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Road vehicles — Injection water —

Part 1: Quality requirements

Véhicules routiers — Injection d'eau —

Partie 1: Exigences de qualité

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Foreword

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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).

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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*.

A list of all parts in the ISO 31120 series can be found on the ISO website.

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 purpose of this document is to define the quality requirements of the water to be used in a water injection system of an internal combustion engine.

The intention is to ensure that a consistent product is available to automobile manufacturers from water producers by defining an agreed standard against which to supply the product.

Road vehicles — Injection water —

Part 1: Quality requirements

1 Scope

This document specifies water quality used for water injection in internal combustion engines. This document defines quality requirements for injection water including instructions for storage, container materials and production. Testing procedures are also defined.

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 7393-2, *Water quality — Determination of free chlorine and total chlorine — Part 2: Colorimetric method using N,N-dialkyl-1,4-phenylenediamine, for routine control purposes*

ISO 7393-3, *Water quality — Determination of free chlorine and total chlorine — Part 3: Iodometric titration method for the determination of total chlorine*

ISO 7888, *Water quality — Determination of electrical conductivity*

ISO 10304-1, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate*

ISO 10304-4, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 4: determination of chlorate, chloride and chlorite in water with low contamination*

ISO 10523, *Water quality — Determination of pH*

ISO 11885, *Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES)*

ISO 15061, *Water quality — Determination of dissolved bromate — Method by liquid chromatography of ions*

ISO 15923-1, *Water quality — Determination of selected parameters by discrete analysis systems — Part 1: Ammonium, nitrate, nitrite, chloride, orthophosphate, sulfate and silicate with photometric detection*

EN 872, *Water quality — Determination of suspended solids — Method by filtration through glass fibre filtres*

EN 1484, *Water analysis — Guidance for determination of total organic carbon*

DIN 38409-1, *German standard methods for the examination of water, waste water and sludge; parameters characterizing effects and substances (group H); determination of total dry residue, filtrate dry residue and residue on ignition (H 1)*

3 Terms and definitions

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

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

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

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

3.1
shelf life
period of time starting with the completion of the production of the batch in which *injection water* (3.5), stored under specific conditions, remains within the specification defined in Table 1

3.2
production batch of IW
quantity of *injection water* (3.5) produced at one operation at a site where the product has (last) been physically or chemically modified to reach compliance with the specification defined in Table 1

Note 1 to entry: Mixing of IW volumes does not constitute a physical or chemical modification so long as the quality of the volumes before mixing complies with the specification given in this document.

3.3
bulk operation
handling of *injection water* (3.5) in large containers

Note 1 to entry: Large containers can be, for example, road tankers, rail cars, storage tanks and vessels.

3.4
packaged shipment
handling of *injection water* (3.5) in small containers

Note 1 to entry: Small containers can be, for example, drums, cans, bottles and intermediate bulk containers (IBCs).

3.5
injection water
IW
water very low in inorganic, organic or colloidal contaminants, produced, for example, by single distillation, by deionization, by ultra-filtration or by reverse osmosis manufacture

4 IW analysis parameters

Water used for injection in internal combustion engines shall comply with the limits of Table 1.

Table 1 — Water parameter limits

Item	Maximum value	Units	Testing method
Electrical conductivity (25 °C)	15	µS/cm	ISO 7888
pH value	5 to 8	—	ISO 10523
Evaporation residue	30	mg/l	DIN 38409-1
Total organic carbon	1,2	mg/l	EN 1484
Sodium	3	mg/l	ISO 11885
Silicon	1,5	mg/l	ISO 11885
Σ metal cations (Pb, Sb, As, Bi, Cu, Cd, Zn, Se, Te, Na, K, Li, Ca, Mg, Al, B, Sn, Si, Fe, Co, Ni, Cr, Mn)	6,5	mg/l	ISO 11885
Chloride (halogens)	0,5	mg/l	ISO 10304-1
Ammonium	0,1	mg/l	ISO 15923-1

Table 1 *(continued)*

Item	Maximum value	Units	Testing method
Nitrate	0,5	mg/l	ISO 10304-1
Nitrite	0,1	mg/l	ISO 15923-1
Sulfate	0,5	mg/l	ISO 10304-1
Phosphate	0,1	mg/l	ISO 15923-1
Chlorate	0,1	mg/l	ISO 10304-4
Bromate	0,1	mg/l	ISO 15061
Phosphorus	0,1	mg/l	ISO 11885
Sulfur	1	mg/l	ISO 11885
Non-filterable solids	5	mg/l	EN 872
Chlorine	0,1	mg/l	ISO 7393-2 ISO 7393-3

The injection water has to be clear, colourless and free from oil drops (see ISO 7887 and ISO 7027-1). Certificates of analysis shall contain all specified parameters.

5 Storage of purified water

5.1 Requirements for the use of materials compatible with IW

To avoid contamination of IW and to resist corrosion of the devices used (containers, tubes, valves, fittings, gaskets, hoses, etc.), all materials in direct contact with IW during handling, transportation and storage, including sampling, shall be compatible with IW.

It is the responsibility of the user of this document to ensure that the correct materials are used. The list of the materials given in Tables 2 and 3 are for guidance only.

Any material with uncertain compatibility with IW shall not be used.

5.1.1 Recommended materials

Examples of materials recommended[1)] for use with IW are given in Table 2.

Table 2 — Examples of recommended materials

Hard rubber
Polyethylene, free of additives
Polypropylene, free of additives
Polyisobutylene, free of additives
Perfluoroalkoxyl alkane (PFA), free of additives
Polyfluoroethylene (PFE), free of additives
Polyvinylidenefluoride (PVDF), free of additives
Polytetrafluoroethylene (PTFE), free of additives
Copolymers of vinylidenefluoride and hexafluoropropylene, free of additives
NOTE The sequence given in this list does not constitute a ranking of the materials recommended.

1) Materials made of plastics can contain various kinds of additives used either for processing or for special kinds of serviceability. These additives can possibly migrate into IW. For this reason, special care should be taken for testing the contamination of IW by additives from plastic materials used in direct contact with IW.

5.1.2 Materials not recommended

Examples of materials not recommended are given in Table 3.

Table 3 — Examples of not recommended materials

Materials forming compounds as a result of reaction with IW, which may negatively interfere with the engine and its aftertreatment system: carbon steels, zinc coated carbon steels, mild iron, lead
Glass (possible contamination with silicon, metals, silicic acid and/or alkalis)
Metal containers (possible contamination with metals and/or alkalis)

5.2 Physical conditions during transportation and storage

5.2.1 General

In order to protect IW from any contamination carried by the air, well-closed containers or vented containers with filters shall be used.

In addition, the temperature during transportation and storage has an impact on shelf life according to Table 4.

In order to avoid excessive temperature rise, IW should be protected from sunlight.

In order to prevent freezing of IW, storage below 5 °C should be avoided.

Frozen IW may be warmed up at temperatures not exceeding 30 °C. It will not be impaired in quality and may be used as soon as the warmed-up solution is free from solids.

NOTE Frozen IW has an approximately 9 % larger volume than the liquid and, therefore, can cause a fully filled, closed container to burst.

5.2.2 Shelf life

Throughout the entire distribution chain, IW is expected to remain within the specifications given in Table 1 for at least the time periods specified in Table 4 as a function of the constant ambient temperature at which the IW is stored.

Table 4 — Shelf life as a function of temperature

Constant ambient storage temperature °C	Suitability level	Maximum shelf life months
≤10	++	36
≤25	++	18
≤30	+	12
≤35	00	1
>35	–	–

Key

\+ + Recommended constant storage temperature range.

\+ Acceptable constant storage temperature range with possibly significant loss of shelf life.

00 Not recommended constant storage temperature range.

– Critical ambient storage temperatures: verify every batch according the requirements listed in Table 1 before use.

To avoid evaporation during the shelf life, it is recommended to use non-vented storage containers.