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TANZANIA STANDARD

Coal for coke making—Specifications

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.

Coal for coke making—Specifications

1 Scope

This Draft Tanzania Standard specifies product quality grades, technical requirements, test methods, inspection rules, marking, transportation, and storage for commercial coal used in coke making. It applies to the production, processing, commercial trade, storage, transportation, and industrial utilization of single and blended coals intended for coke production.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies; for undated references, the latest edition of the referenced document applies:

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

TZS 2092/ISO 1171, *Coal and coke — Determination of ash*

ISO 1559, *Hard coal — Determination of caking index*

TZS 1936-3/ISO 7404-3, *Methods for the petrographic analysis of coals — Part 3: Method of determining maceral group composition*

TZS 1936-5/ISO 7404-5, *Methods for the petrographic analysis of coals — Part 5: Method of determining microscopically the vitrinite reflectance*

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

TZS 2172/ISO 11724, *Solid mineral fuels — Determination of fluorine content*

ISO 13691, *Solid mineral fuels — Determination of total sodium, potassium and calcium in coal*

TZS 1963(Parts 1-4)/ISO 13909 (Parts 1–4), *Hard coal and coke — Mechanical sampling*

TZS 2984/ISO 18806, *Solid mineral fuels — Determination of chlorine content*

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

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

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/>

3.1 Single Coal

Coal sourced from the same coalfield exhibiting a uniform degree of coalification, where the coefficient of variation of random vitrinite reflectance ($C.V$) is less than or equal to 10% ($C.V \leq 10\%$)

3.2 Blended Coal

Coal produced by blending coals of different coalification degrees to achieve specified coking properties, where the coefficient of variation of random vitrinite reflectance ($C.V$) is greater than 10% ($C.V > 10\%$).

3.3 Random Reflectance of Vitrinite (R_m)

the percentage of light reflected at normal incidence from polished vitrinite surfaces under monochromatic light in oil immersion.

3.4 Caking Coal

Coal that softens, fuses, and agglomerates upon heating in the absence of air to form a coherent residue (coke).

3.5 Non-caking Coal

Coal that does not soften or fuse when heated in the absence of air, leaving a non-coherent, powdery residue.

3.6 Coking Coal

Bituminous coal with plastic properties suitable for producing strong, high-quality industrial coke suitable for metallurgical use.

3.7 Gas Coal

A bituminous coal characterized by high volatile matter content and high gas yield during carbonization, producing moderate caking strength.

3.8 Gas-Fat Coal

Bituminous coal having high volatile matter with strong caking and plastic properties, intermediate between gas coal and fat coal.

3.9 1/3 Coking Coal

Bituminous coal possessing strong caking capabilities and balanced volatile matter, capable of forming high-strength coke on its own or as a primary blending agent.

3.10 Fat Coal

Bituminous coal with exceptionally high fluidity, maximum thickness of the plastic layer, and strong bonding capability upon heating.

3.11 Lean Coal

Bituminous coal with low volatile matter content and moderate-to-weak caking properties, typically used as an additive in coking blends to reduce contraction.

4 Designations and Grades

4.1 Designations

Coal for coke making shall be classified and designated based on its processing category as follows:

4.1.1 Single Coal (SC)

Include gas coal, gas-fat coal, 1/3 coking coal, fat coal, coking coal, and lean coal

4.1.2 Blended Coal (BC)

Coals produced by blending different coalification ranks.

4.2 Differentiation Criterion

Single coal and blended coal are differentiated by the variable coefficient (C.V) of random vitrinite reflectance (R_m), calculated as

$$C.V = s / R_m \times 100\%$$

Where:

s = standard deviation of random vitrinite reflectance.

R_m = mean random reflectance of vitrinite

A value of C.V $\leq$ 10% designates Single Coal (SC), whereas C.V > 10% designates Blended Coal (BC).

4.3 Designation Formula

Products shall be coded in the following format:

Designation = Category - Ash Grade - Sulfur Grade

- a) **Category:** **SC** (Single Coal) or **BC** (Blended Coal)
- b) **Ash Grade:** **A1** (Grade 1), **A2** (Grade 2), **A3** (Grade 3), **A4** (Grade 4), or **A5** (Grade 5)
- c) **Sulfur Grade:** **S1** (Grade 1), **S2** (Grade 2), **S3** (Grade 3), **S4** (Grade 4), or **S5** (Grade 5)

Example: **SC-A1-S2** designates a Single Coal of Ash Grade 1 ($A_d \leq 6.00\%$) and Sulfur Grade 2 ($0.50\% < S_{t,d} \leq 1.00\%$).

5 Requirements

5.1 General Requirements

5.1.1 Industrial coal for coke making shall be clean, uniform, and free from foreign matter, excess dirt, shale, and extraneous inclusions.

5.1.2 Single coals and blended coals shall be properly handled, prepared, and stored to minimize oxidation, weathering, and moisture accumulation prior to carbonization.

5.1.3 Blended coal shall be thoroughly and uniformly mixed to ensure structural stability and consistent coking parameters across furnace charges.

5.1.4 Single coal and blended coal shall be differentiated by the random reflectance of vitrinite (R_m) and its coefficient of variation (C.V)

5.1.5 Without the consent of the user, coal such as anthracite, lean coal, long flame coal weakly caking coal, and non-caking coal shall not be blended to conventional coal for coke making.

5.2 Specific Requirements

Coal for coke making shall conform to the limiting values prescribed in **Table 1** when tested in accordance with the specified reference test methods

S/No	Property / Parameter		Requirement		Test Method
			Single Coal	Blended Coal	
i.	Total Moisture (M_t), Max, %		12.0	12.0	ISO 11722
ii.	Volatile Matter (V_d , dry basis), %		20.0 - 28.0	18.0 - 32.0	TZS 2088/ISO 562 ISO 501
iii.	Ash Content (A_d), %	Grade 1 ($A1$)	$A_d \leq 6.00$	$A_d \leq 6.00$	TZS 2092/ISO 1171
		Grade 2 ($A2$)	$6.00 < A_d \leq 8.00$	$6.00 < A_d \leq 8.00$	
		Grade 3 ($A3$)	$8.00 < A_d \leq 10.00$	$8.00 < A_d \leq 10.00$	
		Grade 4 ($A4$)	$10.00 < A_d \leq 12.50$	$10.00 < A_d \leq 12.50$	

		Grade 5 (A5)	$12.50 < A_d \leq 14.00$	-	
iv.	Total Sulfur ($S_{t,d}$), %	Grade 1 (S1)	$S_{t,d} \leq 0.50$	$S_{t,d} \leq 0.50$	ISO 19579
		Grade 2 (S2)	$0.50 < S_{t,d} \leq 1.00$	$0.50 < S_{t,d} \leq 1.00$	
		Grade 3 (S3)	$1.00 < S_{t,d} \leq 1.50$	$1.00 < S_{t,d} \leq 1.50$	
		Grade 4 (S4)	$1.50 < S_{t,d} \leq 2.00$		
		Grade 5 (S5)	$2.00 < S_{t,d} \leq 2.50$	-	
v.	Chemical Impurities, Max,	a) Phosphorus (P_d), %	0.100	0.100	TZS 1350 (Part 5) / ISO 625
		b) Chlorine (Cl_d), %	0.150	0.150	TZS 2984/ISO 18806
		c) Arsenic (As_d), $\mu\text{g/g}$	20	20	ISO 601
		d) Mercury (Hg_d), $\mu\text{g/g}$	0.250	0.250	ISO 15234
		e) Fluorine (F_d), $\mu\text{g/g}$	200	200	TZS 2172/ISO 11724
		f) Alkali Metals ($K_2O + Na_2O$), %	0.25	0.25	ISO 13691
vi.	Coking & Plasticity Parameters	a) Caking Index (G), <i>min</i>	75	60	ISO 1559
		b) Mean Random Vitrinite Reflectance (R_m), %	0.90 - 1.40	0.70 - 1.50	TZS 1936-3/ISO 7404-3
		c) Vitrinite Reflectance	≤ 10.0	>10.0	TZS 1936-

		Coeff. of Variation (C.V), %			5/ISO 7404-5
		d) Coke Reactivity Index (CRI), %, <i>max</i>	Report	Report	ISO 18894
		e) Coke Strength After Reaction (CSR), %, <i>min</i>	Report	Report	ISO 18894

Note entry 1- Grade 5 Ash ($12.50\% < A_d \leq 14.00\%$) and Grade 5 Sulfur ($2.00\% < S_{t,d} \leq 2.50\%$) apply strictly to single coking coal, fat coal, and lean coal types.

Note entry 2- For Blended coal, total dry ash shall not exceed 12.50% (Grade 4) and total dry sulfur shall not exceed 1.50% (Grade 3) unless explicitly agreed upon by contract.

6 Sampling

Sampling of coal for coke making shall be carried out in accordance with TZS 1963/ISO 13909(all relevant parts) to ensure representative samples are obtained for analysis.

7 Packaging, Marking, and Labeling

7.1 Packaging

7.1.1 Coal for coke making shall be transported and stored in bulk or containers designed to prevent contamination, moisture accumulation, spontaneous combustion, and loss of material during transit.

7.1.2 Transport vessels, rail wagons, and storage bays shall be clean and free from previous cargo residues.

7.2 Marking and Labeling

Each consignment or shipment documentation shall be clearly marked with the following information:

- Name and trademark of the producer/supplier;
- Product designation (e.g single coal i.e **SC-A1-S2** or blended coal i.e **BC-A1-S2**);
- Net mass in metric tonnes;
- Batch or consignment identification number;
- Date of dispatch; and
- Country of origin.

Bibliography

GB/T 397-2022, *Commercial coal quality — Coal for coke making*