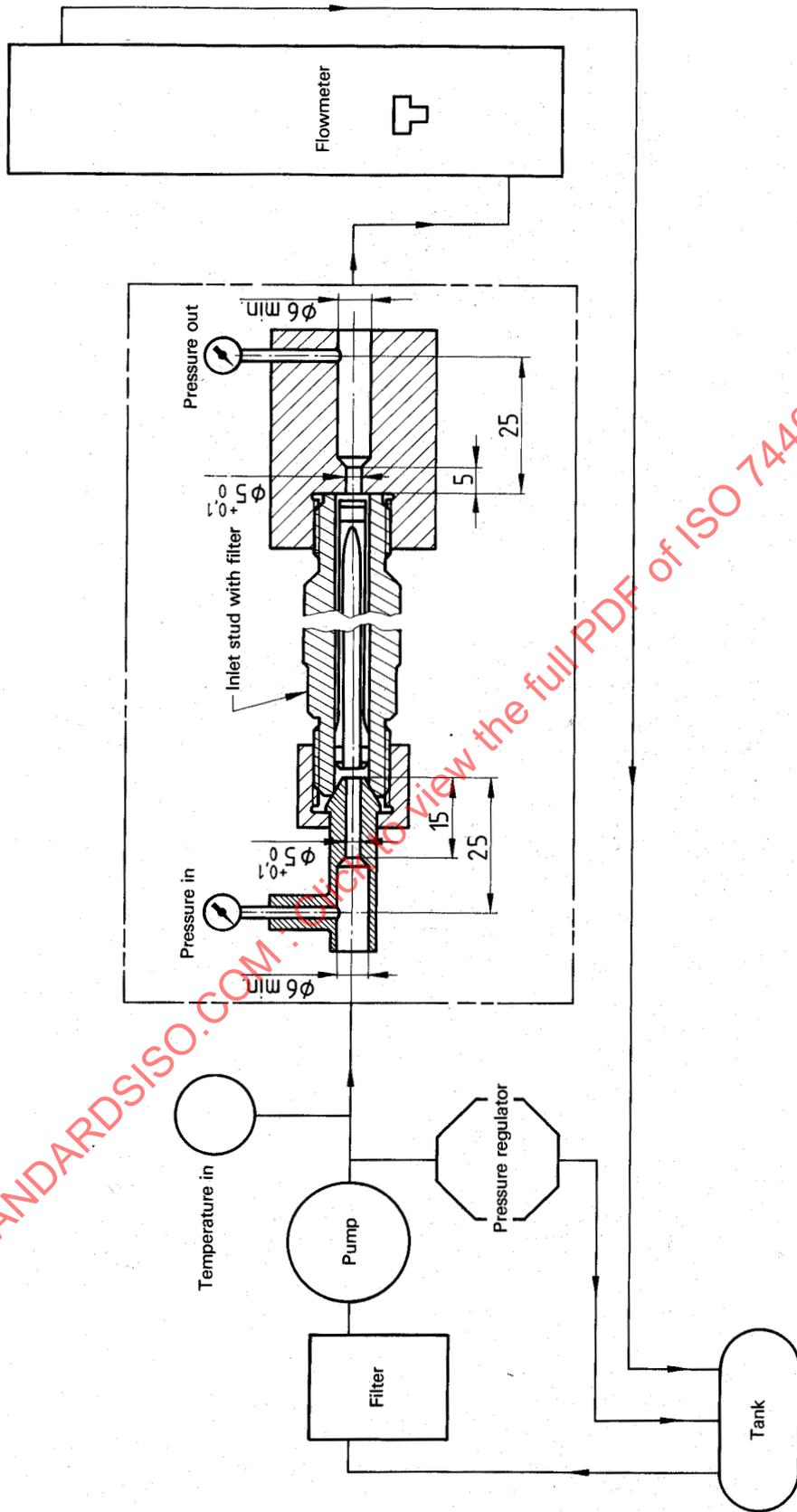


Figure 6 — Inlet stud flow measuring system

4.2.4 Needle valve assembly

The needle valve assembly is shown in figure 7.

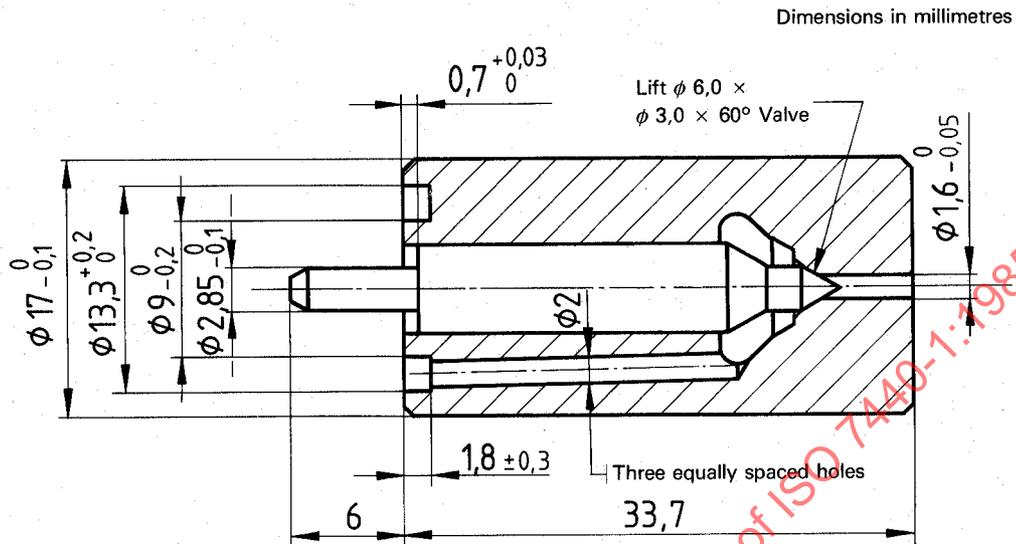
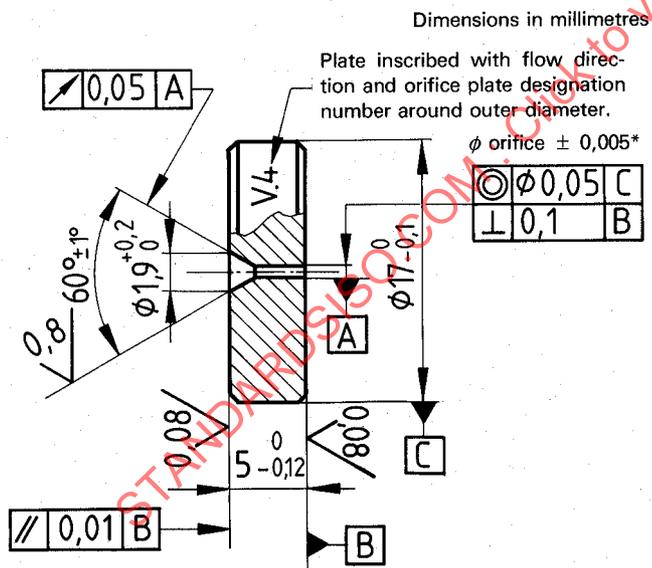


Figure 7 — Needle valve assembly

4.2.5 Single hole orifice plate

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



* 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 part 2 of ISO 7440.

Orifice plate number	.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

4.2.6 Delay pintle type nozzle

The delay pintle type nozzle is specified in ISO 4010.

4.2.7 Distance sleeve

The distance sleeve is shown in figure 9.

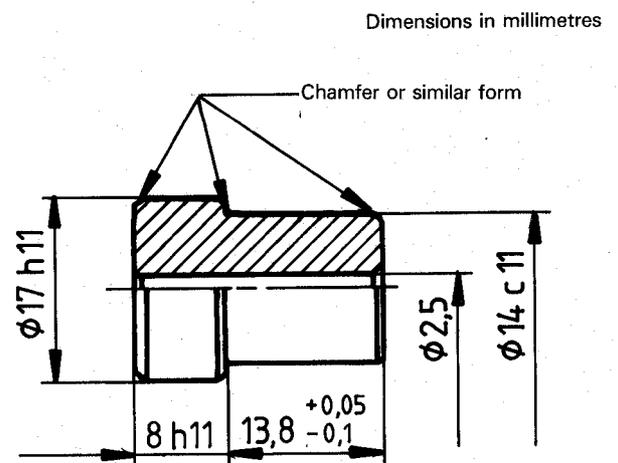
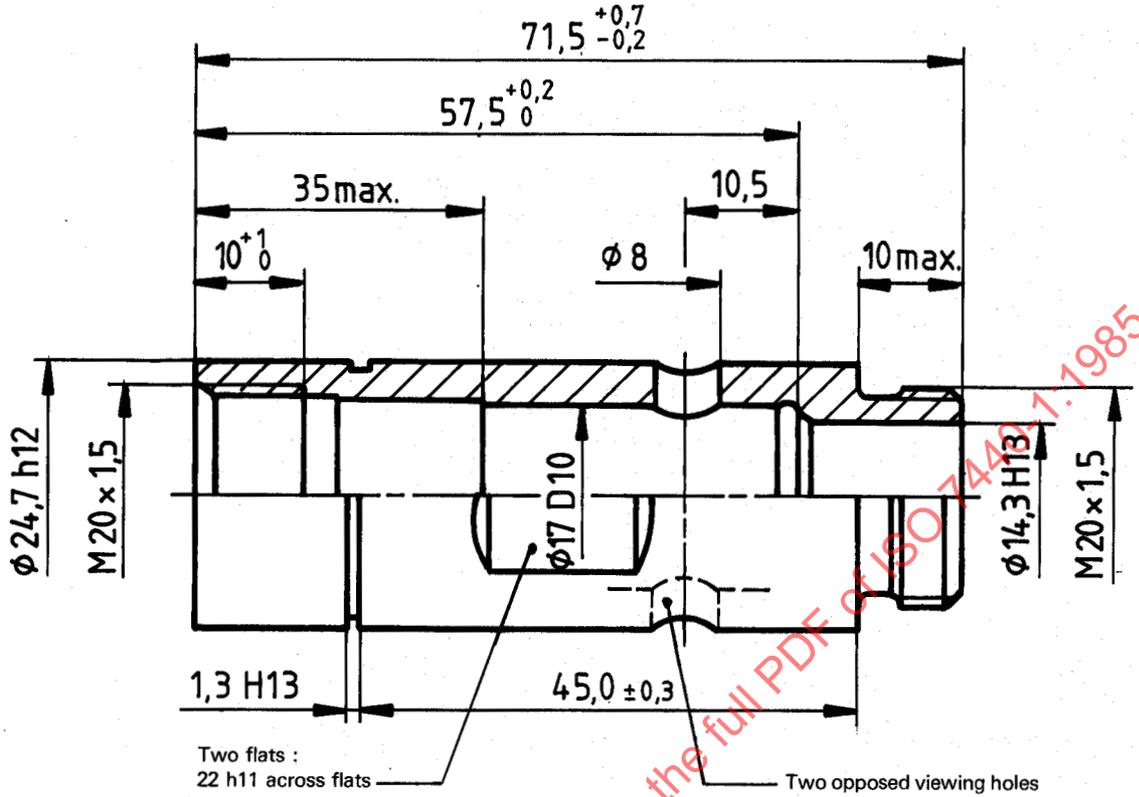


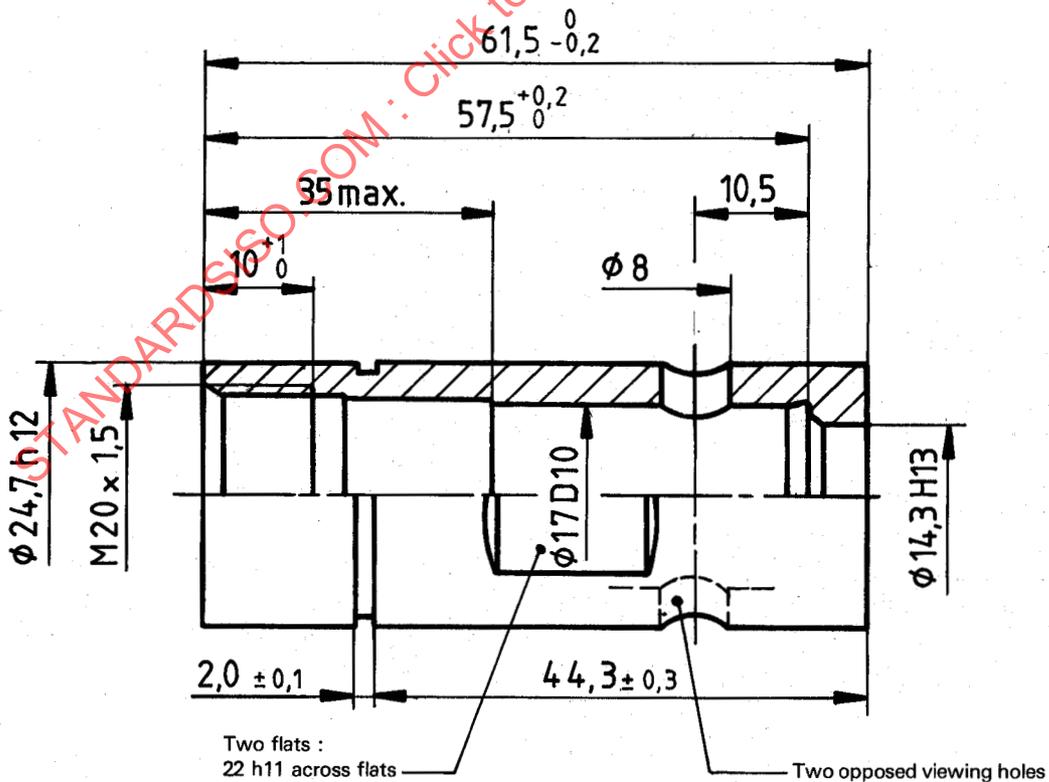
Figure 9 — Distance sleeve

4.2.8 Retaining nuts

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



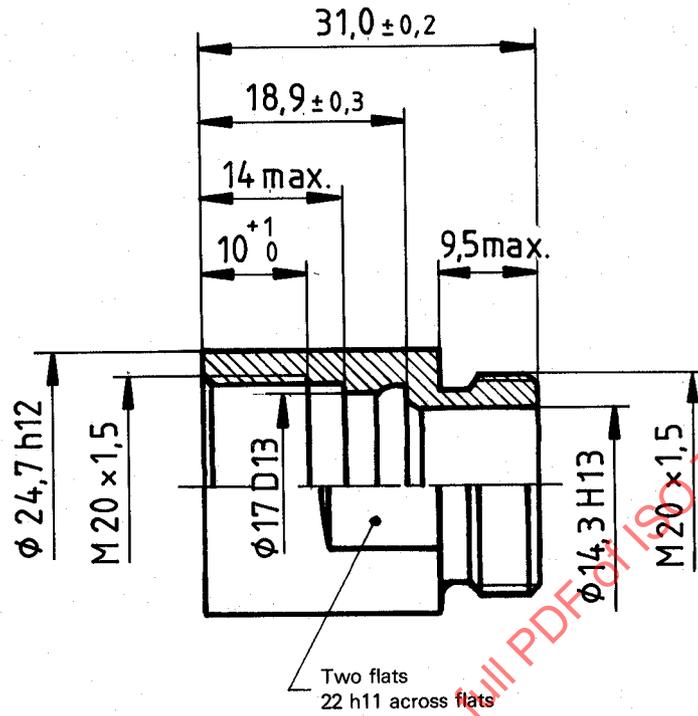
a) Alternative 1 (for use with open spray chamber)



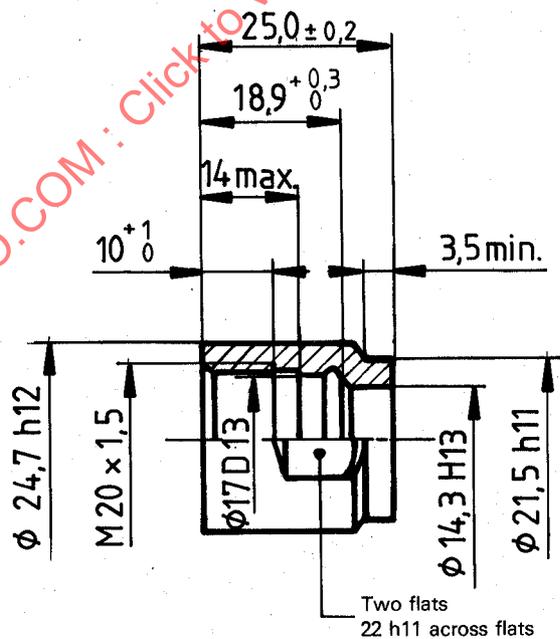
b) Alternative 2 (for use with closed spray chamber)

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

Dimensions in millimetres



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



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

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

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

5 Procedure

5.1 Handling and replacement

The calibrating nozzle and holder assemblies are actually gauges and as such should be carefully handled and maintained. The required accuracy of calibration can only be achieved if these instructions are followed closely.

It is good practice that components, including orifice plates, should not be interchanged between nozzle and holder assemblies. In case of component replacement, the nozzle and holder assembly shall be checked.

5.2 Preparation and adjustment

The calibrating nozzle and holder assemblies are carefully prepared and adjusted by the manufacturer, using the calibration fluid specified in ISO 4113, as shown in table 1.

NOTE — The spray damper, if used, should be removed for this test.

5.3 Flow

The flow of the calibrating nozzle and holder assembly shall be established by the manufacturer.

5.4 Single hole orifice plate

The single hole orifice plates have the greatest influence on the dynamic rate of flow of the calibrating nozzle and holder assembly. These orifice plates shall be made in accordance with figure 8 and carefully flow-measured in accordance with ISO 7440/2.

5.5 Delay pintle type nozzle

The nozzle flow values and method of flowing are described in ISO 4010.

5.6 Inlet stud with edge filter

The inlet stud with edge filter is another element which has significant influence on the dynamic flow of the calibrating

nozzle and holder assembly. It shall be replaced when noticeable flow changes are observed.

5.7 Nozzle holder body

Either of the two executions of the holder body, as shown in figure 3, may be used as long as the inlet stud with edge filter is in accordance with this part of ISO 7440. It is also important that only one type of retaining nut be used within a set, and spray dampers are used only on the type of calibrating test benches which require them. The retaining nut torque is 60 ± 30 N·m.

NOTE — The use of different studs greatly influences the dynamic flow of the calibrating nozzle and holder assembly and consequently the accuracy of the calibration of the injection pump.

6 Designation

6.1 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

6.2 Explanation of the designation

The designation comprises the following four elements, the two last being separated by a hyphen:

1st element : ISO 7440

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

Table 1

Assembly type	Preferred nozzle opening pressure	Seat leakage at room temperature ¹⁾
With single hole orifice plate	20,7 + 0,3 MPa (207 + 3 bar)	10 s at 2 MPa (20 bar) below actual opening pressure
With delay pintle type nozzle	17,2 + 0,3 MPa (172 + 3 bar)	
	14,7 + 0,3 MPa (147 + 3 bar)	
	12,5 + 0,3 MPa (125 + 3 bar)	

1) No droplet which separates from the adapter face during the time shown shall form.