

SPECIFIC SCHEME RULES FOR THE CERTIFICATION OF CEMENT

1. GENERAL

1.1 Application and Use

Pursuant to R3300, General Scheme Rules for the Certification of Products (hereinafter ‘General Rules’), the present Specific Scheme Rules for the Certification of Cement (hereinafter “Specific Rules”) describe the specific certification scheme for 27 distinct common cements, 7 sulfate resisting common cements as well as 3 distinct low early strength blast furnace cements and 2 sulfate resisting low early strength blast furnace cements and their constituents.

The General Rules always prevail over the present Specific Rules in case of any inconsistencies.

1.2 Scope

Table 1. Scope of cements in the scheme

Technical Cluster	Product Category	Products		
Concrete, cement, lime, plaster	Ordinary Common Cements	5 Main Types	Description	Sub-types
		CEM I	Portland cement	n/a
		CEM II	Portland-composite cement,	Portland-slag cement
				Portland-silica fume cement
				Portland-pozzolana cement
				Portland-fly ash cement
				Portland-burnt shale cement
				Portland-limestone cement
				Portland-composite cement
		CEM III	Blast furnace cement	n/a
	CEM IV	Pozzolanic cement	n/a	
	CEM V	Composite cement	n/a	
	Sulphate Resisting Common Cements	3 Main Types	Description	Sub-types
		CEM I	Sulfate resisting Portland cement	n/a
		CEM II	Sulfate resisting blast furnace cement	n/a
CEM IV		Sulfate resisting pozzolanic cement	n/a	

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1.3 Scheme Type

This Cement Scheme is operated in accordance with ZS EN 197:2014 Part 2-Conformity Evaluation. The scheme also shall comply with those clauses of ISO/IEC 17065, ISO/IEC 17020 and ISO/IEC 17025 which are relevant to this scheme. This scheme comprises the following elements

Table 2 Scheme Elements

	PROCESS STEP	ACTIVITIES
1	Pre-certification	<ul style="list-style-type: none"> — Application — Application review, including applicable standard, test requirements, test facility options — Contract/certification Agreement — Audit programme (scheme of inspections and testing, frequency of audits, etc.) — Determining the Audit Time — Considerations for multi-site organizations applicant requirements — Consideration of multiple product standards applicant requirements
2	Planning Audits	<ul style="list-style-type: none"> — Audit scheduling — Audit team appointment — Audit plan
3	Initial Certification	<ul style="list-style-type: none"> — Initial Factory Audit — Initial Type Test (Product Evaluation) — Submission of corrective-action plan, if applicable — Follow-up and Close out of major non-conformities, if applicable — Preliminary Certificate — Initial Period of Control Evaluation of 3 months — Anticontrol testing during Initial Period by the Manufacturer — Sampling of product 3 times at 1 month intervals by ZABS — End of Initial Period (3 months from issue of preliminary Certificate of Conformity)
4	Review	<ul style="list-style-type: none"> — Full Review of application documents, initial factory audit report, initial type test results, autocontrol results, and sampling and testing results during the Initial Period of 3 months

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5	Decision	Decisions for <ul style="list-style-type: none"> — granting or refusing certification; — expanding or reducing the scope of certification; — suspending or restoring certification; and — withdrawing certification or renewing certification.
6	Maintaining Certification	<ul style="list-style-type: none"> — Surveillance activities <ul style="list-style-type: none"> - Annual Factory Audit - 6 samples taken at 2-monthly intervals - Random spot sampling — Recertification — Special audits as necessary — Suspension, Withdrawing or Reducing the scope of certification — Management of Certificates and Marks of Conformity

2. DEFINITIONS

The definitions in section 2 of R3300 General Scheme Rules for the Certification of products and those in ZS EN 197:2011 Part 1 shall apply.

3. REFERENCE STANDARDS/NORMATIVE REFERENCES

The documents listed below form the basis for certification of cement:

3.1 Rules Documents

R3300 General Scheme Rules for the Certification of Products
R3300-2 Specific Scheme Rules for the Certification of Cement

3.2 Standards

ZS EN 197:2011 Part 1-Composition, Specification and Conformity Criteria for Common Cements
ZS EN 197:2014 Part 2-Conformity Evaluation

3.3 Statutory and Regulatory Requirements

Compulsory Standards Act No. 3, 2017 Metrology Act No. 6, 2017

3.4 Additional Standards/Specifications

The following referenced 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 (including any amendments) applies.

EN 196-1, Methods of testing cement — Part 1: Determination of strength

EN 196-2, Methods of testing cement — Part 2: Chemical analysis of cement

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EN 196-3, Methods of testing cement — Part 3: Determination of setting times and soundness

EN 196-5, Methods of testing cement — Part 5: Pozzolanicity test for pozzolanic cement

EN 196-6, Methods of testing cement — Part 6: Determination of fineness

EN 196-7, Methods of testing cement — Part 7: Methods of taking and preparing samples of cement

EN 196-8, Methods of testing cement — Part 8: Heat of hydration — Solution method

EN 196-9, Methods of testing cement — Part 9: Heat of hydration — Semi-adiabatic method

EN 451-1, Method of testing fly ash — Part 1: Determination of free calcium oxide content

4.0 THE MANUFACTURER'S FACTORY PRODUCTION CONTROL

These requirements are supplemental to those set forth in Section 4 of R3300 General Scheme Rules for the Certification of Products.

4.1 Technical Documentation

The following technical documentation shall be available at the manufacturer's facility for inspection:

- a) The client shall have a documented Quality Management System that is aligned to the requirements of ZS ISO 9001 standard.

NOTE: Having a certificate of ISO 9001 is not a mandatory requirement; however the structure of the client's QMS shall be in line with its requirements

- b) The manufacturer's documentation and procedures for factory production control shall be described in Works' quality manual, which shall adequately describe, amongst other things:
- i) the quality aims and the organizational structure, responsibilities and powers of the management with regard to product quality and the means to monitor the achievement of the required product quality and the effective operation of the internal quality control
 - ii) The manufacturing and quality control techniques, processes and systematic actions that will be used
 - iii) The inspections and tests that will be carried out before, during and after manufacture, and the frequency with which they will be carried out
 - iv) The Works' quality manual prepared by the manufacturer for each factory shall include an adequate system of documentation
 - v) The Works' quality manual shall address and document the procedures operated to ensure that the manufactured cement conforms to the technical specifications. The manual may reference associated documents which provide further details of the auto-control testing of samples and the internal quality control. For the purpose of this scheme, the term Works' quality manual shall be considered to include these associated documents.
- c) Raw Material characteristics: type of raw material, name of source, typical composition
- d) Raw material acceptability criteria

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- f) Process description (process steps with key operational parameters): Proportioning, Raw Mixing, Kiln, Clinker, Addition of Gypsum and additives, finished products packaging and storage
- g) Finished product characteristics that should be defined as often as possible with target, acceptable limits and rejection limits:
 - Physical properties, for example, fineness, heat of hydration,
 - Chemical properties: loss of ignition, insoluble residue, sulphate content, chloride content, pozzolanicity
 - Mechanical Properties and durability: Early strength, Standard strength, durability
 - Packaging parameters (e.g., torque standards, filling levels)
- h) Packaging description (primary, secondary, tertiary packaging)
- i) Shelf-life definition (e.g., Best Before Date definition)
- j) Batch definition and coding rules
- k) Specific handling, storage and transportation requirements
- l) Control plans (or at least reference to the applicable Control Plan)

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Table 3 Physical, Chemical, Mechanical and durability testing parameters

Property	Parameter	Specification	Final product Tolerance requirements	Frequency of testing
Mechanical properties	Standard Strength	ZS EN 197-1:2011	All should meet requirement	To be determined by the manufacturer and justified in the quality management documents/ Minimum should meet ZS EN 197 requirements
	Early Strength	ZS EN 197-1:2011	All Should meet minimum requirements	
Physical properties	Initial Setting time	ZS EN 197-1:2011	All Should meet minimum requirements	
	Soundness	ZS EN 197-1:2011	All Should meet minimum requirements	
	Heat of hydration	ZS EN 197-1:2011	All Should meet minimum requirements	
Chemical Properties	Loss of ignition	ZS EN 197-1:2011	All Should meet minimum requirements	
	Insoluble residue	ZS EN 197-1:2011	100% conformity	
	Sulphate content	ZS EN 197-1:2011	100% conformity	
	Chloride Content	ZS EN 197-1:2011	All Should meet minimum requirements	
	Pozzolanicity	ZS EN 197-1:2011	All Should meet minimum requirements	
Durability Properties	Durability	ZS EN 197-1:2011	All Should meet minimum requirements	

4.2 Product Testing

Tests on final products shall be conducted for every batch produced. Parameters shall meet ZS EN 197-1 Specification requirements. The manufacture's quality management documents shall stipulate the determined sampling frequency and rationale of the adopted testing frequency. It shall also stipulate when the tests are done, how often they are done, and responsible persons for testing.

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4.2.1 Laboratory

Manufacturer of cement shall have a quality assurance laboratory to carry out factory production control testing to ensure that the cement produced comply with the requirements of the standard specification ZS EN 197:2011

A laboratory shall be maintained which shall be suitably equipped and staffed to carry out appropriate chemical, physical and mechanical tests, and durability tests where different tests given in the specification shall be carried out in accordance with the methods given in the specification. The standard testing procedures for all tests shall be documented and maintained.

The manufacturer shall prepare and maintain a calibration plan and records for the test equipment.

4.2.2 Test Records

The manufacturer shall maintain test records for the tests carried out to establish conformity.

4.3 Sampling and testing

The manufacturer shall operate a system of auto-control testing for each certified cement. This system shall be used to demonstrate conformity to the requirements in the clause entitled “Assessment and verification of constancy of performance – AVCP” in the relevant product specification standard. The properties to be tested, the testing methods, the minimum frequency of auto-control testing during routine testing and initial period testing and the conformity criteria shall be in accordance with the requirements given in the clause entitled “Assessment and verification of constancy of performance – AVCP” in the relevant product specification standard. For cements not being dispatched continuously, the frequency of testing and the point of sampling shall be as specified in the Works’ quality manual.

NOTE: In earlier versions of product standards the title of the clause “Assessment and verification of constancy of performance – AVCP” is or was “Conformity criteria”.

All test data shall be documented.

At a minimum, the following tests in Table 4 shall be carried out by the manufacturer at determined frequency to ensure the final product complies with ZS EN 197:2011,

Cement shall conform to the requirements in the table below:

Table 2: Testing Records

Testing	Frequency
Standard Strength	As per quality document/ At Minimum, ZS EN 197-1:2011 standard
Early strength	
Chemical analysis	
Physical properties	
Durability Properties	

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At the sole discretion of the Zambia Bureau of Standards, some tests shall be carried out by an independent Laboratory that meets the relevant requirements of ISO/IEC 17025

4.4 Quality Management System

Quality Management System The client shall have a Quality Management System that is aligned to the requirements of ZS ISO 9001 standard.

NOTE: Having a certificate of ZS ISO 9001 is not a mandatory requirement, however the structure of the client's QMS shall be in line with its requirements

5.0 THE CERTIFICATION PROCESS

The details of this certification process are supplemental to Section 5 to 11 of the General Rules.

5.1 Sampling and Testing for Granting Certification

5.1.1 Sampling

Product samples shall be drawn during the Initial Factory Audit and sent for complete testing for all requirements of the Zambian Standard ZS EN 197:2011 Part 1. Cement samples shall be drawn from bulk containers such as silos or at suitable sampling points. No special equipment is required for sampling cements other than a suitable flexible container capable of collecting cement from the nozzle of a pump or sampling point at a silo or points of release from the factory or depot.

The following details should be indicated on the sample details form:

- Sample Description:
- Sample Identification:
- Sample source:
- Date sampled:
- Sampled By:
- Audit/test location:
- Date of Audit/test:
- Name of testing Facility

The sample sizes to be drawn for for testing of cement shall be as follows:

Type of Test	Sampling Unit Weight	Number of Units in Sample
Mechanical and physical	8 Kg	3 sealed bags
Chemical	1 Kg	3 sealed bags

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5.2 Testing for Granting of Certification

Table Mechanical and Physical Parameters

Table 4— Mechanical and physical requirements given as characteristic values

Strength class	Compressive strength MPa			Initial setting time	Soundness (expansion)
	Early strength		Standard strength		
	2 days	7 days	28 days	min	mm
32,5 L ^a	-	12,0	32,5	75	10
32,5 N	-	16,0			
32,5 R	10,0	-			
42,5 L ^a	-	16,0	42,5	60	
42,5 N	10,0	-			
42,5 R	20,0	-			
52,5 L ^a	10,0	-	52,5	45	
52,5 N	20,0	-			
52,5 R	30,0	-			

a Strength class only defined for CEM III cements.

Table 5 — Chemical requirements given as characteristic values

1	2	3	4	5
Property	Test reference	Cement type	Strength class	Requirements ^a
Loss on ignition	EN 196-2	CEM I CEM III	All	≤ 5,0 %
Insoluble residue	EN 196-2 ^b	CEM I CEM III	All	≤ 5,0 %
Sulfate content (as SO ₃)	EN 196-2	CEM I CEM II ^c CEM IV CEM V	32,5 N 32,5 R 42,5 N	≤ 3,5 %
			42,5 R 52,5 N 52,5 R	≤ 4,0 %
		CEM III ^d	All	

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Chloride content	EN 196-2	all ^e	All	≤ 0,10 % ^f
Pozzolanicity	EN 196-5	CEM IV	All	Satisfies the test
<p>a Requirements are given as percentage by mass of the final cement.</p> <p>b Determination of residue insoluble in hydrochloric acid and sodium carbonate.</p> <p>c Cement types CEM II/B-T and CEM II/B-M with a T content > 20 % may contain up to 4,5 % sulfate (as SO₃) for all strength classes.</p> <p>d Cement type CEM III/C may contain up to 4,5 % sulfate.</p> <p>e Cement type CEM III may contain more than 0,10 % chloride but in that case the maximum chloride content shall be stated on the packaging and/or the delivery note.</p> <p>f For pre-stressing applications cements may be produced according to a lower requirement. If so, the value of 0,10 % shall be replaced by this lower value which shall be stated in the delivery note.</p>				

NOTE: each sample must be drawn from the same batch

Testing parameters shall be conducted in accordance with the test methods listed in section 3.4.

Where appropriate, a comparison shall be made between the client's routine test results, results of witness testing and results of testing by the independent testing laboratory.

If the result of the test conducted by the ZABS approved laboratory shows non-conformance, the retest shall be carried out on the reference sample kept by the client or on new samples collected by the authorized auditor on which full testing shall be carried out, if necessary.

If the retest passed, the initial product assessment is considered conforming to product specification. If not, the client will be advised to take corrective action.

Only after re-assessment and subsequent product compliance shall the client be allowed to use the ZABS Conformity Mark on the product.

6.0 CHANGES TO CERTIFICATION AND COMMUNICATION OF CHANGES

These requirements set forth in Section 6 of R3300 General Scheme Rules for the Certification of Products.

7.0 TRANSFERS OF ACCREDITED CERTIFICATES

These requirements set forth in Section 7 of R3300 General Scheme Rules for the Certification of products.