

 Eskom	Specification	Technology
---	---------------	------------

Title: **Belt Conveyor Structural Steelwork and Welding Specification**

Unique Identifier: **240-55864504**

Alternative Reference Number: **GGSS 0407**

Area of Applicability: **Engineering**

Documentation Type: **Specification**

Revision: **2**

Total Pages: **19**

APPROVED FOR AUTHORISATION

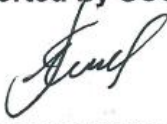


TECHNOLOGY ENGINEERING

DOCUMENT CENTRE ☎ X4962

Next Review Date: **March 2024**

Disclosure Classification: **CONTROLLED DISCLOSURE**

Compiled by  R. Pillay Structural Design CoE Engineer Date: <u>25/03/2019</u>	Approved by  Q. Cai Structural Design CoE Chief Engineer Date: <u>25/03/2019</u>	Authorised by  G. Macintosh Structural design CoE Manager (Acting) Date: <u>25/03/2019</u>
		Supported by SCOT/SC/TC  G.N. Dudenska Civil TC Chairperson Date: <u>27/03/2019</u>

CONTENTS

	Page
1. INTRODUCTION	4
2. SUPPORTING CLAUSES	4
2.1 SCOPE	4
2.1.1 Purpose	4
2.1.2 Applicability	4
2.2 NORMATIVE/INFORMATIVE REFERENCES	4
2.2.1 Normative	4
2.2.2 Informative	5
2.3 DEFINITIONS	5
2.3.1 Classification	5
2.4 ABBREVIATIONS	5
2.5 ROLES AND RESPONSIBILITIES	5
2.6 PROCESS FOR MONITORING	6
2.7 RELATED/SUPPORTING DOCUMENTS	6
3. BELT CONVEYOR STRUCTURAL STEELWORK AND WELDING SPECIFICATION	6
3.1 GENERAL	6
3.2 DESIGN BASIS OF STRUCTURAL STEELWORK	6
3.2.1 General	6
3.2.2 Conveyor support trestles and Gentries	7
3.2.3 Tail and head frames	7
3.2.4 Drive frames	7
3.2.5 Overland and ground conveyors	7
3.3 MATERIALS	7
3.3.1 Structural steel	7
3.3.2 Ordinary Bolts	8
3.3.3 High Strength Friction Grip Bolts	8
3.3.4 Flooring and Grating	8
3.3.5 Walkways, Platforms, ladders and stairways	8
3.3.6 Handrails and Stanchions	9
3.4 FABRICATION OF STRUCTURAL STEELWORK	9
3.4.1 General	9
3.4.2 Bolting	11
3.4.3 Welding	11
3.4.4 Galvanizing	11
3.4.5 Painting	11
3.4.6 Marking	11
3.4.7 Drawing approval	12
3.5 CLADDING	12
3.5.1 Cladding materials	12
3.5.1.1 Roof, wall and doghouse cladding	12
3.5.1.2 Flashing	12
3.5.1.3 Gutters and rainwater downpipes	12
3.5.1.4 Translucent sheeting	12
3.5.2 Cladding design	12
3.5.3 Installation of cladding	13
3.5.3.1 General	13
3.5.3.2 Roofing and wall cladding	13
3.5.3.3 Gutters and rainwater downpipes	13
3.6 STRUCTURAL WELDING	14
3.6.1 General	14
3.7 DELIVERY TO SITE AND ERECTION	14
3.7.1 Temporary Works	14

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

3.7.2 Transport and delivery	14
3.7.3 Site storage	15
3.7.4 Erection	15
3.7.4.1 Setting out	15
3.7.4.2 Security during erection	15
3.7.4.3 Installation of high-strength bolts	15
3.7.4.4 Installation of holding-down bolts	15
3.7.4.5 Bedding of stanchion bases	16
3.7.4.6 Clearances and Deviations	16
3.7.4.7 Damaged materials	16
3.7.4.8 Grouting.....	16
3.7.5 Tolerances.....	17
3.8 DOCUMENTATION.....	17
3.8.1 Approval and auditing of structural design calculations	17
3.8.2 Completion	17
3.8.3 Drawings.....	18
3.9 TESTING AND INSPECTIONS.....	18
3.9.1 Testing by the engineer or test authority	18
3.9.2 Hardness testing	18
3.9.3 Non-destructive examination.....	18
3.9.4 Inspections	19
4. AUTHORISATION.....	19
5. REVISIONS	19
6. DEVELOPMENT TEAM	19
7. ACKNOWLEDGEMENTS	19

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

1. INTRODUCTION

This specification sets out the requirements for the standardization of structural steelwork and welding associated with belt conveyor systems.

2. SUPPORTING CLAUSES

2.1 SCOPE

This specification applies to all structural steelwork related to Belt conveyor Structures and Conveyor systems. This includes requirements for the structural steelwork design, materials, fabrication, welding and erection.

2.1.1 Purpose

The purpose of this document is to clearly define governance codes, standards and requirements for design, construction and erection of the Belt conveyor structures and Conveyors.

2.1.2 Applicability

This document applies to Group Technology Engineering, Generation (Gx).

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

- [1] Structural Design and Engineering Standard – 240-56364545
- [2] Standard for Welding Requirements on Eskom Plant – 240-106628253
- [3] Standard for Non-Destructive Testing (NDT) on Eskom Plant – 240-83539994
- [4] Design Review Procedure – 240 -53113685
- [5] Engineering Drawing Standard – Common Requirements – 240-86973501
- [6] Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693
- [7] Eskom Health, Environment and Quality (SHEQ) Policy 32-727
- [8] SANS 2001-CS1:2012 – South African National Standards Construction Works Part CS1:Structural Steelwork
- [9] SANS 2001-CC1:2012 – South African National Standards Construction Works Part CC1:Concrete Works (Structural)
- [10] SANS 657-1:1989, Steel tubes for non-pressure purposes — Part 1: Steel tubes for scaffolding and for structural and general engineering purposes.
- [11] SANS 14713-2 Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures Part 2: Hot dip galvanizing
- [12] SANS 1700-16-1:2003, Fasteners Part 16: Washers Section 1: Plain washers for metric bolts, screws and nuts for general purposes - General plan
- [13] SANS 1200-H:1990, Standardized specifications for civil engineering construction — Section H: Structural steelwork
- [14] SANS 1200-HA:1990, Standardized specifications for civil engineering construction — Section HA: Structural steelwork (sundry items)

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

- [15] 0.00/2901: Standard Drawing – Details of Steel Staircases, Walkways and Platforms
- [16] SANS 1200 HB Standardized specifications for civil engineering construction — Section HB: Cladding and sheeting.
- [17] SANS 1200 HC Standardized specifications for civil engineering construction — Section HC: Corrosion protection of structural steel.
- [18] SANS 50025-1:2009 Hot rolled products of structural steels Part 1: General Technical delivery conditions
- [19] SANS 50025-2:2009 Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels
- [20] EN 1263, Safety Nets – Part 1: Safety requirements, test methods
- [21] EN 1263, Safety Nets – Part 2: Safety requirements for the positioning limits
- [22] Belt Conveyor Design Manual – 240-55864457
- [23] Southern African Institute of Steel Construction handbook, published by the Southern African steel construction.
- [24] Construction Regulations, 2014

The latest revision of the above standards shall apply.

2.2.2 Informative

None

2.3 DEFINITIONS

Swarf	Fine chips or filings of metal produced by a machining operation
Dieline	Positive grip pressed section walkways
Nosings	A projecting edge of a moulding at the edge of a step or stair

2.3.1 Classification

- a. **Controlled Disclosure:** Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
SANS	South African National Standard
HSFG	High Strength Friction Grip
HD	Holding Down
IBR	Inverted Box Rib
BMH	Bulk Material Handling

2.5 ROLES AND RESPONSIBILITIES

Complied by: LDE/Engineer

Functional Responsibility/Approved by: Senior Engineer/Chief Engineer

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

Authorised by: Corporate Specialist/CoE Manager

It is the responsibility of the BMH LDE to ensure that this Specification is included in all Technical Specifications, where so required. The Civil and Structural LDE is to provide support in the implementation of this Specification.

2.6 PROCESS FOR MONITORING

This document will be updated periodically in response to developments in technology, experience as well as the inspection findings/possible trends. The 'Technical Custodian', or an appropriate competent person nominated by the Structural Design Engineering Manager, should be consulted on any proposals for modifications or improvements to this document, including feedback on experience from any application in service.

2.7 RELATED/SUPPORTING DOCUMENTS

None

3. BELT CONVEYOR STRUCTURAL STEELWORK AND WELDING SPECIFICATION

3.1 GENERAL

- a. Structural steelwork shall comply with the requirements of SANS 2001-CS1:2012, relevant sections of SANS 1200H, SANS 1200HA, SANS 1200 HB, SANS 1200HC and the relevant portions of SANS 1200 A, except where the particular requirements in this document differ, in which case these particular requirements shall take precedence.
- b. When the requirements of this specification are in conflict with the design drawings, the requirements in the design drawings shall take precedence.
- c. All welding shall be performed in accordance with Standard for Welding requirements on Eskom Plant 240-106628253 and this specification.
- d. All corrosion protection shall be in accordance with the Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693 [6].

3.2 DESIGN BASIS OF STRUCTURAL STEELWORK

3.2.1 General

- a. The design of all structural steelwork shall be in accordance with SANS 10162-1:2011.
- b. All structures shall be designed to take the permanent loading, superimposed floor loadings specified herein, together with the concentrated masses of all conveyors and other equipment as well as wind, notional, seismic (if applicable), dynamic effects, fatigue and all other loadings that may be imposed on the structure during construction.
- c. All flooring at conveyor drive floor levels, intermediate floors, platforms, stairways and galleries shall be designed for a minimum superimposed loading of 5 kN/m².
- d. In particular, conveyor gantries shall be designed with a minimum superimposed loading of 2.5 kN/m² over the whole plan area of the gantry including the walkway. The loading of material on the belt shall be over and above this superimposed load and an impact factor of 1.20 shall be applied to the conveyed material load, idlers and belt.
- e. All loadings e.g. dead loads, live loads and wind loads shall be presented in tabular form to facilitate structural design/work. Forces given shall indicate pressure uplifts and shear forces acting on the foundation so that worst loading cases can be readily established for civil design purposes

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

3.2.2 Conveyor support trestles and Gantries

- a. Care shall be taken in the design to limit the deflection of trestles so that no malfunction or misalignment of mechanical equipment will occur. Deflection criteria shall be confirmed by the mechanical engineers.
- b. Special care shall be taken regarding deflections of conveyor gantries. Gantries shall be erected with a pre-camber equal to the expected deflection under all dead loading. The maximum deflection under the imposed loading shall not exceed span/300.
- c. The supports of conveyor gantries shall be designed such that one end is free and one end fixed to facilitate horizontal movement of the gantry.

3.2.3 Tail and head frames

- a. Care shall be taken in the design of tail and head frames such that the deflection does not impair or cause damage to any mechanical equipment.
- b. Tail and head frames shall be designed to transmit forces down to the supporting structures and, where mounted on concrete, loadings giving the worst combinations shall be tabulated on the drawings.
- c. The head frame and its supporting structure shall, in addition, be designed for a start-up factor varying from 1.4 to 2.0 depending on the mechanical equipment being used. Structures shall be designed to give maximum access to mechanical equipment for installation and maintenance.

3.2.4 Drive frames

- a. Drive frames shall be designed to sustain all imposed loads from mechanical equipment in addition to dead, live, notional, seismic (if applicable) and wind loads, and the deflection of these frames shall be within the requirements of the mechanical specifications so that no malfunction or misalignment of mechanical equipment is caused.
- b. All forces transmitted from a drive frame to the civil structures for the worst conditions of loading, shall be given on the drawings in tabulated form.
- c. Drive frames shall be designed to give maximum access to mechanical equipment for installation and maintenance.

3.2.5 Overland and ground conveyors

- a. Where conveyors are not supported on elevated gantry structures the following shall be adhered to:
 - Where stringers have eccentric connection from suspended idlers the rotation of the stringer about its centroid shall be limited to 3°;
 - The deflection in the plane of bending of such a stringer shall be limited to 4 mm;
 - Vertical leg supports shall be limited to 3 mm deflection at their free ends;
 - Ground modules shall be designed to give maximum access to mechanical equipment for maintenance and installation.

3.3 MATERIALS**3.3.1 Structural steel**

- a. The steel used shall comply with the requirements of SANS 50025 - 1. Unless otherwise specified or shown on the drawings the steel shall be grade S355JR and only new materials shall be used.

CONTROLLED DISCLOSURE

3.3.2 Ordinary Bolts

- a. Ordinary bolts and nuts shall mean bolts acting in bearing and shear rather than in the friction grip mode and shall comply with SANS 1700.
- b. Washers for ordinary bolts and nuts shall comply with SANS 1700-16-1:2003.

3.3.3 High Strength Friction Grip Bolts

- a. HSFG Bolts, nuts and washers shall comply with SANS 10094.

3.3.4 Flooring and Grating

- a. Unless otherwise approved, hot-dip galvanized open-grid flooring shall be used throughout for all floors in transfer towers and shall be of welded construction.
- b. Hot-dip galvanized "Dieline" flooring shall be used in all gantries, walkways, etc.
- c. Open-grid flooring or "Dieline" flooring shall be removable for maintenance purposes. Angles and kick-plates, with a standard height of 100 mm above finished floor level, shall be provided around all wall openings and at the edges of floors, except at the entrance to staircases. The kickplates shall preferably not be attached to the open-grid flooring and shall not be attached to "Dieline" flooring.
- d. All openings in open-grid flooring and "Dieline" flooring for pipes, etc. to pass through the floor, shall be surrounded by toe guards or kick plates extending 100 mm above the top of the grating, so that no exposed edge of flooring remains.
- e. All grating shall be galvanized welded steel grating. Unwelded pressure locked grating is not permitted.
- f. Grating shall be removable unless otherwise specified on the drawings.
- g. Split grating shall be used where pipes or chutes pass through the grating.
- h. Grating fasteners shall comply with the manufacturer's requirements.

3.3.5 Walkways, Platforms, ladders and stairways

- a. Platforms, stairways, ladders and gangways shall be provided as required for access and maintenance to equipment. They shall give convenient access to all parts of the plant and shall be located in positions approved by Eskom.
- b. All stairs and handrail details shall be in accordance with the requirements shown on Eskom drawing number 0.00/2091.
- c. Staircases shall be constructed at an angle not exceeding 45° to the horizontal and shall have treads of open-grid flooring without risers and shall be fitted with an approved friction nosing.
- d. Ladders shall be vertical wherever possible. Vertical ladders shall have treads of two rods not less than 15 mm diameter and shall be provided with single handrails on both sides. The treads of other ladders shall be of a type similar to those used in staircases. Ladders shall extend the full distance between the levels with which they are linked. No staircase or ladder shall extend across a vertical height of more than 3.6 m without a landing.
- e. Gangways or openings for access to plant shall be not less than 750 mm wide on the tread unless otherwise approved. The tread shall be of open-grid construction, painted as specified in Standard for the external corrosion protection of Plant, equipment and associated piping and coating, and supported on stringers of ample depth to ensure rigidity. Gangways shall be provided with double handrails on both sides, stepped out beyond the stringers to give free passage.
- f. All necessary mild steel brackets, stanchions and supports for platforms, staircases, ladders and gangways shall be provided.

CONTROLLED DISCLOSURE

- g. Stair treads shall be made of galvanized steel grating with perforated or non-skid plate standard nosings. The treads shall be fabricated from grating as specified in Structural Design and Engineering Standard – 240-56364545.

3.3.6 Handrails and Stanchions

- a. All handrail and Stanchions to be in accordance with Eskom drawing 0.00/2901.
- b. Handrail stanchions shall be straight and mounted plumb and all straight sections of handrailing shall be mounted in straight lines without kinks or irregularities. Prefabricated radiuses bends shall be supplied where necessary. All connections between handrails and between handrails and stanchions shall be a continuous weld all round and filed or ground to a smooth finish. Handrailing shall be positioned 1 m above the top of the flooring, in accordance with drawing 0.00/2901.
- c. Handrailing and stanchions may be fabricated from Commercial Grade mild steel or mild steel to Grade 300 W in accordance with SANS 50025-1:2007.
- d. Stanchions shall be tubular hollow section pattern with a minimum wall thickness of 3 mm. Stanchions shall be suitably sealed to prevent the ingress of moisture and shall be provided with palms as shown on Drawing 0.00/2901.
- e. Handrails, kneerails, bends, closures and fittings shall be fabricated from angle, hollow section or tubular section material with a wall thickness of at least 3 mm. The sizing of angle section components shall be substantiated by design calculations.

3.4 FABRICATION OF STRUCTURAL STEELWORK

3.4.1 General

- a. The Contractor shall comply with the following shop detailing and fabricating requirements unless otherwise permitted by the engineer:
- All connections shall be made using class 8.8 bolts unless noted otherwise specified on drawings. Contacting surfaces at joints shall be galvanized or painted;
 - The contractor shall supply and install erection clips to facilitate welded connections;
 - There shall be ample clearances to facilitate field erection;
 - The thickness of gusset plates shall be at least 10 mm;
 - Stanchions shall have milled ends for full bearing at splices and at end plates when required by the engineer; and
 - All sharp corners and burrs shall be removed before galvanizing or painting.
- b. Stanchion splices and butt joints of compression members dependent on contact for the transmission of compressive stresses shall be accurately prepared to butt so that the permitted stress in bearing is not exceeded nor eccentricity of loading created which would induce secondary bending in the members. Stanchion caps and bases shall be prepared in a similar manner and where this is done by machining, it shall be ensured that gussets, connecting angles or channels are not reduced in thickness by more than 2 mm.
- c. All bolts with countersunk heads shall have strong feathers forged on the neck and head to prevent turning and the bolt holes shall be prepared to accommodate the bolts.

CONTROLLED DISCLOSURE

- d. All structural steel, both before and after fabrication shall remain within the tolerances specified in SANS 50025, Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels, and shall be flat, and straight (unless required to be formed to another shape) and shall remain free from twists to maintain the tolerances of outline, profile and clearances as specified.
- e. At all stages of fabrication, all structural steel shall be positively identified by grade by means of a suitable marking system. In addition, all steelwork shall be marked to facilitate erection.
- f. Cutting or hole forming may be done by sawing, shearing, cropping using a mechanical saw, guillotine, cropper, punch, drill, profile cutter or combinations thereof. When cutting the following shall be observed:
- the standards to which edge profiles are produced shall obviate dressing using hand grinders;
 - the profile of cutouts shall have no sharp corners (to inhibit stress-raising effects);
 - gussets shall be profiled by cropping corners to avoid burning of corners during welding and to prevent the interruption of continuous fillet welds; and
 - edges shall be free from any defects or distortions and burrs. Notches shall be removed. Holes for fasteners shall comply with the following:
 - Flame cutting or forming of holes by flame cutting is prohibited
 - holes may be punched, provided the diameter of the hole is the lesser of 12 mm or the thickness of the structural material involved;
 - holes for ordinary bolts and HSFG bolts of diameter up to 24 mm shall not exceed the diameter of the Bolt by more than 2 mm. For bolt diameters larger than 24mm, the diameter of the holes shall not exceed the diameter of the bolt by more than 3 mm;
 - holes for HD bolts of diameter up to 24 mm shall not exceed the diameter of the Bolt by more than 6 mm. For bolts with diameters between 24mm and 36mm, the diameter of the holes shall not exceed the diameter of the bolt by more than 10 mm. For bolt diameters larger than 36mm, the diameter of the holes must be as per the specification data or shown on the design drawings.
 - all burrs shall be removed from holes before assembly.
- g. The preparation of the abutting surfaces of joints for the transmission of loads shall ensure that the full load bearing area is utilized.
- h. Ribbed or gusseted brackets shall be stress relieved after all operations which induce stresses, that are sufficient to alter the dimensional or geometric profiles of the component have been completed.
- i. Stress relieving shall be sufficient to ensure dimensional stability of the component subsequent to its manufacture.
- j. Unless protection against corrosion is provided by other means, the interior of any hollow section shall be sealed to prevent the ingress of moisture. Where a sealed hollow member is holed for a fastener or pin, provision shall be made to prevent the ingress of water to the interior of the member. Vent holes for galvanizing shall be sealed after galvanizing is completed.
- k. All matching holes for fasteners or pins shall be accurately aligned so that the fasteners can be inserted freely through the assembled members at right angles to the faces in contact. Drifting to align holes shall not distort the metal or enlarge the holes.

CONTROLLED DISCLOSURE

3.4.2 Bolting

- a. Where a tubular member is drilled to take bolts or studs, provision shall be made to prevent ingress of moisture to the interior of the tube. For example, a transverse sleeve can be inserted where a bolt passes through a tube, or grommets can be used under bolt heads and nuts.
- b. The joined parts shall be firmly drawn together. Where necessary, washers shall be tapered to give bolt heads and nuts a full bearing. Where bolt holes have greater than the normal clearance, washers shall be used under bolt heads and nuts.
- c. The length of each bolt shall be such that, after tightening, at least one full thread projects through the nut and at least one full thread (in addition to the thread run out) remains clear between the nut and the unthreaded shank.
- d. The use of friction grip bolts shall be in accordance with SANS 10094.

3.4.3 Welding

All welding of structural steelwork shall be carried out in accordance with Standard for Welding requirements on Eskom Plant 240-106628253 and AWS D1.1.

3.4.4 Galvanizing

- a. Structural steelwork shall be hot dip galvanized in accordance with SANS 14713-2 Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures, Part 2: Hot dip galvanizing, the requirements of SANS 1200 HC, SANS 121 and Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693. Components for galvanizing shall have all scale and rust removed and shall be brushed thoroughly before pickling. The smelter used shall contain not less than 98 % of pure zinc and not more than 0.05 % of iron.
- b. The increase in mass of all articles after treatment shall be not less than 380 g/m² of surface (one side galvanized), unless otherwise stated.
- c. Galvanised bolts are prohibited

3.4.5 Painting

- a. Painting of steelwork shall be carried out in accordance with Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693.
- b. Dependent on the structural element and type of environment, the appropriate corrosion protection system is selected from the Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693.
- c. Unless otherwise specified all handrailing shall be degreased, wire brushed and painted in accordance with Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693.
- d. The application of the top paint coatings shall be in accordance with Standard for the external corrosion protection of Plant, equipment and associated piping and coating – 240-106365693.

3.4.6 Marking

- a. All structural steel shall be prominently marked with suitable erection marks for identification in assembly that shall be clearly shown on the erection drawings supplied by the contractor.
- b. Prior to galvanizing, structural components shall be erection marked using either one of the following methods:

CONTROLLED DISCLOSURE

- Mark with characters at least 20 mm high and stamped deep enough so that they will be legible after galvanizing; and
- Marked with characters, formed with a run of weld, of sufficient size to be legible after galvanizing.

3.4.7 Drawing approval

- a. All drawings must follow the Eskom design review procedure for obtaining acceptance and to comply with the Eskom Engineering drawing standard.

3.5 CLADDING

3.5.1 Cladding materials

3.5.1.1 Roof, wall and doghouse cladding

- a. Galvanized 0.6 mm thick, IBR sheeting in accordance with SANS 1200 HB or similar approved sheeting shall be used for roof, wall and doghouse cladding.
- b. Where possible the sheets shall be of one length, from eaves to eaves for roofs and from floor to roof or as otherwise indicated for walls. However, if these lengths are greater than standard sheet lengths, the number of laps shall be kept to a minimum and shall conform to the manufacturer's recommendations for the roof slopes indicated.
- c. The roofing and cladding shall be complete with all the necessary flashings, ridging, hip and corner coverings, ridge and eaves closers, etc., and these shall be of galvanized sheet steel of the sizes and shapes required to suit the sheeting.

3.5.1.2 Flashing

Sizes, shapes and positions of flashings shall be as shown on the drawings and shall be 0.7 mm thick sheet steel of before surface treatment.

3.5.1.3 Gutters and rainwater downpipes

Sizes and shapes of the gutters and downpipes with galvanized mild steel brackets and clips shall be as shown on the drawings and shall be 0.7 mm thick sheet steel.

3.5.1.4 Translucent sheeting

- a. Corrugated or fluted translucent sheeting shall match the roofing and cladding. This must be submitted to the engineer for approval. Translucent sheeting shall be manufactured from fibre glass matting and a resin, using a continuous laminating process. The glass content shall not be less than 0,46 kg/m³ and the nominal mass of the sheeting shall not be less than 1.83 kg/m². The nominal thickness of the sheeting shall be at least 1.1 mm, white in colour and 65 % opalescent unless otherwise indicated on the drawings. The sheeting shall be treated with surface tissue on one side only or on both sides where indicated.
- b. The contractor shall provide a suitable guarantee that the sheeting will not deteriorate unacceptably or lose the required translucency within 10 years of being installed.

3.5.2 Cladding design

Cladding design is vendor specific, however the interaction with the supporting members, including the girt and purlin design must be taken into account for the imposed loading on the sheeting and self-weight of the sheeting.

CONTROLLED DISCLOSURE

3.5.3 Installation of cladding

3.5.3.1 General

- a. The erection of roof sheeting, cladding, accessories and translucent sheeting shall be in accordance with the manufacturer's recommendations.
- b. All laps in roof sheeting shall be sealed with a sealant in accordance with the manufacturer's specification, which shall be subject to Eskom acceptance prior to use.
- c. All swarf, grindings and surplus fasteners shall be removed from the roof sheeting, cladding, translucent sheeting and accessories after completion.
- d. All holes for fasteners in roof sheeting, wall cladding, translucent sheeting, accessories, purlins and sheeting rails shall be drilled.
- e. All roofing and wall cladding fixed to the building shall be waterproof.
- f. Joints in brickwork or concrete shall be raked out for flashings and painted with cement mortar after fixing of flashings.
- g. Conveyor sheeting (dog-house) shall have an easily detachable joint every 50m to enable easy removal for belt splicing.

3.5.3.2 Roofing and wall cladding

- a. Roofing, cladding and accessories shall be fixed to purlins and sheeting rails with 60 mm long, hexagon headed, No. 14 carbon steel, self-tapping screws, each complete with a 19 mm diameter galvanized steel washer over a 16 mm diameter approved sealing grommet.
- b. The sides of the sheets shall be lapped over for a minimum of one corrugation or in accordance with the manufacturer's recommendations, and shall be sealed and stitched with 20 mm long, hexagon headed, No. 14 carbon steel, self-tapping screws, each complete with a 19 mm galvanized steel washer over a 16 mm diameter approved sealing grommet.
- c. End laps shall only occur at purlins and sheeting rails and each sheet shall extend beyond the purlin or rail by 150 mm.
- d. Roof sheeting shall be laid with the narrow flutes uppermost whereas for the wall cladding the broad flutes shall be fixed externally.
- e. All internal wall panelling shall be welded or screwed to the steel columns of the building framework.

3.5.3.3 Gutters and rainwater downpipes

- a. Gutters shall be manufactured with beaded edges and shall be lapped for a minimum of 75 mm at each joint. Gutter joints shall be riveted and soldered and shall be watertight.
- b. Gutters shall be mounted on suitable galvanized mild steel brackets and shall slope towards the outlets as shown on the drawings. The brackets shall be accurately bent to shape, with the outer edge clipped over the beaded edge of the gutter and shall be fixed to the roofing in an approved manner.
- c. The seams of the downpipes shall be riveted and soldered and all slip joints shall be soldered and shall be watertight.
- d. The downpipes shall be mounted 25 mm clear of the finished wall face or structure using suitable galvanized mild steel brackets.

CONTROLLED DISCLOSURE

3.6 STRUCTURAL WELDING

3.6.1 General

- a. All welding done on any Eskom component shall adhere to the requirement the Standard for Welding Requirements on Eskom Plant (240-106628253).
- b. Before any welding is done on any Eskom equipment, the responsible business partner/ contractor shall ensure that the following documents are in place/ qualified and reviewed by the relevant parties:
 - Qualified Welding Procedure Qualification Record
 - Qualified Welding Procedure Specification
 - Qualified Welder qualification record
 - Approved detailed Quality Control plan
- c. The contractor shall specify the welding procedure and the non-destructive examination (NDE) to be used, on the manufacturing drawings. NDE and Welding Procedure Number or Identification may be shown either in the fabrication drawings, notes or on the relevant weld joint as further detailed in 3.9.3.
- d. All costs and materials required for the qualification of welders shall be at the contractor's expense.

Welding will not be measured or paid for as a separate item and costs shall be allowed for in the rates for the items being welded.

3.7 DELIVERY TO SITE AND ERECTION

3.7.1 Temporary Works

The *Contractor* designs all temporary *works* necessary to execute the *works* in accordance with the applicable codes and standards, as stated in section 2.2.

The *Contractor's* appointed ECSA professionally registered structural engineer:

- a) Reviews and approves (by signature) the designs and drawings of all temporary works and additional supports and method statements produced by the *Contractor*; and
- b) Supervises, inspects and approves the *works* as per such.

The *Contractor* takes note that review and acceptance of any document/ drawing/ design calculations by the *Employer* in no way relieves the *Contractor* of his liability for the *works*. The *Contractor* remains liable for all *works* conducted as per this scope.

3.7.2 Transport and delivery

- a. All material shall be properly loaded, secured and protected to prevent damage in transit. Bolts, nuts, washers, etc. shall be packed and marked for identification in boxes or kegs. Bevelled plate edges prepared for field welding shall be protected. Loose clips and other small structural parts shall be either boxed or secured to larger components. Floor plates shall be bundled for transport.
- b. Care shall be taken during the loading, transport, off-loading and stacking on site of the panels or stair treads.

CONTROLLED DISCLOSURE

- c. Accurate records and where necessary mill certificates shall be made and kept of deliveries to site which will be checked against layout drawings by the contractor and Eskom site staff.
- d. The main contractor shall provide on request, key dates during execution of the work and the successful tenderer shall submit on request, a detailed manufacturing and delivery programme.
- e. Care shall be taken during the loading, transport, off-loading and stacking on site of the panels or stair treads. Adequate "nesting" shall be provided to prevent distortion and suitable "lagging" to prevent scuffing and scratching of painted surfaces.

3.7.3 Site storage

- a. The contractor shall arrange for the storage of all structural steelwork and materials on site and materials likely to be damaged by exposure to the elements shall be stored under cover.
- b. The contractor shall make his own arrangements for loading, off-loading, handling, transporting and storing of structural steelwork and materials.
- c. All structural steel shall be stored and handled so that no component is subjected to excessive stresses and damage.

All steelwork and materials shall be stored above ground level. All structural steelwork are to be stacked on palates or raised platforms to prevent contact and ingress of water.

3.7.4 Erection

3.7.4.1 Setting out

The positioning and levelling of all steelwork, plumbing of stanchions and the placing of every part of the structure shall be in accordance with approved drawings and to the satisfaction of the engineer.

3.7.4.2 Security during erection

- a. During erection, components shall be securely bolted or otherwise fastened, and where necessary, temporarily braced, to adequately cater for any erection stresses and loading conditions, including those due to the use of erection equipment. Permanent bolting or welding shall be done before proper alignment has been achieved.
- b. The approval of the engineer shall be obtained before any temporary attachments are welded to any part of the structure. Such attachments shall eventually be removed and the surfaces to which they were attached shall be ground smooth and any damage to paintwork or galvanizing shall be made good to the satisfaction of the engineer.
- c. Safety nets shall be in accordance with EN 1263, Safety Nets – Part 1 and 2.

3.7.4.3 Installation of high-strength bolts

Installation of high strength bolts must be in accordance with SANS 10094, the use of high strength friction grip bolts. The turn of the nut method must be used.

3.7.4.4 Installation of holding-down bolts

Bolts used as holding-down bolts shall be provided with adequate anchor plates, hooks or feathers. Holding-down bolts grouted into pockets in the concrete shall be thoroughly cleaned before grouting. Holding-down bolts passing through concrete slabs shall be provided with properly aligned, painted anchor plates of adequate size.

The specifications of the anchor plate size and pocket dimensions required for the required diameter of holding down bolts is as specified in the Structural steel tables in the Southern African Institute of Steel Construction handbook, published by the Southern African steel construction.

CONTROLLED DISCLOSURE

3.7.4.5 Bedding of stanchion bases

Bedding of stanchions must be done in accordance with SANS 2001-CS1:2012.

3.7.4.6 Clearances and Deviations

Clearances and deviations must be in accordance with SANS 2001-CS1:2012.

3.7.4.7 Damaged materials

Damaged or defective structural steelwork and materials shall be set aside for the engineer to inspect and to decide whether such items shall be rectified, repaired, or rejected. The engineer shall have the right to order the removal, from the Works, of any defective or damaged materials that have not been replaced or rectified to his satisfaction, even if the materials have been built into the Works. The contractor shall repair and replace all defective materials and rectify all defective workmanship at his own cost.

3.7.4.8 Grouting

Grouting shall be done in accordance with SANS 2001-CC1:2012 and SANS-CS1:2012, in addition to the following:

- a. Prior to grouting at least three test specimens shall be made to prove the grout design mix with respect to strength by crushing standard test cubes and with respect to shrinkage, by allowing the grout to set in a watertight container or mould and measuring the shrinkage with a dial gauge.
 - Grouting shall be divided into the following categories:
 - normal grout or special high strength grout for stationary plant, equipment and structures; and
 - non-shrink grout for reciprocating and vibrating machinery.
- b. Grout shall have a compressive strength of not less than the foundation concrete. Non-shrink additives, where approved by the Engineer, shall be added in accordance with the recommendations of the manufacturer, and the set grout shall have a zero shrink tolerance.
- c. The concrete area to receive grout shall be chipped back to remove all dirt, oil, grease, loose particles, etc., to expose the aggregate. Just prior to grouting, the foundation shall be thoroughly wetted for at least four hours, whilst at the time of grouting all standing water and any water in bolt sleeves shall be removed.
- d. The bearing surfaces of steelwork, machinery and equipment bases shall be thoroughly cleaned.
- e. For permanent connections, the bolt sleeves shall be filled with liquid grout before dry grouting is applied under the base plates. Where bolts are to be kept free for future adjustment, fill the bolt sleeve with a high melting point mastic, and apply a rope or other approved material to the bolt over the extent of the grout layer and up to a diameter equal to that of the bolt sleeve before grouting as above.
- f. For equipment or machinery that requires part of the base to remain ungrouted (i.e. engine crank cases), such spaces shall be blocked off with rope or other approved materials. When shims need to be removed at a later stage, they may be blocked off from the grout.
- g. Grout shall be placed by dry packing or by pouring if so directed by the engineer. Trapped air shall be eliminated from bolt sleeves and all other grout spaces. Grout shall be cured as specified for concrete

- h. After sufficient set has been attained, excess grout shall be trimmed away flush with the bottom of the steelwork. The grout surface, or any new cement topping to replace non-shrink grout shall be trowelled smooth and shall slope away to the edge of the concrete base with a 1 in 50 fall. The grout shall be finished off by topping to line up with the edge of the concrete. Corners shall be chamfered.

After the curing period, levelling screws shall be backed off and shims removed from under reciprocating machinery and equipment, whereafter the anchor bolts shall be tightened. Cavities left by the removal of shims shall be grouted to match the rest of the surface.

3.7.5 Tolerances

- a. The tolerances of hot rolled sections shall be as specified in the Structural steel tables in the Southern African Institute of Steel Construction handbook, published by the Southern African steel construction and SANS 2001 CS1-1:2012.

3.8 DOCUMENTATION

3.8.1 Approval and auditing of structural design calculations

All structural design calculations shall be performed by a professionally registered structural engineer. The calculations and the drawings shall be submitted to the Project Manager for his acceptance before manufacturing commences.

3.8.2 Completion

Data Books are submitted for review and acceptance before completion of the *works* to the *Employer*.

This must include, but not limited to, the following:

- Document List
- Instruction for Work/Purchase Order
- Approved ITP's, QCP's
- Method statements and specification adhered to
- Rigging studies
- Risk assessments
- Approved Drawings
- Fabrication Drawings
- Material Certificates
- Weld Map
- Weld Matrix Sheet
- Weld Sequence
- Welding Consumables Certificates
- Welding Procedure
- Welders' Qualifications
- ESKOM approved NDT Contractor
- Approved NDT procedure
- NDT Technician Qualifications

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

- NDT Reports / Results
- Certificate of Manufacture
- Inspection Reports
- Corrosion Protection Consumables Certificates
- Calibration Certificates
- Notifications
- Modifications
- Concessions
- TQ's, ER's and communication with *Employer*
- Non-conformance reports
- Internal Release Notes
- Transport notifications
- Calculations for any temporary works that may be required for the safe execution of the *works*.
- Concrete cube test results and reports
- Structural completion Certificate signed by the *Contractor's* Professional Engineer/Technologist certifying that the works are constructed in accordance with the *Contractor's* design as stipulated in the National Building Regulations.

3.8.3 Drawings

Drawings shall be submitted for acceptance in accordance with the Engineering Drawing Standard.

3.9 TESTING AND INSPECTIONS

3.9.1 Testing by the engineer or test authority

- a. The engineer may nominate a testing authority to inspect the Works and conduct tests to determine compliance with the specifications. Where required, test samples of welds shall be prepared, by the contractor at no charge to Eskom. The contractor shall when required, pay for the cost of testing and shall allow for this in his rates for steelwork.
- b. Welds made by procedures that are not pre-qualified or have not been properly qualified and approved, will be rejected by Eskom and shall be completely removed by the contractor.
- c. The engineer shall designate on the shop drawings the extent to which welds are to be inspected, and the contractor shall co-operate with inspection personnel so that welds can be efficiently examined.

3.9.2 Hardness testing

- a. The preferred method of hardness testing is the Brinell hardness test.
- b. Where postweld heat treatment is specified, hardness tests shall be performed after such treatment.

3.9.3 Non-destructive examination

- a. Non-destructive procedures, techniques, and acceptance criteria shall be executed in accordance with the Standard for Non-Destructive Testing (NDT) on Eskom Plant – 240-83539994.

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

- b. All non-destructive examinations shall be performed in accordance with written procedures. The engineer shall have the right to examine and approve the written procedures.
- c. Results of non-destructive examinations shall be reported on annex E forms as contained in the AWS code and copies of the reports shall be supplied to the engineer upon request.

3.9.4 Inspections

- a. All materials and components shall be inspected during and after manufacture by the main Contractor's and Eskom's Inspectors in accordance with the Contract.
- b. At least seven days notification to Eskom's inspectors is required prior to the when date the contractor plans to inspect any section of the work undertaken

4. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
Gareth Macintosh	Structural Design CoE Manager (Acting)
Qingbo Cai	Structural Design CoE, Chief Engineer
Niloshen Moodley	Structural Design CoE, Engineer
Kameel Burath	Structural Design CoE, Engineer
Byron Thomas	Structural Design CoE, Engineer
Denise Naidoo	Structural Design CoE, Engineer
Andrew Matlala	BMH, Chief Engineer
Viren Naidoo	BMH , Senior Engineer
Ranwedzi Mukhodobwane	BMH, Engineer
Morongwa Mogale	Material, Welding, NDT and RBI department

5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0.3	M. Masina	Draft Document for review created from GGSS 0407
November 2012	1	M. Masina	Final Document approved
January 2019	1.1	R. Pillay	Document review required
March 2019	2	R. Pillay	Document updated after internal and Eskom wide review

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- R. Pillay

7. ACKNOWLEDGEMENTS

None

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.