

 Eskom	Standard	Technology
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1. INTRODUCTION

All horizontal tube mill drums contain liners which protect the drum and aid in the coal grinding process within the mill. These liners are required to have superior abrasion resistance and withstand the harsh environment within the mill. Depending on the material specification chosen for the liners, the station coal properties, mill throughputs and liner design characteristics the life of these liners can differ considerably. It is therefore important to define the material specification of such liners to optimise performance and reduce life cycle costs of the mill.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

This standard details Eskom's requirements for the manufacture and supply of tube mill liners to Eskom fossil fired power stations.

2.1.2 Applicability

All Eskom stations with horizontal tube mills. Tube mill liners include the drum shell liners and drum end/head liners.

2.2 NORMATIVE/INFORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions indicated were valid. All standards and specifications 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 documents listed below. Information on currently valid national and international standards and specifications can be obtained from Megawatt Park.

2.2.1 Normative

- [1] SABS ISO 9001:2008: Quality management systems - Requirements
- [2] BS 4844:1986: Specification for abrasion resisting white cast iron
- [3] SANS1338:2008: Abrasion-resisting white cast irons
- [4] QM-58, Supplier Contract Quality Requirements Specification

2.2.2 Informative

- [5] None.

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2.3 DEFINITIONS

Definition	Description
Approved Supplier	A supplier who has supplied tube mill liners to Eskom Power Stations to an acceptable quality standard.
Batch	Liners of the same type having been processed together through all heat-treatment cycles.
New Supplier	A supplier who has not previously supplied tube mill liners to Eskom Power Stations.
Tube Mill Liners	All mill internal components nominated on Eskom's drawings, to be manufactured to this standard.

2.3.1 Classification

Controlled Disclosure: Controlled Disclosure to External Parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

None.

2.5 ROLES AND RESPONSIBILITIES

None.

2.6 PROCESS FOR MONITORING

None.

2.7 RELATED/SUPPORTING DOCUMENTS

None.

3. TUBE MILL LINER MATERIAL STANDARD

3.1 REQUIREMENTS

3.1.1 Quality management system

Only suppliers who have obtained approval in terms of SABS ISO 9001:2008 will be accepted.

3.1.2 Approved suppliers

Only Eskom approved suppliers shall supply tube mill liners.

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3.1.3 New suppliers

New suppliers shall be subjected to a capability assessment by Generation Technology Division. Upon successful completion of the assessment, the supplier shall produce a prototype liner for each liner type. The prototype liners shall be subjected to the tests outlined in clause 3.2. Upon successful manufacture of each prototype liner, the supplier shall be considered an approved supplier.

Failure to meet all the requirements as stipulated in Section 3.2 and 3.3 shall result in the prototype liner being rejected. Following such rejection, the supplier shall produce further prototype liners until all the requirements of Section 3.2 and 3.3 are met.

3.1.4 Manufacture

The method of manufacturing shall be electric melting. The casting method shall be at the discretion of the manufacturer, but may be inspected, on request, by Eskom.

3.1.5 Design

The final design of the liners and specific drawing to be used for manufacture shall be approved by Eskom in writing before production commences. This Eskom person shall be the mill system engineer at the respective power station.

3.2 TESTS

The following tests shall be performed on each prototype liner:

- a. Dimensional as per paragraph 3.3.1
- b. Breaking of the casting to check for internal soundness and preparation of suitable test specimens to determine the micro – structure from surface to core, and the hardness gradient from surface to core.
- c. Visual and/or dye-penetrant test, as in paragraph 3.3.2.
- d. Chemical analysis, as in paragraph 3.3.3
- e. Review of heat-treatment charts, as in paragraph 3.3.4
- f. Hardness, as in paragraph 3.3.5
- g. Identification, as in paragraph 3.3.6
- h. Retained austenite determination, as in paragraph 3.3.4

3.3 BATCH ACCEPTANCE

Acceptance of each batch of castings shall be based on the following:

3.3.1 Dimensional inspection

One liner per batch shall be inspected to ensure conformance to drawing requirements. Dimensions shall be recorded. The balance of each batch may be checked for conformance by means of gauges. All necessary templates, jigs and gauges shall be provided by the supplier.

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3.3.2 Surface condition

Each liner shall be visually inspected and, in case of doubt, a dye – penetrate examination shall be performed. No surface cracks shall be allowed.

3.3.3 Chemical composition

Ladle analysis shall be within the following range:

Carbon	C	2,4 % to 2,8 %
Silicon	Si	1,0 % maximum
Manganese	Mn	0,5 % to 1, 5 %
Sulphur	S	0,05 % maximum
Phosphorus	P	0,05 % maximum
Chromium	Cr	22,0 % to 28,0 %
Nickel	Ni	0,5 % maximum
Copper	Cu	1,0 % maximum

Chromium/carbon ratio shall be between 9.1 and 11.1.

Liners of section thickness greater than 100 mm shall have a molybdenum content of 0,4 % to 0,6 %.

3.3.4 Heat Treatment

Heat treatment shall be such that all the requirements of this standard are met. As a minimum requirement, the heat treatment shall be a two stage process, consisting of a hardening (austenite destabilisation) stage and a tempering (stress-relieving) stage.

Heat treatment charts shall be kept to review by Eskom, and shall detail all heat treatment stages, including heating rate, soaking temperature, soaking time and cooling rate, for each stage in the heat treatment process.

3.3.5 Hardness

Each liner shall be checked for hardness and the highest and lowest readings for each batch shall be recorded. Hardness of the finished castings shall be 600 Brinell minimum

3.3.6 Identification

The following identification shall be cast onto the non – working face of each liner:

- Material cast identification
- Supplier identification
- Material grade, and
- Casting pattern number.

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3.4 REPAIRS

Local surface imperfections may be removed by grinding, provided the repaired area does not exceed 5mm in depth. Dye-penetrant testing shall be carried out after defect removal. Welding shall not be permitted on any area of the casting.

3.5 DOCUMENTATION

The following documentation shall be provided:

3.5.1 Prototype liners

Documentation covering the results of all tests listed in Section 3.2. This documentation shall be reviewed by Eskom and, if acceptable, approval shall be given for production to commence.

3.5.2 Production batches

Documentation covering the results of all test listed in Section 3.3 for each batch of castings. This documentation shall be reviewed by Eskom prior to final inspection and release at the supplier's works.

3.5.3 End user documentation

As part of the requirement for Section 3.5.2, a completed inspection report shall be supplied to the relevant power station, together with the finished castings.

3.5.4 Records

Copies of all documentation shall be kept by the supplier for a period of at least 10 years.

3.6 INSPECTION

3.6.1 General

Eskom reserves the right to carry out random checks in terms of any of the tests of requirements detailed in this standard.

3.6.2 Rejection

If, during final inspection, two or more liners are found to be rejectable in accordance with Section 3.2, the entire consignment shall be rejected. The supplier shall then re-inspect the consignment of all inspection requirements, before an Eskom product release note shall be issued.

3.7 PACKING AND TRANSPORTING

The supplier shall provide details of the proposed method of packing to prevent mechanical damage, during transportation and to facilitate safe handling.

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4. AUTHORISATION

This document has been seen and accepted by:

Name and Surname	Designation
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5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	M.A. Muller	Draft document for review created from 36-805 Rev 0.
October 2013	1	M.A. Muller	Final Document for Authorisation and Publication.

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

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7. ACKNOWLEDGEMENTS

None.

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APPENDIX A: DEVIATION SCHEDULE

- A1** Any deviations/modifications/alternatives offered this standard shall be listed below, with reasons for variations.
- A2** No deviations/modifications/alternatives offered to the standard will be recognised unless listed on this schedule.
- A3** If no deviations/modifications/alternatives are offered, this schedule must be marked "Not Applicable".

Standard/schedule page number	Standard/schedule clause number	Proposed deviation/modification/alternative

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