

BUREAU OF INDIAN STANDARDS**DRAFT FOR COMMENTS ONLY**

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Draft Indian Standard

METHODS FOR CHEMICAL ANALYSIS OF CAST IRON AND PIG IRON**PART 1 DETERMINATION OF TOTAL CARBON BY THERMAL CONDUCTIVITY METHOD
(FOR CARBON 1.00 TO 4.50 PERCENT)**

[First Revision of IS 12308 (Part 1)]

ICS 77.080.10

Methods of Chemical Analysis of Metals
Sectional Committee, MTD 34

Last date of comments
16 March 2023

FOREWORD

This draft Indian Standard (Part 1) (First Revision) subject to its finalization, is to be adopted by the Bureau of Indian Standards on recommendation of the Methods of Chemical analysis of Metals Sectional Committee and approval of the Metallurgical Engineering Division Council.

Chemical analysis of cast iron and pig iron was covered in IS 228 : 1959 'Methods of chemical analysis of pig iron, cast iron and plain carbon and low alloy steels (*revised*)'. During the second revision of this standard, it was decided that a comprehensive series on above standard should be prepared only for chemical analysis of all types of steels and chemical analysis of pig iron and cast iron be covered in a separate standard. Accordingly, IS 228, in its various parts, was published for the chemical analysis of steels.

This standard was first published in 1987 in different parts covering methods for chemical analysis of cast iron and pig iron. This standard (Part 1) covers determination of total carbon by thermal conductivity method (for carbon 1.00 to 4.50 percent).

The other parts in the series are:

- Part 2 Determination of sulphur by iodimetric titration method
- Part 3 Determination of manganese by periodate spectrophotometric method
- Part 4 Determination of total carbon, graphitic carbon and combined carbon by gravimetric method
- Part 5 Determination of phosphorus by Alkalimetric method (for phosphorus 0.01 to 0.50 percent)
- Part 6 Determination of Silicon (for Silicon 0.1 to 6.0 percent)

- Part 7 Determination of nickel by dimethylglyoxime (Gravimetric) method (for nickel 0.5 to 36 percent)
- Part 8 Determination of chromium by persulphate oxidation method (for chromium 0.1 to 28 percent)
- Part 9 Determination of molybdenum by thiocyanate (Spectrophotometric) method (for molybdenum 0.1 to 1.0 percent)
- Part 10 Determination of manganese (up to 7.0 percent) by arsenite (Volumetric) method
- Part 11 Determination of total carbon by the direct combustion volumetric method (for carbon 1.50 to 4.50 percent)
- Part 12 Determination of copper by atomic absorption spectrometric method (for copper 0.01 to 0.5 percent)
- Part 13 Determination of magnesium by atomic absorption spectrometric method (for magnesium upto 0.1 percent)
- Part 14 Determination of titanium by hydrogen peroxide (Spectrophotometric) method (for titanium up to 0.25 percent)

This revision has been brought out to bring the standard in the latest style and format of the Indian Standards.

In reporting the result of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

*Draft Indian Standard***METHODS FOR CHEMICAL ANALYSIS
OF CAST IRON AND PIG IRON****PART 1 DETERMINATION OF TOTAL CARBON BY THERMAL
CONDUCTIVITY METHOD
(FOR CARBON 1.00 TO 4.50 PERCENT)***(First Revision)***1 SCOPE**

This standard (Part 1) covers method for determination of total carbon in cast iron and pig iron in the range of 1.00 to 4.50 percent.

2 REFERENCE

The Indian Standards listed below contains provisions which through reference in this text, constitutes provisions of this standard. At the time of publication the edition indicated was valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No</i>	<i>Title</i>
IS 266 : 1993	Sulphuric acid – Specification (<i>third revision</i>)

3 SAMPLING

3.1 The sample shall be drawn and prepared as prescribed in the relevant Indian Standard.

3.2 The sample is to be cleaned with analar grade organic solvent (like acetone, benzene or ether) by washing it thrice and dried in an air oven at 100 ± 5 °C.

4 QUALITY OF REAGENTS

Unless specified otherwise, analytical grade reagents shall be employed in the test.

5 DETERMINATION OF TOTAL CARBON BY THERMAL CONDUCTIVITY METHOD**5.1 Outline of the Method**

The sample is burnt in stream of oxygen in presence of metal accelerator. The carbon dioxide formed is selectively adsorbed on the molecular sieve and released by heating at 300 °C. The detector is a thermistor cell, which senses the difference between the thermal conductivity of the carrier gas (oxygen) and that of the carrier gas containing carbon dioxide.

5.2 Reagents

5.2.1 *Oxygen (O₂)* – 99.5 percent pure (minimum).

5.2.2 *Ascarite or sodalime* – 0.80 to 2.00 mm.

5.2.3 *Magnesium perchlorate* – 0.80 to 2.00 mm.

5.2.4 *Concentrated sulphuric acid* – rd = 1.84 (conforming to IS 266)

5.2.5 *Sulphur trap* – Containing activated manganese-dioxide (MnO₂).

5.2.6 *Carbon dioxide convertor* – Containing copper oxide maintained at 300 °C.

5.2.7 *Accelerators* – Copper, tin or iron granules (free from carbon and sulphur).

5.2.8 *Crucibles*

Pre-ignited crucibles of precise dimensions which may be accommodated in the combustion tube of induction furnace.

5.3 Apparatus

Any analyzer consisting of induction furnace, molecular sieve, chromatographic column and thermistor type detector.

5.4 Procedure

5.4.1 *Standardization*

5.4.1.1 Switch on the instrument for 4 hours before analyzing the sample for attaining the thermal stability of the cell.

5.4.1.2 Start the flow of purified oxygen gas and pass it continuously through the system at a rate of 1 000 to 1 500 ml/minute.

5.4.1.3 Transfer into the pre-ignited crucible, 0.5 g standard sample which has a value of carbon in the range of interest and add 0.5 g accelerator.

5.4.1.4 Insert the crucible into the induction furnace, wait for 30 seconds and start the induction.

5.4.1.5 Note the percentage of carbon, adjust, if necessary, the standardization until the certified value of carbon for the standard sample is obtained and with the desired reproducibility.

5.4.2 *For Sample*

5.4.2.1 Transfer 0.5 g of accurately weighed sample into the pre-ignited crucible and add 0.5 g of accelerator.

5.4.2.2 Insert into the induction furnace and proceed until the percentage of carbon is read out.

5.4.3 *Reproducibility* – ± 0.5 percent.