International Standard 7440/2

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Road vehicles — Fuel injection equipment testing — Part 2 : Orifice plate flow measurement

Véhicules routiers — Essai des équipements d'injection de combustible — Partie 2: Mesurage du débit des pastilles à trou

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Foreword

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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.

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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.

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Road vehicles — Fuel injection equipment testing — Part 2 : Orifice plate flow measurement

1 Scope

This part of ISO 7440 specifies the flow measuring system, including the fixture, to be used for flow testing the single hole orifice plates used in an orifice plate type nozzle and holder assembly (described in ISO 7440/1) which are intended for testing and setting diesel fuel injection pumps on test benches.

2 Field of application

The flow measuring system and fixture described in this part of ISO 7440 ensure accurate flow testing of the entire range of orifices from 0,4 to 0,8 mm diameter as specified in ISO 7440/1. It is intended primarily for use by the manufacturers of single hole orifice plates.

3 References

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

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

4 Measuring procedure

4.1 Orifice flow measuring system

The schematic flow diagram of the orifice flow measuring system is shown in figure 1.

The two most important and functionally most critical parts of this system are:

a) orifice plate holding (measuring) fixture;

b) flow measuring method.

The exactitude of these items greatly affects the measuring accuracy; they are therefore standardized in this part of ISO 7440.

4.2 Orifice plate holding fixture for flow measurement

The functionally critical details and dimensions of the fixture are shown in figure 2; other dimensions are shown as guidance only. Dimensions not specified and construction techniques are left to the discretion of the manufacturer of the fixture, but shall be such that the fixture has unrestricted and undisturbed flow.

4.3 Flow measuring procedure

4.3.1 The flow measuring method is a functionally critical part of the whole system, and its design is shown in figure 3. The flow values presented in ISO 7440/1 were derived by the method shown.

4.3.2 The flow measuring system is downstream of the orifice plate. The flow shall be measured by flowing into a known measuring volume and recording the time required to fill the volume.

4.3.3 For the orifice plate flow measurement, the calibrating fluid specified in ISO 4113 shall be used.

4.3.4 The gauge pressure at the inlet of the single hole orifice plate shall be maintained at 10 ± 0,01 MPa (100 ± 0,1 bar) and the outlet pressure shall be atmospheric.

4.3.5 The temperature at the inlet of the single hole orifice plate shall be maintained at 40 ± 1 °C.

4.3.6 The measuring volume shall be at least 4 000 cm^3 capacity, which gives measuring times of between 60 and 240 s for the full range of single hole orifice plate sizes. The measuring volume should either be calibrated wet or a system should be employed actively to dry the walls between every test.

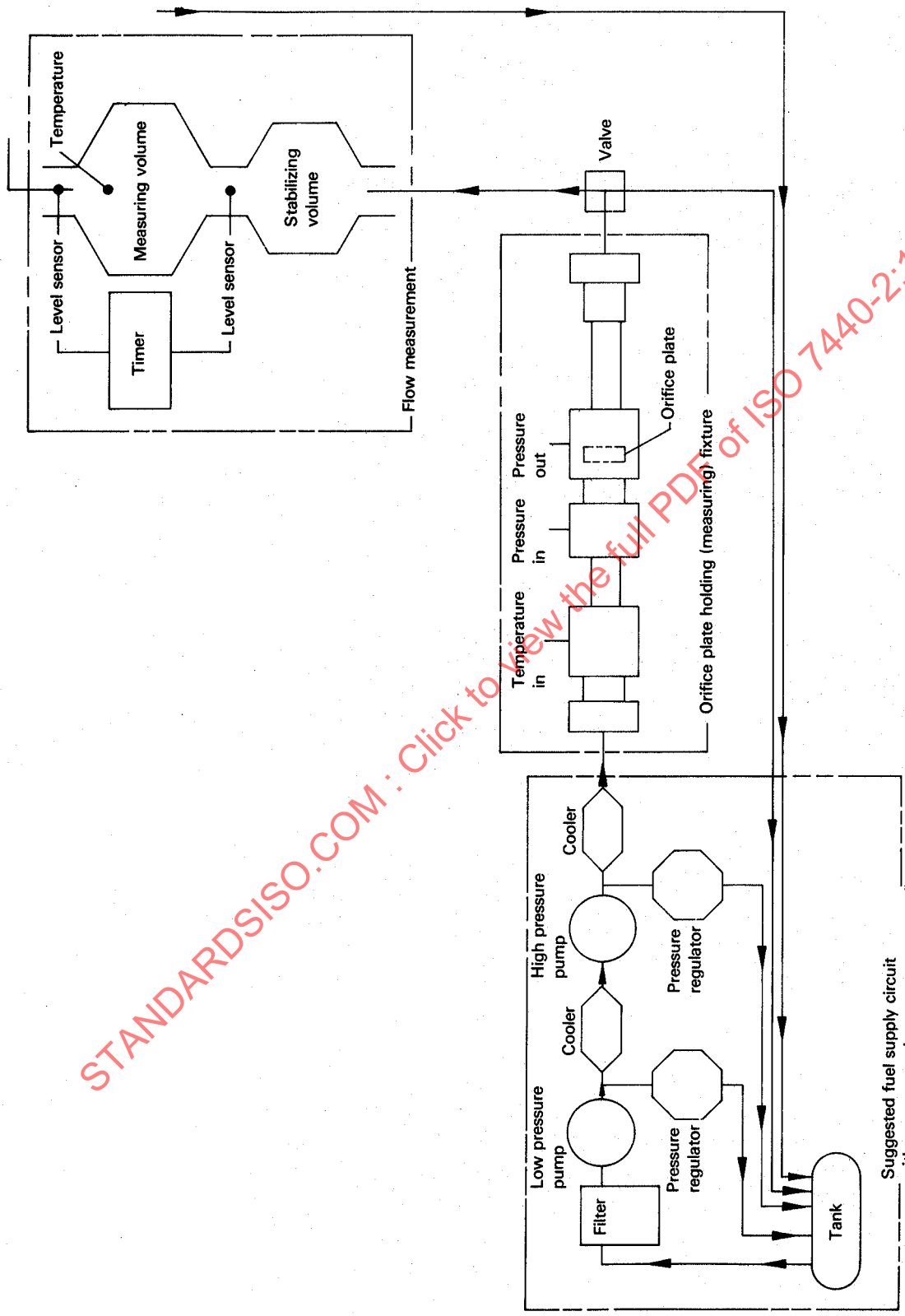

Figure 1 — Orifice flow measuring system

Dimensions in millimetres

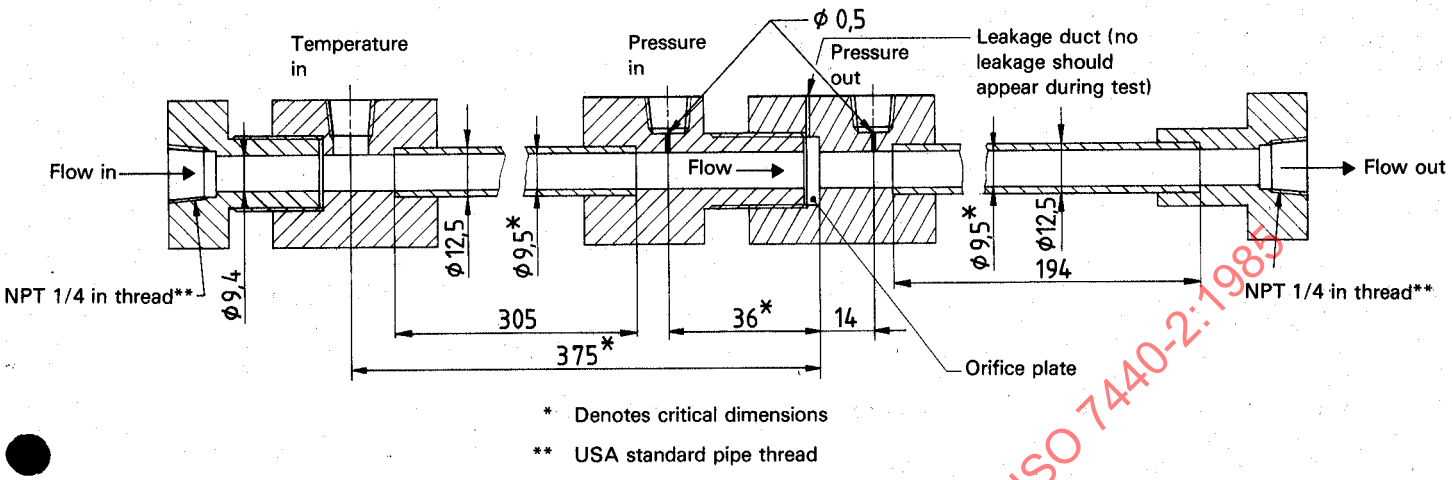

Figure 2 — Orifice plate holding fixture for flow measurement

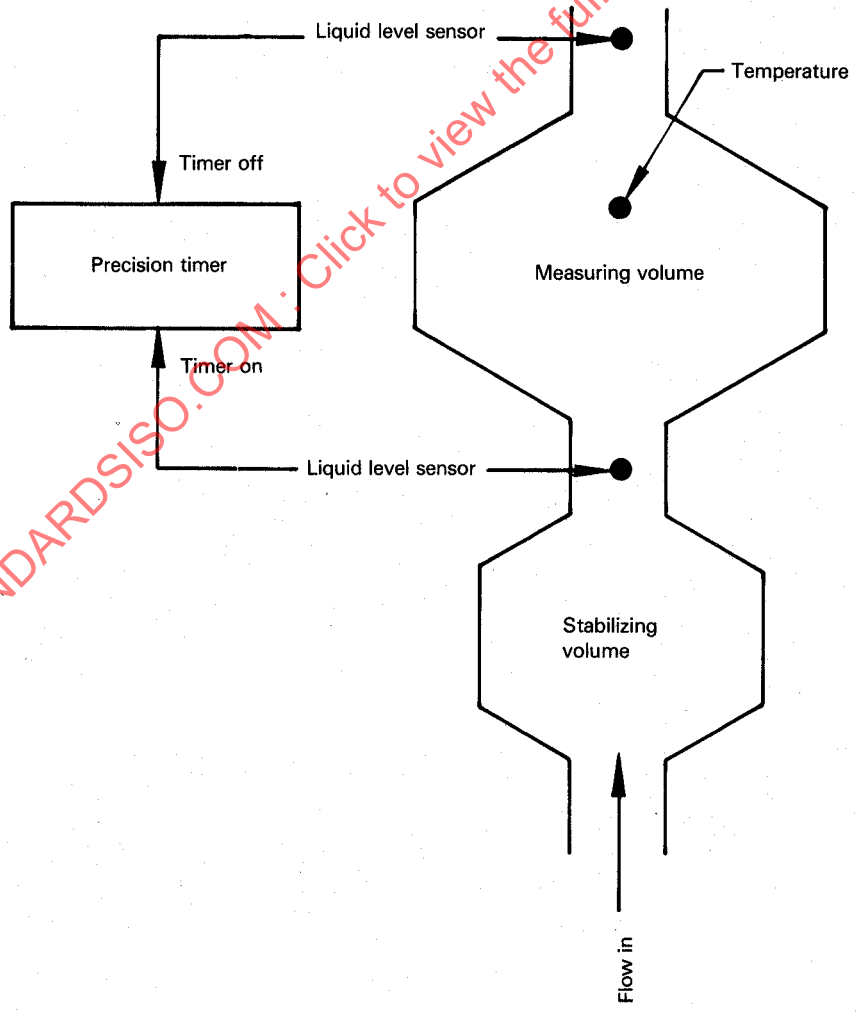

Figure 3 — Flow measuring method

4.3.7 The stabilizing volume shall be at least 1 000 cm^3.

4.3.8 The level sensors and the flow area at the sensor level shall have an accuracy and repeatability within 2 cm^3 of displaced volume. The flow area at the sensor level should also be selected so that the accuracy and repeatability are not affected by either the capillary action or the rising velocity of the fluid.

4.3.9 The precision timer shall be accurate to ± 0,01 s.

4.3.10 The density of the calibrating fluid shall be measured in the measuring volume.

4.3.11 As the calibrating fluid reaches the upper level sensor, and the timer is stopped, the mean temperature T_m (prevailing at this moment) in the measuring volume shall be read.

4.3.12 The flow measurement shall be corrected to the mean density at 40 °C of the calibration fluid specified in ISO 4113 using the following formula:

$$q_{40} = \frac{V_{Tm}}{t} \times \frac{\varrho_{Tm}}{\sqrt{\varrho_{40} \times 0{,}808}}$$

where

q_{40} is the flow-rate corrected to the mean density at 40 °C;

V_{Tm} is the volume collected at temperature T_m;

t is the time measured;

ϱ_{Tm} is the measured density at temperature T_m;

ϱ_{40} is the measured density at 40 °C.