ICS 91.100.10

CCS Q11

JC

Mechanical Industry Standard of the People's Republic of China

JC/T 2859-2024

Portland cement for high-temperature cementing

Issued: October 24, 2024

Effective: May 1, 2025

Ministry of Industry and Information Technology Issued

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Foreword

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This document is proposed by China Building Materials Federation.

This document is administered by National Technical Committee 184 on Cement of Standardization Administration of China (SAC/TC184).

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Portland cement for high-temperature cementing

1 Scope

This document specifies the composition and materials, technical requirements, test methods, inspection rules, packaging, marking, transportation and storage of portland cement for high temperature cementing.

This document applies to portland cement for high temperature cementing.

2 Normative References

GB/T 176 Methods for chemical analysis of cement

GB/T 203 Granulated blast-furnace slag used for cement

GB/T 1596 Fly ash used for cement and concrete

GB/T 2847 Pozzolanic admixtures used for cement

GB/T 5483 Natural gypsum

GB/T 8074 Test method for specific surface of cement — Blaine method

GB/T 9774 Sacks for cement

GB/T 10238 Oil-well cement

GB/T 12573 Method of sampling cement

GB/T 18046 Ground granulated blast-furnace slag used for cement and concrete

GB/T 19139 Test methods for oil-well cement

GB/T 21372 Portland cement clinker

3 Terms and Definitions

The following terms and definitions apply to this document.

3.1 portland cement for high temperature cementing (HTPC)

Hydraulic cementitious material prepared by grinding portland cement clinker of appropriate composition with a suitable amount of gypsum and admixtures, suitable for cementing operations under high temperature and high pressure.

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4 Composition and Materials

4.1 Composition

The content of granulated blast-furnace slag, fly ash, pozzolanic admixture or ground granulated blast-furnace slag powder in cement shall not exceed 10% (mass fraction).

4.2 Materials

4.2.1 Clinker

The content of dicalcium silicate ($2CaO \cdot SiO_2$, C_2S) in cement clinker shall be no less than 30.0% (mass fraction),

the content of tricalcium aluminate ($3CaO \cdot Al_2O_3$, C_3A) shall be no more than 5.0% (mass fraction),

and the content of free calcium oxide shall be no more than 0.5% (mass fraction).

4.2.2 Natural gypsum

Gypsum or blended gypsum of Class G or Class M Grade 2 or higher in accordance with GB/T 5483.

4.2.3 Admixtures

Granulated blast-furnace slag conforming to GB/T 203,

fly ash conforming to GB/T 1596,

pozzolanic admixtures conforming to GB/T 2847,

and ground granulated blast-furnace slag powder conforming to GB/T 18046.

5 Technical Requirements

5.1 Chemical Composition

5.1.1 Magnesium oxide (MgO)

The content of magnesium oxide in cement shall not exceed 6.0% (mass fraction).

5.1.2 Sulfur trioxide (SO_3)

The content of sulfur trioxide in cement shall not exceed 3.0% (mass fraction).

5.1.3 Loss on ignition (LOI)

The loss on ignition of cement shall not exceed 3.0% (mass fraction).

5.1.4 Insoluble residue (IR)

The content of insoluble residue in cement shall not exceed 0.75% (mass fraction).

5.1.5 Clinker mineral composition (optional index)

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The content of dicalcium silicate ($2CaO \cdot SiO_2$, C_2S) in cement clinker shall be no less than 30.0% (mass fraction),

the content of tricalcium aluminate ($3CaO \cdot Al_2O_3$, C_3A) shall be no more than 5.0% (mass fraction),

and the content of free calcium oxide shall be no more than 0.5% (mass fraction).

5.1.6 Alkali content (optional index)

The alkali content of cement is expressed as the calculated value of

$\omega(Na_2O) + 0.658\omega(K_2O)$,

which shall be determined by mutual agreement between the buyer and the seller.

5.2 Physical Properties

5.2.1 Specific surface area

The specific surface area shall be no less than 280 m^2/kg and no more than 500 m^2/kg.

5.2.2 Thickening time

The thickening time shall be no less than 60 min and no more than 180 min.

The maximum consistency within 30 min after the start of the thickening time test shall not exceed 30 Bc.

5.2.3 Free fluid

The free fluid content shall not exceed 5.0% (volume fraction).

5.2.4 Compressive strength

The compressive strength shall comply with the provisions of Table 1.

Table 1 Compressive Strength of Portland Cement for High Temperature Cementing

Curing Condition		Compressive Strength / MPa	
Curing Temperature /°C	Curing Pressure /MPa	24 h	7 d
38	0.1	≥14.0	≥20.0
120	20.7	≥20.0	≥20.0

6 Test Methods

6.1 Calcium oxide (CaO), silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), iron(III) oxide (Fe_2O_3), magnesium oxide (MgO), sulfur trioxide (SO_3), loss on ignition (LOI), insoluble residue (IR), potassium oxide (K_2O) and sodium oxide (Na_2O)

Shall be tested in accordance with GB/T 176.

6.2 Tricalcium silicate and dicalcium silicate in clinker

Shall be tested in accordance with GB/T 21372.

6.3 Specific surface area

Shall be tested in accordance with GB/T 8074.

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