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Conceptual Architectural Design Specifications for Structures and Other Buildings

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Conceptual Architectural Design Specifications for Structures and Other Buildings

CONTENTS

1. GENERAL

1.1 Description, extent and location of the activity:

As illustrated in the site layout Plan in Appendix A of the Final Environmental Impact Report dated 22 May 2006 the proposed development comprises the following:

- The construction of a 4800MW coal fired power station near Lephalale on approximately 700ha of the farm Naauwontkomen 509 LQ
- The installation of ancillary infrastructure including the ashing facility on 500-1000 ha of the farm Eenzaamheid 687LQ
- The construction of a conveyor belt for coal supply on a northern alignment
- The re-routing of the Steenbokpan Road to the northern alternative
- The construction of the overland ash conveyor belt

This document covers the Architectural parameters for the design of all buildings at the Medupi Power Station.

The specifications, finishes and requirements presented on the relevant drawings for each building together with the "General Specifications" shall take precedence over the specifications and requirements of this specification. Where the drawing specifications, finishes and requirements do not include a description for a particular specification, finish or requirement, the equivalent particular specification, finish or requirement contained in this specification shall apply.

2. ARCHITECTURAL CONCEPT

2.1 Building Layout and Aesthetics

The following is a general description for the design of all the buildings although the Architect and the Employer may in agreement decide to design certain buildings differently.

Buildings should generally be square/rectangular in shape to economize structural design and make sealing of roofs easier.

Roofs on the Admin Island will have curved roofs, generally with monitors. Other roofs will generally have four slopes at min. 10° with hips**.** Roof metal sheeting shall be in continuous lengths between the ridge and the edge of the curved fascia as well as the hips and the edge of the curved fascia. Sheeting in other roof applications shall also be in continuous lengths. All roof sheeting shall be "HH Robertson Klip-Lok 700" profile with bullnose eaves of 450 mm radius. In certain areas where good thermal insulation is required , Isowall panels or a gypsum board and mineral wool construction is to form part of the roof assembly. Special metal brackets are needed for secret fixing.

Eaves over walls shall be 750 mm min. to outer face of wall finish for all walls where practical. Eaves closed see description at paragraph 3.2.2.2.

All roof sheeting shall be HH Robertson Klip-Lok 700 profile 0,58 mm thick high yield stress ASTM 446 grade E (3T), heavy industrial Z 275 galvanised and finished on the outside with the following paint specification or similar and approved by the architect.

Type:	Global-Duro
Primer:	Beckry Prim 209
Topcoat:	Beckry Duro DJ 284
Film thickness:	55 microns
Application:	Reverse roller coating

This paint finish must have a 10 year guarantee.

Roof sheeting fixed to manufacturers specification. Colour of finish see colour schedule below.

Metal sheet cladding shall be in continuous lengths from top to bottom. If this can't be done in special occasions the overlap visual joint position must line up with the top or bottom of windows or any other architectural element. All cladding shall be IBR 890 (supaclad) profile 0,58 mm thick high yield stress ASTM 446 grad E (3T) heavy industrial Z 275 galvanised and finished on the outside with the following paint specification or similar and approved by the Architect.

Type:	Global-Duro
Primer :	Beckry Prim 209
Topcoat:	Beckry Duro DJ 284
Film thickness:	55 microns
Application:	Reverse roller coating

Colour of finish see schedule below.

Where structures are lifted above ground level the cladding is turned horisontal with a bullnose in the same radius as for the roof to close the bottom of the structure.

All exposed gutters shall be the same colour as the roof sheeting.

Generally roofs don't need gutters or down pipes provided that a concrete apron is provided around the building wide enough to receive all the roof water. Except for the substations, buildings on the Admin Island is to be provided with gutters and downpipes.

Roof gutters except for box gutters are manufactured out of 0,8 mm thick, mild steel with Z 450 galvanised finish on both sides and finished both sides with Globalcoat Global – PVDF. Colour to match colour of roof or out of anodised aluminium.

Exposed downpipes and or spouts form an integral part of the design of the building and will have to be to the approval of the architect and employer which includes choice of material and colour finish. Metal downpipes which could be square or round to be manufactured out of either 0.8 mm thick mild steel with Z 450 galvanised finish on both sides and finished both sides with Global coat Global – PVDf or out of aluminium.

Round powder coated aluminium downpipes and pvc pipes with a special paint finish to the manufacturers specification for the polluted air environment may be used.

Cladding to Boiler Houses above top of Turbine House level may have intermittent horizontal bands of frosted polycarbonate sheeting in the same profile as the Klip-Lok 700.

All flashings including ridge and hip flashings constructed of the same material as for roofs and finished with the same Globalcoat finish. Colour to match colour of roof.

Colour Schedule

	Element	**Colour**
XX	Cladding to boiler houses above top of Turbine house	Plascon Inspired Colour Y7-D2-2 majestic beauty. Special colour.
	Cladding to Turbine houses	Aloe Green
XX	Roofs to boiler houses	Plascon Inspired Colour Y7-D2-2 majestic beauty. Special colour
	Roofs to Turbine houses	Aloe Green
	Cladding to other structures	Aloe Green
	Roofs to other structures	Aloe Green

XX **This is a special colour and will have to be ordered well in advance from the Factory as this is not a standard Chromadek colour.**

3. BASIC BUILDINGS SPECIFICATIONS

3.1 DESIGN PARAMETERS

3.1.1 Design Codes

Buildings and structures shall be designed to comply with the following codes:

	1995	Standard System of Measuring Building Work
	1999	Model Preambles for all Trades
	Latest	Safety, Health & Environmental Requirements for *Contractor*s (Obtain from Medupi Power Station's Safety, Health & Environmental officer)
	2003	Construction Regulations
(OHASA) 85	1995	Occupational Health and Safety Act
ASHRAE 15		Safety Codes for mechanical refrigeration
ASHRAE 52/76		Standard test method
ASHRAE 55		Thermal environmental condition for human occupancy
ASHRAE 62		American Society of Heating Refrigeration and Air Conditioning Engineers. Ventilation for acceptable indoor air quality.
ASHRAE G1		Guideline for commissioning air conditioning systems
BS 5720		British Standard: Code of practice for mechanical ventilation and air conditioning in buildings
BS 8233		British Standard: Code of practice for sound insulation and noise reduction in buildings
[1]		Catering Regulations R918
ESK AM AAA 1	Latest	Eskom Corporate Identity Manual
ESK AM AAA 1	May 2004	Interior Specifications
GGG 0838		Employer Battery rooms standard
GGS 0462	Rev 0	Safety and Quality Specifications

GGSS0456		Employer electrical standard
NKPA 1980[2]	1980	**NATIONAL KEY POINTS ACT** 102 OF 1980
SANS 0108	1974	Classification of hazardous locations
SANS 0173		Installation, testing and balancing of air-conditioning ducting
SABS 0400	1990	The application of the National Building Regulations
SANS 10021	2002	The water-proofing of buildings (Including damp-proofing and vapour barrier installation
SANS 10049[1]		Food Hygiene Management
SANS 10062	2003	Fixing of concrete interlocking roofing tiles
SANS 10082	1988	Timber buildings
SANS 10100-1	2000	The structural use of concrete Part 1: Design
SANS 10100-2	1992	The structural use of concrete Part 2: Materials and the execution of work
SANS 10109-1	1995	Concrete floors Part 1: Bases to concrete floors
SANS 10109-2	2004	Concrete floors Part 1: Finishes to concrete floors
SANS 10120		Code of Practice for use with other SANS specifications
SANS 10133[1]		Pesticides in Food handling catering establishments
SANS 10143	1980	Building drawing practice
SANS 10144	1995	Detailing of steel reinforcement for concrete
SANS 10145	2000	Concrete masonry construction
SANS 10155	1980	Accuracy in buildings
SANS 10156[1]		Handling Chilled and Frozen Food
SANS 10160	1989	The General Procedure and Loadings to be adopted in the Design of Buildings
SANS 10161	1980	The design of foundations for buildings
SANS 10162-1	2005	The Structural use of Steel Part 1: Limit States design of

		hot-rolled steelwork
SANS 10162-2	1993	The Structural use of Steel Part 2: Limit States design of cold-formed steelwork
SANS 10162-4	1997	The Structural use of Steel Part 4: The design of cold-formed stainless steel structural members
SANS 10163-1	2003	The Structural use of Timber Part 1: Limit-states design
SANS 10163-2	2001	The Structural use of Timber Part 2: Allowable stress design
SANS 10164-1	1980	The Structural use of Masonry Part 1: Un-reinforced masonry walling
SANS 10164-2	2003	The Structural use of Masonry Part 2: Structural design and requirements for reinforced and pre-stressed masonry
SANS 10330[1]		Requirements for Haccp System
SANS 11799[3]	2005	Information and documentation - Document storage requirements for archive and library materials
SANS 1200	2004	Standardised Specification for Civil Engineering Construction; sections A, AH, DA, DB, G, GB, GE, GF, H, HA, HB, HC, HE, L, LB, LD.
SANS 1238		Air conditioning ductwork
SANS 1424		Filters used in air conditioning and general ventilation
SANS 14001[1]		Environment Management System
SANS OHSAS 18001[1]		
SANS 193 / BS 476		Fire dampers
SANS 6079		Electrical Apparatus for explosive gas atmosphere
SANS 22000[1]		Food Safety Management System
SANS 31000[1]		Integrated Risk Management System

[3]		Green Building Guidelines
[1]	Applicable to Canteen	
[2]	Applicable to Access Control Building	
[3]	Applicable to Admin Building	

3.2 DESIGN GUIDELINES

3.2.1 General

General information is given on elements and components for all buildings. However, requirements for certain buildings are specified in more detail.

Materials containing asbestos shall not be used.

3.2.2 Roofs

3.2.2.1 Flat roofs

Nominally flat roofs shall be made of reinforced concrete, poured in situ. Prefabricated concrete elements shall not be used for roof construction. The minimum slope for nominally flat roofs shall be 1:50 **(2%)** in accordance with SABS 0400 LL5.3(a).

Slopes to be formed with low and high density light weight screed. Minimum thickness to outlets 30 mm. Light weight screed must have an excellent thermal insulation quality. Material to be used to be approved by the Architect.

Roofs and kerbs shall be made completely water-proof by any proprietary water-proofing treatment. Derbigum as specified by the manufacturer or similar and approved material is to be used. The composite roof shall comply with criteria for thermal insulation and fire protection. Condensation shall be avoided. Where frequent roof traffic is expected, adequate walkways made of steel grating on steel supports shall be provided. Gravel shall not be used to protect the water-proofing. Precast smooth concrete tiles layed on pedestals to provide a 50 mm min. void space between the tiles and the waterproofing and to cover the total area of the roof for solar thermal and traffic protection must be used.

3.2.2.2 Pitched roofs, Box gutters and Hail guards

The design theme for all roofs is illustrated on photos attached and numbered from P01 to P14.

The height of the curved roof fascia is not a fixed dimension for all buildings. There is a proportion between the height and size of building and the height of the curved roof fascia. This will be determined by the project Architect for each building.

For pitched roofs, the plan shape shall be kept as simple as possible, with hips and ridges but without valleys. The construction shall be such as to result in a completely water-proof roof. See SANS 1200 section HC.

Roof insulation material to be firm against the metal roof sheeting to avoid condensation below the roof sheeting.

Roofs will generally have four slopes at min.3°. Rainwater gutters (min. 1 cm^2 cross section per m^2 of roof area x 1,4) and down pipes (min. 1 cm^2 cross section per 1 m^2 of roof area) shall be provided.

Roof will generally have bull-nosed eaves of 450 mm radius.

All box gutters constructed of 3.5 mm steel plates welded to max. lengths for a hot dip galvanising bath. Box gutters with welded vertical end stops and welded outlets before gutter is hot dip galvanised. Gutters installed with vertical end stops against each other and covered with a Z 450 galvanised covered flashing sealed on sides. Box Gutters provided with large diameter (min 110mm dia) overflow pipes at both ends, and insides waterproofed with Sika Sealoflex .

Hot dip galvanised hail guards fixed above all box gutters. Hail gutters must be able to flap open to get access to box gutters.

Roof eaves closed horisontally in line with the bottom of the roof overhang with 10 mm smooth high density Nutec boards painted**.** End joints butt jointed and sealed with acrylic silicone and painted. All overhangs sealed dust proof.

Under all roof eaves, adequate concrete aprons shall be designed at ground level with concrete slabs on all sides to prevent erosion**.** Expansion joints at paving 10-20mm. Sealing all paving against buildings to prevent water ingress. Use of gutters, downpipes and concrete block channels to remove water to the storm water system.

3.2.2.3 Roofs to Boiler House and Turbines

Roofs will have a 10° slope as described in paragraph 2.1 p23.

3.2.3 Floors

3.2.3.1 General

Floors shall be either:

- Mass concrete supported directly on soil with an intervening vapour barrier (applicable to ground floors only if soil conditions permit), or
- Reinforced concrete, or
- Prefabricated concrete slabs supported by concrete or steel beams, but only when no people are accommodated underneath.

Where requirements warrant it, epoxy-based flooring could be considered. However, alternative materials shall be used only with the Employer's approval.

All floors exposed to weather, liquid spillage or washing-down operations shall be laid with adequate falls, e.g. a minimum of 1 in 100 to gulleys or channels placed in such a way that quick and effective drainage is possible. The Canteen kitchen is excluded from this due to the use of trolleys and the stringent management in place. The falls shall be such that, allowing for normal tolerances, there is no possibility of ponding, or water being trapped by stanchions or footings. Drains from upper floors shall be routed in such a way that blockages are unlikely and shall have adequate inspection covers so that, if blockages do occur, they can be cleared easily.

- The finished floor level shall be at least 150 mm above the finished levels around the building. All outside doors must have a threshold of a minimum of 20mm on the inside of the door if the door swing outwards or at the centre of the door if the door swings inwards. The bottom of the door swinging outwards must be at least 13 mm below the inside floor level The apron from the threshold slopes away from the door with a minimum slope of 1:80 and a maximum slope of 1:12.
- Termite treatment to be done for the total area of the floor area before vapour barrier is layed down**.**
- Provision of ramps and access for wheelchairs.
- Details for floor ducts, sliding doors and roller shutter doors.

3.2.3.2 Workshop floors

In a workshop floor, provisions shall be made to allow for cable-laying and machine foundations.

The floor shall be constructed as follows:

- A reinforced concrete construction floor to base all machine foundations.
- A layer of sand about 200 mm thick to accommodate cables and piping.
- A reinforced concrete floor, strong enough to carry all the traffic in the workshop, which can be easily removed for relocation of equipment without disturbing the lower construction floor. This top floor shall be level with the surrounding floors.

3.2.3.3 Raised floors

For the installation of computers and other instrument or electrical equipment with cable connections at the bottom of the equipment, a special cavity floor shall be installed.

The elevated floor shall be flush with the surrounding floor finishes. For this reason the reinforced concrete floor shall be constructed at a lower level.

The removable panels shall be 600 x 600 mm, constructed of pressed galvanised metal sheet, finished with 2 mm thick melamine factory-applied, anti-static, wearing surface at the top. Colour and texture of finish to Architects' approval.

The floor panels shall rest on adjustable pedestals manufactured of mild steel with galvanised mild steel foot and top plates.

The pedestals shall be fixed with epoxy to the concrete floor, adjustable in height, providing a distance between the top of the cavity floor and the top of the concrete floor of ± 500 mm. The adjustable part shall have automatic positive locking.

Electrical requirements shall be in accordance with electrical specifications.

Bracings shall be installed to prevent lateral movement of the flooring system.

Separate steel structures shall be provided to support electrical equipment and battery benches.

Each floor panel shall be capable of supporting a concentrated load of 4,450 kN, applied on an area of 650 mm^2 at any point, or 15 kN/m^2 with a max. deflection of 1 mm.

The reinforced concrete floor and the walls under the cavity floor shall be painted with a white PVA paint to prevent formation of dust.

Provision of ample sleeves into cavity floors and very accurate set out to obtain 100% square sides.

3.2.3.4 Finish of floors

See Architects' drawings

Finish of floors for the inside of the following buildings will be indicated on the finishing schedules of the Architects' drawings.

- Access Control Building
- Canteen and Kitchen
- Fire and Medical Building
- Admin Building
- Auxiliary Bay Building
- Station Services Building
- Water Treatment Pant
- Laboratory
- Workshops and Stores
- Substations
- Conference Centre

- Ablution Blocks

3.2.4 Ceilings

3.2.4.1 Materials

Moisture-resistant materials shall be used for the ceilings of all toilet rooms, bathing facilities, kitchens and other areas exposed to moisture and humidity. All materials to be used for ceilings shall consist of non-combustible materials or fire-rated materials in accordance with the applicable codes.

3.2.4.2 Finish of ceilings

See Architects' drawings

Finish of ceilings for the inside of the following buildings will be indicated on the finishing schedules of the Architects' drawings.

- Access Control Building
- Canteen and Kitchen
- Fire and Medical Building
- Admin Building
- Auxiliary Bay Building
- Station Services Building
- Water Treatment Pant
- Laboratory
- Workshops and Stores
- Substations
- Conference Centre
- Ablution Blocks

3.2.5 Walls

3.2.5.1 External walls

External walls shall be designed to prevent condensation and to resist penetration of external moisture due to rain into the inside of the building. External walls should be made of face bricks minimum Class FBS. Colour and texture of facebricks as follows:

- External Walls – Corobrik Firelight Satin

- Internal Walls – Corobrik Silver Grey Satin

Finishing of joints to Architects' drawings..

Plastering and painting (or cladding) shall only be used where bricks of suitable appearance are not available locally. If administration and service buildings are made of concrete blocks, the external surfaces shall be either plastered with pre-coloured Resin Bonded Plaster or plastered and painted.

A damp-proof course shall be included in all walls over the full length at floor levels. Whenever necessary, termite barriers shall be provided in the construction.

Where wall cladding is used, plastering and painting of the wall behind it shall be omitted. If cladding is used in service buildings, a dwarf wall of min. 2125 mm height shall be erected to protect the cladding against damage by motor vehicles. Steel crash barriers may only be used as an alternative to a dwarf wall if approved by the Employer.

Auxiliary rooms, control buildings and similar buildings shall be made gas-tight. The joints between brickwork and concrete structure shall be sealed, as well as the joints between door and window frames and the brickwork or concrete structure.

Where louvers are used for ventilation they shall be of the "horisontal louver" type.

The minimum thickness of the cladding shall be 0, 58 mm.

Double sheeted, insulating cladding shall be considered for buildings frequently occupied by people. Where natural or forced draft ventilation is required, a ridge vent shall be provided over the full length of the building in combination with wall louvers. Alternatives must be supported by an HVAC Engineer's calculations.

To prevent possible accumulation of gases in the walls, cavity walls shall not be used in auxiliary rooms and similar buildings. Hollow concrete blocks shall not be used for outside brickwork, unless the cavities are filled with concrete/mortar. The holes for cable entries below ground shall be sealed gas and water tight; Multi Cable Transit (MCT) blocks should be used. Unused cable entries shall be closed with spare solid blocks. Material to be used for closing of above ground holes for cable entries shall have the same fire rating as the particular element.

Preventive measures shall be taken to avoid inflow of rain water or released flammable liquids. All openings for cables or piping shall be above groundwater level. External walls for buildings shall satisfy the general requirements given in the Local Building Regulations.

Lightly coloured, heat-reflecting, thermal insulating properties and low maintenance shall be the major considerations in the selection of all exterior finishes. Appropriate jointing and backing systems shall be incorporated into the design of all exterior finish systems.

Such systems shall resist all local weather conditions, such as rainstorms, high winds, etc.

Special attention shall be paid to the selection of appropriate coatings for the finishing of exterior surfaces. In particular, metals require special coatings as a protection against corrosion and heat absorption. See SANS 1200 section HC.

3.2.5.2 Cladding to Boiler House and Turbines

Vertical cladding to form a parapet wall of 1,200 mm minimum above the roof level.

3.2.5.3 Interior walls and partitions

Only moisture-proof finishes shall be specified in toilet rooms, bath facilities, kitchens and other areas exposed to humidity or water. Walls surrounding showers, bath tubs and urinals shall be finished with glazed ceramic tiles, or specially designed sanitary partition walls.

Terrazzo shall have an integral coved base. All plastered corners shall be protected against impact damage by an integral bullnose element.

A damp-proof course may be omitted for partition walls, if erected on the concrete floor, except for wash rooms and other wet rooms.

3.2.5.4 Finish of walls

See Architects' drawings

Finish of walls for the inside of the following buildings will be indicated on the finishing schedules of the Architects' drawings.

- Access Control Building
- Canteen and Kitchen
- Fire and Medical Building
- Admin Building
- Auxiliary Bay Building
- Station Services Building
- Water Treatment Pant
- Laboratory
- Workshops and Stores
- Substations
- Conference Centre
- Ablution Blocks

3.2.6 Doors

3.2.6.1 General

Read in conjunction with building door schedules. In external walls, door frames shall be made of galvanised steel or powder coated aluminium. Pressed steel door frames to be 1.2mm thick.

All door frames to service ducts to have thresholds with same profile as frame.

In exceptional cases, solid hardwood doors can be used, treated with a fire retardant.

Fire doors to comply with the National Building Regulations.

NOTE: Aluminium shall not be used in substations, because this material is too weak to hold the door or window pane in place during an explosion.

Plastic shall not be used because of the development of dangerous gases in the case of fire.

Steel doors, where specified, shall be double-sheeted and insulated with rockwool, or timber doors clad with steel plate

In all other internal walls where doors are required, pressed steel or hardwood door frames, solid-cored, flush-veneered wooden doors with two concealed post lipped hardwood edges on both sides shall be used. Doors finished with Velvaglo paint of approved colour.

All main entrances and all other entrances to buildings which are frequently used shall have airlocks to control the indoor temperature.

Where visibility is required, doors shall be glazed. Outside doors in administration buildings may have a clear opening for glazing. Laminated safety glass.

External doors shall always open outwards and in the direction of the escape route. Revolving doors and sliding doors are not allowed for emergency exits.

If the dimensions of doors are impractical for easy handling, a wicket door shall be provided for frequent passage of persons, i.e. in workshop doors, the door for the receiving bay of the store and the equipment doors of control buildings.

Weather seals (pile seals) are needed to maintain the climate inside the building and to exclude all dust and moisture infiltration. Sliding doors shall be designed in such a way that an accumulation of dust and sand does not influence the proper functioning of the doors.

Overhead hydraulic door closers to be fitted to the door frames.

The external doors of the substation shall be made tight-fitting by means of heavy-duty PVC seals, so that no dust, gas or other foreign matter can enter the building.

The sealing of the analyser house doors, internal and external, shall be made tight-fitting by means of heavy-duty PVC seals**.**

Smoke and fire doors to be installed as specified in the National Building Regulations.

Mat wells shall be installed inside all entrances of the buildings listed in paragraph 3.2.5.4.

The following general principles shall apply:

- Doors may be electrically operated but shall have a facility for quick disconnection of the electric driver after which easy manual opening shall be possible (balanced doors).
- Internal doors to toilets and showers shall have a 100 mm free opening from the finished floor.
- Doors in corridors of office buildings should not be located directly opposite each other.
- To all doors of non-production buildings ensure min. 1 mm and max. 2 mm free even clearance all round after painting and lying of floor finishes. Also most important that doors are painted on top and bottom before fitted into position

3.2.6.2 Dimensions

Required minimum dimensions shall be as shown below. All these dimensions shall be increased if required for installation of equipment in the buildings.

MINIMUM CLEAR OPENINGS OF INTERNAL DOORS	WIDTH x HEIGHT (mm)
First-aid facilities, for passage of stretcher only	1500 x 2100
Instrument shop	1200 x 2100
Between electrical shop and mechanical shop	2000 x 2100
Basement of control building between instrument and electrical room	1800 x 2500
Between warehouse and bulk store	1800 x 3000
One door in each laboratory room	Large enough for the necessary equipment (e.g. fume cupboard) to pass through
Toilets and showers	760 x 2100
Other doors	800 x 2100

MINIMUM CLEAR OPENINGS OF EXTERNAL DOORS		WIDTH X HEIGHT (mm)
Main entrances of offices, canteen, training and first-aid building		1500 x 2100
Control building	Equipment entrance	1800 x 2500
	All other doors	800 x 2100
Workshops and warehouses (shall be sliding doors or rollershutter doors)		3000 x 3000
Between covered area and workshop		4000 x 4000
Store for heavy field tools or rigging equipment		1800 x 3000

Bottom track for heavy duty sliding doors as per sketch 6 and 10.

MINIMUM CLEAR OPENINGS OF EXTERNAL DOORS		WIDTH X HEIGHT (mm)
Substations	Equipment entrances	1800 x 2500
	Personnel entrance	800 x 2100
Analyser houses		800 x 2100
Other external doors		800 x 2100

3.2.6.3 Fixing

- Fixing of frames for doors and windows to the building shall be such as to ensure solid, void-free, water-proof joints.
- Steel frames shall be built into the building by using hot dip galvanised metal lugs.

The joints shall be caulked with polymethane sealants to be painted.

3.2.6.4 Fittings

- Locks, handles, handle plates, barrel bolts, panic bolts, door stops, kick plates, and automatic door closers shall be provided as necessary. For doors to air locks, air-conditioned rooms, pressurised rooms, main entrances to sanitary blocks, and for all fire-check doors, automatic door closers or self-closing doors shall be installed. For other external doors, door catches shall be provided.
- All fittings of the same kind shall be of one make and type. Where fixing is done with screws corrosion resistant screws must be used. Finishes to fittings must be corrosion resistant.
- The emergency exit doors of analyser houses, electrical substations and the active leaf of the double door of electrical substations shall be provided with a single panic bolt. As only the single doors shall be used for normal passage, the panic bolts of these doors shall be operated by means of a cylinder lock with key and locking knob or biometric device. These locks shall be keyed to a master key system.
- Doors to toilets and showers shall be provided with an indicator bolt only. On the inside of these doors coat hooks shall be fitted, one on each toilet door and three near each shower door. These coat hooks can also be mounted against the wall on a strip of hardwood. Coat hooks to be vandal proof. Doors for disabled ablution facilities will be appropriate to their intended use.

3.2.6.5 Finish

Doors, windows, frames and fittings made out of steel shall be hot-dip galvanised.

3.2.6.6 Issue counters

A hatch with a hardwood or concrete issue counter shall be provided in the dividing wall between the workshop and the tool room, and in the warehouse

These issue counters, as well as the issue counter in the canteen, shall be provided with metal roller shutter doors with suitable locking arrangements.

3.2.7 Windows

3.2.7.1 General

- Windows, including their frames in external walls, shall be made of hot dip galvanised steel or epoxy coated aluminium as per window schedules.
- Movable parts of external windows shall open outwards, unless otherwise required for safety reasons.
- Where insect screens are required, they shall be easily removable and rustproof.
- Electrical substations shall not be provided with any windows.
- The underside of all windows in workshop and warehouse buildings shall be at least 1200 mm above finished floor level. The underside of all other windows, where possible, shall be min. 1000 mm above finished floor level.
- External window sills should project beyond the external wall face. Internal sills shall be made of tiles or similar material to suit the type of room concerned.
- Bracings, rainwater down-pipes and sewer pipes shall not obstruct the windows in steel-framed buildings.

3.2.7.2 Sun-load protection

- The design of buildings shall be such that the heat due to solar radiation through glazed areas shall not raise the temperature in the rooms above the allowable design conditions. This may be achieved by installation of louvres, heat-absorbing/reflecting window panes, double glazing, canopies, or similar sun-protection devices. A study of their optimum shape in relation to the sun, as well as their economics related to HVAC equipment and operation costs should be made. Such devices should have low heat-absorptive properties and minimum contact with the building surfaces to which they are attached.
- In addition, interior shading, such as blinds and curtains, should be provided, ensuring sufficient air circulation between them and the window pane. Blinds shall be designed using materials resistant to intense heat, and curtains shall have stable colours that resist fading. All curtains and draperies shall be self-extinguishing.
- When specifying special glazing, such as reflective mirror glass and heavily tinted glass, consideration shall be given to replacements and availability in the country in question.

3.2.7.3 External glazing

3.2.7.3.1 General

- All glazing shall comply with SABS 0400 and SANS 10139.
- All window openings shall be designed in such a way that only a minimum of different glass sizes is required.

- In all buildings, laminated glass shall be used consisting of two layers of float glass of at least 3 mm each and a polyvinyl-butyral (PVB) interlayer of one of the following, depending on the application requirement:.

  (i) Normal Strength (NS) for human impact safety (0,38 mm PVB interlayer)

- Hermetically-sealed double-glazing units shall be used when transparency needs to be combined with heat insulation. The double-glazing units reduce sound transmission appreciably, but this is an incidental benefit.

  These glazing units, prefabricated by the manufacturer, shall be composed of two spaced glass panes with a cavity of dehydrated air.

NOTES:

1. To prevent mistakes during fitting of the units into the frames, the inner pane of laminated glass shall be marked clearly by the manufacturer (e.g. the *Employer*'s name or company logo in the glass).

2. When these units are to be exposed to low pressure (e.g. during air transport or if mounted at a level above 800 m) the manufacturer of these units shall be informed and the necessary precautions taken.

3. If considerable protection against the spread of fire is required, as well as protection during an explosion, wired laminated glass shall be applied, e.g. in analyser houses. This glass shall consist of one layer of wired glass, 6 mm thick and one layer of float glass, 3 mm thick with an PVB interlayer of 1,52 mm.

4. Allowance is to be made for a means to equalise the pressure in double glazed units with the ambient temperature if these units are produced in a location with different air pressure from the site.

3.2.7.3.2 Fixing requirements for external glazing

To enhance keeping the glass pane in the window frame in the case of an explosion, the following requirements shall apply **(see also Appendix 2):** Read in conjunction with the relevant building window schedule.

- The window frame of galvanised steel shall have a minimum rebate of 18 mm instead of the normal standard of 12 mm. The glass manufacturer may specify even more than 18 mm, in which case this bigger rebate shall be provided.
- The glass panes shall be fitted from the outside.
- Single and double external glazing shall be fixed with structural silicon.
- As shown in **Appendix 2,** each of the edges of the pane shall have a minimum clearance of 5 mm with the frame. Both faces of the pane shall have a minimum 3 mm clearance with the frame.

  The clearances shall be maintained by the use of neoprene setting blocks and side spacers **(see Appendix 2).**
- The glass shall be fitted in the steel frame using a non-hardening adhesive compound. A self-adhesive aluminium tape shall be taped on the edge of the window pane to act as a separation between the adhesive compound and the

PVB interlayer in the case of possible harmful reaction between components of the adhesive compound and the PVB interlayer **(see Appendix 2).**

- The fixing method shall ensure void-free and water-proof joints.
- The transport, the application of primers, compounds, aluminium to neoprene setting blocks and neoprene side spacers shall be in accordance with the instructions of the manufacturers of the glass and the compounds.

3.2.7.4 Internal glazing

Normal glass with thickness as per SABS 0400 Part N, shall be applied.

Internal glass in timber doors and in hardwood frames shall be fixed with screwed hardwood beads.

If considerable protection against the spread of fire is required, transparent Georgian polished wired glass shall be applied in view of its resistance to fragmentation.

Wired glass, thickness 6 mm, shall be fixed with screwed metal beads in steel frames and with wooden beads in wooden doors

Transparent Georgian polished wired glass shall be used if visibility is required, otherwise translucent Georgian wired-cast glass shall be applied.

3.2.8 Special requirements for plants handling toxic products

Walls, floors, ceilings, windows, doors, air ducts, partitions, piping, etc., and all internal surfaces shall be designed and constructed to eliminate as far as possible any ledges or surfaces on which dust and dirt can settle. All surfaces shall have a smooth texture and shall be easy to clean.

The floor surface of the plant shall be smooth and impervious (e.g. by means of non-slippery glazed tiles) in order to prevent absorption of any toxic residue in the floor. The floor should slope gently (1:100) towards the drainage point. A small ridge around the more critical areas or recess of this area, i.e. underneath the filling equipment, shall be applied. This separated area should also be connected with a drainage system suitable for toxic materials.

The mixing room shall have self-closing doors, to restrict the spreading of toxic product as far as possible.

3.2.9 Staircases

3.2.9.1 General

All stairs shall be designed and located in terms of SABS 0400 Part T and to meet the local fire authority requirements for means of escape in the case of fire. The proposed location shall be approved by the Employer.

Swinging of doors to be in accordance with SABS 0400 for fire escape routes.

Signs shall be supplied and erected to indicate clearly the route of escape in an emergency.

Handrails to be in accordance with SABS 0400.

Main internal staircases of administration buildings, control buildings, laboratories, etc., along with their related lobbies and landings, shall be enclosed by suitable fire-resistant materials

Where equipment is located on top of a roof, the installation of a steel staircase or cage ladder will depend on the maintenance/inspection/operating requirements of the equipment, subject to the approval of the Employer. For steel staircases and ladders, see Eskom standard drawings.

The concrete platforms in front of equipment doors shall be calculated to be able to bear the equipment that will be transported through these doors.

If in an electrical substation a basement is required, two manholes of 600 x 800 mm covered with 25 mm deep galvanised grating and located in opposite corners of the building shall be provided in the ground floor, providing access and natural ventilation to the basement.

A fixed vertical steel ladder leading to each manhole shall be provided in the basement.

Vertical steel grabrails shall be fixed next to each manhole.

3.2.9.2 Dimensions

Minimum width between handrails	1100 mm.
Width and length of landings	Same as width of stair
Minimum head room	2100 mm.
Height of handrail above front of tread	900 mm.
Height of handrail above landing	1100 mm.
Centre line of doorway to first adjacent staircase riser, min. distance	1500 mm.

No stairway shall exceed 16 risers or 3000 mm in any one flight, but if more are necessary a landing shall be provided.

The maximum slope shall be 3:4.

For risers and goings the following shall apply:

- Risers (R): min. 170 mm - max. 200 mm.
- Treads (T): min. 250 mm - max. 310 mm.
- Preferred ratio is 2R+T = 610 to 640

And further:

- (R x T) min. 48 000 mm^2, otherwise too dangerous to descend.
- (R x T) max. 55 000 mm^2, otherwise too tiring to ascend.

Staircases in general 170mm risers (on brick scale) and 275mm tread.

From (2R+T = 610 to 640) applied gives 340mm + 275= 615mm

3.2.9.3 Disabled People

Access for Disabled People shall be provided in accordance with SABS 0400 Part S

3.2.10 Utilities

3.2.10.1 Drainage and sewage

3.2.10.1.1 General

Drainage systems outside the area of 1 m from the outside of the buildings, shall comply with SABS 0400 and local authority regulations/standards. Within 1 m of the outside of the building, the following is applicable:

- A complete drainage system including floor drains and sewage piping from sanitary fitments shall be provided. The design shall be adequate to cover future extensions of various buildings.
- Drainage lines shall be designed to provide self-cleansing velocities and easy access for clearing of obstructions. Such access points within buildings shall have screwed or bolted air-tight covers. Interconnecting pits outside the buildings shall be provided with cast-iron removable covers.
- In areas likely to be affected by frost, the external drain lines shall be laid at frost-free level.
- Suitable intercepting chambers and vents shall be provided where required, to prevent foul liquids or gases from flowing back into the buildings. Special attention shall be paid to having these vents at a suitable distance from air-conditioning inlet openings.
- Particular attention should be paid to the provision of seals to prevent any possible ingress of process gas or hydrocarbon liquids.
- A grease trap shall be provided for the waste water from the canteen building and mess room. The grease traps shall be located such that the temperature does not exceed 37°C, as this will inhibit the grease dispersing agent.
- Basements shall be provided with an emergency drain pit.
- Rainwater downpipes and other drainpipes shall not pass through electrical equipment rooms or basements.
- Designs shall be such that leaking taps or water spillages from the ablution areas cannot drain along passage ways and onto electrical or control equipment. Ablutions shall therefore have low drainage points in the floor that can drain water spillages directly into the nearest sewer down pipe.

3.2.10.1.2 Connection to oil-contaminated drainage system

The oil-contaminated water drain from laboratories, analyser buildings and similar buildings shall be connected to the continuous oil-contaminated drainage system of the process plant, through suitable water seals, keeping these drainage lines always flooded. The water table shall be at least 50 mm above the inside top of the highest part of the drain line.

If the laboratory is too far away from the above drainage system, an underground oil collecting tank shall be installed, to be emptied by a vacuum truck.

3.2.10.1.3 Connection to existing third-party sewage system

If a sewage system belonging to a local authority exists in the neighbourhood, the building sewage may, after the necessary permission has been procured, be connected to this existing system. The drainage design shall then be completely governed by the stipulations made by the local authority concerned.

3.2.10.1.4 New sewage disposal system

If there is no possibility of discharging into an existing system, a new disposal system shall be designed. Sewage and waste water shall be jointly or separately treated in effective septic tanks or other treating plants according to the specifications or local practice.

3.2.10.1.5 Materials

Materials shall be selected and laid in such a manner that underground pipes or fittings, traps, pits, etc., shall not give rise to leakage, particularly after settlement of the overburden or surrounding soil, or from any other cause. All drain pipes shall be resistant to corrosion, erosion, and the action of acids, detergents, hot water or other wastes to be drained.

In areas with high solar exposure, ultraviolet resistant materials shall be used.

3.2.10.1.6 Testing

Prior to any back-filling, all underground drain pipes and pits shall be water-tested in accordance with relevant SANS 1200 Specifications.

3.2.11 Water supply and related plumbing

3.2.11.1 Minimum flow rates

Fitment	Flow rate (L/min)	
	Cold water	Hot water (minimum 60 °C)
Lavatory hand basins (WB)	10	7
Wash troughs (WT), per tap	10	7
Sinks (S)	15	20
Showers/sprays (SW)	7	7

3.2.11.2 Piping systems

A complete cold water piping system shall be designed for all buildings.

The type of water to be used for the different services shall be as specified in the project specification.

Facilities for supply of hot water shall be designed for wash rooms, mess rooms, kitchen, pantry, and first-aid facilities. Additional designs for installation of cold and hot water supply shall be made as indicated in the project specificationIn very dry areas a permanent underground garden water piping system shall be installed in the administration area. The use of treated effluent water should be considered.

Piping materials shall be HD Copper; PVC or polyethylene; min. 25mm diameter up to 50 mm before fitting, for hot and cold water**.** HVAC top-up water may use smaller diameters, but not smaller than 15mm.

Piping and fittings shall be such that back-syphoning is excluded. The entire piping system shall be capable of being drained at low points conveniently located. Dismantling points shall be provided at easily accessible locations. All pipes shall be firmly fixed to the building.

Supply lines to fitments shall be provided with ball type (where possible) stop valves and unions so that any fitment can be isolated and replaced.

All pipes and fittings shall be hydrostatically tested after installation at 1,5 times the system pressure.

3.2.11.3 Toilets

The accommodation for male and female personnel shall be kept separate. The minimum number of fitments shall be as follows:

- For offices, laboratories, training centres, canteens, etc., see table below.

Fitment	Male Personnel	Female Personnel
WC Pans (W)	1 - for 1 - 15 persons	1 - for 1 - 12 persons
	2 - for 16 - 40 persons	2 - for 13 - 25 persons
	3 - for 41 - 70 persons	3 - for 26 - 40 persons
	4 - for 71 - 100 persons	4 - for 71 - 100 persons

Fitment	Male Personnel	Female Personnel
Urinals (U)	Nil for up to 2 persons	
	1 - for 3 - 10 persons	
	2 - for 11 - 20 persons	
	3 - for 21 - 40 persons	
	4 - for 41 - 100 persons	

Fitment	**Male Personnel**	**Female Personnel**
Wash Basins (WB)	1 - for 1 - 20 persons	1 - for 1 - 15 persons
	2 - for 21 - 40 persons	2 - for 16 - 30 persons
	3 - for 41 - 60 persons	3 - for 31 - 45 persons
	4 - for 61 - 80 etc.	4 - for 46 - 60 etc.

- For processing plants, 1 WC and 1 Wash Basin shall be provided for every 10 persons on day shift. In addition, 1 Urinal shall be provided for every 10 men.
- Toilets for Disabled persons shall be provided in accordance with SABS 0400 – Part S and details as per Contract Specifications.

3.2.11.4 Washrooms/locker rooms

In non-processing sections of a plant (i.e. washrooms in workshops and fire stations etc.), showers shall be provided at the rate of one per 20 personsIn processing plants, for every 5 operators in day shift one shower shall be installed and 1200 mm length of water trough with two taps. In dirty plants for every 3 operators in day shift one shower shall be installed and 800 mm length of water trough with one tap.

For female personnel the same numbers shall be used.

3.2.11.5 Battery rooms

Each battery room except those with sealed batteries shall be provided with an eye-wash basin, a sink and a floor drain. See Eskom standard 'Design Guide for Battery Rooms'.

3.2.11.6 Equipment rooms

Rooms within the buildings where equipment will be installed (e.g. compressors, engines etc. for air-conditioning, heating or other purposes), shall be provided with a tap, hose connection and a floor drain.

3.2.11.7 Cleaners' cupboards

A Cleaner's store shall be provided for every floor (also applicable to every Unit individually). Each cupboard shall be provided with a bucket sink, a hose connection, a floor drain, racks for brooms and other cleaning/polishing equipment such as vacuum cleaners, and shelves for small material.

3.2.11.8 Fitments

All fitments of the same kind shall be of one uniform make and type.

(i) **Pedestal-type WC suite**

This type WC shall consist of white-glazed vitreous china closet with 'S' or 'P' trap, seat lugs, solid plastic seat with seat cover, hinges, buffers and necessary flushing facilities. Flushing facilities shall be capable of delivering a minimum of eight litres of water per flush, in not more than six seconds. A flushmaster valve to be used for all toilets.

(ii) **Squatting-type WC**

This, where required by local custom, shall consist of white vitreous fire-clay or stainless steel wash down closet, with 'S' or 'P' trap, vertical inlet, flushing rim, integral foot treads, and necessary flushing facilities of the same capacity as in (i). A pair of hand shall be provided. An extra water tap shall be installed at a convenient location.

(iii) **Urinal**

This shall consist of a stainless steel or white-glazed vitreous china wall-type bowl urinal with flushing rim, complete with flushing facilities and trap. Flushing facilities shall be capable of discharging five litres of water per flush per urinal. For multiple units of urinals automatic flushing facilities may be provided, maintaining the above capacity**Hand-Wash Basins and Foot-Wash Basins**

Material shall be white-glazed vitreous china or stainless steel. Minimum dimensions shall be 500 x 400 mm. Basins shall be provided with chromium-plated, easy-clean, screw-down type pillar taps or, if hot water is also provided, mixing valves shall be installed. Waste water shall be led through a seal trap (re-seal traps in the case of ranges of WB's) to the waste water system.

Centrally above each wash basin supply and fix with 4 off chrome plated dome capped screws a 6 mm thick mirror with all round polished edges (minimum size 600 x 450 mm).

Fix mirror with top at 1800mm above finished floor level. Control rooms, subject to ECP 200-49532 (Ergonomic Study) have different requirements for mirrors.

(iv) **Sinks**

Material shall be vitreous white-glazed fire-clay, or, if with draining boards, stainless steel. For cold water, chromium-plated bib taps shall be installed. Where hot water facilities are provided, a chromium-plated mixing valve with swivel spout shall be installed. Waste water fittings shall be as in (iv). The sink in the cleaners' cupboard shall be provided with a chromium-plated bucket grating with hinges. Taps shall be installed at such a height as to facilitate easy filling of buckets.

(v) **Wash troughs**

These shall be made of stainless steel and shall be provided with chromium-plated mixing valves at 600 mm centres. Mirrors shall be provided, one set for every two mixing valves. Waste water fittings shall be as in (iv).

(vi) **Showers**

Showers shall be provided with a seal trap connected to the waste water drainage system. The vandal resistant type shower rose shall be connected to a hot and cold water mixing valve. Each shower shall be provided with a seat.

(vii) **Emergency showers and eye-wash**

Emergency showers and eye-wash shall be provided in laboratories (see Eskom standard spec.) and in other areas where people can come into contact with dangerous products (see Eskom standard spec.). For connection of these showers, the instructions of the manufacturer shall be followed.

NOTE: The cold feed to emergency showers and eye washes shall not be subject to unacceptable heat gains.

(viii) **Drinking water coolers**

Provisions shall be made for future installation of water coolers at locations indicated in the Project Specification. These shall consist of installation of water supply, drain and electrical connections, all suitably plugged off.

(ix) **Vending machines**

Provisions for the connection of vending machines for coffee, tea, cocoa, cool drinks, cigarettes, chocolate, etc. shall be provided at convenient places in the buildings when specified.

3.2.12 HVAC Systems

3.2.12.1 General/Architectural impact

All equipment is to be arranged as far as is practically possible to minimize visual impact and provide good aesthetic design. This is coordinated with the architectural finishing standards prevailing in each building.

3.2.12.2 Objectives

The systems will be designed to achieve the following:

- To control environmental conditions within buildings for the comfort of operating and maintenance personnel
- To control environmental conditions in buildings within limits for proper operation and protection of equipment and systems. The HVAC equipment selected shall be suitable for air dehumidification and filtration to the required standard.
- To air pressurise the buildings to prevent the ingress of untreated air
- To provide air pressurisation for smoke control in protected personnel escape routes
- To remove hazardous gases and fumes
- To remove internal and external waste heat loads.
- To supply fresh air and maintain the minimum number of air changes per hour.
- To control the spread of fire, hot gases and smoke
- To provide appropriate filtration in switchgear and control rooms, offices and all other rooms with equipment that is sensitive to dust particles.

3.2.12.3 The HVAC systems scope

- All AHU's, fans, motors, filters, cooling coils, humidifiers and ventilation devices required to move air within the system.
- All air conditioning units including chillers (where applicable), condensing units, fans and motors for operation.
- All ductwork including dampers, fire dampers, heaters attachments and connections;
- Grills in fanlight openings above doors and openings for door grilles through brickwork etc.
- Process controls and instrumentation associated with HVAC plant
- Control panels, switchboards and associated electrical equipment.
- Interlocks with the fire detection system.
- Smoke extract systems.
- Cable tunnel ventilation.

- Plant codification and labelling.
- Quality assurance.
- Documentation and operating and maintenance manuals.
- Testing and commissioning.
- All other associated items of plant and equipment necessary for the complete works.
- Ventilation of substations and other external plant.

3.2.12.4 Design Data

3.2.12.4.1 Outdoor Conditions

Summer 36°C DB 20°C WB

Winter 4°C DB

3.2.12.4.2 Indoor Conditions

Computer rooms, control rooms, equipment rooms

22^{O}C DB $\pm$ 2^{O}C summer/ winter

45% RH + 10%

Filtration - two stages of filtration, filtration level 85% dust spot efficiency (Ashrae)

Attenuation - Yes

Fresh air - min. 20%, maximum 100%

Smoke extraction - Yes

Smoke detection - Yes

Battery and DC Rooms

Maximum 25^{O}C humidity- not controlled, minimum temperature-not controlled

100% fresh air supply (no recirculation)

Extraction system with ExN equipment.

Smoke extraction - No

Hydrogen detection and alarm

LV and MV Switchgear rooms and other electrical equipment rooms

Maximum 30°C humidity - not controlled, minimum temperature-not controlled filtration - two stages of filtration, filtration level 85% dust spot efficiency (ASHRAE)

100% fresh air supply (no recirculation)

Smoke extraction - Yes

Smoke detection - Yes

Turbine House ventilation

To limit temperature at operating level to 40°C max. humidity - not controlled, minimum temperature-not controlled

Filtration- not required

Smoke extraction - Yes

Smoke detection - Yes

Boiler House ventilation assumed to be self ventilated.

Temperature in the accessible areas shall not exceed WBGT (wet bulb globe temperature) required for the duration of maintenance activity during plant operation.

Smoke extraction - No

Smoke detection - Yes

Offices, workshops laboratories, etc.

22°C DB + 2°C summer/winter

45% RH + 10%

Humidity control - only in winter

Filtration - two stages of filtration, filtration level 85% dust spot efficiency (Ashrae)

Attenuation - Yes

Smoke extraction (only within auxiliary bay, not in other buildings)

Smoke detection – Yes

3.2.12.4.3 Sound level

Sound created by air-conditioning and ventilation equipment shall not exceed in general the background sound level.

For offices and control rooms 35 dB on NC scale is required.

3.2.12.4.4 Heating

Heating is required in permanently occupied areas.

Buildings and areas with HVAC systems

	Buildings/areas with HVAC Systems	Filtration	Fresh air as % of supply	Refrige-rated Cooling	Heating	Noise Attenua-tion NC	Humidi-fication	Smoke Ventila-tion	Opera-tion hr/day	Gas Extraction
1.	**TURBINE HALL**		100%	none	none	none	none	X	24	Incl.
1.1.	Ancillary areas in the Turbine Hall	2 stages	20%	X	none	none	none	none	24	none
2.	**BOILER HOUSE**	none	none	none	none	none	none	none	none	none
3.	**AUXILARY BAY**									
3.1	Central control room and associated offices	2 stages-	20%-100%	X	X	35	X	X	24	none
3.2	C&I equipment room	2 stages	20%-100%	x	x	35	X	x	24	none
3.3	Electronic parts storage room(s) and instrument repair rooms	2 stages	20%-100%	x	x	40	X	x	24	none
3.4	Power Control Centres (LV, MV)	2 stages	20%-100%	X	none	40	none	X	24	none
3.5	Administrative offices, or mess room	2 stages	20%-	X	X	35	X	X	10	none

			100%							
3.6	Diesel Generator room	none	100%	none	none	none	none	none	24	none
3.7	Battery & DC rooms	2 stages	100%	X	none	40	none	none	24	x
	Ablution block	none	100%	none	none	40	none	none	24	none
4.	**MISCELLANEOUS BUILDINGS**									none
4.1	Offices	1 stage	10%	x	x	35	none	none	10	none
4.2	Auditorium	2 stage	20%-100%	x	x	35	x	x	On demand	none
4.3	Canteens and kitchen	1 stage	100%			40			10	X
4.4	Chemical laboratories	2 stages	20-100%	x	x	35	x	none	10	none
4.5	Locker rooms and Toilet area	1 stage	100%	none	none	40	none	none	10	none
4.6	Substations	2 stages	100%	X	none	50	none	X	24	none
4.7	Battery rooms	1stage	100%	none	none	50	none	none	24	X
4.8	Pump houses and Compressor rooms	none	100%	none	none	50	none	none	24	none
4.9	Cable tunnels	none	100%	none	none	50	none	X	24	none
5.0	**STORES**	none	100%	none	none	50	none	none	24	none
5.1	Mechanical Workshops	1 stage	100%	x	x	40	none	none	10	none

Note: **Filtration efficiencies (ASHRAE standard)**

- Where two stages of filtration is specified – it require a primary filter of 92% average gravimetric efficiency and
  secondary filtration of 85% dust spot efficiency
- Where one stage of filtration is specified it requires average gravimetric efficiency of 92%

3.2.12.5 Electrical installation

All HVAC electrical installation to fully comply with LV standards approved for Alpha project/ Medupi. The emergency ventilation shall be supplied via emergency supply line. The system which requires 100% standby shall be supplied from two independent switchboards.

3.2.12.6 Environmental Protection

The standard of equipment is to be as generally used in the applicable HVAC industry, particularly as regards filtration of mechanically supplied air as appropriate in all forced ventilation plants. Control/electronic equipment rooms are to be supplied with filtered air at a rate, which exceeds any applicable extract rate, in order to discourage ingress of dust and hazardous gas. Where filtration is required the filters shall be easily accessible and also have a delta-P indicator to monitor condition of filter. In accordance with the implications of the United Nations Environmental Program 1987 Montreal Protocol, the refrigerant used in the comfort cooling and air conditioning systems is to be R22 or R134a. No refrigerant mixtures will be used.

3.2.12.7 Maintenance

The design is to be based on the use of well-proven components and of materials consistent with modern industrial HVAC practice. Wherever practically possible, corresponding components of different units are to be interchangeable.

Components of systems used shall be readily available in South Africa.

The equipment is to employ standard components and permit ready access in order to minimize the time taken for repair and maintenance.

The Contractors attention is drawn to the exposed industrial marine environment to which the equipment will be exposed and corrosion protection requirements of Section 4.6.

3.2.12.8 Redundancy

Redundancy of HVAC system depends on operating requirement. If continuous operation of the plant 24 hr/day is needed, the HVAC system will be 100% redundant or as the employer may decide differently.

REVISIONS	date	By
Notes and questions added	28–01-08	TCS
Notes and corrections added	08-02-08	WMS
Notes and corrections added	13-08-09	WMS

3.2.12.9 Summary Schedule for Revisions

Revision No	Date	Remarks
P3	28-01-08	Notes and questions added
P4	08-02-08	Notes and questions added
P5	27-05-2014	Page 2 clause 2.1 Remove translucent sheeting Page 3. Last paragraph. Description for roof sheeting changed and paint specification added. Page 3. Roof slope to boiler, house and turbine roof altered. Page 4. Fourth paragraph. Description for cladding changed and paint specification added. Page 4. Profile of translucent sheets changed to IBR 890. Page 4 Clause 2.1 First paragraph added. Page 5 Clause 2.1 Paragraph for "General roofs don't need …." Altered.

		Paragraph for "Roof gutters ……" altered. Paragraph for "Exposed down pipes …." Altered. Page 5. Colour Schedule changed. Page 9. Roof slope to boiler, house and turbine roof altered. Page 9. Paragraph 3.2.2.3 altered. Page 9 Clause 3.1.1 Design code SABS 0400-1990 added. Page 11 Clause 3.2.3.1 Paragraph for "The finished floor …." Altered. Page 11. Building list updated. Page 12. Building list updated. Page 14.Paragraph 3.2.5.2 altered Page 17 Clause 3.2.6.1 First paragraph. Add "Read in conjunction with building door schedule." Page 17 Paragraph 7. "Steel doors and frames shall …." omitted. Page 17 Paragraph 10. "All main entrances ….." altered. Page 17 Paragraph 11. "Where visibility is required …… glazing. not exceeding 1.0m^2 per door omitted. Page 17 Paragraph 14. "Weather seals …..doors. Last sentence omitted. Page 17 Paragraph 15. "Built in overhead hydraulic …. Altered. Page 18 Paragraph "The Tracks shall be easily cleanable. Use bottom track and wheels. Omitted. Page 18 General principles first bullet omitted. Page 18 Bullet 4 Altered. Page 20 Clause 3.2.6.3 bullet 3 altered. Page 20 Clause 3.2.6.4 Paragraph for "All fittings ….." altered. The next paragraph omitted. Page 20 Clause 3.2.6.4 bullet 3 altered. The single door replaced with emergency exit .... Second sentence ..... or biometric device added. Page 20 Clause 3.2.6.4 bullet 4 "Both leaves of the ….. inside" omitted. Page 21 Clause 3.2.7.1 first bullet "Windows, including ….. steel" added or epoxy coated … schedules". Page 21 Bullet 6 "External window sills …." altered Page 21 Bullet 7 "All exterior windows ….." omitted. Page 21 Clause 3.2.7.2 First bullet …. Double glazing … added.

		Page 22 Clause 3.2.7.2 bullet 3 paragraph "Windows shall be designed …" omitted. Page 22 Clause 3.2.7.3.1 bullet 5 "Each unit …… metal cover". Omitted Page 23 Clause 3.2.7.3.2 Add reference to window schedule. Page 23 Clause 3.2.7.4 Paragraph "Normal glass ….." altered. Page 23 Remove clause 3.2.7.5 Page 24 Clause 3.2.9.1 Paragraphs for "All doors …." And "Handrails shall be …." Altered. Page 25 Clause 3.2.9.2 Dimension 1250mm changed to 1100 mm Page 25 Clause 3.2.10.1.1 Paragraph "Basements shall…..drain pit" altered. Page 26 Clause 3.2.10.1.1 Paragraph "All sewer lines …." The first two sentences are omitted. Page 27 Clause 3.2.10.1.4 Paragraph "Rainwater down pipes …. " omitted Page 27 Clause 3.2.11.8 Paragraph (vii) altered. Page 33. Description of boiler house ventilation rectified. Page 36 Clause 3.2.12.8 Add to the first paragraph "……" or as the employer may decide differently"