



Exploration & Production

GENERAL SPECIFICATION

CIVIL WORKS

GS EP CIV 300

Reinforced and prestressed concrete

04	10/08	General review
03	10/07	Update of Reference documents and change of sections 3, 4, 5, 6, 7, 8, 9 and 11
02	10/05	Addition of "EP" root to GS identification
01	09/03	Change of Group name and logo
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1. Scope

This specification defines the minimum requirements applicable to the construction of reinforced and prestressed concrete structures.

Nonetheless some equipment and/or works may present particular problems. In such a case the COMPANY reserves the right to modify the general specifications or supplement them with particular specifications.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Where there are national regulations, their particular requirements, and those of the standards or codes to which they refer, must be applied, supplementing or amending the provisions of this document.

If there are no mandatory national regulations, international regulations, standards and codes shall be applied.

If there are no applicable international standards and codes, the national standards and codes shall be chosen from those listed below according to the projects in hand and shall be defined in the job specification.

In the absence of any particular specifications from the OWNER, French national regulations shall be applied.

In the absence of a specific exemption, duly justified by the CONTRACTOR and agreed by the OWNER, codes and standards of different origins may not be used in whole or in part.

If certain points in these regulations need to be clarified, the CONTRACTOR shall describe and justify the changes and/or additions to be made so that they can be adapted to the nature and environment of the structure. Such proposals shall be considered acceptable only when they have been examined and approved by the COMPANY.

A definitive list of regulations, standards and codes proposed by the CONTRACTOR shall be taken from the reference documents defined in this specification and the project's job specification.

Only the main standards are mentioned; the CONTRACTOR shall be responsible for compliance with any secondary standards. The list provided in this document should not be regarded as exhaustive.

Unless otherwise indicated in specific contractual conditions, for all documents cited for reference and their addenda, the latest issue applies.

Standards

International standards and codes

Reference	Title
ISO 1803	Building construction - Tolerances - Expression of dimensional accuracy - Principles and terminology
ISO 1920-1	Testing of concrete – Part 1: Sampling of fresh concrete
ISO 1920-2	Testing of concrete – Part 2: Properties of fresh concrete
ISO 1920-3	Testing of concrete – Part 3: Making and curing test specimens
ISO 1920-4	Testing of concrete – Part 4: Strength of hardened concrete
ISO 1920-5	Testing of concrete – Part 5: Properties of hardened concrete other than strength
ISO 1920-6	Testing of concrete – Part 6: Sampling, preparing and testing of concrete cores
ISO 1920-7	Testing of concrete – Part 7: Non-destructive tests on hardened concrete
ISO 2736	Concrete tests - Tests specimens
ISO 3443	Tolerances for building
ISO 3443-1	Tolerances for building – Part 1: Basic principles for evaluation and specification
ISO 3443-2	Tolerances for building – Part 2: Statistical basis for predicting fit between components having a normal distribution of sizes
ISO 3443-3	Tolerances for building – Part 3: Procedures for selecting target size and predicting
ISO 3443-4	Tolerances for building – Part 4: Method for predicting deviations of assemblies and for allocation of tolerances
ISO 3893	Concrete – Classification by compressive strength
ISO 4103	Concrete - Classification of consistency
ISO 4108	Concrete - Determination of tensile splitting strength of test specimens
ISO 4109	Fresh concrete - Determination of the consistency - Slump test
ISO 4110	Fresh concrete - Determination of the consistency - Vebe test
ISO 4111	Fresh concrete - Determination of the consistency - Degree of compactibility (Compaction index)
ISO 4848	Concrete - Determination of air content of freshly mixed concrete - Pressure method
ISO 6105-1	Blanks for superabrasive cutting-off wheels – Part 1: Manually guided cutting-off in building and civil engineering
ISO 6105-2	Blanks for superabrasive cutting-off wheels – Part 2: Hand-held cutting-off in building and civil engineering
ISO 6275	Concrete, hardened - Determination of density

Reference	Title
ISO 6276	Concrete, compacted fresh - Determination of density
ISO 6782	Aggregates for concrete - Determination of bulk density
ISO 6783	Coarse aggregates for concrete - Determination of particle density and water absorption - Hydrostatic balance method
ISO 6784	Concrete - Determination of static modulus
ISO 6934	Steel for the prestressing of concrete
ISO 6935	Steel for the reinforcement of concrete
ISO 7033	Fine and coarse aggregates for concrete - Determination of the particle mass-per-volume and water absorption - Pycnometer method
ISO 7728	Typical horizontal joints between AN external wall of prefabricated ordinary concrete components and A concrete floor. Properties, Characteristics and classification criteria
ISO 7729	Typical joints between two prefabricated ordinary concrete external wall components. Properties, characteristics and classification criteria
ISO 7844	Grooved vertical joints with connecting bars concrete infill between large reinforced concrete panels. Laboratory mechanical tests. Effect of tangential loading
ISO 7845	Horizontal joints between load-bearing walls and concrete floors. Laboratory mechanical tests. Effect of vertical loading and of moments transmitted by the floors
ISO 9882	Performance standards in building. Performance test for precast concrete floors. Behavior under non-concentrated load
ISO 9883	Performance standards in building. Performance test for precast concrete floors. Behavior under concentrated load
ISO 11082	Certification scheme for welded fabric for the reinforcement of concrete structures
ISO/TR 12662	Certification scheme for prestressing steels
ISO 14654	Epoxy-coated steel for the reinforcement of concrete
ISO 14655	Epoxy-coated strand for the prestressing of concrete
ISO 14656	Epoxy powder and sealing material for the coating of steel for the reinforcement of concrete
ISO 15630-1	Steel for the reinforcement and prestressing of concrete – Test methods – Part 1: Reinforcing bars, wire rod and wires
ISO 15630-2	Steel for the reinforcement and prestressing of concrete – Test methods – Part 2 : welded fabric
ISO 15630-3	Steel for reinforcement and prestressing of concrete – Test methods – Part 3: Prestressing steel
ISO 16020	Steel for the reinforcement and prestressing of concrete – Vocabulary

Reference	Title
ISO 19338	Performance and assessment requirements for design standards on structural concrete
ISO 22965-1	Concrete – Part 1 : Methods of specifying and guidance for the specifier
ISO 22965-2	Concrete – Part 2 : Specification and constituent materials, production of concrete and compliance of concrete
IBC	International Building Code

European standards and codes

Reference	Title
EN 196-1	Method of testing cement – Part 1: Determination of strength
EN 196-2	Method of testing cement – Part 2: Chemical analysis of cement
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 197-1	Cement – Part 1: composition, specifications and conformity criteria for common cements
EN 197-2	Cement – Part 2: Conformity evaluation
EN 197-4	Cement – Part 4: Composition, specifications and conformity criteria for low early strength
EN 206-1	Cement – Part 1: Specification, performance, production and conformity
EN 413-1	Masonry cement – Part 1: Composition, specifications and conformity criteria
EN 413-2	Masonry cement – Part 2: Test methods
EN 445	Grout for prestressing tendons. Test methods
EN 446	Grout for prestressing tendons. Grouting procedures
EN 447	Grout for prestressing tendons. Specification for common grout
EN 450-2	Fly ash for concrete - Part 2 : conformity evaluation

Reference	Title
EN 451-1	Method of testing fly ash - Part 1 : determination of free calcium oxide content
EN 451-2	Method of testing fly ash. Part 2 : determination of fineness by wet sieving
EN 480-13	Admixtures for concrete, mortar and grout – Test methods – Part 13: Reference masonry mortar for testing mortar admixtures
EN 480-14	Admixtures for concrete, mortar and grout – Test methods – Part 14: Determination of the effect on corrosion susceptibility of reinforcing steel by potentiostatic electro-chemical test
EN 523	Steel strip sheaths for prestressing tendons – Terminology, quality control,
EN 524-1	Steel strip sheaths for prestressing tendons – Part 1: Test methods
EN 524-2	Steel strip sheaths for prestressing tendons – Part 2: Determination of flexural behavior
EN 524-3	Steel strip sheaths for prestressing tendons – Part 3: to –and-fro bending test
EN 524-4	Steel strip sheaths for prestressing tendons – Part 4: Determination of lateral load resistance
EN 524-5	Steel strip sheaths for prestressing tendons – Part 5: Determination of tensile load resistance
EN 524-6	Steel strip sheaths for prestressing tendons – Part 6: Determination of leaktightness (Determination of water loss)
EN 932-1	Tests for general properties of aggregates – Part 1: Methods for sampling
EN 932-2	Tests for general properties of aggregates – Part 2: Methods for reducing laboratory samples
EN 932-3	Tests for general properties of aggregates – Part 3: Procedures and terminology for simplified petrographic description
EN 932-5	Tests for general properties of aggregates – Part 5: Common equipment and calibration
EN 932-6	Tests for general properties of aggregates – Part 6: Definitions of repeatability and reproducibility
EN 933-1	Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution. Sieving method
EN 933-2	Tests for geometrical properties of aggregates. Part 2 : determination of particle size distribution. Test sieves, nominal size of apertures
EN 933-3	Tests for geometrical properties of aggregates. Part 3 : determination of particle shape. Flakiness index
EN 933-4	Tests for geometrical properties of aggregates - Part 4 : determination of particle shape - Shape index
EN 933-5	Tests for geometrical properties of aggregates. Part 5 : determination of percentage of crushed and broken surfaces in coarse aggregate particles.

Reference	Title
EN 933-6	Test for geometrical properties of aggregates - Part 6 : assessment of surface characteristics - Flow coefficient of aggregates
EN 933-7	Tests for geometrical properties of aggregates - Part 7 : determination of shell content - Percentage of shells in coarse aggregates
EN 933-8	Tests for geometrical properties of aggregates. Part 8 : assessment of fines. Sand equivalent test
EN 933-9	Tests for geometrical properties of aggregates. Part 9: assessment of fines. Methylene blue test
EN 934-2	Admixtures for concrete, mortar and grout - Part 2 : concrete admixtures - Definitions, requirements, conformity, marking and labeling
EN 934-3	Admixtures for concrete, mortar and grout - Part 3 : admixtures for masonry mortar - Definitions, requirements, conformity, marking and labelling
EN 934-4	Admixtures for concrete, mortar and grout - Part 4 : admixtures for grout for prestressing tendons - Definitions, requirements, conformity, marking and labeling
EN 934-6	Admixtures for concrete, mortar and grout - Part 6 : sampling, conformity control and evaluation of conformity
EN 1097-1	Tests for mechanical and physical properties of aggregates - Part 1 : determination of the resistance to wear (micro-Deval)
EN 1097-2	Tests for mechanical and physical properties of aggregates - Part 2 : methods for the determination of resistance to fragmentation
EN 1097-3	Tests for mechanical and physical properties of aggregates - Part 3 : determination of loose bulk density and voids
EN 1097-4	Tests for mechanical and physical properties of aggregates - Part 4 : determination of the voids of dry compacted filler
EN 1097-5	Test for mechanical and physical properties of aggregates - Part 5 : determination of the water content by drying in a ventilated oven
EN 1097-6	Tests for mechanical and physical properties of aggregates - Part 6 : determination of particle density and water absorption
EN 1097-7	Tests for mechanical and physical properties of aggregates - Part 7 : determination of the particle density of filler - Pyknometer method
EN 1097-8	Tests for mechanical and physical properties of aggregates - Part 8 : determination of the polished stone value
EN 1097-9	Tests for mechanical and physical properties of aggregates. Part 9 : determination of the resistance to wear by abrasion from studded tyres. Nordic test.
EN 1097-10	Tests for mechanical and physical properties of aggregates - Part 10 : determination of water suction height

Reference	Title
EN 1169	Precast concrete products – general Rules for factory production control of glass-fibre reinforced cement
EN 1170-1	Precast concrete products. Test method for glass-fibre reinforced cement. Part 1: Measuring the consistency of the matrix, "Slump test" method
EN 1170-2	Precast concrete products. Test method for glass-fibre reinforced cement. Part 2: Measuring the fiber content in fresh GRC, " Wash test"
EN 1170-3	Precast concrete products. Test method for glass-fibre reinforced cement. Part 3: Measuring the fibre content of sprayed GRC
EN 1170-4	Precast concrete products. Test method for glass-fibre reinforced cement. Part 4: Measuring bending strength, " Simplified bending test" method
EN 1170-5	Precast concrete products. Test method for glass-fibre reinforced cement. Part 5: Measuring bending strength, " Complete bending test" method
EN 1170-6	Precast concrete products. Test method for glass-fibre reinforced cement. Part 6: Determination of the absorption of water by immersion and determination of the dry density
EN 1170-7	Precast concrete products. Test method for glass-fibre reinforced cement. Part 7: Measurement of extremes of dimensional variations due to moisture content
EN 1328	Cement bonded particleboards. Determination of frost resistance
EN 1744-3	Tests for chemical properties of aggregates - Part 3 : preparation of eluates by leaching of aggregates
EN 1744-4	Tests for chemical properties of aggregates - Part 4 : determination of water susceptibility of fillers for bituminous mixtures
EN 1744-5	Tests for chemical properties of aggregates - Part 5 : determination of acid soluble chloride salts
EN 1744-6	Tests for chemical properties of aggregates - Part 6 : determination of the influence of recycled aggregate extract on the initial setting time of cement
EN 12350-1	Testing fresh concrete - Part 1 : sampling
EN 12350-2	Testing fresh concrete - Part 2 : slump test
EN 12350-3	Testing fresh concrete - Part 3 : Vebe test
EN 12350-4	Testing fresh concrete - Part 4 : degree of compactability
EN 12350-5	Testing fresh concrete - Part 5 : flow table test
EN 12350-6	Testing fresh concrete - Part 6 : density
EN 12350-7	Testing fresh concrete - Part 7 : air content - Pressure methods
EN 12390-1	Testing hardened concrete - Part 1 : shape, dimensions and other requirements for test specimens and moulds
EN 12390-2	Testing hardened concrete - Part 2 : making and curing specimens for strength tests

Reference	Title
EN 12390-3	Testing hardened concrete - Part 3 : compressive strength of test specimens
EN 12390-4	Testing hardened concrete - Part 4 : compressive strength - Specification for testing machines
EN 12390-5	Testing hardened concrete - Part 5 : flexural strength of test specimens
EN 12390-6	Testing hardened concrete - Part 6 : tensile splitting strength of test specimens
EN 12390-7	Testing hardened concrete - Part 7 : density of hardened concrete
EN 12390-8	Testing hardened concrete - Part 8 : depth of penetration of water under pressure
PR EN 12390-9	TEST METHODS FOR THE FREEZE/ THAW RESISTANCE OF CONCRETE - Testing hardened concrete - Part 9 : freeze-thaw resistance - Scaling - PART 1 : SCALING
EN 12504-1	Testing concrete in structures - Part 1 : cored specimens - Taking, examining and testing in compression
EN 12504-2	Testing concrete in structures - Part 2 : non-destructive testing - Determination of rebound number
EN 12504-3	Testing concrete in structures - Part 3 : determination of pull-out force
EN 12504-4	Testing concrete - Part 4 : determination of ultrasonic pulse velocity
EN 13263 1 & 2	Silica fume for concrete
EN 13851	Methods of test for hydraulic setting floor smoothing and/or leveling compounds – Determination of flexural and compressive strength
EN 13872	Method of test for smoothing and/or leveling compounds – Determination of shrinkage
EN 14216	Cement – Composition, specifications and conformity criteria for very low heat special cements
EN 14227-1	Hydraulically bound mixtures – Specifications – Part 1 : Cement bound granular mixtures
EN 14647	Calcium aluminates cement – Composition, specifications and conformity criteria
EN 14649	Precast concrete products – Test method for strength retention of glass fibres in cement and concrete
EN 14845-1	Test methods for fibres in concrete – Part 1: Reference concretes
EN 15057	Fibre cement profiled sheets – Impact resistance test method

French standards and codes

Reference	Title
NF A35-015	Reinforcing steels - Weldable smooth steel - Bars and coils
NF A35-016-1	Reinforcing steels - Weldable ribbed steel - Part 1 : bars and coils
NF A35-016-2	Reinforcing steels - Weldable ribbed steel - Part 2 : welded fabric
NF A35-017	Steels for concrete reinforcement - Non weldable ribbed bars and coils
NF A35-019-1	Reinforcing steels - Weldable intended steel - Part 1 : bars and coils
NF A35-019-2	Reinforcing steels - Weldable indented steel - Part 2 : welded fabric
NF A35-020-1	Steel products. End coupling or anchoring devices for high adherence steel for concrete reinforcement. Part 1 : requirements for mechanical performances.
NF A35-020-2	Steel products - End coupling and anchoring steel devices for high adherence steel for concrete reinforcement - Part 2 : test methods
NF A35-021	Steels for concrete. Weldable wires used for the fabrication of reinforcing steels.
NF A35-024	Steels for concrete reinforcement - Surface welded fabric composed of wires with a diameter less than 5 mm
NF A35-027	Steel products for reinforced concrete - Reinforcements
NF A35-029	Armatures pour béton armé - Assemblages soudés - Qualification d'un mode opératoire de soudage. Qualification des soudeurs
PR NF A35-030	Steel products - High-bond ribbed steel bars for concrete poles, supports for over head lines
NF A35-031	Armatures pour béton armé - Barres soudables à verrous de diamètre supérieur à 40 mm
XP A35-045-1	Steel products - Prestressing steels - Part 1 : general requirements
XP A35-045-2	Steel products - Prestressing steels - Part 2 : wire
XP A35-045-3	Steel products - Prestressing steels - Part 3 : strand
P12-223	Specification for Mortar for masonry – Part 3: Products for external rendering and internal plastering based on organic binders
EN 197-1	Cement – Part 1 : Composition, specifications and conformity criteria for common cements – Sulfate resisting cement
EN 197-4	Cement – Part 4: composition, specifications and conformity criteria for low early strength balstfurnace cements
P 15-317	Ciments pour travaux à la mer
P15-318	Hydraulic binders – Cement with limited sulphides content for use un prestressed concrete
P15-330	Hydraulic binders. Calcium aluminate cement for refractories. Composition, specifications and conformity criteria

Reference	Title
P15-431	Hydraulic binders. Methods for testing cement. Setting test
P15-433	Methods of testing cement. Determination of shrinkage and swelling
P15-466	Binders. Rapid recognition of cement at the time of delivery in comparison with a reference sample
P15-467	Hydraulic binders. Practical instrumental method for the analysis of cement X-ray fluorescence spectrometry
P15-471-7	Methods of testing cement – Part 7: methods of taking and preparing samples of cement
P15-481PR	Methods of testing cement – Part 10: Determination of the water-soluble chromium (VI) content of cement
P15-590	Cement – Assessment of the conformity of cement to the requirements of Directive 2003/53/EC concerning the soluble hexavalent chromium content
P18-805	Special products for hydraulic constructions. Hydraulic binder based products. Determination of hydraulic binder
P18-808	Special products for hydraulic constructions. Hydraulic binder based products. Mineralogical analysis and potential composition according to bogue
P19-829-8	Test method for glass-fibre reinforced cement – Part 8: Cyclic weathering type test
P98-171	Cement concrete roadways. Dense concrete formulation study. Determination of the granular composition leading to the maximum density of fresh concrete
P98-240-1	Road testing. Measurement of the rate of hydraulic binders and additives in the cementitious materials. Part 1: Chemical method for the determination of the cement content in a new mixed material
P98-244	Test relating to pavements. Measurement of the position steel in cement concrete
P98-246	Tests relating to pavements. Measurements of the impermeability of joints on cement concrete pavements

American standards and codes

Reference	Title
ACI 117	Standard specifications for tolerances for concrete construction and materials
ACI 201.2R	Guide to durable concrete
ACI 211.1	Standard practice for selecting proportions for normal, heavyweight and mass concrete

Reference	Title
ACI 212.3R	Chemical admixtures for concrete
ACI 212.4R	Guide for the use of high-range water-reducing admixtures (superplasticizers) in concrete
ACI 214	Recommended practice for evaluation of strength test results of concrete
ACI 221R	Guide for use of normal weight and heavyweight aggregates in concrete
ACI 222R	Corrosion of metals in concrete
ACI 223	Standard practice for the use of shrinkage-compensating concrete
ACI 224R	Control of cracking in concrete structures
ACI 224.1R	Causes, evaluation and repair of cracks in concrete structures
ACI 224.2R	Cracking of concrete members in direct tension
ACI 224.3R	Joints in concrete construction
ACI 225R	Guide to the selection and use of hydraulic cements
ACI 228.1R	In-place methods to estimate concrete strength
ACI 228.2R	Nondestructive test methods for evaluation of concrete in structures
ACI 232.2R	Use of fly ash in concrete
ACI 233R	Ground granulated blast-furnace slag as a cementitious constituent of concrete
ACI 234R	Guide for use of silica fume in concrete
ACI 301	Specification for structural concrete
ACI 302.1R	Guide for concrete floor and slab construction
ACI 304R	Guide for measuring, mixing, transporting and placing concrete
ACI 304.2R	Placing concrete by pumping methods
ACI 304.4R	Placing concrete with belt conveyors
ACI 305R	Hot weather concreting
ACI 306R	Cold weather concreting
ACI 306.1	Standard specification for cold weather concreting
ACI 308R	Guide to curing concrete
ACI 308.1	Standard specification for curing concrete
ACI 309R	Guide for consolidation of concrete
ACI 309.1R	Behavior of fresh concrete during vibration
ACI 309.2R	Identification and control of visible effects of consolidation on formed concrete surfaces

Reference	Title
ACI 309.3R	Guide to consolidation of concrete in congested areas
ACI 311.4R	Guide for concrete inspection
ACI 318	Building code requirements for structural concrete
ACI 347	Guide to formwork for concrete
ACI 357R	Guide for the design and construction of fixed offshore concrete structures
ACI 372R	Design and construction of circular wire and strand wrapped prestressed concrete structures
ACI 373R	Design and construction of circular prestressed concrete structures with circumferential tendons
ACI 423.3R	Recommendations for concrete members prestressed with unbonded tendons
ACI 439.3R	Mechanical connections of reinforcing bars
ACI 504R	Guide to sealing joints in concrete structures
IBC	International Building Code
ASTM A82	Specification for steel wire, plain, for concrete reinforcement
ASTM A184/A184M	Specification for fabricated deformed steel bar mats for concrete reinforcement
ASTM A185 -	Specification for steel welded wire fabric, plain, for concrete reinforcement
ASTM A416/A416M	Specification for steel strand, uncoated seven-wire for prestressed concrete
ASTM A421/A421M	Specification for uncoated stress-relieved steel wire for prestressed concrete
ASTM A496	Specification for steel wire, deformed, for concrete reinforcement
ASTM A497	Specification for steel welded wire fabric, deformed, for concrete reinforcement
ASTM A615/A615M	Specification for deformed and plain billet-steel bars for concrete reinforcement
ASTM A704/A704M	Specification for welded steel plain bar or rod mats for concrete reinforcement
ASTM A706/A706M	Specification for low-alloy steel deformed and plain bars for concrete reinforcement
ASTM A722/A722M	Specification for uncoated high-strength steel bar for prestressing concrete
ASTM A779/A779M	Specification for steel strand, seven-wire, uncoated, compacted, stress-relieved for prestressed concrete

Reference	Title
ASTM Volume 04.01	Cement - Lime - Gypsum
ASTM Volume 04.02	Concrete and aggregates
ASTM C642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C682	Standard Practice for Evaluation of Frost Resistance of Coarse Aggregates in Air-Entrained Concrete by Critical Dilation procedures
ASTM D512	Standard test methods for chloride ion in water

British standards and codes

Reference	Title
BS 410	Specification for test sieves
BS 476	Fire test on building materials and structures (Part 3 to 7, 21 to 24 and 31)
BS 812	Testing aggregates
BS 1370	Specification for low heat Portland cement
BS 1881	Testing concrete
BS 4027	Specification for sulfate-resisting Portland cement
BS 4248	Specification for supersulphated cement
BS 4449	Specification for carbon steel bars for the reinforcement of concrete
BS 4482	Specification for cold reduced steel wire for the reinforcement of concrete
BS 4483	Steel fabric for the reinforcement of concrete
BS 4486	Specification for hot rolled and hot rolled and processed high tensile alloy steel bars for the prestressing of concrete
BS 4550	Methods of testing cement
BS 5896	Specification for high tensile steel wire and strand for the prestressing of concrete
BS 6089	Guide to assessment of concrete strength in existing structures
BS 6610	Specification for Pozzolanic pulverized-fuel ash cement
BS 7583	Specification for Portland limestone cement
BS 8000-2.1 and 2.2	Workmanship on building sites. Code of practice for concrete work
BS 8110	Structural use of concrete

Professional Documents

International documents

Reference	Title
RILEM report (1988)	Corrosion of steel in concrete P. SCHIESSL

French documents

Reference	Title
LCPC	Recommandations pour la prévention des désordres dus à l'alcalinité (Recommendations for preventing alkali-related damage)
SNBATI - ITBTP – AFAC	Recommandations professionnelles relatives à l'utilisation des démoulants (Professional recommendations related to the use of demoulding products)

American documents

Reference	Title
	Manual of cement testing Manual of aggregate and concrete testing

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP CIV 301	Design of reinforced and prestressed concrete
GS EP CIV 401	Minimum requirements for building design and construction

3. Field of application

3.1 Weather conditions

3.1.1 Hot weather

In addition to the standards to be used for the construction of reinforced and prestressed concrete, special considerations listed in Section 12 shall be applied for concrete manufacturing and placing in the following conditions (measurements performed over a 24-hour period):

- Maximum temperature $> 33^{\circ}\text{C}$
- and/or mean temperature $> 28^{\circ}\text{C}$

If The COMPANY judges it necessary, temperature could be lower, particularly in case of drying wind. It shall be defined in Particular Specifications.

3.1.2 Cold weather

In addition to the standards to be used for the construction of reinforced and prestressed concrete, special considerations listed in Section 13 shall be applied for concrete manufacturing and placing in the conditions described below.

The temperatures shall be measured by means of a thermometer set on the work site, in open air, 1.50 m above ground and sheltered from solar radiation and rain. A log shall summarize temperatures recorded at 7 a.m. ($t_{\min}$) and at 2:30 p.m. ($t_{\max}$) as well as their arithmetic mean value (t_{mean}).

Intervals of mean temperature (t_{mean}) and minimum temperature ($t_{\min}$) characterize each one of the types of weather considered below. The selected type shall correspond to the most severe interval, taking into account aggravation expected within three days.

Type 1: $5^{\circ}\text{C} > t_{\min} > 0^{\circ}\text{C}$

Type 2: $5^{\circ}\text{C} > t_{\text{mean}} > 0^{\circ}\text{C}$ or $0^{\circ}\text{C} > t_{\min} > -3^{\circ}\text{C}$

Type 3: $0^{\circ}\text{C} > t_{\text{mean}} > -5^{\circ}\text{C}$ or $-3^{\circ}\text{C} > t_{\min} > -7^{\circ}\text{C}$

Type 4: $-5^{\circ}\text{C} > t_{\text{mean}} > -10^{\circ}\text{C}$ or $-7^{\circ}\text{C} > t_{\min} > -12^{\circ}\text{C}$

In case concreting with more severe temperature conditions is necessary, a special study suited to the appropriate case shall be made.

The Construction CONTRACTOR shall submit all construction procedures for COMPANY approval.

3.2 Type of construction

3.2.1 Onshore construction

Onshore construction is located on a site not affected by sea condition. Near shore (1km from the sea) construction are concerned by particular specifications due to the chloride effect on concrete structure.

3.2.2 Offshore construction

Offshore construction concerns all works performed at sea and refers in particular to offshore platforms or Floating Production Unit.

3.3 Type of concreting

3.3.1 Cast-in-place concrete

Cast-in-place concrete is poured on site.

Specific measures for placing concrete must be taken according to the weather conditions prevailing on the site (see Section 3.1).

3.3.2 Precast concrete

Precast concrete is implemented using manufacturing processes producing concrete elements to be assembled on site.

4. Technical specifications for materials

4.1 General principles

The materials and products to be used for the construction works will be supplied by the Construction CONTRACTOR and submitted to the COMPANY for approval.

Materials, including fabrication and supply, shall be submitted to tests: composition or approval tests, operational tests and acceptance tests.

4.2 Submission of sample materials

Upon award of the contract to the Construction CONTRACTOR, a list of SUPPLIERS for materials shall be submitted to the COMPANY for approval and material samples shall be made available to the COMPANY, at the Construction CONTRACTOR expenses. The COMPANY shall keep these material samples until the contract is fulfilled. Samples supplied later on shall strictly have the same characteristics.

No change in the list of SUPPLIERS will be allowed without prior approval from the COMPANY.

4.3 Cement

4.3.1 Cement types

The types of cement shall be selected according to the type of works to be performed (marine works, underground works, structural works, etc.).

Selected cements shall comply with standards listed here above and particular specifications.

All cements must be certified by the MANUFACTURER in compliance with the required standards.

The certificates shall specify the mechanical and physical-chemical characteristics.

The Construction CONTRACTOR shall issue to the COMPANY the relevant certificates.

In case certification proves to be unsatisfactory to the COMPANY representatives on site, the latter may require additional tests to be carried out. These tests will be performed at the Construction CONTRACTOR expenses.

Only one brand of cement should be used for a specific work. In case this requirement cannot be fulfilled, whichever the reason is, the Construction CONTRACTOR shall prove the compatibility between brands.

Under no circumstance shall different types of cement be used in the same mix.

a) For general works

Unless specified otherwise, cement shall be Ordinary Portland Cement (OPC).

Only cement suited to the environment and produced by plants approved by the COMPANY shall be used.

b) For works in water with high sulphate content

Sulphate Resisting Cement (SRC) shall be used.

c) For works in chemically pure water

Cement with a high slag content shall be used.

d) For mass concrete

Cement with a low heat of hydration shall be used.

The cement heat of hydration should be assessed according to the semi-adiabatic method given in [EN 196-9](#) when uncracked concrete properties are to be adopted in design. An upper limit of 270 J/g is suggested where a low heat concrete is targeted due to warm weather working. This can typically be achieved by using either 50% ground-granulated blast furnace slag or 30% pulverised fuel ash as the cement replacement.

4.3.2 Sampling

The COMPANY reserves, at any time, the right to ask the Construction CONTRACTOR to supply cement samples taken from the stock intended for the work site. The COMPANY laboratory shall test these samples.

4.3.3 Delivery and storage

Supplier's certificates shall be provided to COMPANY confirming that cement delivered to the site has been tested and found to comply with the requirements of the appropriate Standards. The certificates shall be sent to site prior to dispatch of each consignment from Supplier's works. If subsequent tests on any consignment of cement show it not to comply with requirements Standards, the whole consignment shall be removed immediately from the site.

Unless authorization is given for bulk delivery under specific conditions, cement must be delivered in strong, solid bags or containers.

The cement store for bagged cement shall be a weatherproof building or shed, ventilated, free of dampness. The size shall be sufficient to hold enough cement for continuous execution of the works. Bags for cement shall be lined in polythene or other damp-proof material.

Access facilities shall be provided to allow for inspection, easy sampling and identification on each delivery.

Each delivery shall be stored separately and distinctively, after having been controlled by weighing.

Any cement from torn bags or unsealed containers shall be rejected.

If cement in bulk is to be used, prior approval by COMPANY must be obtained. It shall be stored in silos purpose made for storage of cement. These storage devices must be approved by the COMPANY and equipped with thermometric probes.

Cement must be supplied in adequate quantities to ensure concrete work being neither stopped nor suspended.

No cement shall be kept on the site longer than 3 months from the certificate date before use.

Any cement; which is stored on site in excess of 28 days, shall be tested in accordance with relevant standard prior to use, and evacuated within 48 hours in case of failure to meet the required Standards. Sufficient cement for one week's consumption shall be available at all times. Cement shall be in sequence in which it is delivered.

The COMPANY reserves the right to adapt maximum storage time if the concrete works take place by hot or cold weather.

Cement temperature shall not exceed 50°C before use, except by special agreement of the COMPANY.

4.3.4 Rejection

The COMPANY reserves the right to order that any shipment or part of a shipment shall not be used in the works and be removed from the site for failing to comply with the standards.

4.4 Aggregates

4.4.1 General

Aggregates shall be in compliance with the relevant standards.

The reaction of aggregates to alkalis shall be in compliance with [ASTM C 33](#), Section 8.1 and appendix A1.

The characteristics of aggregates shall be selected according to the quality of concrete to be produced.

Otherwise the possibility of not supplying the desired aggregates might lead to limitation of concrete characteristics.

4.4.2 Aggregate characteristics and source of supply

Aggregates for concrete shall be obtained from quarries proposed by the Construction CONTRACTOR and approved by the COMPANY. Their quality, grading and other characteristics shall be in compliance with the relevant specifications. The aggregates may be either natural (rolled stone) or crushed stone.

Aggregates shall be in compliance with the standards for cleanliness, strength, hardness and durability. They shall be free from adherent coatings, laminated particles or admixtures likely to be deleterious of concrete. They shall have a suitable grading from fine to coarse, within the allowed limits.

4.4.3 Grading

Gravel size shall be limited to a maximum being compatible with the type of works to be carried out. Aggregate grading and maximum dimensions shall be submitted for COMPANY approval.

If necessary, the Construction CONTRACTOR may submit limitation methods or grading correction methods for the COMPANY approval.

4.4.4 Fine aggregates or sand

Fine aggregates shall consist of crushed gravel, crushed stone or natural sand with rounded particles. It must be free of organic matter or other harmful substance, such as excessively fine or friable particles

Fine aggregates shall be washed as necessary to comply with Standards requirements:

- Clay lumps and friable particle < 2 %
- Material finer than 75µ: Sand or Crushed graded 3%, Crushed rock 5%
- Organic Impurities < 0.5%
- Water Absorption < 2%
- Chlorides < 0.06%
- Sulfates < 0.04%
- Sand equivalent > 85% (One test of sand equivalence shall be provided per 75 m³ of sand supplied)

Fine aggregates containing more than 15 % of their weight in flat and/or sharp particles shall be rejected.

Nominal maximum size of fine aggregate shall be 4 mm particle. The fineness modulus shall be between 2.3 and 3.0.

Aggregates shall be obtained from sources approved by COMPANY

One test of sand equivalence shall be provided per 100 m³ of sand supplied.

4.4.5 Coarse aggregates (gravel)

Coarse aggregate shall be clean, hard, strong, free from adherent coating or organic matter or other deleterious substance. It shall consist of crushed or uncrushed gravel or crushed rock. It shall be selected, re-crushed, screened and washed with water meeting requirements of section 4.5 to comply with the following:

- Flakiness Index 25% by weight
- Elongation Index 25% by weight
- Water absorption < 2.5%
- Drying shrinkage 0.05%
- Thermal expansion $12 \times 10^{-6} / ^\circ\text{C}$
- Clay lumps and friable particles < 2 %
- Shell NMS < 10 mm: 15 %, NMS > 10 mm: 8%
- Material finer than 75 µ: natural/crushed gravel 1%, crushed rock 3%

- Sulfates < 0.4%
- Chlorides < 0.03%

Grading: In general, coarse aggregates for reinforced concrete shall be limited to 25 mm maximum nominal size. This may be increase to a maximum of 40 mm or decreased to 12.5 mm for certain structures/foundations subject to COMPANY approval.

4.4.6 Cleanliness

If the COMPANY judges it necessary, aggregates shall be washed and/or screened to eliminate any salt, earth, dust, clay particles and muddy matter. Only freshwater meeting requirements of section 4.5 shall be used for washing aggregates. In particular all crushed aggregates shall be washed to eliminate fines.

4.4.7 Transportation, Storage and Testing

During transportation, all aggregates are to be protected from wind-borne contaminants. Should these contaminants be present at the time of delivery to site, then the aggregates shall be washed with water meeting the requirements of section 4.5. Transport vehicles shall be cleaned from possible contamination due to previous use.

Storage areas shall be sheltered.

Different type or size of aggregates shall be stored separately according to their granulometry in order to avoid segregation and excessive gradation variation, separated by permanent partition walls. Sufficient quantities of each type of aggregate shall be maintained on site all times to ensure continuity of work.

Storage areas shall be drained and covered with a 10-cm thick layer of concrete mixed with 150 kg of cement per m³. Other arrangements (floors or silos) may be acceptable, on the condition that similar cleanliness is provided (prevention of contamination).

The Construction CONTRACTOR shall back up his offer with a complete description and detailed drawings of the site arrangement in order to assure the COMPANY of the suitability of storage, handling, inspection and casting concrete conditions according to the magnitude of the works to be undertaken.

4.5 Water

Water used for mixing concrete shall be fresh, clean and free of any harmful particle, oil, organic matter or other substances detrimental to concrete or reinforcement.

The PH of water shall be greater than 7 and less than 9.

The salt content pf water and limitation of inorganic contamination shall not be such the maximum limits specified herein shall not be exceeded:

- Dissolved solids excluding those listed below: 0.2%
- Sulphates: 0.075%
- Alkali carbonates or bicarbonates: 0.075%
- Chlorides 0.05%
- Total dissolved solids: 0.30%
- Suspended solids: 0.20%