

## **PART C3: SCOPE OF WORK**

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## **PART C3: SCOPE OF WORKS**

### **1. PURPOSE OF THIS DOCUMENT**

The purpose of the Works Information includes is to specify and describe the structural engineering works which are to be provided and any other requirements and constraints relating to the manner in which the contract work is to be performed. The works information will also provide information with regards to the following:

- Reference to Specifications for the Works,
- Drawings,
- Facilities available and required, and
- Requirements to be met by the Contractor

#### **Note:**

Should any requirement or provision of the Works Information conflict with any requirement or provision of any other specification section or clause that are applicable to the Contract or any drawing, the requirement or provision of the Works Information shall prevail.

### **2. EXTENT OF PROJECT**

The work areas applicable to the works are limited to the following areas only:

- The site is located within the Port of Cape Town, Western Cape, South Africa. The location of the High Masts is at: A-berth; Quayside at Eastern Mole end; Tanker Basin; Marshalling Yard; and South Arm entrance.

Any reference to work outside of these areas or not defined in the Bill of Quantities is included for information only and should be regarded as BY OTHERS. This background information is also included to assist the Contractor in understanding the scope of work of the other Contractors, and where the interfaces shall be.

### **3. STRUCTURAL ENGINEERING SCOPE OF WORK**

#### General

This Scope of Work lists the minimum requirements for the works installations required for the structural works required for the Port of Cape Town Lighting and Equipment Upgrade.

Compliance with this Scope of Work does not relieve the Contractor of the responsibility to provide workmanship, quality and safety in line with the regulations, codes, standards and procedures for the service described.

The Contractor shall submit a list of all qualifications/ deviations from this Scope of Work with the bid package, and shall describe each in detail. Any exception to this Scope of Work shall be stated in writing by the Contractor.

The work covered in this Scope of Work shall be executed by Contractors and personnel that have been proven competent in similar work and are appropriately trained and qualified through schooling and formal training institutions.

The Contractor shall ensure that labour performing critical tasks have been appropriately assessed, trained and are sufficiently experienced to be able to undertake the tasks assigned.

This document and all documents referenced herein is deemed to form part of the Employer's Requirements, as defined by the contract.

The general scope of the Contractor shall include all concrete and structural steelwork but not be limited to the points listed below:

- All works relating to: Concrete Bases installation and High Masts installation
- All work in the areas applicable to this contract only, as described in this scope of work and specifically itemised in the Bill of Quantities
- Professional services, management, supervision, and labour throughout the work execution
- Plant, materials, supplies, tools, rigging, scaffold erection, mobile cranes and equipment, machinery, construction consumables, and all other items to be used directly or indirectly for the complete installation of the scope of work.
- Project management, including management of safety, quality, preparation of schedules, plans and progress reporting from order placement to final sign off
- Receiving, unloading, de-stuffing, inspection, on-site transport and placement of new equipment
- Installation in accordance with drawings, specifications, OEM/Vendor's installation manuals and other relevant contract documents
- Ensure compliance with the Employer's engineering drawings, documentation and specifications
- The installation of miscellaneous items and consumables
- Self-provision of compressed air requirements and construction lighting requirements
- Refuse collection and removal to an approved dump site.

All work not referred to in this Scope of Work, or referred to in the Scope of, shall be included in the Works unless otherwise clearly specified as supplied by others.

The onus will be with the Contractor to detail (in writing) any requirements in respect of access, information, equipment, manuals, inductions, medicals, lifting equipment, personal tools and any other items required from the Employer.

The Contractor will be responsible for the rectification of workmanship defects related to the activities of the Contractor that develop during the Warrantee period after the final hand over to site of the Plant and Materials.

## 1.1 **Structural Works**

### 1.1.1 **Concrete, Formwork and Reinforcement**

#### 1.1.1.a.1 **Specifications for concrete**

1.1.1.a.1.1 The following specifications shall apply:

1.1.1.a.1.2 NB: All in situ concrete work (mass and reinforced) shall comply with SANS Specification 1200G ("8 Measurement and Payment" is not applicable) supplemented by the clauses in this section. Where SANS Specification 1200G and the clauses in this section are in conflict the clauses in this section shall take precedence.

1.1.1.a.1.3 In addition the "Model Preambles for Trades" as recommended and published by the Association of South African Quantity Surveyors, 1999 Edition, shall be read in conjunction with and shall apply to all items in the Bill of Quantities not covered by the 'SANS Standardised Specifications' SANS 1200 Series.

1.1.1.a.1.4 Where the term "plain concrete" appears in SANS Specification 1200G it shall be read as "mass concrete".

SANS 1200 G	Concrete
SANS 2001: CC1	Construction <i>Works</i> : Concrete <i>Works</i> (Structural)
SANS 1083: 2006	Aggregates from natural sources
SANS 10100-2:2000	The Structural use of concrete – Part 2: Materials and execution of work.
SANS 50197-1:2000	Cement – composition, specifications and conformity criteria. Part 1: Common cements
SANS 1491-1:2005	Portland cement extenders – Part 1 Ground granulated blast furnace slag.
SANS 1491-2:2005	Portland cement extenders – Part 2 Fly ash.
SANS 1491-3:2006	Portland cement extenders – Part 3 Condensed Silica Fume
S437 (Transnet)	Concrete Pavement

#### 1.1.1.a.2 **Cement**

Common cements, complying with SANS 50197-1 shall be used for all concrete work. On no account shall masonry cements be used for concrete work, even if the strength designations are the same as for common cements.

The *Supervisor* for test purposes may require samples of cement from any one, or from every consignment. Cement in any consignment from which a sample may have been taken for testing shall not be used until it has been approved. Allowance must be made for possible delay in that tests may take 10 days to carry out.

Bags of cement shall be stacked in a waterproof, solidly constructed shed with a central door and a floor rendered damp-proof with a tarpaulin. The bags of cement shall be closely stacked

(but not against walls) in order to reduce air circulation in such a manner that the cement is used in the order in which it was received, i.e. first in first out.

#### 1.1.1.a.2.1 **Alkali reactive concrete**

1.1.1.a.2.1.1 Alkali Reactive Aggregates shall not be used in this project. The equivalent Na<sub>2</sub>O content of the concrete shall not exceed 2, 0 kg/m<sup>3</sup> where % Na<sub>2</sub>O equivalent = % Na<sub>2</sub>O + (0,658 x %K<sub>2</sub>O)

#### 1.1.1.a.2.2 **Aggregates**

1.1.1.a.2.2.1 Fine and coarse aggregate shall comply with the relevant clauses of SANS 1083. Where aggregates have constituents, which in the opinion of the *Project Manager*, may give rise to damage due to alkali-aggregate reactions, the provisions of clause 6.3 shall be applicable.

1.1.1.a.2.2.2 Evidence of compliance of the aggregates with the requirements of SANS 1083 clause 6.3 shall be furnished as early as practical. No aggregate shall be delivered for use in the *Works* until approval is given.  
Sand (fine aggregate):

1.1.1.a.2.2.3 The fine aggregates shall comply with the requirements of SANS Specification 1083. Other aggregates may be approved if they have a satisfactory history and / or test results.

1.1.1.a.2.2.4 No aggregate may be used until it has been approved. Samples having a mass of 25kg (16.5 litres) of the proposed aggregate to be used may be required by the *Supervisor* for test purposes. Samples having a mass of 25kg shall be forwarded every 3 months during concreting work and also if the source of supply is changed. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

#### 1.1.1.a.2.3 **Admixtures**

1.1.1.a.2.3.1 Admixtures containing chlorides will not be permitted in reinforced concrete.

#### 1.1.1.a.2.4 **Cover blocks**

1.1.1.a.2.4.1 Cover blocks used to ensure the cover to reinforcement shall be made of cement mortar.

1.1.1.a.2.4.2 Cover blocks shall be dense and have a minimum 28 day crushing strength of 30 MPa and shall be cured in water for at least 14 days before being used.

1.1.1.a.2.4.3 Cover/spacer blocks made of plastic will not be permitted

#### 1.1.1.a.3 **Concrete quality**

Prior to the start of any concrete work on site, the *Contractor* shall submit a quality assurance plan which will ensure compliance with specification and provide acceptable documentary evidence that all specified operations have been carried out satisfactorily.

Where the minimum dimension to be placed during a single pour is larger than 600mm, and the cement content of the reinforced concrete exceeds the following:

Cement Types I and II/ \* S : 400 kg/m<sup>3</sup>  
Cement Types II/B-V and II/B-W : 450 kg/m<sup>3</sup>

The *Project Manager* may require that measures be instituted to reduce heat development in the concrete.

#### 1.1.1.a.3.1 **Unreinforced concrete**

1.1.1.a.3.1.1 Class A Concrete

1.1.1.a.3.1.2 Filling to cavity of hollow walls.

#### 1.1.1.a.3.2 **Unreinforced concrete cast against excavated surfaces**

1.1.1.a.3.2.1 15 Mpa/19mm Concrete

1.1.1.a.3.2.2 Surface blinding under footings and bases.

#### 1.1.1.a.3.3 **Reinforced concrete**

1.1.1.a.3.3.1 30 MPa/19mm Concrete:

1.1.1.a.3.3.2 Bases

1.1.1.a.3.3.3 Foundation beams.

1.1.1.a.3.3.4 Surface beds cast in panels on waterproofing

1.1.1.a.3.3.5 Walls in foundations (Provisional)

1.1.1.a.3.3.6 Columns in foundations (Provisional).

#### 1.1.1.a.4 **Batching**

1.1.1.a.4.1 All cementitious binders shall be batched by full sack or by mass batching with approved precision weighing equipment.

1.1.1.a.4.2 All aggregates shall be precisely measured by mass using approved precision weigh-batching equipment, unless otherwise permitted by the *Project Manager*.

1.1.1.a.4.3 Should any variation in the composition of the aggregate become apparent, the *Project Manager* shall be notified and a further sample of aggregate submitted immediately for his approval.

#### 1.1.1.a.5 **Concrete placing**

1.1.1.a.5.1 The size, shape and depth of any excavation shall be approved by the *Project Manager* before concrete is placed.

1.1.1.a.5.2 Unless otherwise permitted by the *Project Manager*, no concrete shall be placed until the fixed reinforcement has been accepted by him and confirmed in writing by way of a release certificate.

#### 1.1.1.a.6 **Construction joints**

1.1.1.a.6.1 Unless otherwise shown on the drawings, the exact position of horizontal construction joints shall be marked on the formwork by means of grout checks in order to obtain truly horizontal joints.

1.1.1.a.6.2 Stub columns, stub walls and stays on footings shall be cast integrally with the footing and not afterwards, even where another class of concrete is being used.

1.1.1.a.6.3 Joint lines shall be so arranged that they coincide with features of the finished work.

1.1.1.a.6.4 Where new concrete is to be cast against a hardened concrete surface, neat cement slurry mixed to a creamy consistency shall be brushed onto the cleaned concrete surface.

1.1.1.a.6.5 Contraction joints shall be smooth and shall have one coat of limewash or PVA applied to the older surface prior to casting the fresher concrete.

#### 1.1.1.a.7 **Slip Joints between Concrete and Brickwork**

1.1.1.a.7.1 Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and towelling smooth the bearing surfaces of brickwork with 3:1 cement mortar and covering the bearings before the concrete is baste, with two layers of one side smooth tempered hardboard, with the smooth sides in contact.

1.1.1.a.7.2 The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 13mm thick bitumen impregnated soft board or expanded polyethylene strips placed vertically against the brickwork before the concrete is cast.

1.1.1.a.7.3 Similar slip joints shall be provided between brickwork and concrete lintels cast In situ, but without soft board or expanded polyethylene strips at ends.

#### 1.1.1.a.8 **Movement Joints**

1.1.1.a.8.1 All movement joints are to be filled in with approved bitumen impregnated soft board or expanded polyethylene strip unless otherwise specified or detailed on drawings. Descriptions (Prices) of movement joints shall be deemed to include formwork.

#### 1.1.1.a.9 **Grouting**

1.1.1.a.9.1 25 MPa non-shrink cementitious grout:

1.1.1.a.9.2 Bedding approximately 25mm thick under base plate including chamfered edges all round.

#### 1.1.1.a.10 **Curing compound**

Unless otherwise directed by the *Project Manager*, the curing compound shall be:

An approved trafficable, resin-based, white pigmented, membrane forming for slopes flatter than 1:1.

An approved clear, aesthetically acceptable, membrane forming for all other concrete surfaces, including beam and slab soffits.

The curing compound shall comply with specification ASTM C309, except that the maximum permissible water loss in the test shall be 0, 40 kg/m<sup>2</sup>.

Alternatively, the curing compound shall be acceptable if the treated concrete retains 90% or more of its mixing water when subject to the test set out in BS 8110 Part 1 – Chapter 6.6.

#### 1.1.1.a.10.1 **Curing compound application**

1.1.1.a.10.1.1 The total application rate of the curing compound shall be the greater of the supplier's specification or 0.90 l/m<sup>2</sup>. On textured concrete surfaces, the total application rate shall be 0.90 l/m<sup>2</sup>.

1.1.1.a.10.1.2 In cases of concrete surfaces with run-off problems, it may be necessary to apply more than one coat of membrane forming curing compound to obtain the specified total or cumulative application rate.

1.1.1.a.10.1.3 Curing in accordance with SANS 1200 G shall commence on all concrete surfaces as soon as it is practical in the opinion of the *Employer's* Engineers and *Project Manager*.

1.1.1.a.10.1.4 On unformed surfaces the curing compound shall be applied after finishing and as soon as the free water on the surface has disappeared and no water sheen is visible, but no so late that the liquid curing compound will be absorbed into the concrete.

1.1.1.a.10.1.4.1 On formed surfaces, the exposed concrete shall be wet with water immediately after the forms are removed and kept moist until the curing compound is applied.

1.1.1.a.10.1.4.2 Application of the curing compound shall begin once the concrete has reached a uniformly damp appearance with no free water on the surface.

1.1.1.a.10.1.4.3 Application of the compound may be done by hand or power spray.

1.1.1.a.10.1.4.4 The compound shall be applied at a uniform rate with two applications at right angles to each other to ensure complete coverage.

1.1.1.a.10.1.4.5 Pigmented compounds, without a thixotropic agent, shall be adequately stirred to assure even distribution of the pigment during application.



1.1.1.a.10.1.4.6 Unless otherwise directed by the *Project Manager*, the initial 24 hour curing of concrete surfaces not covered by formwork shall be carried out by ponding, covering with constantly wetted sand or mats, or continuous spraying in accordance with SANS 1200 G when the following climatic conditions occur:

Wind velocity greater than 5 m/s  
and/or  
Ambient temperature is above 25 °C  
and/or  
The relative humidity is below 60 %

1.1.1.a.10.1.4.7 If plastic shrinkage occurs, the concrete, while still plastic, shall be re-vibrated, floated and re-coated with curing compound as if no curing has previously taken place.

### 1.1.1.a.10.2 **Curing period**

1.1.1.a.10.2.1.1 The curing period for concrete containing only CEM 1 shall be 7 days.

1.1.1.a.10.2.1.2 The curing period for concrete containing CEM 1 plus cement extenders (MGBS, FA) shall be 10 days.

1.1.1.a.10.2.1.3 The curing period will start on completion of the concrete pour and for formed surfaces shall be included the time for which forms are still in place after the pour.

### 1.1.1.a.11 **Concrete records**

The *Contractor* shall maintain the following daily records for every part of the concrete structure and shall make these available at all times during the progress of the work for inspection by the *Project Manager*.

- I. The date and time during which concrete was placed
- II. Identification of the part of the structure in which the concrete was placed
- III. The mixed proportions and specified strength
- IV. The type and brand of cement
- V. The slump of the concrete
- VI. The identifying marks of test cubes made
- VII. Curing procedure applied to concrete placed
- VIII. The times when shuttering was stripped and props removed
- IX. The date of despatch of the cubes to the testing laboratory
- X. The test results

The records shall be delivered to the *Project Manager* each week except in the case of sub-standard concrete, when the *Project Manager* shall be informed immediately.

### 1.1.1.a.11.1 **Tolerances**

1.1.1.a.11.1.1 Deviations shall be within the limits listed in SANS 1200 G for degree of accuracy II unless otherwise specified

### 1.1.1.a.11.2 Testing and monitoring

1.1.1.a.11.2.1 Frequency of sampling and testing shall be as specified in SANS 1200 G.

### 1.1.1.a.11.3 Cost of tests

1.1.1.a.11.3.1 The costs of making, storing and testing of concrete test cubes as required under clause 7 'Tests' of SANS 1200 G shall include the cost of providing cube moulds necessary for the purpose, for testing costs and for submitting reports on the tests to the *Project Manager*. The testing shall be undertaken by an independent firm or institution nominated by the *Contractor* to the approval of the *Project Manager* (Test cubes are measured separately)

1.1.1.a.11.3.2 If the quantity of concrete from which samples were taken exceeds 40 m<sup>3</sup>, it shall be subject to the testing of a minimum of 3 sets of samples per day from each grade of concrete placed in each independent structure

1.1.1.a.11.3.3 If the quantity of concrete from which samples were taken is less than 40 m<sup>3</sup>, it shall be subject to the testing of a minimum of 2 sets of samples per day from each grade of concrete placed in each independent structure.

1.1.1.a.11.3.4 If the *Contractor* disputes the results of the tests on concrete cubes, the concrete represented by the cubes will be considered acceptable if the *Contractor*, at his own cost, proves to the satisfaction of the *Project Manager* that the estimated actual strength of cores taken from the structure, determined in accordance with SANS Standard Method SM 856, is not less than the specified strength.

1.1.1.a.11.3.5 If the strength of the concrete fails to meet the acceptance criteria stipulated, the *Project Manager* may in his sole discretion and in addition to the options listed in SANS 1200 G:

- Accept the concrete subject to approved remedial measures being undertaken by the *Contractor*, or
- Permit the concrete to remain subject to the payment of a penalty

1.1.1.a.11.3.6 The penalty referred to will be determined as follows:

$$\text{Penalty} = V \times R \times F$$

Where

V = Volume (in the opinion of the *Project Manager*) of concrete of unsatisfactory strength represented by the test result.

R = Relevant scheduled rate

$$F = 1 - \sqrt{\frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}}$$

Where the relevant scheduled rate (R) includes the cost of formwork or

$$F = 1 - \frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}$$

Where the relevant scheduled rate (R) excludes the cost of formwork or where no formwork was involved.

### 1.1.2 Formwork

Descriptions of formwork shall be deemed to include use and waste only (except where described as left in or permanent), for fitting together in the required forms, wedging, plumbing and fixing to true angles and surfaces as necessary to ensure easy release during stripping and for reconditioning as necessary before re-use

Formwork to sides of bases, pile caps, ground beams, etc. have been measured provisionally and will only be paid for where it is specifically prescribed by the Technical Officer for design reasons. Formwork necessitated by irregularity or collapse of excavated faces will not be measured and the cost thereof shall be deemed to be included in the allowance for taking the risk of collapse of the sides of the excavations, provision for which is made in Earth *Works*

#### a) Rough formwork (degree of accuracy ii)

##### 1.1.2.a.1 Rough Formwork to Sides:

- Strip footings.
- Bases.
- Walls in foundations.
- Outer face of walls flushes with perimeter of concrete structure.
- Rectangular columns in foundations.
- Edges not exceeding 300mm high
- Rough Formwork to Circular Columns

#### b) Smooth formwork (degree of accuracy ii)

##### 1.1.2.b.1 Smooth Formwork to sides:

- Inner face of shaft walls.
- Edges not exceeding 300mm high

#### c) Movement joints etc.

##### 1.1.2.c.1 Expansion joints with soft board between vertical concrete surfaces:

12mm Joints not exceeding 300mm high.

d) **Saw cut joints**

3.2 x 50mm And 6.4 x 20mm saw cut joints in two operations in top of concrete.  
Seal Sikaflex-11FC on backing chord to manufacturer's specification  
Horizontal toggle construction joints through concrete including thick cement slurry to one face.  
Surface beds not exceeding 300mm thick.

e) **Reinforcement (provisional)**

High tensile steel reinforcement to structural concrete work:  
In various diameters and lengths  
Mild steel reinforcement to structural concrete work  
In various diameters and lengths  
High tensile steel reinforcement to structural concrete work  
Fabric reinforcement:  
Fabric reinforcement type as specified on structural drawings.

f) **Forming key to concrete for plaster, mosaic tiles and other finishes**

- 1.1.2.f.1 Where rough formwork has been used, surfaces of concrete to receive plaster, mosaic tiles and other finishes, shall, immediately after the formwork has been removed, be well wetted and wire brushed whilst the concrete is still green and then shushed over with 2:1 cement grout to form a key for the finish, all to the approval of the *Supervisor*. The shushing is to be allowed to set hard before the finish is applied.
- 1.1.2.f.2 Where smooth formwork is used, surfaces of the concrete to receive plaster, mosaic tiles and other finishes shall be hacked, on the distinct understanding that hacking of concrete shall be at no extra cost to the *Employer*.
- 1.1.2.f.3 Surfaces of concrete receiving plaster or other finishes shall not be plastered or finished until the *Supervisor* has signified his opinion in writing that the surfaces are suitable to receive plaster or other finishes.

g) **Sleeve Pieces and Ties**

- 1.1.2.g.1 Where it is necessary to leave plugs or holes in beams, slabs or any other reinforced concrete, all such plugs or holes must be situated in positions approved by the *Supervisor* before concreting. Where it is necessary to carry pipes, bolts, wires or any other fittings through reinforced concrete members, approved pipe sleeves must be provided and placed in position before concreting.
- 1.1.2.g.2 Where waste, ventilation water, heating or other pipes under 100mm diameter pass through concrete slabs and beams, galvanised mild steel sleeve pieces or diameters shown or required shall be cast into such concrete slabs and beams.
- 1.1.2.g.3 Chases shall be formed in edges of slabs or slots shall be formed in the slabs, or sizes required, where two or more pipes pass through together.
- 1.1.2.g.4 All necessary bolts, plugs, brackets, cramps, etc. shall be cast into the concrete as the work proceeds.

1.1.2.g.5 Where brickwork abuts against concrete, the brickwork is to be tied to the concrete with galvanized hoop-iron ties 1.6m thick by 32mm wide and approximately 600mm long to every third course of brickwork with one end of each tie cast approximately 150mm deep into the concrete. Where such fixing is impossible, i.e. where steel formwork is used, the ties are to be gun-nailed against concrete with steel nails to less than 38mm long.

h) **Bagged Finish to Concrete**

1.1.2.h.1 Concrete surfaces to receive bagged finish shall be prepared by removing sharp projections and making good defects with 3:1 cement mortar. Finish by rubbing over the whole area with wet rough sacking and cement grout to obtain an even surface.

i) **Power Floated Finish**

1.1.2.i.1 Power floated finish to floors etc. means that surfaces shall be floated c\mechanically to a smooth and even finish before the concrete has set. Small areas inaccessible to the machine are to be floated by hand. Under no circumstances is cement mortar to be added while floating the concrete.

j) **"No Fines" Concrete**

1.1.2.j.1 "No-fines" concrete, for grading flat concrete roofs and the like to falls, shall be in the proportion of 12 parts 19 iron cubical stone to 1 part cement mixed with 20 litres water per bag of cement and be laid to falls of not less than 15mm per linear metre for mastic asphalt and not less than 20mm per linear metre for sheet roof covering. For heavy load applications special mix designs may be required.

1.1.2.j.1.1 Fillets against up stands:

1.1.2.j.1.1.1 Form triangular fillets, size 100 x 100mm, in corners with walls, kerbs, etc. neatly mitred at angles, stopped where necessary and finished smooth ready to receive waterproofing.

1.1.2.j.1.2 To raised floor, bases, etc:

1.1.2.j.1.2.1 No-fines" concrete for raised floors, bases, etc. shall be in the proportions specified. Finished smooth with 3:1 sand/ cement screed to receive waterproofing.

k) **Precast Concrete**

1.1.2.k.1 **Materials**

Cement, water, aggregates and reinforcement shall be as described under: **CONCRETE, FORMWORK AND REINFORCEMENT.**

1.1.2.k.2 **Concrete**

1.1.2.k.2.1 Concrete shall be as described under: **CONCRETE, FORMWORK AND REINFORCEMENT** and, unless otherwise specified. Class E concrete shall be used but with coarse aggregate of an appropriate size.

### 1.1.2.k.3 **Smooth Finish**

- 1.1.2.k.3.1 Where described as “finished smooth from the mould” such surfaces shall have a layer of fine stuff composed of 1:4 (1 part cement and 4 parts clean fine sand by volume) packed against the faces of the mould before placing the concrete backing. The concrete backing shall be disposed into the moulds in a wet state (not dry pressed) while the facing is still wet.
- 1.1.2.k.3.2 Projections shall be rubbed off the faces shall be of even colour and free from blemishes, cracks and other imperfections. Salient angles shall be arras rounded.

### 1.1.3 **STEEL WORK**

#### a) **Codes and Standards**

ANSI/AWS D1.1	Structural Welding Code - Steel
BS-EN 287 Part 1	Approval testing of welders/fusion welding
BS-EN 288 Part 3	Specification and approval of welding procedures for metallic materials
BS 5135:	Metal arc welding of carbon and carbon manganese steels
BS 4360/SANS 50025	Weldable structural steel
BS 2573 Part 1:	Classification, stress calculations and design of structures
BS 3923:	Methods for ultrasonic examination of welds
BS 2600:	Radiographic examination of fusion welded butt joints in steel
DIN 1026	Metric channels
ISO R657	Angles
SANS 10094	The use of high strength friction grip bolts and nuts
SANS 135	ISO metric bolts, screws and nuts (hexagon and square) (coarse thread free fit series)
SANS 136	ISO metric precision hexagon-head bolts and screws, and hexagon nuts (coarse thread medium fit series)
SANS 435	Mild steel rivet

b) **Structural Steelwork**

1.1.3.b.1 All structural steelwork shall be such as to provide a robust and rigid structure requiring the minimum of maintenance and providing a long service life.

- Non-hollow structural sections and plate used on the structure, in conjunction with the hollow section framework, must comply with the relevant requirements of this specification.
- All steel sections shall be manufactured in accordance with the following standards :-

Weldable structural steel:	BS 4360/SANS 50025
I and H sections:	BS 4 Part 1
Metric channels:	DIN 1026
Structural steel, hot rolled sections:	BS 4 Part 1
Angles:	I SO - R657
Hot finished hollow sections:	BS 4848 Part 2
Cold formed sections:	BS 6363
Forgings:	BS 29
Steel castings:	BS 3100
Cast iron:	BS 1452

c) **Welding**

- 1.1.3.c.1 All the provisions of BS 5135 shall be complied with as far as applicable.
- 1.1.3.c.2 Weld joints shall be such that crevices, overlaps, pockets, arc strikes and dead ends do not exist.
- 1.1.3.c.3 All joints shall be completely seal welded in accordance with BS 5135. Special care must be taken to prevent the ingress of moisture into the tubular members by ensuring that each such tubular member is airtight. "Stitch" welding will not be permitted. Only continuous welding will be accepted.
- 1.1.3.c.4 Weld cracks, undercut, or pock marks will not be accepted.
- 1.1.3.c.5 All welds on the load bearing frame structure, containers, piping, pipe line flanges, etc., shall be continuous and shall be visually inspected for cracks and other discontinuities.
- 1.1.3.c.6 Welds on the main chords must be tested ultrasonically in accordance with BS 3923 or X-rayed in accordance with BS 2600 and those on minor joints by the dye-penetrant method. The equipment required for these tests must be supplied by the *Contractor* and the testing done at his cost.
- 1.1.3.c.7 Steel, except in minor details, which has been partially heated, shall be properly annealed. (Electrically welded structural members excepted.)
- 1.1.3.c.8 All brackets, clamps, lugs, straps, suspenders, etc. required for attaching mechanical and electrical equipment must be welded on prior to erection and special precautions must be taken not to damage welds or puncture tubes during erection.
- 1.1.3.c.9 The welding of all rails shall be done by an approved method.
- 1.1.3.c.10 Welding shall only be carried out by a coded welder according to SANS 10044, BS-EN 287 Part 1 and BS-EN 288 Part 3 or ANSI/AWS D1.1.
- 1.1.3.c.11 All parts to be welded shall be thoroughly cleaned and dried before welding. The welding will only be done in dry surroundings and all steps taken to prevent hydrogen embrittlement.
- 1.1.3.c.12 Where materials of different compositions are joined by welding, especially carbon steel to chrome steel, the filler welding method and post welding treatment shall be such that embrittlement and other degradation of both steel and filler is prevented.
- 1.1.3.c.13 It must be ensured that welded joints are ductile.

d) **Fasteners**

- 1.1.3.d.1 All bolts, nuts and rivets shall be manufactured in accordance with the following standards:

Commercial bolts and nuts Grade 4.6:	SANS 135
Precision bolts and nuts Grade 8.8:	SANS 136



Friction Grip Bolts and nuts Grade General: SANS 10094

Rivets: SANS 435

- 1.1.3.d.2 All friction grip fasteners shall be hot dip galvanised, including high tensile bolts (and their nuts and washers), structural rivets and Huck bolts.
- 1.1.3.d.3 All holding down bolts and nuts and brackets, as well as all fixing bolts, studs, nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.
- 1.1.3.d.4 Bolts and set screws shall be locked in an approved manner and shall not be stressed in tightening to beyond the recommended loads.
- 1.1.3.d.5 The quality of friction grip bolts, nuts and washers, bolt lengths, sizes of holes, tightening standards, surface condition of clamped components, shop and site assembling and acceptance inspection of friction grip joints shall comply with the latest edition of SANS 10094. Certificates shall be supplied for all bolts of grade 8.8 and 10.9.
- 1.1.3.d.6 All bolt and rivet holes must be accurate to size and location, the centres of holes shall not be placed nearer the edge of a plate than 1,5 diameters with an extra allowance of 3mm for sheared edges. All holes in the structural work shall be drilled or otherwise punched to a diameter not exceeding 1,5mm less than the diameter of the finished hole on the die side, and afterward reamed out to the exact size
- 1.1.3.d.7 Where possible the adjoining parts forming a connection shall be drilled or reamed together, with holes not exceeding 1,5 mm diameter the rivet or bolt for which it is made. No rough or broken edge shall be left around any of the holes.
- 1.1.3.d.8 For turned and fitted bolts, the holes shall be accurately drilled or reamed; the diameter of the hole shall not exceed the finished diameter of the bolt by more than 0,25mm.
- 1.1.3.d.9 The holes, after assembly of the parts, shall be true throughout the thickness of all the parts and perpendicular to the axis of the member.
- 1.1.3.d.10 Rivets shall be cup-headed or countersunk as required, unless otherwise specified. No rivet head shall contain less metal than does a length of the rivet equal to 1,25 times its diameter. All loose and defective rivets shall be cut and replaced by sound ones; also others when required for the purpose of examining the work. Rivets shall be driven with pressure tools whenever possible and pneumatic hammers shall be used in preference to hand driving.
- 1.1.3.d.11 All field rivets must be supplied with shanks of suitable length for pneumatic riveting.
- 1.1.3.d.12 Bolts shall be of such a length as to accommodate a full nut when tightening up, and project at least two thread pitches beyond the nut. Excessive projection of threads beyond the nuts should be avoided.
- 1.1.3.d.13 All bolts having countersunk heads shall have strong feathers forged on the neck and head to prevent turning and the bolt holes shall be cut to receive same. All nuts and bolts (excluding countersunk bolts) shall be furnished with circular washers of sufficient thickness, the outside diameter being at least twice the nominal diameter of the bolt, and washers fitted correctly.

1.1.3.d.14 Where bolt heads or nuts are seated on bevelled surfaces of beams or channel flanges, bevelled washers must be inserted.

e) **Joints and Mating Surfaces of Members**

1.1.3.e.1 Mating surfaces of members to be joined by high tensile steel bolts in friction grip shall be cleaned and primed as specified for the rest of the steelwork. Mating surfaces shall lay flat against each other to eliminate gaps which may allow ingress of water. After joining, the edges shall be sealed with an approved brand of Butyl/ Rubber sealing compound by means of a suitable caulking gun, or shall be seal welded.

1.1.3.e.2 Other joints shall be formed by one of the following methods:

1.1.3.e.2.1 The mating surfaces of members shall be blast cleaned, primed and protected prior to sub-assembly by the liberal application of caulking compound. While the compound is still wet, the members shall be bolted together and caulking compound which is squeezed out shall be completely removed.

1.1.3.e.3 The mating surfaces shall be protected with the full corrosion protection system as specified, the surfaces joined together and the joint so formed shall be sealed with butyl rubber sealer.

1.1.3.e.4 After being cleaned and primed the surface shall be joined together and the joint so formed shall be seal welded.

1.1.3.e.5 The primer coating on mating surfaces must be applied not more than 4 hours after cleaning and the edges must be sealed within 3 weeks of assembly of the part.

f) **Fabricated Parts**

1.1.3.f.1 All fabricated parts shall be properly fitted during assembly to result in properly aligned equipment having a neat appearance. Fabrications of load bearing members shall have no abrupt changes in cross section and regions of severe stress concentration. All sharp corners accessible by personnel during erection or operation shall be ground, rounded, or removed by other methods. Burrs, welding spatter and stubs of welding wire shall be removed.

1.1.4 **Corrosion Protection (Specification HE9/2/8 - [Version 16] - July 2002)**

a) **Scope**

1.1.4.a.1 Corrosion protection of Structural steelwork in coastal area (within 10km from coast).

b) **Specifications**

1.1.4.b.1 The specification covers requirements for protective coating of iron and steel structures, electrical motors, gear boxes etc. against corrosion and must be read in conjunction with the main specification as well as the following (latest editions):

- SANS 10064 "Preparation of steel surfaces for coating"
- SABS 121 "Hot-dip (galvanized) zinc coatings"
- SANS 1091 "National colour standards for paint"

- BS 5493 "Code of practice for protective coating of iron and steel structures against corrosion"

c) **Types of Corrosion Protection to BE USED**

- 1.1.4.c.1 The coatings specified in this specification are chosen according to BS 5439, Table 3, part 9, to ensure that the condition of the surface will be at least RE2 on the European scale of degree of rust, after 10 years in an environment of frequent salt spray, chemicals and polluted coastal atmosphere. During the 10 years, the normal maintenance painting will be done.
- 1.1.4.c.2 The paint manufacturer shall guarantee the paint for at least 10 years.
- 1.1.4.c.3 Should a tenderer wish to offer coating systems other than those specified, as an alternative, he shall submit full technical details and a list comparing all appropriate details of the alternatives proposed, with the original specified.
- 1.1.4.c.4 Tenderers must ensure that the different coats they offer in their tenders are compatible with each other.
- 1.1.4.c.5 The coating of proprietary items must be done according to Clause d.
- 1.1.4.c.6 All galvanized components including bolts and nuts but excluding walkway gratings, must be painted with the specified system, unless otherwise approved.
- 1.1.4.c.7 The following coating systems must be used unless otherwise specified in the main specification:-

Substrate	Coat No	Generic Description	Approved Brand Products	Dry Film Thickness (µm)
3CR12 steel	1	Surface tolerant epoxy primer	DULUX /SIGMA Sigmacover primer  INTERNATIONAL (PLASCON) Intergard 269  STONCOR (CHEMRITE COATINGS) Carboline 193 Primer	65-75
	2	Two component recoatable, polyurethane finish (Gloss)	DULUX / SIGMA Sigmadur gloss  INTERNATIONAL (PLASCON) Interthane 990  STONCOR	65-75

			(CHEMRITE COATINGS) Carboline 134	
Galvanized Steel	1	Surface tolerant epoxy primer	DULUX /SIGMA- Sigmacover primer  INTERNATIONAL (PLASCON) Intergard 269  STONCOR (CHEMRITE COATINGS) Carboline 193 Primer	65-75
	2	Two component recoatable, polyurethane finish (Gloss)	DULUX /SIGMA- Sigmadur gloss  INTERNATIONAL (PLASCON) Interthane 990  STONCOR (CHEMRITE COATINGS) Carboline 134	65-75

Substrate	Coat No	Generic Description	Approved Brand Products	Dry Film Thickness (µm)
Mild steel	1	Two component self curing inorganic zinc ethyl silicate OR two component zinc rich polyamide cured epoxy primer	DULUX /SIGMA- Sigma MC60 OR Sigma-cover primer  INTERNATIONAL (PLASCON) Interzinc 233 OR Interzinc 52 or 53	65-75

			STONCOR (CHEMRITE COATINGS) Carbo Zinc 11 OR Carbo-line 658 Primer	
	2	Flexible recoatable high build polyamide cured MIO epoxy	DULUX/SIGMA – Sigmacover CM MIO  INTERNATIONAL (PLASCON) Interseal 010 MIO  STONCOR (CHEMRITE COATINGS) Carboline 190 HB M.I.O. or Carboline 193 M.I.O.	125-150
	3	Two component recoatable, polyurethane finish (Gloss)	DULUX/SIGMA Sigmadur gloss  INTERNATIONAL (PLASCON) Interthane 990  STONCOR (CHEMRITE COATINGS) Carboline 134	65-75

1.1.4.c.8 The paint manufacturer's recommendations for the application of the different coating systems, curing time before handling or application of subsequent coats, health and safety recommendations etc. must be carefully adhered to.

1.1.4.c.9 Paint *Contractors* must have a quality management system which must be submitted to the Engineer for approval before commencement of the work.

- 1.1.4.c.10 Galvanizing shall be done to SANS 121 heavy duty hot dip galvanizing to a thickness of at least 85µm. Electroplated components in zinc or cadmium are not acceptable.
- 1.1.4.c.11 All mounting bolts, nuts, washers and brackets as well as all fixing bolts, studs nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.
- 1.1.4.c.12 High tensile bolts for friction grip joints must be hot dip galvanized and painted. High tensile bolts must be certificated after galvanizing.
- 1.1.4.c.13 The full paint system shall be applied to all surfaces which are to be covered with wear pads, linings etc.
- 1.1.4.c.14 For steelwork which will be transported over long distances and erected on site the two pack epoxy primers is preferred.

d) **Propriety Items**

- 1.1.4.d.1 Proprietary items. must either be painted according to this specification or where the coating system is equal to or exceeds this specification sufficient proof of the coating system applied must be provided. Items which are nearly equal to this specification shall be given a finishing coat according to this specification's thicknesses and final colours and to the following procedure:
  - 1.1.4.d.1.1 A cross cut test must be done to SANS SM159 to determine if the original coating adheres correctly to the substrate;
  - 1.1.4.d.1.2 The original coating shall be rubbed down to remove any smooth finishing to form a suitable key for the finish coat and any damaged areas prepared and patch primed with a suitable primer;
  - 1.1.4.d.1.3 The item must then be detergent washed to remove any foreign matter, taking care that no dust, solvent etc. contaminates any working part of the item;
  - 1.1.4.d.1.4 A test shall be done on the existing coat to ensure that the finish coat will not react with and cause undue dissolving and lifting of the existing coat. This can be done by applying a small quantity of the finishing coat thinners.
  - 1.1.4.d.1.5 Should any undue dissolving or lifting occur, a suitable intermediate or barrier coat must be applied before the finishing coat is applied.
  - 1.1.4.d.1.6 Proprietary items which failed the cross cut test and which generally have inadequate protection shall be dismantled and the full corrosion protection specification applied.

e) **Surface Preparation**

- 1.1.4.e.1.1 All steel surfaces shall be detergent washed and fresh water rinsed to remove all oil, grease and surface contaminates before shot blasting.

- 1.1.4.e.1.2 Sharp edges shall be radiused and major roughness of welds shall be removed by grinding. Welding spatter and flux shall be removed.
- 1.1.4.e.1.3 Components manufactured from hot rolled steel sections and steel plate shall be blast cleaned to base metal in accordance with SANS 10064 grade SA2½ - very thorough blast cleaning, to remove all mill scale, rust, weld spatter etc.
- 1.1.4.e.1.4 " Sharp" chilled iron shot, chilled iron grit, or granular abrasive slag is to be used to produce a proper degree of surface roughness.
- 1.1.4.e.1.5 Blast profile shall be determined by micrometre profile gauge, Keane-Tator surface profile comparator or Testex press-o-film.
- 1.1.4.e.1.6 The profile height shall be between 40 and 50µm at any point.
- 1.1.4.e.1.7 Good quality blast cleaning and spray painting equipment shall be used. Air used for spraying and blast cleaning shall be free from all traces of oil, water and salinity. Water and oil traps must be fitted to all equipment.
- 1.1.4.e.1.8 When wet blasting is done the primer shall be applied before oxidization starts or surface contamination occurs.
- 1.1.4.e.1.9 Components manufactured from 3CR12 steel shall be lightly abraded. The components shall then be passivized by using a mixture of 10 - 15% nitric acid in water which is rinsed off after 10 - 15 minutes. The surface shall be neutralized to pH 7 before it is coated.
- 1.1.4.e.1.10 Hot-dip galvanized components, galvanized bolts and nuts etc. shall be lightly abraded with a galvanizing pre-cleaner. The components shall then be washed with detergent and water and washed down with clean water until a water break free surface is achieved. Allow to dry thoroughly.

f) **Joints and Mating Surfaces of Members**

- 1.1.4.f.1.1 Mating (faying) surfaces of members which have to be joined by high tensile steel bolts in friction grip shall be cleaned according to Clause 4 and painted with primer only.
- 1.1.4.f.1.2 After being assembled joints so formed shall be seal welded and painted or after the intermediate coat was applied the edges shall be sealed with an approved brand of paintable flexible sealant or mastic (e.g. Butyl rubber, polyurethane sealer or two component epoxy), by means of a suitable caulking gun.
- 1.1.4.f.1.3 All rivets, bolts, welds, sharp edges etc. must be covered with a "stripe coat" of the primer or intermediate coat specified to ensure the correct dry film thickness on sharp edges, as well as sealing of bolt threads to head etc.
- 1.1.4.f.1.4 All other mating surfaces must be sealed with an approved brand of flexible Butyl rubber, paintable Silicone, polyurethane sealer or two component epoxy sealer, and joined while still wet. All excess compounds must be completely removed.

**g) Painting Procedures**

- 1.1.4.g.1.1 Directly before the application of paint, the area to be painted shall be degreased with a suitable degreaser and left to dry.
- 1.1.4.g.1.2 Paint shall only be applied under the following conditions:
  - There is adequate light.
  - The steel temperature is between 5 and 50°C and at least 3°C above the dew point of the air.
  - The relative humidity of the air is between the limits specified by the paint supplier.
  - Wind does not interfere with the method used and sand and dust cannot be blown onto wet paint.
- 1.1.4.g.1.3 Steelwork shall be supported on trestles, at least 900 mm off the ground for painting purposes.
- 1.1.4.g.1.4 An adequate number of test readings shall be taken per square meter in order to determine the dry film thickness.
- 1.1.4.g.1.5 The paintwork shall be acceptable if the average of the test readings taken falls within or exceeds the ranges given.
- 1.1.4.g.1.6 Paintwork shall not be acceptable if any single test reading is less than the specified minimum thickness.
- 1.1.4.g.1.7 An ultrasonic or electronic magnetic flux thickness measurement gauge shall be used, but in case of dispute, destructive testing shall be applied. The painted steelwork shall present a clean, neat appearance of uniform colour and gloss as applicable to the paint used. Each coat of paint shall be applied as a continuous, even film of uniform thickness. More than one application of paint may be required to achieve the dry film thicknesses specified or to obliterate the colour of the previous coating.
- 1.1.4.g.1.8 The use of thinners or solvents at any stage of the work is prohibited, unless specified by the paint manufacturer.
- 1.1.4.g.1.9 Precautions shall be taken to prevent coatings from being applied to equipment nameplates, instrument glasses, signs etc.

**h) Colour Codes**

- 1.1.4.h.1.1 Machinery and equipment shall be painted in the following final colours:

	Area	Colour	Code No. [SABS 1091 and International No's]



	Mobile equipment (cranes, loaders etc.)		
	a) Structure, machinery and electrical houses, operator's cabins, chutes, hoppers etc.	Transnet White	RAL 9016
	b) Undercarriage, travel bogies, rubber tyred rims	Transnet dark grey	RAL 7024 (Graphitgrau) SABS 1091 GO4 (Bluegrey) BS 381C-633
	Industrial buildings, conveyor structures		
	a) Roofs and canopies	Pantone cool grey 10	RAL 7037 (Staubgrau)
	b) Painted walls	Pantone cool grey 3	RAL 7035 (Lightgrau) or SABS 1091 G62 (Pale grey)
	c) Steel columns, rafters, trusses	Pantone cool grey 5	RAL 7004 (Signalgrau)
	General		
	a) Guards	Golden yellow	SABS 1091-B49 RAL 1003
	b) Sheaves	Orange	RAL 2008
	c) Cable reels (Stainless steel	Orange	RAL 2008
	Machine buffers and parts of machine which could constitute a serious hazard	Golden Yellow (High Gloss) with Luminous green stripes in chevron pattern	SABS B49 and Luminous green

	Area	Colour	Code No. [SABS 1091 and International No's]
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	e) Any exposed rotating part of machinery, electrical Switch-gear (other than starting and stopping devices and emergency stop control), electrical services e.g. conduit and allied fittings	Light Orange (High Gloss)	SABS 1091 B26 BS 381C-557
	f) Low voltage switchgear panels where orange is not aesthetically acceptable	Light grey	SABS 1091-G29 BS 381C-631
	g) Medium voltage cable trays, switchgear and motors (3,3 kV and up)	Oxford Blue	SABS FO2 BS 381C-105 RAL5003
	h) Starting devices, low voltage cable trays and switchgear	Mid Brunswick green (high gloss)	BS 381C-228 SABS1091-EO4 RAL6005
	i) Parts of stationary machinery (Electrical, motors, gearboxes, brakes, transformers, etc.)	Light Grey	SABS G29 BS 381C-631
	j) Hand levers, hand wheels, oiling points, handrails on walkways, ladders	Golden Yellow (High Gloss)	SABS 1091 B49 BS 381C-356
	k) Stopping devices, grease points , motor fan covers and danger signs (not symbolic safety signs for which see SABS 1186)	Signal red (High Gloss)	SABS 1091 A11 BS 381C-537 RAL3001
	l) Walkways (non slip surfaces) (galvanized gratings not to be painted)	Shop floor green	
	m) Informatory signs and notices (not symbolic safety signs for which see SABS 1186)	White on Emerald Green (High Gloss)	White on SABS 1091 E14 BS 381C- 228
	Area	Colour	Code No. [SABS 1091 and International No's]

	Pipe lines		
	a) Reclaim water piping	Aluminium	
	b) Slurry pipe lines	Dark admiralty grey	SABS 1091-G12
	c) Fire protection piping	Signal red	SABS 1091-A11
	d) Washwater drain pipes	Light grey	SABS 1091-G29
	e) Instrument air	White with Strong blue band	White and SABS 1091-F11
	f) Plant air	White with Flag blue band	White and SABS 1091-FO4
	g) Potable water	Grass green	SABS 1091-D14

1.1.4.h.1.2 Colour bands for pipes shall be 75 mm wide for pipe sizes up to 150 mm diameter and 100 mm wide for 150 mm and above. The colour bands shall be applied to the pipe flanges, valves, junctions, walls or structures etc. in such a manner that the pipe may be easily identifiable. On straight sections the maximum spacing shall be 100 x the pipe diameter.

i) **Field Touch-up Painting**

1.1.4.i.1.1 Damaged and unpainted areas, fasteners, welds, etc. shall be cleaned by wire brushing with hand tool or power tool in a manner which will minimize damage to sound paint. Grinding will not be allowed. Rust spots shall be cleaned to bright metal. Thick edges of old paint abutting on bare metal surfaces shall be feathered by scraping and sanding.

1.1.4.i.1.2 Where welding is required on areas already coated with the coating system, the coat should be stepped back for  $\pm 30$ mm around the weld area.

1.1.4.i.1.3 The paint shall be applied to match the original coats in accordance with the manufacturer's recommendations for the specific paint system.

- 1.1.4.i.1.4 Note: Inorganic zinc primers shall not be re-covered with an inorganic primer, but only with an organic zinc primer.
- 1.1.4.i.1.5 Areas of damaged galvanizing shall be repaired with an approved cold galvanizing product or metal sprayed by the wire spraying process with Zinc, and then touched up with the specific paint system.

j) **General**

- 1.1.4.j.1.1 All walkways, floors, maintenance platforms etc. must be painted with a durable, non-skid coating of the appropriate colour.
- 1.1.4.j.1.2 Exposed machined surfaces must be coated with a strippable corrosion inhibitor (e.g. Tectyl).
- 1.1.4.j.1.3 Where different materials will be in contact with each other and galvanic corrosion can occur the contact areas of the materials must be isolated from each other or the joints made water proof to prevent ingress of moisture.
- 1.1.4.j.1.4 All components must be designed with corrosion prevention in mind and specifically the following:
  - No entrapment of dirt, product, moisture etc.
  - No areas must be inaccessible for maintenance such as too narrow gaps etc.
  - Large flat areas rather than complicated shapes and profiles.
  - No sharp corners and discontinuous welds.
- 1.1.4.j.1.5 Parts of equipment which are exposed to high temperatures must be coated with the following system:-

	Coat No	Generic Description	Approved Brand Products	Dry Film Thickness (µm)
	1	Two component self curing inorganic zinc ethyl silicate	DULUX /SIGMA- Sigma MC60  INTERNATIONAL (PLASCON) Interzinc 233  STONCOR (CHEMRITE COATINGS) Carbo Zinc 11	65-75
	2	Single component high temperature moisture curing silicone with aluminium flakes	DULUX/SIGMA – Sigmatherm Silicate  INTERNATIONAL (PLASCON)	40

			Intertherm 50  STONCOR (CHEMRITE COATINGS) Carboline 1248	
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k) **Maintenance Painting of Structures**

1.1.4.k.1 Areas which are only lightly corroded must be cleaned by means of high pressure water blasting or wire brushing by power tool and the following system applied:-

	Coat No	Generic Description	<i>Approved Brand Products</i>	Dry Film Thickness (µm)
	1	Surface tolerant two pack epoxy primer with aluminium pigments	Dulux/SIGMA Aluprimer  STONCOR (CHEMRITE COATINGS) Carbomastic 15  INTERNATIONAL (PLASCON) Intergard 468,	125-150
	2	Same as first coat OR micaceous iron oxide (MIO) epoxy	DULUX/SIGMA – Sigmacover CM MIO  INTERNATIONAL (PLASCON) Interseal 010 MIO  STONCOR (CHEMRITE COATINGS) Carboline 190 HB M.I.O. or Carboline 193 M.I.O.	125-150
	3	Two component recoatable, polyurethane finish (Gloss)	DULUX/SIGMA Sigmadur gloss  <i>INTERNATIONAL (PLASCON)</i> <i>Interthane 990</i>	65-75

			STONCOR (CHEMRITE COATINGS) Carboline 134	
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- 1.1.4.k.2 Alternatively, the Noxyde paint system can be used, consisting of two to three coats of water based Noxyde paint to achieve a DFT of 350 to 400 microns. Where the Noxyde system is used on areas other than slightly corroded structural areas, the following additional requirements must be observed:
  - 1.1.4.k.2.1 Very smooth surfaces (e.g. 3CR12, stainless steel or hot-dip galvanized components, bolts, nuts and fittings, and HT bolts): Parts must be thoroughly degreased using OptiDegreaser, washed down with potable water, and immediately when dry, a single coat of OptiPrimeAqua applied.
  - 1.1.4.k.2.2 Paintable flexible sealant/mastic: Only sealant approved by the paint manufacturer may be used, and an initial coat of OptiPrimeAqua applied over it before the further coats of Noxyde are applied.
  - 1.1.4.k.2.3 Bolted/riveted connections: After blasting or and/or cleaning as required, apply a coat of OptiPrimeAqua and an additional stripe coat of Noxyde, in contrasting colour, to all bolt/nut and plate edges and crevices.
- 1.1.4.k.3 The adhesion of old coatings must be verified by doing a cross cut adhesion test on selected areas.
- 1.1.4.k.4 The compatibility of the new paint system on the old coating must be tested and guaranteed in writing by the paint supplier.
- 1.1.4.k.5 The work and coating system must be guaranteed for a minimum of 12 months.
- 1.1.4.k.6 All heavily corroded areas must be shot blasted to minimum SA2 and the three coat system shall be applied.
- 1.1.4.k.7 Areas where the old coating is still sound need only be high pressure cleaned with a suitable solvent and coated with one of the primers suggested as tie coat and then with one of the top coats to get the appropriate colour and finish. The minimum dry film thickness of this tie coat must be 75 microns and top coat must be 50 microns, but the previous coating colour shall be completely obliterated to present a uniform colour.
- 1.1.4.k.8 Note: Inorganic zinc primers shall not be re-covered with an inorganic primer, but only with an organic zinc primer.
- 1.1.4.k.9 Repairs to the insides of all the enclosed sections of the booms as well as the insides of the crane legs, sill beams, cross beams, pylon cross bracing members etc. shall be done as above but the top coat need not be applied.