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Diesel engines — Procedure for checking the dynamic timing of diesel fuel injection equipment —

Part 2: **Test method**

Moteurs diesels — Procédure pour contrôler le calage dynamique de l'équipement d'injection de combustible diesel —

Partie 2: Méthode d'essai

Reference number
ISO 13555-2:2003(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13555-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 7, *Injection equipment and filters for use on road vehicles*.

ISO 13555 consists of the following parts, under the general title *Diesel engines — Procedure for checking the dynamic timing of diesel fuel injection equipment*:

— *Part 1: Preconditioning*

— *Part 2: Test method*

— *Part 3: Validation of timing measurement devices*

Diesel engines — Procedure for checking the dynamic timing of diesel fuel injection equipment —

Part 2:
Test method

1 Scope

This part of ISO 13555 specifies a test method for referencing the pressure rise in the high-pressure pipe of a diesel fuel injection system consisting of fuel injection pump, high-pressure pipe or pipes and injector or injectors, as part of the procedure for checking the dynamic setting of fuel injection equipment fitted to diesel engines (the pressure rise being related to the start of pumping of fuel at the fuel injection pump and the start of injection).

This part of ISO 13555 is not applicable to unit injector systems or common rail systems and, unless otherwise noted by the original equipment manufacturer (OEM), might not be applicable to systems incorporating line/cylinder disable at idle, fuel injection equipment with electronic controls that control timing or systems incorporating pilot or pre-injection features. The test method does not cover the setting of diesel fuel injection timing, for which reference is to be made to the vehicle, engine or fuel injection manufacturer's data or all these.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2710-1:2000, *Reciprocating internal combustion engines — Vocabulary — Part 1: Terms for engine design and operation*

ISO 7876-1, *Fuel injection equipment — Vocabulary — Part 1: Fuel injection pumps*

ISO 7876-2, *Fuel injection equipment — Vocabulary — Part 2: Fuel injectors*

ISO 7876-3, *Fuel injection equipment — Vocabulary — Part 3: Unit injectors*

ISO 7876-4, *Fuel injection equipment — Vocabulary — Part 4: High-pressure pipes and end-connections*

ISO 8984-2, *Diesel engines — Testing of fuel injectors — Part 2: Test methods*

ISO 13296, *Diesel engines — High-pressure fuel injection pipe assemblies — General requirements and dimensions*

ISO 13555-1, *Diesel engines — Procedure for checking the dynamic timing of diesel fuel injection equipment — Part 1: Preconditioning*

ISO 13555-3, *Diesel engines — Procedure for checking the dynamic timing of diesel fuel injection equipment — Part 3: Validation of timing measurement devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7876-1, ISO 7876-2, ISO 7876-3 and ISO 7876-4 and the following apply.

3.1
triggering level
OEM-defined value which represents a percentage of the peak pressure sensed in advance of the actual measurement, the base pressure value used being the integral of the signal sensed in advance of the measurement

See ISO 13555-3.

3.2
top dead centre
TDC
dead centre when the piston is farthest from the crankshaft

NOTE Adapted from ISO 2710-1:2000, definition 10.1.4.2. For the definition of *dead centre*, see 10.1.4 of ISO 2710-1:2000.

4 Test preparation

4.1 Preconditioning

Carry out preconditioning in accordance with ISO 13555-1.

4.2 Timing measurement device

Ensure that the timing measurement device is of an appropriate type, calibrated in accordance with ISO 13555-3. In addition, refer to the manufacturer's data for specific instructions on its use. Ensure its operation within the temperature range 10 °C to 40 °C.

4.3 Sensing method for top dead centre (TDC)

Identify the sensing method for TDC (see Annex A) and ensure that constituent parts are in good condition (refer to the timing measurement device manufacturer's recommendations).

5 Test procedure

5.1 Principle and general

5.1.1 The principle used in the test is that of referencing the pressure rise sensed in the high-pressure fuel injection pipe (the pipe connecting the fuel injection pump to the fuel injector) to the engine piston TDC.

5.1.2 The pressure rise is sensed either by means of a clip-on device attached externally to the high-pressure pipe (and which measures pipe dilation during pumping) or by means of an in-line pressure transducer. The pressure rise — or a defined point during the pressure rise, such as triggering level — is then related to the TDC in terms of engine crank angle.

5.1.3 The procedure, which is to be used *for checking purposes only*, could be useful in fault diagnostics situations where observed engine or vehicle performance does not match customer or legislative requirements or where neither performance matches such requirements.

5.1.4 This test method is not intended to supersede any OEM data, specifications or procedures. When following the test procedure, care should be taken to refer to OEM and OEM-approved data such as specifications and other data printed by the timing measurement device manufacturer.

5.1.5 The parameter specified by the OEM shall include triggering level, position of clamping on the high-pressure pipe, engine speed and load condition (e.g. idle), as well as the type or TDC sensing required (see Annex A).

5.2 Vehicle/engine/fuel injection equipment specification

Identify the vehicle, engine, and fuel injection equipment specification for the vehicle or engine under test and check this against the OEM data to ensure conformity to specification.

5.3 Checking conditions

Establish checking conditions for the vehicle or engine under test or both, according to the OEM-approved data.

5.4 Clamp position

Determine the required clamp position from the OEM recommendations and determine which high-pressure pipe/cylinder is to be used in the measurement.

5.5 Pipe external condition

Check that the pipe external condition at the clamp position is clean of paint and grease, ensure that there are no bends in the vicinity and mark the position.

5.6 Clamp size

Choose the correct clamp size and install the clamp as recommended.

5.7 Type of and location for TDC sensing pick-up

Identify the type of, and location for, the TDC sensing pick-up and install or connect it as recommended.

5.8 Timing measurement device

Set the timing measurement device and further check its calibration if required.

5.9 Triggering level

Check the specified triggering level and set the timing measurement device, if adjustable.

5.10 Load and speed conditions

Set the engine load and speed conditions as specified by the OEM-approved data.

5.11 Monitor readings

Monitor readings from the timing measurement device over a period of time ($>$ 30 s) sufficient for a stable reading to be determined.

5.12 Reading variation

5.12.1 If the reading variation is within 0,5° engine and the mean is outside the specification, check or reset the timing, or both, following the OEM procedure.

5.12.2 If the reading variation exceeds 0,5° engine, loosen the clamp, repeat the procedures of 5.4 to 5.6 and retest. If the reading is still unstable and the mean is outside the specification, check or reset timing or both, in accordance with the OEM procedure. If still unstable, repeat this procedure until a confident mean can be established, or proceed to Clause 6.

6 Post-test checks

6.1 General

If an incorrect figure is obtained following resetting to the OEM's recommendations, rechecking using the procedure given in Clause 5 or revalidation of the timing measurement device in accordance with ISO 13555-3, then the following aspects should be considered and checks undertaken before removal of the fuel injection pump.

6.2 Pump drive condition

Incorrect belt tension or excessive backlash (free movement) in the drive to the fuel injection pump can lead to an erratic or incorrect timing signal or both. Check the OEM's recommendation.

6.3 Fuel filter condition

Incorrect components or incorrectly fitted components as well as poorly maintained low-pressure systems can lead to incorrect feed pressures that can cause timing errors on some types of fuel injection equipment.

6.4 Air ingress and/or fuel leakage

Ensure that all connections on the fuel injection system are in good condition, free from leakage and correctly fitted.

6.5 High-pressure pipe condition

Check all high-pressure pipes for conformity to specification, and correct condition and size, including end closure effects (see ISO 13296).

6.6 Fuel condition

Ensure that the fuel used is as specified by the OEM. The fuel temperature shall be in the temperature range 10 °C to 40 °C.

6.7 Injector condition

Remove injectors and ensure correctness to specification: check the nozzle opening setting, that spray formation is good and that the leakage rate is within accepted limits (see manufacturer's data and ISO 8984-2).

6.8 Fuel injection equipment input signals

Check that all connections to the fuel injection pump — electrical, pneumatic, hydraulic and mechanical — are in good condition and operating correctly (refer to the OEM's diagnostics data).

7 Identification statement (reference to this International Standard)

If the measurement of the injection pump timing has been performed in accordance with the test method given in this part of ISO 13555 in conjunction with the manufacturer's data, if the preconditioning procedure was performed in accordance with and if the accuracy of the timing measurement devices has then been validated in accordance with ISO 13555-3, it is strongly recommended that the following statement be used in test reports and other related documentation:

“Tested in accordance with ISO 13555 (all parts), *Road vehicles — Procedure for checking the dynamic timing of diesel fuel injection equipment*.”

Annex A
(informative)

Types of TDC sensor

A.1 Diagnostics socket

A diagnostics socket may be provided on the vehicle and used as the TDC sensor in accordance with OEM specifications. In this case, a connection adaptor is fitted between the diagnostics socket and the timing measurement device. See Figure A.1.

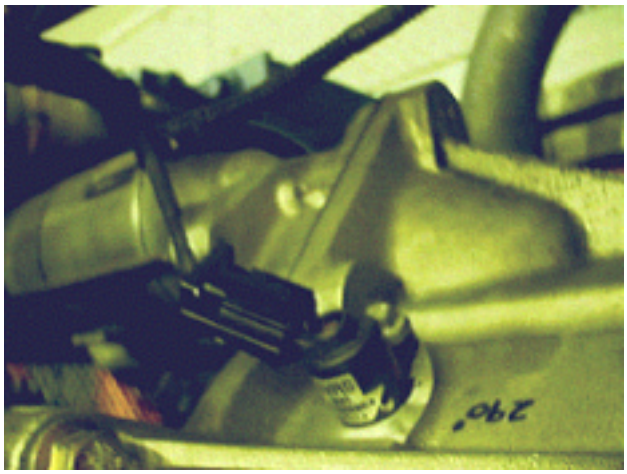

Figure A.1 — Typical engine diagnostics socket

A.2 Magnetic pick-up

A magnetic pick-up may be used as the TDC sensor, fitted into an adaptor on the engine. Figure A.2 shows an example of such an adaptor — first fitted to the engine per the manufacturer's specifications — with the magnetic pick-up end attached. The connector end of the magnetic pick-up is connected to the timing measurement device.

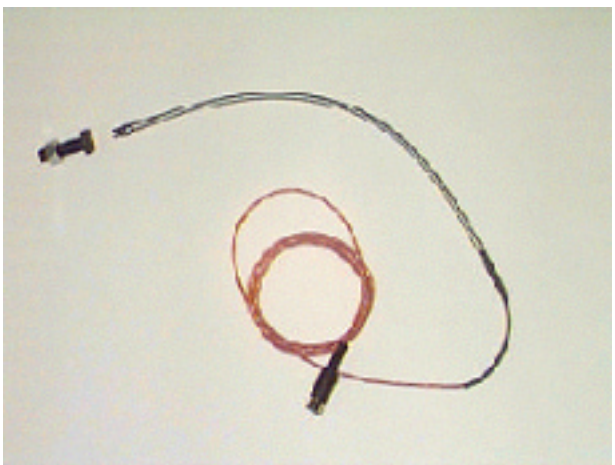

Figure A.2 — Magnetic pick-up and adaptor

A.3 Stroboscope

A stroboscope light may be used as the means of determining TDC. The stroboscope unit (see Figure A.3) usually requires a connection to the vehicle battery for power, with the other connection being made to the timing measurement device.

The engine shall be equipped with a timing mark on its front pulley or flywheel with a stationary pointing device.

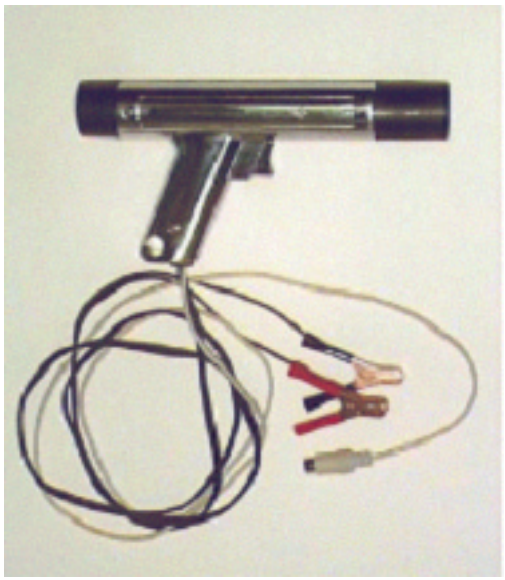

Figure A.3 — Typical stroboscope unit

ICS 43.060.40

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