

INTERNATIONAL STANDARD

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Diesel engines — Fuel injection pumps — High-pressure pipes for testing

*Moteurs diesels — Pompes d'injection de combustible — Tuyauteries
haute pression pour essais*



Reference number
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Foreword

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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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4093 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 7, *Injection equipment and filters for use on road vehicles*.

This third edition cancels and replaces the second edition (ISO 4093:1986), which has been technically revised.

Diesel engines — Fuel injection pumps — High-pressure pipes for testing

1 Scope

This International Standard specifies the functional requirements of a range of high-pressure pipes for use on benches for the testing and setting of fuel injection pumps intended for diesel engines.

Only dimensions and requirements affecting the hydraulic characteristics of the pipes are specified. Other requirements, such as the type of end connections or shape of the pipes when bent, are not included as these depend on the connections provided on the pump outlets and injector inlets, and on the design features of individual pumps and test benches.

This International Standard applies to a range of pipes to enable the pump engine manufacturer to choose a suitable type of pipe for pump deliveries up to 300 mm³/stroke/cylinder. The particular pipe to be used shall be identified by the pump manufacturer in the test schedule for each individual pump type and application.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 8535-1, *Compression-ignition engines — Steel tubes for high-pressure fuel injection pipes — Part 1: Requirements for seamless cold-drawn single-wall tubes.*

3 Dimensions

The thirteen types of pipe specified in Table 1 form a range of standardized high-pressure pipes for testing.

If pipes of dimensions other than those specified in the table must be used for special technical reasons, the dimensions of such non-standard pipes shall be clearly specified in the pump test schedule.

Table 1 — Dimensions of high-pressure pipes for testing

Dimensions in millimetres

ISO designation	Internal diameter $\pm 0,025$	External diameter	Length ± 5	Recommended bend radius min.
ISO 4093-1	2	6	600	16
ISO 4093-2	2	6	845	16
ISO 4093-3	3	6	600	25
ISO 4093-4	3	6	1 000	25
ISO 4093-5	3	8	750	50
ISO 4093-6	3	8	1 000	50
ISO 4093-7	4	8	1 000	50
ISO 4093-8	4	8	1 500	50
ISO 4093-9	2	6	450	16
ISO 4093-10	3	8	600	50
ISO 4093-11	1,5	6	710	16
ISO 4093-12	1,6	6	350	16
ISO 4093-13	1,8	6	450	16

4 General requirements

4.1 The high-pressure pipes for testing shall be made from steel tubes as specified in ISO 8535-1; they shall have a smooth internal bore, free from cracks or other structural weaknesses and from corrosion or other matter likely to cause damage to the fuel injection system.

4.2 After making the connection ends, any closing-in of the pipe shall be removed by inserting a reamer of the nominal internal diameter of the pipe to a depth at least twice that to the length of the deformed end (connection end) of the pipe. Any closing-in of the connection ends after extended use shall also be similarly removed.

4.3 The radius of any bend subsequently made in manufacturing the pipes shall be not less than that recommended in the table measured from the centreline of the pipe.

4.4 Pipes shall be washed internally after the making of connection ends and bending, in order to remove extraneous matter.

4.5 For storage, the ends shall be closed off from ingress of air in order to avoid internal corrosion.

5 Designation of high-pressure pipes

Pipes should preferably be identified by a tag or clip citing the ISO designation in accordance with the table, for example.

Bibliography

- [1] ISO 2974, *Diesel engines — High-pressure fuel injection pipe end-connections with 60° female cone.*
- [2] ISO 4008-1, *Road vehicles — Fuel injection pump testing — Part 1: Dynamic conditions.*
- [3] ISO 4008-2, *Road vehicles — Fuel injection pump testing — Part 2: Static conditions.*
- [4] ISO 4008-3, *Road vehicles — Fuel injection pump testing — Part 3: Application and test procedures.*
- [5] ISO 7440-1, *Road vehicles — Fuel injection equipment testing — Part 1: Calibrating nozzle and holder assemblies.*
- [6] ISO 14681, *Diesel engines — Fuel injection pump testing — Calibrating fuel injectors.*

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