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STANDARD

9950

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**Industrial quenching oils — Determination
of cooling characteristics — Nickel-alloy
probe test method**

*Huiles industrielles pour trempe — Détermination des caractéristiques de
refroidissement — Méthode d'essai à la sonde en alliage de nickel*



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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.

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 9950 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

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Introduction

When hardening steel, quenching is normally the most critical phase of the hardening process. For the quenching, the heat treater has to select among different types of quenching media, such as oils, water-based polymer solutions, emulsions, etc. In addition, a large variety of quenchant is available commercially for each type of medium. Moreover, the cooling characteristics of each quenching medium can change in service due to thermal degradation, contamination, drag-out, etc.

A number of methods are used to evaluate quenching media. Indirect testing, involving hardening of test pieces of a certain steel, gives only limited information about the cooling characteristics. The most common method for direct testing is the so-called silver ball method, where a silver ball (probe) with a thermocouple at its centre is heated and quenched in the quenching medium in question. The temperature is recorded as a function of time, and often also the cooling rate as a function of temperature (or time).

Due mainly to difficulties concerning the silver ball probe manufacture and the assessment of test results, several modified probes have been used but with the same basic method. The probes have been made of various materials and different sizes, the shape normally being cylindrical.

In order to make comparison possible among test results received from different laboratories and among technical descriptions of quenching media provided from different suppliers, it is necessary to use a standard method of testing. Therefore, the International Federation for the Heat Treatment of Materials (IFHT) Technical Committee, *Scientific and Technological Aspects of Quenching*, has evaluated different existing methods and arranged tests in several countries in order to arrive at an agreement about a method to be recommended as a standard. The specification in this International Standard is the result of the work within this committee.

NOTE 1 This standard method is based on, and is identical in all principal details with, a method drawn up by a working party of the Wolfson Heat Treatment Centre Engineering Group, Aston University, Birmingham, UK. The deviation between the two methods concerns the measurement system, where a computer-based system for recording and differentiation of the thermocouple signal has been added as an alternative in the method described in this International Standard.

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Industrial quenching oils — Determination of cooling characteristics — Nickel-alloy probe test method

1 Scope

This International Standard specifies a laboratory test using a nickel-alloy probe for the determination of the cooling characteristics of industrial quenching oils. The test is conducted in non-agitated oils and thus is able to rank the cooling characteristics of the different oils under standard conditions. No correlation can be made between the results of this test and the quench rates in industrial quench installations in which varying degrees of agitation are present.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 2719:1988, *Petroleum products and lubricants — Determination of flash point — Pensky-Martens closed cup method.*

ISO 2909:1981, *Petroleum products — Calculation of viscosity index from kinematic viscosity.*

ISO 3104:1994, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 3405:1988, *Petroleum products — Determination of distillation characteristics.*

ISO 3675:1993, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method.*

British Standard BS 1041, Part 4:1966, *Thermocouples.*

British Standard BS 4937, Part 4:1973, *Nickel-chromium/nickel-aluminium thermocouples. Type K.*

3 Principle

A cylindrical nickel-alloy test piece ("probe") having a thermocouple at its geometric centre is heated in a furnace to the specified temperature, and then transferred into a fixed volume of the quenching oil under test. The change in temperature at the centre of the probe is recorded as a function of time.

The cooling rate may be recorded simultaneously, or determined afterwards.

Measurements taken from these records are used to evaluate the quenching oil under test.

4 Reference quenching fluid

4.1 General

A reference quenching fluid is recommended for initial, and regular, cross-checking of the probe (see 5.2). The fluid shall be stored in a sealed container when not in use and shall be renewed after 200 quenches or two years, whichever is sooner.