

# INTERNATIONAL STANDARD

**ISO**  
**8984-2**

Second edition  
1993-12-15

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## **Diesel engines — Testing of fuel injectors —**

### **Part 2: Test methods**

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*Moteurs diesels — Essais des porte-injecteurs de combustible*  
<https://standards.complets.org/standards/sist/77bbcbe5c0a-40f8-8198-b6340b3c5a1a/iso-8984-2-1993>  
*Partie 2: Méthodes d'essai*



Reference number  
ISO 8984-2:1993(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 8984-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 7, *Injection equipment and filters for use on road vehicles*.

This second edition cancels and replaces the first edition (ISO 8984-2:1987), of which it constitutes an editorial revision.

ISO 8984 consists of the following parts, under the general title *Diesel engines — Testing of fuel injectors*:

- *Part 1: Hand-lever-operated testing and setting apparatus*
- *Part 2: Test methods*

# Diesel engines — Testing of fuel injectors —

## Part 2: Test methods

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#### 1 Scope

**1.1** This part of ISO 8984 specifies tests which may be performed on fuel injectors for diesel (compression-ignition) engines, using hand-lever-operated testing and setting apparatus, as specified in ISO 8984-1.

These tests are

- nozzle opening pressure;
- chatter (atomization);
- spray pattern;
- seat leakage;
- back-leakage.

**1.2** This part of ISO 8984 primarily applies to testing the injectors of fuel injection equipment for diesel (compression-ignition) engines requiring fuel delivery of up to 300 mm<sup>3</sup>/(injection × cylinder) at full load.

**1.3** It is up to the injector manufacturer to specify which tests in this part of ISO 8984 are to be performed on a particular injector, together with the acceptable performance limits.

**1.4** It is also up to the injector manufacturer to specify the adaptor which connects the injector to the apparatus (see 3.4), and any specific requirements not covered by this part of ISO 8984.

**NOTE 1** The terms used in this part of ISO 8984 are in accordance with ISO 7876-2:1991, *Fuel injection equipment — Vocabulary — Part 2: Fuel injectors*.

#### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8984. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8984 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 4008-3:1987, *Road vehicles — Fuel injection pump testing — Part 3: Application and test procedures*.

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 8984-1:1993, *Diesel engines — Testing of fuel injectors — Part 1: Hand-lever-operated testing and setting apparatus.*

### 3 Operating conditions

**3.1** The testing and setting apparatus shall conform to ISO 8984-1.

**3.2** Calibration fluid conforming to ISO 4113 shall be used.

**3.3** The test conditions defined in this part of ISO 8984 apply for fluid operating temperatures of  $23\text{ °C} \pm 5\text{ °C}$ . If operating temperatures outside this range are unavoidable, advice and special instructions should be sought from the injector manufacturer.

**3.4** The injector shall be connected to the test apparatus with an adaptor specified by the injector manufacturer for the particular injector under test. In most cases, this adaptor will be a high-pressure pipe assembly of specific dimensions.

### 4 Test procedures

If detailed diagnostic work on the apparatus is required, it shall precede the following preparation and test procedures.

#### 4.1 Preparation

Stabilize the temperature of the injector to within the operating range defined in 3.3 prior to testing. Connect the injector to the apparatus with the adaptor (see 3.4). Isolate the pressure gauge from the system by closing the isolating valve and flush the injector with several rapid pumping strokes. Ensure that there are no leaks from the adaptor connections, or the injector, other than back-leakage where applicable.

Prior to performing the tests in 4.3 to 4.6, the nozzle opening pressure shall be checked; it should be within the specified limits for the appropriate injector application.

#### 4.2 Nozzle opening pressure test

With the pressure gauge isolating valve fully open, raise the pressure slowly by depressing the operating handle of the apparatus, and monitor the pressure. The point at which the pressure stops rising or drops,

and fluid is emitted from the nozzle tip, is defined as nozzle opening pressure.

The spray pattern should not be assessed during this test.

#### 4.3 Chatter (atomization) test

With the pressure gauge isolating valve closed, pump fluid through the injector by operating the handle. Chatter is the manner in which the nozzle valve rapidly reciprocates and is assessed by

- noting the sound;
- and/or visual observation of the spray;
- and/or feel of the operating handle.

The acceptance criteria for the particular injector under test shall include the rate of pumping.

The spray pattern should not be assessed during this test.

#### 4.4 Spray pattern

With the isolating valve fully closed, depress the operating handle quickly and abruptly. Observe the spray pattern, and compare with the injector manufacturer's specification.

#### 4.5 Seat leakage test

With the isolating valve fully open and with the nozzle angled downwards, carry out the nozzle opening pressure test as detailed in 4.2, recording the actual nozzle opening pressure. Dry the nozzle tip and then slowly operate the handle to raise the pressure to 2 MPa (20 bar) below the recorded nozzle opening pressure. No drop shall separate from the tip after holding the pressure for 10 s.

Additional requirements for the seat leakage testing of orifice plate type calibrating injectors apply; they are detailed in ISO 4008-3.

Ensure that fluid on the outside of the injector from the back-leakage connection where applicable does not interfere with the test.

#### 4.6 Back-leakage test

A fundamental requirement for this test is that the seat leakage test (4.5) has already been passed.

Flush the injector with five pump strokes with the isolating valve closed. With the isolating valve fully open, operate the handle to raise the pressure to a predetermined pressure,  $p_A$ , release the operating handle and allow the pressure to drop freely. Measure the time taken for the fluid leaking between the nozzle valve and its guide to cause the pressure to fall from one predetermined value,  $p_B$ , to a second lower value,  $p_C$ .

Pressure  $p_A$  shall be at least 0,5 MPa (5 bar), and pressure  $p_B$  at least 2,5 MPa (25 bar) below the actual nozzle opening pressure. The pressure drop between

$p_B$  and  $p_C$  shall be 3 MPa (30 bar). The actual pressure levels and the minimum acceptable back-leakage time (maximum acceptable leakage rate) at a reference temperature shall be specified by the injector manufacturer.

NOTE 2  $p_A$ ,  $p_B$ ,  $p_C$  are defined in ISO 4008-3 as pressures A, B, C.

For calibrating injectors conforming to ISO 7440-1, refer to ISO 4008-3.

Repeat the test several times, but flush the injector between each test with the isolating valve closed.

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