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**ICS 73.040**

## **TANZANIA STANDARD**

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**Coke for Industrial use - Specification**

**TANZANIA BUREAU OF STANDARDS**

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## Foreword

This Tanzania Standard was published under the authority of the Board of Director of Tanzania Bureau of Standards.

Tanzania Bureau of Standards (TBS) is the statutory national standards body for Tanzania established by the Standards Act Cap. 130.

Tanzania Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. The Technical Committees work under the supervision of Divisional (sectoral) Committees. The Standards are developed in accordance with the Guide and Procedure for Development of Tanzania Standards and TZS 0, *Guide for presentation of Tanzania Standards*.

Tanzania Standards are subject to review, to keep pace with science and technological advances. Users of the Tanzania Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

This Tanzania Standard was developed under the supervision of the Mining and Minerals Divisional Standards Committee, *MMDC*. The Technical Committee responsible for the standard is *MMDC 3, Solid mineral fuels and related Products*.

The reporting of the results of a test or analysis made in accordance with this Tanzania Standard, if the final value, observed or calculated is to be rounded off, shall be done in accordance with TZS 4.



## Coke for Industrial use — Specification

### 1 Scope

This draft Tanzania Standard specifies technical requirements, sampling methods, and test procedures for industrial coke. It applies to industrial coke intended for use in blast furnaces, foundries, and the ferro-alloys industry.

### 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:

TZS 4, *Rules for rounding off numerical values*

TZS 1935: 2017/ISO 18283, *Hard coal and coke — Manual sampling and sample preparation*

ISO 728, *Coke — Size analysis by sieving*

ISO 11722, *Solid mineral fuels — Hard coal — Determination of moisture in the general analysis test sample by drying in nitrogen*

TZS 2092/ISO 1171, *Solid mineral fuels — Determination of ash*

TZS 2088/ISO 562, *Hard coal and coke — Determination of volatile matter*

TZS 2173/ISO 334, *Solid mineral fuels — Determination of total sulfur — Eschka method*

ISO 19579, *Solid mineral fuels — Determination of sulfur by IR spectrometry*

ISO 625, *Solid mineral fuels — Determination of phosphorus in coal and coke*

ISO 616, *Coke — Determination of shatter index*

ISO 556, *Coke — Determination of mechanical strength (Micum index)*

ISO 18894, *Coke — Determination of Coke Reactivity Index (CRI) and Coke Strength After Reaction (CSR)*

TZS 1934-2/ISO 1213-2, *Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis*

### 3 Terms and Definitions

For the purposes of this document, the terms and definitions given in TZS 1934-2/ISO 1213-2 and the following 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/>

### 4 Designations and Grades

#### 4.1 Designations

Industrial coke for various uses shall be designated as follows:

- i) Blast furnace coke: BFC
- ii) Foundry coke: FC
- iii) Coke for ferro-alloys industry: FAC

#### 4.2 Grades

Industrial coke shall be categorized into the following grades based on ash content:

- a) Blast Furnace Coke (BFC): Grade 1 and Grade 2
- b) Foundry Coke (FC): Special Grade, Grade 1, Grade 2, and Grade 3
- c) Coke for Ferro-Alloys Industry (FAC): Special Grade, Grade 1, Grade 2, and Grade 3

### 5 Requirements

#### 5.1 General Requirements

**5.1.1** Industrial coke shall be homogeneous, porous, and hard.

**5.1.2** The Industrial coke shall be free from foreign matter, excess dust, and extraneous inclusions.

**5.1.3** Industrial coke shall be carbonized uniformly to ensure structural stability and mechanical strength for industrial furnace charges

#### 5.2 Specific Requirements

Industrial coke shall conform to the parameters prescribed in Tables 1a, 1b, and 1c when tested in accordance with the specified test procedures.

**Table 1a — Requirements for Blast Furnace Coke (BFC)**

| S/NO  | Requirement / Property             | Grade 1                                                                                                                                         | Grade 2 | Test Method                   |
|-------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------|
| i.    | Ash %, <i>Max</i>                  | 22.0                                                                                                                                            | 25      | TZS 2092/ISO 1171             |
| ii.   | Moisture %, <i>Max</i>             | 4                                                                                                                                               | 4       | ISO 11722                     |
| iii.  | Volatile Matter %, <i>Max</i>      | 1                                                                                                                                               | 1.5     | TZS 2088/ISO 562              |
| iv.   | Sulphur %, <i>Max</i>              | 0.7                                                                                                                                             | 0.7     | TZS 2173/ISO 334<br>ISO 19579 |
| v.    | Phosphorus %, <i>Max</i>           | 0.15                                                                                                                                            | 0.25    | ISO 625                       |
| vi.   | Coke Strength After Reaction (CSR) | 60 - 62                                                                                                                                         | 58 – 60 | ISO 18894                     |
| vii.  | Coke Reactivity Index (CRI)        | 21 - 23                                                                                                                                         | 22 - 25 | ISO 18894                     |
| viii. | Micum Index (+ 40 mm), <i>Min</i>  | 78                                                                                                                                              | 76      | ISO 556                       |
| ix.   | Micum Index (- 10 mm), <i>Max</i>  | 10                                                                                                                                              | 12      | ISO 556                       |
| x.    | Porosity %                         | 38–45                                                                                                                                           | 38–45   | TZS 1934-2/ISO 1213-2         |
| xi.   | Size Range                         | Material shall be in the size range between 25 mm and 100 mm, with size tolerance of 5% by mass for oversize and 10% by mass for undersize<br>- |         | ISO 728                       |

**Table 1b — Requirements for Foundry Coke (FC)**

| S/N  | Requirement / Property            | Special Grade | Grade 1 | Grade 2 | Grade 3 | Test Method                   |
|------|-----------------------------------|---------------|---------|---------|---------|-------------------------------|
| i)   | Ash %, m/m, <i>Max</i>            | 20            | 25      | 30      | 35      | TZS 2092/ISO 1171             |
| ii)  | Moisture %,m/m, <i>Max</i>        | 4             | 4       | 4       | 4       | ISO 11722                     |
| iii) | Volatile Matter %,m/m, <i>Max</i> | 2             | 2       | 2       | 2       | TZS 2088/ISO 562              |
| iv)  | Sulphur %, <i>Max</i>             | 0.7           | 0.7     | 0.7     | 0.7     | TZS 2173/ISO 334<br>ISO 19579 |
| v)   | Phosphorus %, <i>Max</i>          | 0.15          | 0.3     | 0.3     | 0.3     | ISO 625                       |
| vi)  | Shatter Index (> 50 mm),          | 90            | 85      | 80      | 75      | ISO 616                       |

|       |                                |        |       |       |       |                       |
|-------|--------------------------------|--------|-------|-------|-------|-----------------------|
|       | Min                            |        |       |       |       |                       |
| vii)  | Shatter Index (> 12.5 mm), Min | 96     | 95    | 94    | 92    | ISO 616               |
| viii) | Porosity, %                    | 35–45  | 35–45 | 35–45 | 35–45 | TZS 1934-2/ISO 1213-2 |
| ix)   | Size Range (mm)                | report |       |       |       | ISO 728               |

**Table 1d —Requirements for Ferro-Alloys Industry Coke (FAC)**

| S/N  | Requirement / Property        | Special Grade                                                                                           | Grade 1 | Grade 2 | Grade 3 | Test Method                   |
|------|-------------------------------|---------------------------------------------------------------------------------------------------------|---------|---------|---------|-------------------------------|
| i)   | Ash %, m/m, Max               | 20                                                                                                      | 22      | 25      | 30      | TZS 2092/ISO 1171             |
| ii)  | Moisture %,m/m, Max           | 5                                                                                                       | 5       | 5       | 5       | ISO 11722                     |
| iii) | Volatile Matter %,m/m, Max    | 2                                                                                                       | 3       | 3       | 3       | TZS 2088/ISO 562              |
| iv)  | Sulphur %, Max                | 0.7                                                                                                     | 0.7     | 0.7     | 0.7     | TZS 2173/ISO 334<br>ISO 19579 |
| v)   | Phosphorus %, Max             | 0.04                                                                                                    | 0.10    | 0.16    | 0.16    | ISO 625                       |
| vi)  | Reactivity to CO <sub>2</sub> | 180                                                                                                     | 150     | 120     | 120     | ISO 18894                     |
| vii) | Size Range (mm)               | The material shall be supplied in three size ranges: 25 mm to 50 mm; 5 mm to 25 mm; and 6.3 mm to 20 mm |         |         |         | ISO 728                       |

## 6 Sampling

### 6.1 Sampling Method

Representative samples of industrial coke shall be drawn in accordance with TZS 1935:2017/**ISO 18283**.

### 6.2 Blast Furnace Coke Sampling

For Blast Furnace Coke (BFC), samples shall be taken from the skip or at a point immediately prior to the skip. Where sampling directly at the skip is not practicable, representative samples shall be collected from the wharf and conditioned for stabilization as described in **Annex A**.

## **8 Packaging and Marking**

### **8.1 Packaging**

Coke for industrial use shall be supplied either in bulk (loose in wagons/trucks) or packaged in clean, sturdy bags or containers that prevent contamination and excessive breakage during transport and handling.

### **8.2 Marking and Labelling**

Each container, bag, or bulk consignment dispatch document shall be clearly and indelibly marked with the following information:

- i. Name and designation of the product (e.g., Coke for Industrial use— BFC Grade 1);
- ii. Name and trademark of the manufacturer or supplier;
- iii. Batch or lot identification number;
- iv. Net mass in kilograms or metric tonnes;
- v. Country of origin.

## **Annex A**

### **(Normative)**

### **Methods of Stabilizing Coke**

#### **A.1 General**

When coke samples must be collected directly from the wharf (such as in merchant coking plants), mechanical pre-treatment is required to bring the sample to the structural condition it would reach during movement from the wharf to the blast furnace.

#### **A.2 Apparatus**

The apparatus used for stabilization shall conform to the specifications defined for the shatter test in **ISO 616**.

#### **A.3 Procedure**

- i) Collect approximately 400 kg of coke retained on a 50 mm sieve and divide it into eight equal portions of 50 kg each.
- ii) Load a 50 kg portion into the shatter box, placing individual lumps carefully by hand.
- iii) Raise the box to a height of 2 metres and release the bottom latch to drop the coke onto the steel base plate. Repeat this 2-metre drop procedure a second time for the same portion. (Note: Each of the eight 50 kg portions shall undergo the double-drop procedure separately).
- iv) Transfer each treated portion into a Micum drum and rotate for 1 minute (25 revolutions).
- v) Screen the treated coke through a 50 mm square hole sieve and discard the fraction passing through.
- vi) Screen the retained material further using 125 mm, 100 mm, and 75 mm sieves, and draw representative samples for physical testing from the graded fractions in accordance with TZS 1935:2017/ISO 18283.

## **Annex B**

### **(Informative)**

#### **Determination of Reactivity of Coke to Carbon Dioxide**

##### **B.1 Methods**

Reactivity of coke to carbon dioxide may be evaluated by Method A (gas volumetric analysis) or Method B (mass loss and drum strength after reaction).

##### **B.2 Method B Summary (CRI & CSR)**

- a. Sample Mass & Size: 200 g of coke sized between 19 mm and 21 mm.
- b. Reaction Conditions: Heated to  $1100\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  under inert gas ( $\text{N}_2$  or Argon), soaked for 15 minutes, then exposed to  $\text{CO}_2$  flowing at 5 L/min for 120 minutes.
- c. Post-Reaction Testing: After cooling under inert gas, mass loss is recorded to calculate the Coke Reactivity Index (CRI). The reacted coke is then rotated in an I-type drum at 20 rpm for 30 minutes (600 revolutions) and screened over a 10 mm round hole sieve to determine the Coke Strength After Reaction (CSR).

## **Bibliography**

IS 439: 1989, *Industrial Coke — Specification*

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