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**Diesel engines — Fuel injection pump  
testing — Calibrating fuel injectors**

*Moteurs diesels — Essai des pompes d'injection de carburant — Porte-  
injecteurs de carburant complets 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. 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 14681 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 7, *Injection equipment and filters for use on road vehicles*.

Annex A of this International Standard is for information only.

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## Introduction

Calibrating fuel injectors are intended to simulate closely the function of fuel injectors in the fuel injection system of a diesel (compression-ignition) engine.

Injection pumps for emission-controlled engines require a new generation of calibrating injectors in order to comply with the higher injection pressures. The field of application is similar to those of the calibrating injectors specified in ISO 7440-1 and of the calibrating nozzle specified in ISO 4010. Compared with calibrating injectors according to ISO 7440-1, the new designs show the following differences:

- change-over from high spring nozzle holder to low spring nozzle holder,
- reduction of masses,
- reduction of dead volumes, e.g. edge filter.

Therefore, the following parts are modified:

- nozzle holder body,
- nozzle retaining nut,
- edge filter,
- spring,
- needle valve assembly and pintle nozzle,
- distance sleeve.

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The following parts are not modified:

- the orifice plates with the orifice diameter range from 0,4 mm to 0,8 mm,
- the optional spray damper,
- the distance sleeve of the calibrating fuel injector with the single hole orifice plate.

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# Diesel engines — Fuel injection pump testing — Calibrating fuel injectors

## 1 Scope

This International Standard specifies two types of calibrating injectors intended for testing and setting diesel fuel injection pumps on test benches.

It applies to

- a) calibrating injectors for different orifice plates, max. delivery range 400 mm<sup>3</sup>/stroke;
- b) calibrating injectors with pintle type nozzle, max. delivery range 200 mm<sup>3</sup>/stroke.

The field of application is similar to the calibrating injectors specified in ISO 7440-1 and to the calibrating nozzle specified in ISO 4010.

Compared to the calibrating injector specified in ISO 7440-1, the calibrating injectors specified in this International Standard represent an advanced stage of design which is more appropriate to modern high pressure/high performance fuel injection systems.

Specification of the type of calibrating fuel injectors to be used, the appropriate single hole orifice plate size or pintle nozzle (as applicable), high pressure pipes, exact limits, etc. is left to the manufacturer of the injection equipment and/or the manufacturer of the engine.

## 2 Normative references

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

ISO 4010:—<sup>1)</sup>, *Diesel engines — Calibrating nozzle, delay pintle type.*

ISO 4113:1988, *Road vehicles — Calibration fluid for diesel injection equipment.*

ISO 7440-1:1991, *Road vehicles — Fuel injection equipment testing — Part 1: Calibrating nozzle and holder assemblies.*

ISO 7440-2:1991, *Road vehicles — Fuel injection equipment testing — Part 2: Orifice plate flow-measurement.*

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<sup>1)</sup> To be published. (Revision of ISO 4010:1977)

### 3 Requirements

#### 3.1 Calibrating fuel injectors

##### 3.1.1 With single hole orifice plate

The two alternative designs of the calibrating fuel injectors with the single hole orifice plate specified in figure 11 are shown in figure 1.

##### 3.1.2 With delay pintle type nozzle

The two alternative designs of the calibrating fuel injectors with the delay pintle type nozzle specified in figure 14 are shown in figure 2.

#### 3.2 Components

The calibrating fuel injectors consist of the components specified in 3.2.1 to 3.4.2 with their functionally critical dimensions.

##### 3.2.1 Holder body

The holder body may include two spill tubes:

- one tube for the leakage fuel passing the needle valve assembly in the direction to the spring housing;
- another tube (optional) used with vented holder only.

The holder body is shown in figure 3.

##### 3.2.2 Spring

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The spring is shown in figure 5. It is designed for low stress in order to prevent fatigue.

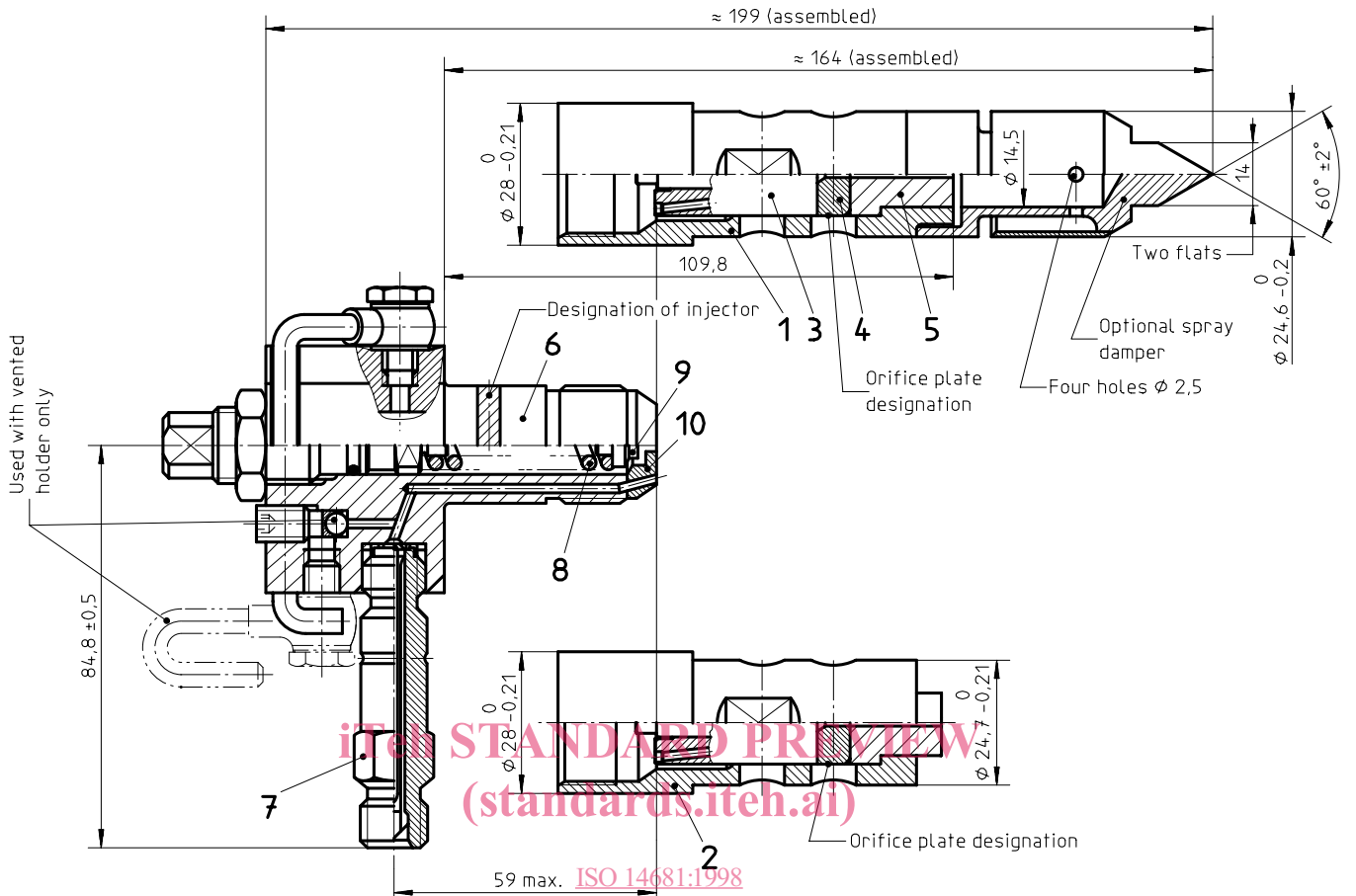
##### 3.2.3 Spring seat

The spring seat, which provides the connection of the low situated spring with the needle, is shown in figure 6.

##### 3.2.4 Inlet stud with edge filter

The inlet stud with edge filter is shown in figure 7. It may be flow-tested as shown in figure 8. The outlet of the fixture (within dotted lines) shall be ambient pressure.

Dimensions in millimetres



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Alternative 1: Preferably for use with calibrating test benches having open spray chamber

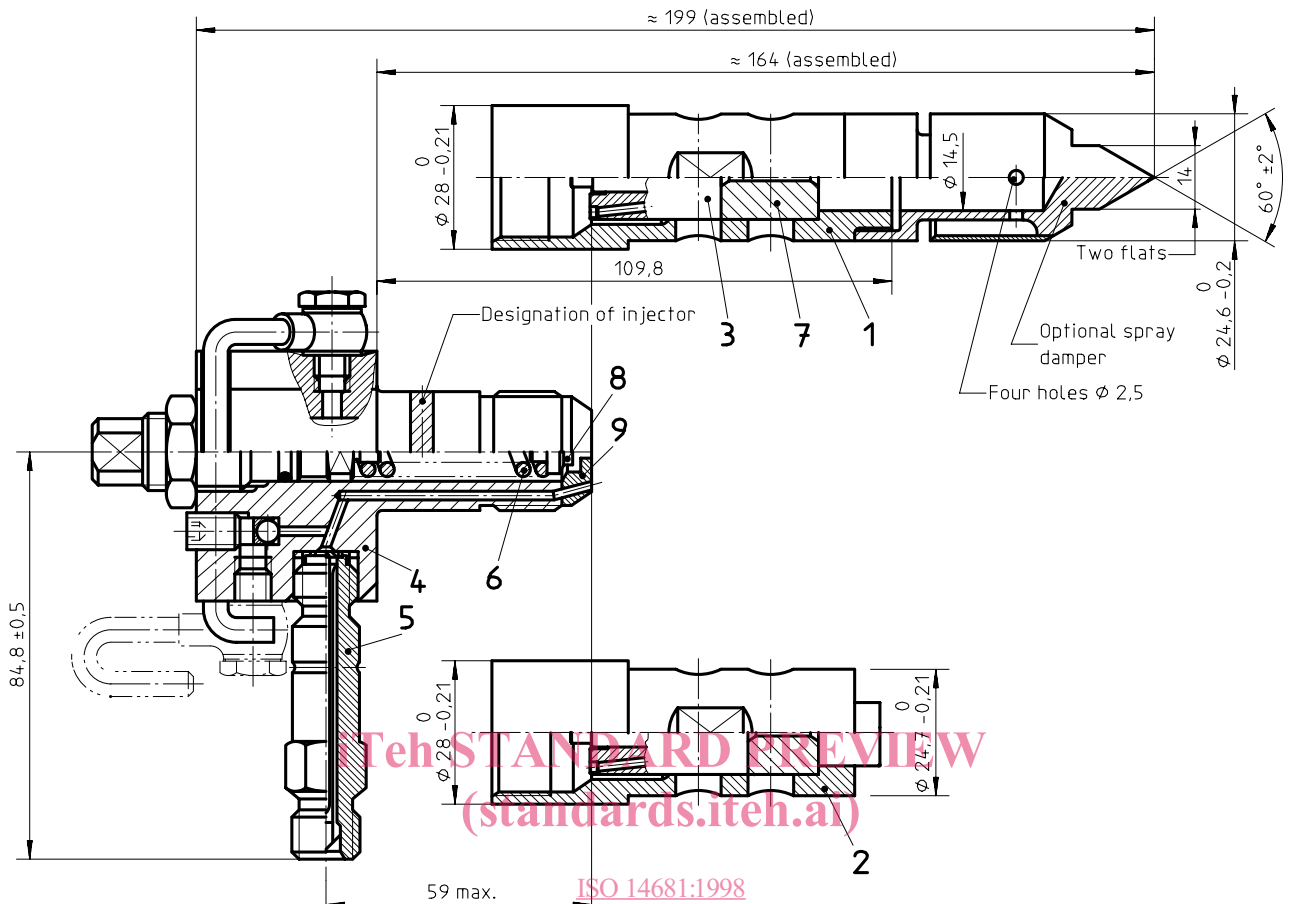
Alternative 2: Preferably for use with calibrating test benches having closed spray chamber

**Key**

- 1 Retaining nut, alternative 1
- 2 Retaining nut, alternative 2
- 3 Needle valve assembly
- 4 Single hole orifice plate
- 5 Distance sleeve
- 6 Holder body
- 7 Inlet stud with edge filter
- 8 Spring
- 9 Spring seat
- 10 Adaptor plate

**Figure 1 — Calibrating fuel injector with single hole orifice plate**

Dimensions in millimetres



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Alternative 1: Preferably for use with calibrating test benches having open spray chamber

Alternative 2: Preferably for use with calibrating test benches having closed spray chamber

**Key**

- 1 Retaining nut, alternative 1
- 2 Retaining nut, alternative 2
- 3 Delay pintle type nozzle
- 4 Holder body
- 5 Inlet stud with edge filter
- 6 Spring
- 7 Distance sleeve
- 8 Spring seat
- 9 Adaptor plate



Dimensions in millimetres

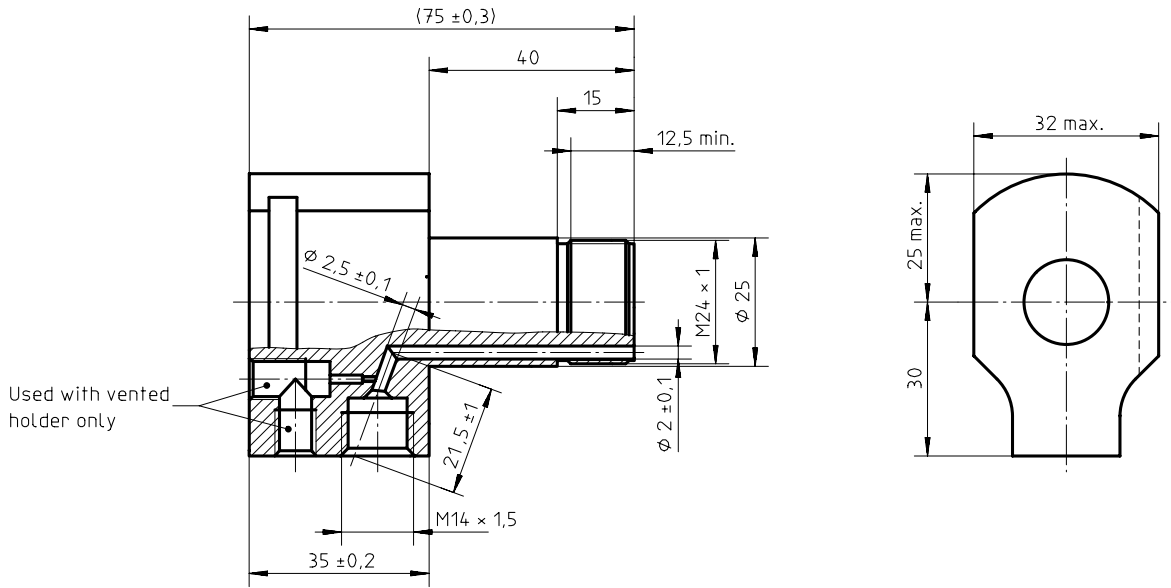


Figure 3 — Holder body

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Dimensions in millimetres

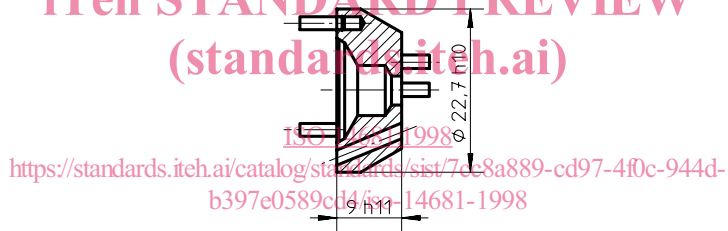


Figure 4 — Adapter plate

Dimensions in millimetres

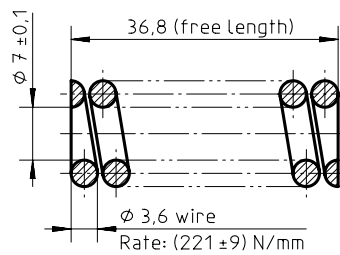
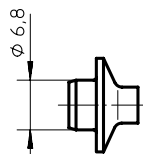
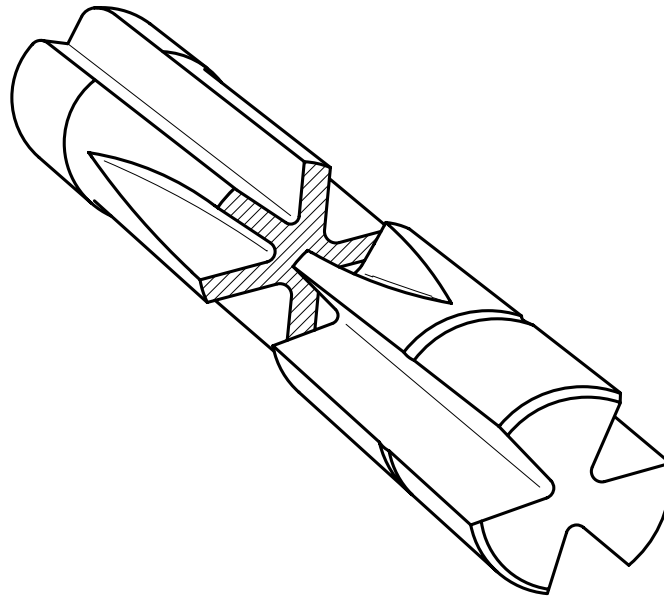


Figure 5 — Spring

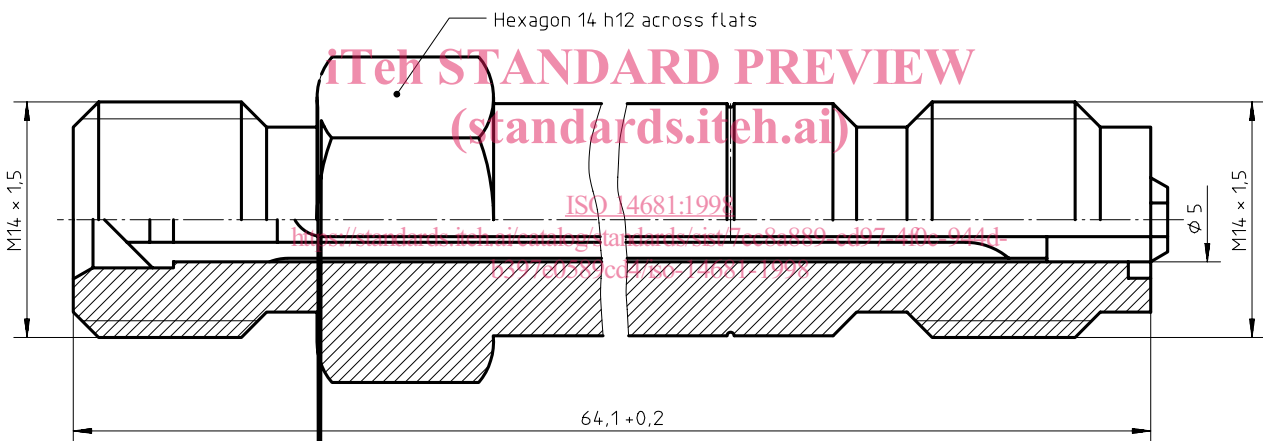
Dimensions in millimetres



Dimensions in millimetres



a) Edge filter with flutes (schematic)

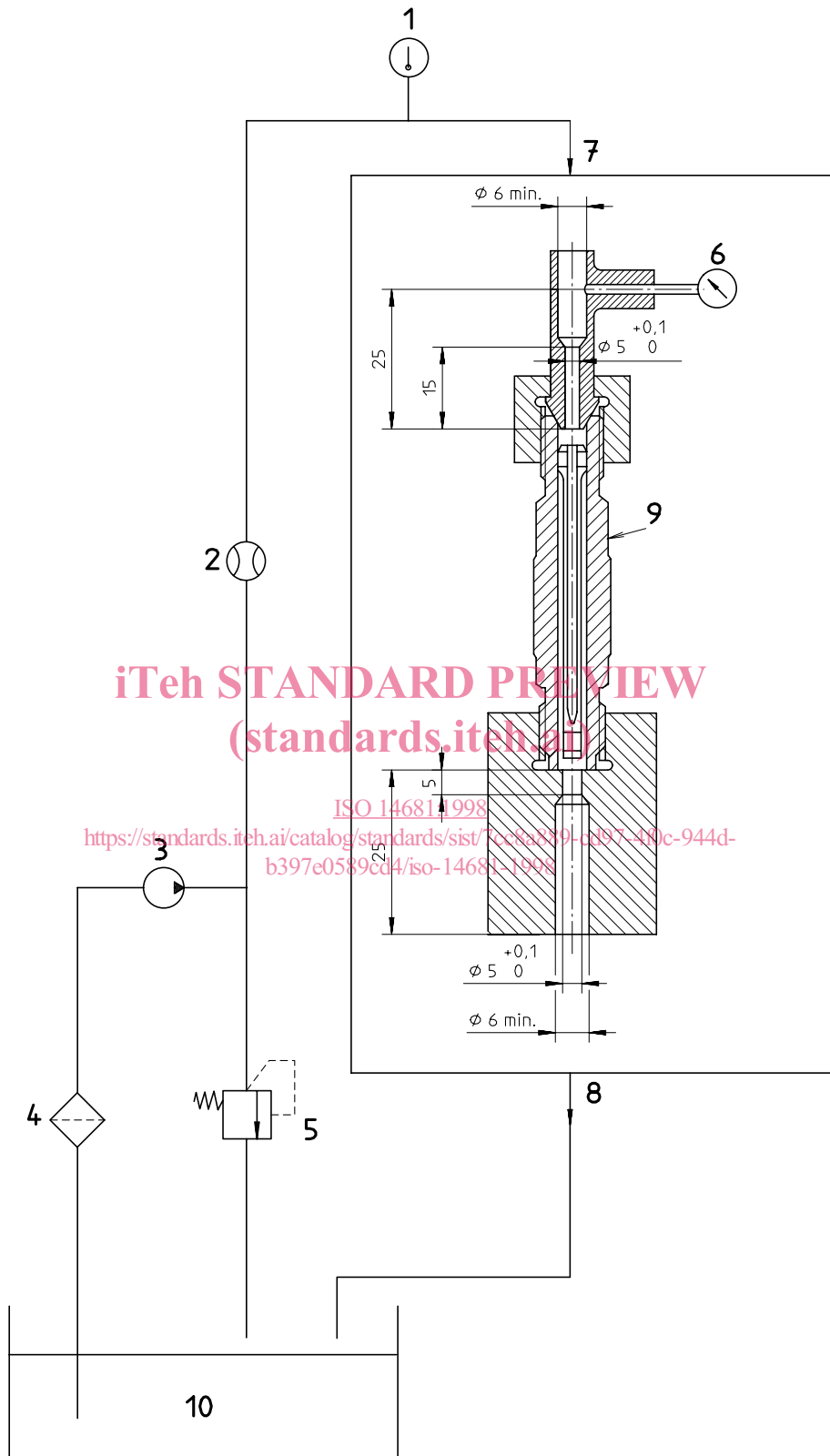


b) Inlet stud with edge filter

Filter clearance (radial)	0,02 mm to 0,031 mm
Filter clearance area	6 mm <sup>2</sup> min.
Flow area for three flutes [see figure 7a)]	5,2 mm <sup>2</sup>
Internal volume	700 mm <sup>3</sup> ± 20 mm <sup>3</sup>
New filter flow at 0,3 MPa (3 bar) pressure <sup>1)</sup>	2800 cm <sup>3</sup> /min to 4600 cm <sup>3</sup> /min
Minimum flow of assembled holder body with inlet stud and edge filter at 0,3 MPa (3 bar) pressure <sup>1)</sup>	2000 cm <sup>3</sup> /min
Minimum acceptable flow in service of the edge filter (to replace) at 0,3 MPa (3 bar) pressure <sup>1)</sup>	2500 cm <sup>3</sup> /min
<sup>1)</sup> These tests shall be made using calibration fluid as specified in ISO 4113 at 40 ± 1°C and the tolerance of the supply pressure shall be ± 0,03 MPa (0,3 bar).	

Figure 7 — Characteristic dimensions and values of the inlet stud with edge filter

Dimensions in millimetres



**Key**

- |                  |                      |                               |
|------------------|----------------------|-------------------------------|
| 1 Temperature in | 5 Pressure regulator | 8 Outlet                      |
| 2 Flowmeter      | 6 Pressure in        | 9 Inlet stud with edge filter |
| 3 Pump           | 7 Inlet              | 10 Tank                       |
| 4 Filter         |                      |                               |

**Figure 8 — Inlet stud flow measuring system**