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भारतीय मानक मसौदा

**मार्कुएञ्चिङ्ग तेल - विशिष्टी**

*(IS 4543 का दूसरा पुनरीक्षण)*

*Draft Indian Standard*

**MARQUENCHING OILS — SPECIFICATION**

*(Second Revision of IS 4543)*

(ICS No. 75.100)

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Lubricants and their Related Products  
Sectional Committee, PCD 25

Last date for receipt of comment is  
**3 January 2025**

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**FOREWORD**

*(Formal clauses will be added later)*

Marquenching is a steel hardening process to produce finished products of high precision and quality from relatively less expensive low alloy steels. The finished products include gears, tools dies, bearing races, etc. The process of marquenching essentially consists of rapid hot quenching of the finished products in baths maintained at about 200 °C to ensure temperature equalization throughout the steel before conversion to the martensite structure during subsequent air or water cooling.

This standard was originally published in 1967. The first revision was carried out taking into consideration the views of producers, users and technologists to align with the prevailing trade practices followed in the country. This second revision has been carried out to incorporate the following major changes:

- a) The oil suitable for marquenching should have a high and constant quench rate along with satisfactory steel hardening characteristics. Hence, a performance test based on a Quenchometer with Cooling Curve analysis has been included in the requirements. It should have high flash point and low volatility to minimize fire hazards.
- b) Globally, marquenching oils are specified and marketed on the basis of the kinematic viscosity at 40 °C. Additionally, viscosity index of a quenching oil is directly related to its

performance, affecting its behaviour over varying temperatures. The base oils commonly used in the manufacture of quenching oils inherently have a sufficiently high viscosity index. Hence, the viscosity and viscosity index requirements of marquenching oils have been revised to reflect the representative viscosity.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## **1 SCOPE**

This standard prescribes the requirements and the methods of sampling and test for marquenching oils.

## **2 REFERENCES**

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
IS 1447 (Part 1) : 2021	Methods of Sampling of Petroleum and its Products Part 1 Manual Sampling ( <i>second revision</i> )
IS 1448	Methods of test for petroleum and its products
(Part 10/Sec2): 2021/ISO 3016: 2019	Petroleum and related products from natural or synthetic sources Section 2 Determination of pour point ( <i>third revision</i> )
(Part 15) : 2004 / ISO 2160 : 1998	Petroleum products — Corrosiveness to copper — Copper strip test ( <i>third revision</i> )
(Part 25/Sec 1) : 2018 / ISO 3104: 1994	Transparent and opaque liquids Section 1 Determination of kinematic viscosity and calculation of dynamic viscosity ( <i>second revision</i> )
(Part 56): 2013 / ISO 2909 : 2002	Calculation of viscosity index from kinematic viscosity ( <i>third revision</i> )
(Part 65): 2018	Oxidation Test for Lubricating Oils ( <i>third revision</i> )
(Part 69): 2019 / ISO 2592:2017	Determination of flash and fire points — Cleveland open cup method ( <i>second revision</i> )

## **3 REQUIREMENTS**

### **3.1 General**

**3.1.1** The material shall consist of refined mineral oil, with or without additives.

**3.1.2** The material shall be homogeneous and free from water, suspended matter, dust, sediment and any other visible impurities.

### **3.2 Specific Requirements**

**3.2.1** The material shall comply with the requirements prescribed in Table 1, when tested according to the methods prescribed in col 4 of Table 1.

**3.2.2** The material shall also pass the performance test using Quenchometer with Cooling Curve analysis as described in Annex C. The value for this test shall be as agreed between the purchaser and the supplier.

## **4 PACKING AND MARKING**

### **4.1 Packing**

The material shall be packed in securely closed metal drums and containers of appropriate size and strength as agreed to between the purchaser and the supplier.

### **4.2 Marking**

Each container shall be marked with the following information:

- a) Name of the material;
- b) Manufacturer's name, initials or trade- mark, if any;
- c) Quantity of the material; and
- d) Batch number and year of manufacture.

**Table 1 Requirement for Marquenching Oils**

(Clause 3.2.1 and 5.2.2)

<b>Sl. No.</b>	<b>Characteristic</b>	<b>Requirement</b>	<b>Method of Test</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
i)	Flash point, Cleveland (open) cup, °C, <i>Min</i>	230	IS 1448 (Part 69)
ii)	Kinematic at viscosity at 40 °C, mm <sup>2</sup> /s	198 to 242	IS 1448 (Part 25 / Sec 1)
iii)	Viscosity index, <i>Min</i>	90	IS 1448 (Part 56)
iv)	Pour point, °C, <i>Max</i>	0	IS 1448 (Part 10)
v)	Viscosity ratio after oxidation, <i>Max</i>	1.5	IS 1448 (Part 65)
vi)	Volatile matter at 200 °C for 2 h, percent by mass, <i>Max</i>	1.0	Annex A
vii)	Sulphur, percent by mass, <i>Max</i>	2.5	IS 1448 (Part 33)
viii)	Crackle test	To pass the test	Annex B

ix)	Copper strip corrosion for 3 h at 100 °C, <i>Max</i>	1	IS 1448 (Part 15)
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**4.2.1** The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

## 5 SAMPLING

**5.1** Representative samples of the material shall be drawn as prescribed in IS 1447 (Part 1).

### 5.2 Number of Tests

**5.2.1** Tests for kinematic viscosity and crackle test shall be conducted on each of the individual samples.

**5.2.2** Tests for all other characteristics given in Table 1 and the Quenchometer performance test given in Annex C shall be conducted on the composite sample.

### 5.3 Criteria for Conformity

**5.3.1** For crackle test the lot shall be considered to have met the requirements for this test if each of the individual samples passes the test.

**5.3.2** For kinematic viscosity, the average and range (R) shall be calculated from test results on the individual samples, the lot shall be considered to have satisfied the requirements for this characteristic if the expression  $\bar{x} \pm 0.6R$  lies within 198 mm<sup>2</sup>/s to 242 mm<sup>2</sup>/s.

**5.3.3** In respect of each characteristic tested on the composite sample the lot shall be declared to meet the requirement if the test result on the composite sample satisfies the corresponding requirement.

**5.3.4** The lot shall be declared as conforming to the requirements of this specification if **5.3.1**, **5.3.2** and **5.3.3** are satisfied.

## ANNEX A

[Table 1, Sl No. (vi)]

### DETERMINATION OF VOLATILE MATTER

#### A-1 PROCEDURE

**A-1.1** Weigh (10.00 ± 0.05) g of oil in a glass Petri dish of approximately 80 mm diameter and 15 mm height. Keep it in a draught-free electric oven for 2 h at (200 ± 0.5) °C. After this period reweigh the Petri dish.

## **A-2 CALCULATION**

$$\text{Volatile matter, percent by mass} = \frac{S-M}{S} \times 100$$

where

$S$  = initial mass, in g, of sample, and

$M$  = mass, in g, of sample, after drying in electric oven.

## **ANNEX B**

[Table 1, Sl No. (viii)]

### **CRACKLE TEST**

#### **B-1 PROCEDURE**

**B-1.1** Place a sample of oil in a clean dry test tube about 125 mm long and 1 mm diameter, in sufficient quantity to fill the test-tube to one quarter of its depth, care being taken that the oil is not in an aerated condition. Heat the test tube containing the oil rapidly on a silent flame until the oil commences to boil during which process crackling shall not be detectable.

**B-1.1.1** The material shall be considered to have passed the test if no audible indication of free moisture by cracking is observed.

## **ANNEX C**

[Table 1, Item (ix)]

### **TEST FOR DETERMINATION OF COOLING CHARACTERISTICS BY COOLING CURVE ANALYSIS**

#### **C-1 APPARATUS**

**C-1.1** Nickel probe assembly made of nickel alloy 600 of diameter  $(12.5 \pm 0.01)$  mm and a length of  $(60 \pm 0.25)$  mm, with a 1.45 mm to 1.65 mm sheathed K-Type thermocouple in the centre, with a computer based data acquisition system capable of providing cooling curve analyses.

**C-1.2** Electric furnace capable of maintaining a temperature of 850 °C over the length of the probe.

**C-1.3** Sample container of diameter and height able to provide 50 ml of tested fluid above and below the transferred probe during quenching process.

#### **C-2 PROCEDURE**

**C-2.1** Heat the Nickel probe assembly in the furnace till it maintains 850 °C for at least 2 minutes. Fill the sample container with the marquenching oil sample. Transfer the heated probe into centre of the oil sample, activating the data acquisition software to record the cooling characteristics.

#### **C-3 REPORT**

**C-3.1** From the temperature-time graph, report -

a) To the nearest 0.1s, the time at 600 °C, 400 °C and 200 °C

**C-3.2** From the cooling rate-temperature graph, report -

a) Maximum cooling rate, in °C/s;

b) Temperature where the maximum cooling rate occurs, in °C;

c) Cooling rate at 300 °C, in °C/s.

**C-3.3** Report the cooling curves and the cooling rate curves.