INTERNATIONAL STANDARD

ISO 22561

First edition

Gasoline engines with direct fuel injection (GDI engines) — Installation of the injectors to the engine

Moteurs à essence à injection directe de carburant (moteurs à injection directe d'essence) — Installation des injecteurs sur le moteur

PROOF/ÉPREUVE

Reference number
ISO 22561:2020(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols and abbreviated terms **2**
4.1 Injector dimensions 2
4.2 Rail assembly and injector cup bore dimensions 2
4.3 Cylinder head bore dimensions 2
5 General requirements **3**
5.1 Injector description 3
5.2 Injector mounting arrangement 5
6 Dimensions and tolerances **6**
6.1 General 6
6.2 Injector cup 6
6.3 Cylinder head bore 7
6.4 High pressure connector 8
Bibliography **9**

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The motor vehicle industry is increasingly being pressured by the world's regulators to improve fuel consumption thus reducing exhaust CO_2 emissions. The challenge for automotive engineers is to balance the trade-offs between the technology to improve fuel consumption and to reduce any other regulated emissions (such as NO_X, HC and particulates).

The most promising new engine technology of late is the direct injection spark ignition engine [also known as the gasoline direct injection (GDI) engine]. Listed amongst the advantages of GDI are a significantly improved fuel economy and corresponding lower CO_2 emissions than on contemporary gasoline engines.

With this technology comes new fuel system components and updates to their interfaces with the engine. One component of the GDI fuel system is the injectors, which inject the fuel directly into the combustion chambers using fuel which is supplied at high pressure from the fuel rail.

This document provides design engineers with standard dimensions for the mounting of the GDI injectors in the cylinder head and for their connection to the fuel rail.

NOTE Gasoline direct injection systems typically operate at a pressure range of up to about 35 MPa. For gasoline systems this is considered as high pressure, thus the pump is called high pressure pump. If this pressure range is regarded in the view of all injection systems, diesel and gasoline, it is considered as medium pressure, as diesel injection operates at much higher pressures. So, even if the terms differ (high pressure connector in this document, medium pressure liquid fuel supply connections in ISO 18418-1 and ISO 18418-2), they mean the same pressure range and are designed for the same purpose.

Gasoline engines with direct fuel injection (GDI engines) — Installation of the injectors to the engine

1 Scope

This document specifies the dimensions required for the installation and integration of the fuel injectors in gasoline (GDI) engines. It also describes the interface of the fuel injector cup within the fuel rail to the individual injector.

NOTE When the word “fuel” is used in the terms listed, it can be omitted, provided there is no misunderstanding.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2974, *Diesel engines — 60° female cones for high-pressure fuel injection components*

ISO 18418-1, *Gasoline engines — Medium pressure liquid fuel supply connections — Part 1: 60° female cone connectors*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
fuel injector
device energized by an electrical signal that opens an internal valve via a solenoid or a piezo-electric actuator and injects fuel directly into the combustion chamber

3.2
fuel rail
pipe that serves as a reservoir for the pressurized fuel and as an adapter to provide the fuel to the inlets of the injectors

Note 1 to entry: The rail also serves to apply the necessary force to the injectors in order to position them in their locations in the cylinder head such that they can withstand the combustion pressure.

3.3
fuel injector cup
location in the *fuel rail* (3.2), which is placed over the inlet feed of the injector and transfers the fuel into the injector and applies a hydraulic force on the injector

4 Symbols and abbreviated terms

4.1 Injector dimensions

d_1 = injector nozzle diameter

d_1 = injector nozzle diameter

d_2 = injector body outside diameter

L_1 = distance of nozzle tip to injector body seating face (support surface)

L_2 = distance of injector clamping surface to injector body seating face (support surface)

L_3 = distance of seal ring groove to injector body seating face (support surface)

L_4 = length of seal ring groove

NOTE Uppercase letter "D" denotes diameters of bores, lowercase letter "d" denotes diameters of shafts.

4.2 Rail assembly and injector cup bore dimensions

A_1 = coaxiality of the rail cup (D_1) to the nozzle bore (D_2)

A_2 = parallelism of the rail cup (D_1) to the nozzle bore (D_2)

A_3 = perpendicularity of rail lower cup surface to nozzle bore (D_2)

D_1 = rail cup bore diameter

L_5 = distance of rail cup to injector body seating face (support surface)

L_6 = complete depth of rail cup

L_7 = depth of finished section within rail cup bore (surface roughness)

L_8 = depth of insertion taper of rail cup

R_1 = radius between insertion taper and lower cup surface

R_2 = radius between rail cup bore and insertion taper

W_1 = angle of insertion taper of rail cup

Z_1 = surface roughness within rail cup bore and insertion taper

NOTE Uppercase letter "D" denotes diameters of bores, lowercase letter "d" denotes diameters of shafts.

4.3 Cylinder head bore dimensions

A_4 = perpendicularity of injector seat (support surface) to nozzle bore (D_2)

A_5 = flatness of injector seat (support surface)

A_6 = coaxiality of injector guide (D_4) to nozzle bore (D_2)

A_7 = cylindricity of injector guide (D_4) to nozzle bore (D_2)

D_2 = nozzle bore diameter

D_3 = diameter of injector lower guide bore

D_4 = diameter of injector upper guide bore

D_5 = diameter of injector bore upper section

L_9 = depth of injector lower guide bore

L_{10} = depth of lower end of insertion taper for injector sealing

L_{11} = height of injector guide bore

L_{12} = distance of injector seat (support surface) to combustion chamber

R_3 = radius between injector lower guide bore and injector seat (support surface)

R_4 = radius between injector seat (support surface) and injector lower guide bore

R_5 = radius at lower end of injector lower guide diameter

R_6 = radius at upper end of insertion taper for injector sealing

R_7 = radius at lower end of insertion taper for injector sealing

W_2 = angle of insertion taper for injector sealing

Z_2 = roughness within nozzle bore diameter and within insertion taper

Z_3 = roughness at injector seat

NOTE Uppercase letter "*D*" denotes diameters of bores, lowercase letter "*d*" denotes diameters of shafts.

5 General requirements

5.1 Injector description

The injectors are divided in 2 types for d_1 diameter:

— type A with a 6 mm nozzle diameter,

— type B with a 7,5 mm nozzle diameter.

The injectors include a seal ring at the nozzle to seal against the combustion pressure and also an O-ring at the fuel inlet feed to the injector for fuel sealing. A device shall be provided for the angular positioning of the injector, e.g. a pin at the injector and a corresponding location on the rail.

Figure 1 shows the dimensions of the injector, which are important for its installation within the cylinder head.