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1. INTRODUCTION 3

2. SCOPE 3

3. NORMATIVE REFERENCES 3

4. VARIATIONS TO SANS 2001-CC1 3

4.1. DURABILITY CONCRETE MIXES 5
4.2. POTENTIAL HEAT GENERATION 5

5. QUALITY DOCUMENTATION 6

5.1. PRIOR TO CASTING CONCRETE 6
5.2. ON PARTIAL AND/OR FULL COMPLETION OF THE WORKS 6
5.2.1. *Casting records. Casting records must include: 6*
5.2.2. *Concrete strength test results 7*
5.2.3. *Report on any remedial works undertaken on the concrete 7*

1. INTRODUCTION

This Specification covers the variations to SANS 2001-CC1, Construction works, Part CC1: Concrete works (structural), for the supply, delivery, handling, fabrication, storage and installation of concrete works required for use on marine structures.

2. SCOPE

This Specification defines the minimum requirements for the materials, production, handling, placement, and curing of concrete for use in marine structures. SANS 2001-CC1 covers structural concrete works for buildings and other land-based structures. It specifically excludes marine works, and this specification details the additional requirements for concrete in the marine environment.

The standard, SANS 2001-CC1 Construction works, Part CC1: Concrete works (structural), as modified by this Specification, must be used for marine concrete works.

3. NORMATIVE REFERENCES

The work completed under this Specification must conform to the current issue, including amendments, of the applicable normative standards given in SANS 2001-CC1.

4. VARIATIONS TO SANS 2001-CC1

Variations to SANS S2001-CC1 are detailed in Table 4-1.

Table 4-1: Variations to SANS 2001-CC1.

Clause No	Description	Variation
4.2.3.4	Use of plums	Plums must not be used in the works.
4.2.3.5	Material tests	The tests listed in the clause must all apply. The potential for alkali-aggregate reaction must be determined for the intended cement and aggregates according to SANS 6245 or ASTM C1260.
4.2.6	Grade of concrete	Concrete grades for each concrete element will be defined on the drawings. Concrete grade is defined as Grade X/Y, where X is the 28 day cube crushing strength in MPa, and Y is the maximum nominal aggregate size in mm.
4.2.7	Grout	A proprietary pre-packaged non-shrink grout must be used for grouting of dowels, anchor bolts, and similar applications.

Clause No	Description	Variation
4.4.3	Cover	The concrete cover to the reinforcement must be 65 mm (extreme exposure condition), as defined in Table 3, unless specified otherwise on the drawings.
4.7.4	Chloride and sulfate content	The maximum chloride contents in Table 5 of SANS 2001-CC1 specified for the marine environment for reinforced and post-tensioned concrete must be applied.
4.7.5	Durability	In order to enhance durability and notwithstanding strength considerations the concrete mixes must satisfy one of the mixes given in the Table 2 below. Blends of CEM I and Condensed Silica Fume (CSF) must not be used for steel reinforced concrete. Ternary blends containing two extenders, such as CSF, FA, GGCS or GGBS, may be considered provided that they can be shown to be equivalent in durability to the mixes given.
4.7.13	Curing and protection	All reinforced concrete must be cured by moist curing methods. Curing compound (clause 4.7.13.2e) must not be used for curing reinforced concrete. The curing periods must be as defined SANS 2001-CC1 Table 8.
4.7.15.	Concrete surfaces	The unformed surfaces of concrete armour units must be wood-floated.
4.7.19	Defects	All defective concrete must be repaired in accordance with the requirements of *EN 1504: Products and systems for the protection and repair of concrete structures, Parts 1 to 10*. *EN 1504* defines the type of products for the protection and repair of concrete structures. Furthermore, the quality control of the repair materials production and the execution of the works on site are also part of this standard.
4.7.22	Records	In addition to the records listed in clause 4.7.22 the quality records listed in clause 5 below must be provided.
5.2	Tolerances	The concrete works must be constructed to Degree of accuracy II, unless specified otherwise on the drawings.

4.1. Durability concrete mixes

Concrete mixes are detailed in Table 4-2.

Table 4-2: Concrete mixes.

Concrete Type	Cement Type & % Content	Extender Type & % Content	Minimum Binder Content (Cement + Extender) Kg/M ^{3}	Maximum Water/Binder Ratio
PLAIN	CEM I 100%	NIL	340	0.50
PLAIN	CEM I ≥75%	FA ⩽ 25%	340	0.50
PLAIN	CEM I 35% - 65%	GGBS/GGCS 35% – 65%	340	0.50
PLAIN	CEM I 65% – 74%	FA 26% – 35%	300	0.55

Note:

1. CEM I may be CEM I 42,5, 42,5 R, 52.5 or 52.5R.
2. GGBS - Ground Granulated Blast Furnace Slag
3. GGCS - Ground Granulated Corex® Slag
4. FA - Fly Ash
5. Factory blended cements (CEM II/B-V, CEM II/B-W or CEM III/A) will be accepted provided that they conform to one of the blends specified in the table. The *Contractor* must supply certification thereof.
6. Water-reducing admixtures may be used to improve workability (See also Clause PSG 2.3 above). The water cement ratio must include the water content of admixtures.
7. Cement/binder content valid only for nominal maximum size of aggregate of 20mm.

4.2. Potential heat generation

In addition to the requirements of SANS 2001-CC1 clause 4.7.14, Adverse weather, consideration must be given to the potential heat generation when casting large concrete elements.

Where the minimum dimension of concrete to be placed at a single time is greater than 600 mm and especially where the cement/binder content is likely to be 400 kg/m3 or more, measures to reduce the temperature, such as the selection of a cement type with a slower release of heat of hydration, should be considered. In exceptional cases other measures to reduce the temperature or to remove evolved heat may be necessary.

5. QUALITY DOCUMENTATION

The minimum quality documentation required for the concrete works is listed in this section.

5.1. Prior to casting concrete

i. Materials sources and certification for each type.
ii. Manufacturers' product sheets for proprietary items such as admixtures, cover blocks, waterstops, joint fillers etc.
iii. Report on concrete mix designs for each required grade. Report to include details of all materials (cements, extenders, aggregates, water and admixtures), and strength test results from trial mixes.
iv. Report on potential for alkali aggregate reaction, and mitigation measures to be implemented if required.
v. Construction method statements

5.2. On partial and/or full completion of the works

5.2.1. Casting records. Casting records must include:

5.2.1.1. Records of pre-casting inspections

i. Founding
ii. Formwork
iii. Reinforcement
iv. Cover blocks
v. Cast-in items
vi. Safety (access, formwork)
vii. Etc.

5.2.1.2. Records of post-casting inspections

i. Dimensions
ii. Finish
iii. Defects
iv. Construction joints
v. Test results (slump)
vi. Curing records
vii. Etc.

5.2.2. Concrete strength test results

5.2.3. Report on any remedial works undertaken on the concrete