C3: SCOPE OF WORKS

C3.1: DESCRIPTION OF THE WORKS

C3.1.1 EMPLOYER'S OBJECTIVES

The Employer's objective is to build structural infrastructure ("support structures") in the form of ground-mounted masts and building-mounted brackets on the Alpha Apron of CTIA (airside). The completion of such infrastructure will facilitate the subsequent installation and completion of ACSA's Advanced Visual Docking Guidance System (AVDGS) system by a separate OEM Contractor. It is intended that the Separate AVDGS OEM contractor will be on site, working in parallel, for the duration of this contract. Handover of infrastructure will thus require to be achieved in a phased manner.

C3.1.2 OVERVIEW OF THE WORKS

This contract comprises, inter alia, the following work:

- The establishment on site of facilities for the Contractor and the provision of the necessary plant, personnel, and equipment.
- Measuring on site to confirm dimensions for the proposed infrastructure, and for setting out of infrastructure.
- Scanning of the ground for services in proposed routes for trenching for new electrical sleeves.
- Scanning of reinforced concrete in preparation for installing chemical anchors
- Off-site construction of pre-cast concrete foundations.
- Off-site fabrication of structural steel masts and brackets.
- Delivery to site and placement of pre-cast concrete bases on predetermined set-out points.
- Delivery to site and erection of structural steel masts and brackets on predetermined set-out points.
- Grouting up under concrete bases and steel base plates.
- The re-installation of existing bracket chemical anchors.
- Localized hand excavation for standard barrier/bollard concrete footings.
- Installation of standard barriers/bollards.
- Relocation of CCTV cameras (ACSA nominated subcontractor), including temporary relocation.
- Decommissioning and removal to storage of existing 15 No. ADS units (ACSA nominated subcontractor). The Contractor shall decommission the existing ADS units, remove, and place in storage. The Contractor shall store the existing ADS units in a container. The container shall be provided by the contractor. The existing ADS units shall be kept in storage for the duration of the contract. If the units have not been collected by ACSA Local maintenance by the end of the contract, these units shall be disposed of. A disposal certificate shall be provided by the Contractor. Electrical isolation is by others (ACSA).
- Removal of the existing bay indicator board/s and reinstall.
- Removal of existing steel brackets/masts.
- Electrical works at Alpha 3 & Alpha 4, primarily extending power supply from the existing point to the new mast via new conduit and buried (new trenching – hand excavation) sleeves.
- Design, supply, installation, and handover of structural steel marshalling stairs. Design, site monitoring, and signoff of marshalling stairs are to be by professional structural engineer directly appointed by the contractor.
- The removal of plant, equipment and site establishment and final tidying up of the site on completion of the works,
- The making good of defects in the works as required in terms of Clause 7.8.1. of the General Conditions of Contract for Construction Works (Third Edition) 2015 for period of 12 months from the date of issue of the Certificate of Completion.

(a) Changes to Scope of Work

It is a condition of this contract that the employer reserves the right to limit the total expenditure on the Works due to possible budget constraints. Should the tender sum exceed the budgeted amount, the scope of the works may be reduced at any time before or during the contract period to ensure that the final contract amount does not exceed the budgeted amount.

C3.1.3 LOCATION OF THE WORKS

The site of the Works is situated at the Alpha Apron on the Airside of CAPE TOWN INTERNATIONAL AIRPORT in Western Cape. The site is under the jurisdiction of the Airports Company South Africa (ACSA). The most likely location of the site is shown on the construction drawings. The contractor's site camp will be situated within ACSA's premises and shall be indicated at the tender clarification meeting.

C3.1.4 TEMPORARY WORKS

The Contractor shall obtain written permission from the Engineer before construction of any temporary works may commence. Temporary works will include the following:

(a) Placing and removal of barricades where required.

(b) All facilities within the Contractor's construction camp. The design shall compile with the specifications where provided in these documents and all statutory requirements such as the Occupational Health and Safety Act and Regulations. The area is to be reinstated upon completion.

C3.2: ENGINEERING

C3.2.1 DESIGN SERVICES AND ACTIVITY MATRIX

The responsibilities for design and related documentation are as follows:

DESCRIPTION	RESPONSIBILITY
Detailed design for construction	Engineer's Representative
Temporary works (Section C3.1.4):	Contractor
As-built drawings: Provision of data and marked up drawings Preparation of drawings	 Contractor Engineer's representative

C3.2.2 EMPLOYER'S DESIGN

The extent of the Employer's design is shown on the construction drawings.

C3.2.3 CONTRACTOR'S DESIGN BRIEF

The design brief for Temporary Works is provided in Section C3.1.4.

C3.2.4 DRAWINGS

Drawings required for Temporary Works are to be designed and drawn by the Contractor.

The reduced drawings that form part of the tender documents shall be used for tender purposes only. The Contractor will be issued with an A0 paper copy and PDF file of each of the drawings required for construction. The Contractor shall, at his own expense, produce all further prints required for the construction of the Works.

The Contractor shall not use the drawings for any purpose other than the execution of the works.

Only figured dimensions on the drawings shall be used, and drawings shall not be scaled. The Engineer shall supply any figured dimensions which have been omitted from the drawings.

The Engineer may issue additional drawings as necessary to the Contractor from time to time during the progress of the works. The Contractor shall timeously notify the Engineer of the priority in which drawings and details are required.

Before a Certificate of Completion will be issued, all as-built data must be provided to the Engineer on completion of the Permanent Works. The data must be provided in electronic form (as per the Engineer's format) or where appropriate marked up on a set of drawings. Any information in the possession of the Contractor necessary for the Resident Engineer to complete his as-built drawings shall be supplied to the Resident Engineer on a regular basis and all information must be delivered before a Certificate of Completion will be issued.

The drawings as found in C5.1 Annexure C form part of the tender documents and shall be used for tender purposes only.

C3.2.5 DESIGN PROCEDURES

No design procedures are specified.

C3.2.6 CONSTRUCTION IN CONFINED AREAS

Working space for some of the work to be carried out under this contract is restricted. The construction method used in these confined areas largely depends on the Contractor's plant. However, the Contractor must note that measurement and payment will be according to the specified cross-sections and dimensions irrespective of the method used, and that the rates and prices tendered will be deemed to include full compensation for difficulties encountered, while working in confined areas.

C3.3: PROCUREMENT

C3.3.1 PREFERENTIAL PROCUREMENT PROCEDURES

The Works shall be executed in accordance with the requirements specified in Section T1.2, Tender Data and submitted by the Contractor in his Returnable Schedules.

C3.3.2 SUBCONTRACTING

(a) Scope of Mandatory Subcontract Works

The sub-contractors specified by ACSA as follows, shall be appointed by the awarded contractor of this tender:

- CCTV:

  Vendor Name: [*T.B.C.*]

  Contact Person: [*T.B.C.*]

  Contact Number: [*T.B.C.*]

- Cabling (for CCTV):

  Vendor Name: [*T.B.C.*]

  Contact Person: [*T.B.C.*]

  Contact Number: [*T.B.C.*]

- Decommissioning and removal of Existing ADS Units:

  Vendor Name: [*T.B.C.*]

  Contact Person: [*T.B.C.*]

  Contact Number: [*T.B.C.*]

(b) Preferred Subcontractors

The subcontractors must meet the requirements as laid out in the terms of this document.

(c) Subcontracting Procedures

The sub-contracted works shall be subcontracted to contractors with relevant letters of good standing.

(d) Attendance on Subcontractors

The Contractor shall provide any necessary facilities in order to manage the specialist subcontractors to ensure that the works are carried out in accordance with:

- The programme of works, and
- The contract requirements, and
- In the Project requirements concerning access to and from the airport facilities at the beginning and end of working shifts. He shall also ensure that the subcontractor complies with the requirements of the Safety Plan, Environmental Management Plan and Operational procedure requirements.

C3.4: CONSTRUCTION

C3.4.1 GENERAL DESCRIPTION OF WORKS

This contract covers all work associated with the provision of structural supports ("masts" and "brackets") at the Alpha Apron of ACSA Cape Town International Airport, to enable subsequent mounting of AVDGS units and bay signage (by others).

C3.4.2 DESCRIPTION OF SITE AND ACCESS

The area over which the Works are to be constructed lies within the Airport Precinct of Cape Town International Airport, specifically the Airside Zone.

Access to the site is from the Airport Approach Road off the N2 freeway. A locality sketch is bound into the back of this volume.

For entry into the Airside zone, each person shall have and must be in possession of an ACSA-issued access permit. Individuals requiring access permits must undergo and pass ACSA's Airside Induction Training (AIT). Furthermore, persons operating vehicles and plant on the airside must be in possession of a vehicle permit for that specific vehicle and have undergone and passed additional Airside Vehicle Operators Permit (AVOP) training. Persons related to the contract wishing to enter the airside, who do not have an Access Permit, will be refused entry. Furthermore, persons related to the contract wishing to enter the airside with a vehicle, who do not have a Vehicle Permit, will be refused entry. All personnel entering airside are required to pass through metal detectors and are liable to be searched, and delays, particularly at peak periods, must be anticipated. The costs of any such delays are deemed to be included in the tender prices.

Contractors shall make their own arrangements regarding the necessary training, permits and/or photo passes and all other requirements pertaining to access through the various check points. Tender prices shall be deemed to cover all costs involved in complying with the requirements for entry to the site. It should be noted that commencement of the works and site access cannot proceed until the training and permit application process for the contractor's personnel is completed.

Before the contractor may begin works on Airside, the below items shall be in order:

(a) ACSA required permits for all the contractors' staff.
(b) An approved Airside Safety Plan document, compiled by the contractor.
(c) An approved OHS File.

It is estimated that the time required for this process would be approximately 40 working days.

C3.4.3 CONSTRUCTION PROGRAMME

Within two weeks of the acceptance of his tender, the Contractor shall provide a detailed programme giving labour and plant resources and an estimated cash flow related to the cost and duration of the various items of work. The critical path shall be clearly defined and the programme shall be drawn up in sufficient detail so that possible interface problems with the Employer's operations and those of other contractors may be identified and avoided as far as possible.

The construction of the structural supports at Alpha Apron and associated infrastructure works shall be completed within **120 working days** of the **commencement** date. Permits, approved OHS file and Airside Safety file is required before the bidder will be granted access to site. **The**

estimated time to complete these mandatory documents is 40 days, refer to Section C3.4.2. The estimated Construction Start is end March 2024. If this activity is not completed by the due date, the penalties set out in SCC 1.10 shall be applied until such time as the activity is completed.

Installation of masts and brackets will proceed concurrently with the separate AVDGS OEM Contractor's installation works. Apron stands are required to be handed over in a sequential manner on completion to allow the AVDGS OEM contractor to proceed with Unit installation on the masts/brackets. It is envisioned that the Alpha Support Structures contractor (this contract) may have two teams working in parallel at any one time to achieve the required completion date.

The Airside of CTIA is a live environment and disruption to other activities must be limited. The service road must remain open during construction and only a partial closure (one lane, with provision of adequate traffic control measures) may be tolerated. Any full closure must be sequence for "after hours" work. When aircraft are docking in an apron stand, work must pause until the plane is safely docked. It is anticipated that such delays could be in increments of 15 minutes, up to an average total of 2 hours per bay, per day. The Bill of Quantities allows for such delay to be priced and claimed for. ACSA's docking schedule will be made available in advance and will serve as a record of the number of flights that actually docked in a bay, per day. Unobstructed access to the marshalling stairs for ACSA's marshals must be permitted during aircraft docking procedures.

The works at Alpha 9, 10, 11, & 12, are located on the apron stand itself. The portion of the red-&-white Equipment Restraint Area / safety-distance exclusion line that runs parallel to the service road may be temporarily moved for the duration of the works, up to 10m away from the current position, to allow work to be conducted.

Work at Alpha 9, 10, 11, & 12, is viewed as potentially more disruptive due to proximity. As such, construction shall be sequenced to spread out these bays, such that work at these bays is paired with works taking place on a minimally disrupted bay. Works at these bays must be programmed to be spread across the duration of the works, and not concentrated over one time period.

The works at Alpha 3 & Alpha 4 (international docking bays) must be programmed as late as possible in the programme, to ensure the contractor is well conversant with the works by the time these bays are worked on.

The Tenderer shall enter the Time for Completion against Clause 45(1) in the Appendix to Tender.

Progress shall be monitored against the agreed programme. If construction does not in fact take place in accordance therewith a separate "catch-up" programme shall be provided showing how the lost time will be made up.

C3.4.4 FEATURES REQUIRING SPECIAL ATTENTION

Existing Services and Excavation

A number of services are known to exist over the whole area of the Works, therefore all excavations on site shall be excavated by hand only. Prior to commencing work in any area the Contractor shall consult with the Engineer for existing services drawings and shall locate the exact positions and depths of such services in the area. Should any additional services be discovered, they shall be recorded and plotted by the Contractor on a signed sketch which shall be submitted to the Engineer. The Contractor shall assist, when required, in the alterations to such services by providing labour, plant and material and shall carry out the necessary work as

instructed by the Engineer. Any necessary alterations to services will be paid for on a daywork basis.

The above operations shall be continuous and at least two weeks ahead of construction in order to allow time for the necessary alteration to services or amendments to the design of the works.

Claims for extension of time or for damages in this connection will NOT be entertained if the operation of locating services is less than two weeks ahead of construction.

Responsibility for protection of all known services shall rest solely with the Contractor and he shall bear all costs which may arise as a result of any damage which he may cause to such services or which may arise as a result of his operations.

Notwithstanding the provisions of various payment clauses in the Earthworks sections of SANS 0, no additional payment will be made for work in the vicinity of existing services as the unit rates tendered shall be deemed to cover any such additional costs as may be involved.

DUE TO THE PRESENCE OF NUMEROUS SERVICES, ALL EXCAVATION WITHIN THE EXISTING SITE SHALL BE CARRIED OUT BY HAND, EXCEPT WHERE PROVING TRENCHES AROUND THE PROPOSED EXCAVATION HAVE SHOWN THAT THERE ARE NO SERVICES IN THIS AREA. THE COST OF EXCAVATION OF PROVING TRENCHES SHALL BE INCLUDED IN THE RATES TENDERED.

In the event of water being encountered in excavations, the Contractor shall, to the approval of the Engineer, make arrangements to lower the water table locally or to dewater, if required, and all costs in connection herewith shall be borne by the Contractor.

Safety

The site is a hazardous area and therefore all statutory regulations, as well as those of the Employer, regarding hot-work, smoking and the use of naked flames in these areas shall apply; the Contractor's personnel shall be subject to all safety procedures and regulations as laid down by the Employer.

The work permit system as detailed in the Annexure to the Special Conditions of Contract shall be rigidly enforced for the execution of this contract. Hot-Work may be stopped periodically due to the transfer of flammable products. If noxious or flammable vapours are present, personnel may be asked to leave the site until safe conditions prevail again.

The Contractor shall be responsible for ensuring the satisfactory and safe condition of all power tools and power equipment. All electrically powered equipment shall be intrinsically safe. The use of electrically powered equipment shall be subject to the prior approval of the Employer. Petrol driven equipment shall not be used inside the depot.

Safety Requirements

These are referred to in C1.2.2, the Special Conditions of Contract. In the event of a fire at the site of the works, the Contractor shall provide a first response to minor fires, inform ACSA Fire & Rescue personnel of the fire and shall then vacate the site immediately. He shall not be responsible for fighting fires within the site.

The Contractor shall provide fire extinguishers which shall be placed in positions readily accessible from areas where hot work is being carried out.

Furthermore, attention is drawing to the following important health and safety related documents:

- Annexure A – Health and Safety Specifications
- Annexure D – Volume 5, ACSA CTIA Manual of Procedures for Working Airside

Security Requirements

In addition to the security requirements contained in C1.2.2, the Special Conditions of Contract, the following shall apply:

All Contractor personnel shall at all times wear their security ID card and a hard hat bearing their employer's name or colour code so as to be easily identifiable as being employed by the particular company concerned.

Furthermore, attention is drawing to the following important Security related documents:

- Annexure D – Volume 5, ACSA CTIA Manual of Procedures for Working Airside

Other Activities on Site

The Employer's normal operations (live airside environment) and maintenance will continue on the site during the currency of this contract. In addition, other contractors will be undertaking other works concurrently. It is possible, therefore, that the site may become congested at times, and careful co-ordination is thus essential in order to minimise disruptions to all parties. In the event of two Contractors wishing to work in the same area simultaneously the Engineer shall decide priorities based on the relevant information available at the time.

Occupational Health and Safety Act (Act 85 of 1993)

All Occupational Health and Safety Act Regulations pertaining to the work being carried out must be adhered to. The Contractor's employees and Sub-Contractors (including their employees) shall at all times be supervised by a competent Supervisor appointed in writing in terms of the regulations of the Occupational Health and Safety Act and made aware of his responsibilities. The Engineer reserves the right to judge the competence of the appointed Supervisor for the task being performed before and during the progress of the work.

The Contractor shall, when called upon to do so, enter into and execute an Agreement with the Employer as provided for under Section 37(2) of the Occupational Health and Safety Act (1993). The Agreement shall be in the form of the proforma included elsewhere in this document.

C3.4.5 APPLICABLE STANDARDISED AND PARTICULAR SPECIFICATIONS

Although not bound in nor issued with this document, the latest versions of the following standardised specifications shall form part of the contract document and, not withstanding the provisions of Subclause 2.2 of SANS 1200 A, editions specified below shall apply:

SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles Specifications and test methods
SANS 282	ending dimensions and scheduling of steel reinforcement for concrete
SANS 878	Ready mix concrete
SANS 920	Steel bars for concrete reinforcement
SANS 1024	Welded steel fabric for reinforcement of concrete
SANS 1200 A	General
SANS 1200 AB	Engineer's office
SANS 1200 C	Site clearance
SANS 1200 DA	Earthworks (small works)
SANS 1200 DB	Earthworks (pipe trenches)
SANS 1200 G	Concrete (structural)
SANS 1200 HA	Structural steelwork (small works)
SANS 1200 HC	Corrosion Protection of Structural Steelwork

SANS 1200 GE	Precast concrete (structural)
SANS 1200 LC	Cable ducts
SANS 2001	Construction works
SANS 4998	Continuous hot-dip zinc-coated carbon steel sheet of structural quality
SANS 5863	Concrete tests - Compressive strength of hardened concrete
SANS 10100	The structural use of concrete
SANS 10144	Detailing of steel reinforcement for concrete
SANS 10160	Basis of structural design and actions for buildings and industrial structures
SANS 10162	The structural use of steel
SANS 14713	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures
SANS 10684	Fasteners - Hot dip galvanized coatings
SANS 12944	Paints and varnishes - Corrosion protection of steel structures by protective paint systems
SANS 50025	Hot rolled products of structural steels

All local and municipal regulations and bylaws.

C3.5: MANAGEMENT

C3.5.1 MANAGEMENT OF THE WORKS

(a) Planning and Programming

The Contractor's programme must be based on the time for completion specified below. Penalties will be imposed if these Interim Milestone dates are not achieved. Refer to Section C1.2 (contract Data), Sub-clause 5.13.1.

PROJECT COMPLETION TIME: 120 WORKING DAYS FROM COMMENCEMENT DATE.

The Contractor must draw up his own programme that complies with the project phasing requirements as shown on the construction drawings and also with all requirements of this project and which suits his own resources.

Note that the specified project completion time does not include the time required for completing the airside training and permit processes. Site access and commencement will only take place after such process has been completed.

(b) Sequence of the Works

The sequence of the Works will be determined by the logical order of activities as illustrated in the construction drawings and the specified time for completion above. It is important to note that:

(a) The Airside of CTIA is a live environment and disruption to other activities must be limited.

(b) The service road must remain open during construction and only a partial closure (one lane, with provision of adequate traffic control measures) may be tolerated. Any full closure must be sequence for "after hours" work.

(c) When aircraft are docking in an apron stand, work must pause until the plane is safely docked. It is anticipated that such delays could amount to 2 hours per bay, per day. The Bill of Quantities allows for such delay to be priced and claimed for. ACSA's docking schedule will be made available in advance and will serve as a record of the number of flights that actually docked in a bay, per day.

(d) Unobstructed access to the marshalling stairs for ACSA's marshals must be permitted during aircraft docking procedures.

(e) Bay closures are anticipated at Alpha 9, 10, 11, & 12, since the works are located on the apron stand itsself. As such, construction shall be sequenced to spread out bay closures, such that a bay closure is paired with works taking place on a minimally disrupted bay, and that bay closures are separated by work not requiring a bay closure.

(f) The works at Alpha 3 & Alpha 4 (international docking bays) must be programmed as late as possible in the programme, to ensure the contractor is well conversant with the works by the time these bays are worked on.

(c) Quality Plans and Control

The requirements for Quality Plans and Control are stated in Section B1205 of the Project Specification (C3.6).

(d) Construction Method Statement

Within 14 days of the Commencement Date the Contractor shall submit a Construction Method Statement to the Engineer for approval by the Employer. No work on Airside will be allowed until the Employer has approved this Construction Method Statement.

The Method Statement shall include:

i. All measures to be implemented to comply with the requirements of the OHS Act.

ii. A contingency plan to deal with interruptions of shifts by inclement weather, plant breakdowns or emergency closures of the work areas.

iii. Special measures, such as availability of back-up plant, to be implemented in normal shifts to comply with the Project Specifications.

iv. Measures and equipment that will be used on site to limit the ingress of water into the excavations and to remove rain water from the excavations.

v. Measures to protect services (above and below surface) during construction.

vi. Procedures to ensure the whole work area are safe before removing staff or handing over of the site at the end of the each work shift.

vii. A watchman to remain on site of excavations/construction with telephone contact to the contract manager in case of emergency.

viii. The cost of complying with the ACSA approved method statement is deemed to be covered by the tendered rates for the Contractor's General Obligations.

(e) Environment

The Environmental requirements are specified in Generic Specifications (Section C3.7.2)

(f) Accommodation of Traffic on Roads and Accesses used by the Contractor

ACSA staff and other stake holders will also use the access roads on and around the site and camp. It is therefore a requirement that the contractor coordinate with all stakeholders on a daily basis (to be minuted at the daily meeting) on the usage of the roads by the Contractor's vehicles and construction equipment. **The contractor will access site via Foxtrot 3/3A**. The site camp will be located at the ACSA Power and lighting facility. The contractor to provide containers for offices. The location of the proposed camp site areas is shown on the image below.

(g) Testing, Completion, Commissioning and Correction of Defects

Procedures for testing, completion, commissioning and correction of defects will be provided to the Contractor by the Engineer on site.

(h) Recording of Weather

The contractor shall provide a rain gauge and maximum/minimum thermometer. He shall erect them according to the requirements of the weather bureau. The contractor shall record and keep a record of the daily rainfall and maximum/minimum temperatures and supply the data to the Engineer on a daily basis.

The contractor shall also record wind speed measurements on site as agreed with the Engineer's Representative. Data can also be obtained from the local weather bureau but has to be recorded on site on a daily basis.

The cost of complying with these requirements is deemed to be covered by the tendered rates for the Contractor's General Obligations.

(i) Format of Communications

All instructions or requests need to be confirmed in writing through:

- Site instructions.
- Requests for information.

(j) Key Personnel

The Contractor, Engineer and Employer must compile a schedule of their Key Personnel with their contact numbers and keep it updated. The list must be made available to the Engineer, Employer and Contractor.

(k) Management Meetings

The following formal meetings will be held at the Contractor's Site Office between the representatives of the Employer, Engineer and the Contractor:

- Contractor only: Daily kick-off meeting (One hour before the start of a shift).
- Contractor only: Weekly progress meeting (Two hours before the start of a shift).
- Employer, Engineer, & Contractor: Fortnightly site meeting (Date and time to be agreed by attendees).
- Employer, Engineer, & Contractor: Fortnightly technical meeting (Date and time to be agreed by attendees).

The representatives must have the necessary delegated authority in respect of aspects such as planning, change management and health and safety.

(l) Daily records

The Contractor must keep daily records of resources (people and equipment employed) and site diaries in respect of work performed on the site. A copy of the previous day's daily record must be provided to the Engineer on a daily basis.

(m) Bonds and Guarantees

Original copies of the bonds and guarantees must be lodged at the office of ACSA, CAPE TOWN INTERNATIONAL AIRPORT, and one copy of each must be kept on site. On release, the bond and guarantees can be collected from ACSA.

(n) Payment Certificates

The Engineer's certificate will be issued only after receipt by him of a draft certificate prepared by the Contractor at his own expense in the form prescribed by the Engineer. The cost of duplicating and delivering copies of the certificate to the Contractor, the Engineer and the employer shall be borne by the Contractor. The Engineer and the employer shall require three (3) sets of A4-sized paper copies in total.

(o) Permits

All requirements in connection with the application for and usage of permits are stated in the ACSA CTIA Procedure Manual for Working Airside - Volume 5 (refer to Annexure D).

(p) Insurance Provided by the Employer

For information on the Employer Insurance, refer to Clause 35.1 Section C1.2.

C3.5.2 HEALTH AND SAFETY

(a) Health and Safety Requirements and Procedures

Health and Safety requirements and procedures are presented in Section C5.1 (Annexure A)

(b) Hoarding/Barricades and lighting

Requirements for the provision and usage of barricades and lighting are stated in Section C3.7.

C3.6: PARTICULAR (PROJECT) SPECIFICATIONS

The Standard Specifications provide, in certain clauses, for a choice to be specified in the Construction Specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternatives or additional requirements applicable to this Contract are contained in this part of the Specifications. It also contains some additional specifications required for this particular contract.

The number of each clause and each payment item in the Particular (Project) Specifications consists of the prefix B followed by a number corresponding to the number of the relevant clause or payment item in the Standard Specifications. The number of a new clause or a new payment item, which does not form part of a clause or a payment item in the standard specifications and is included here, is also prefixed by B followed by a new number. The new numbers follow on the last clause or item number used in the relevant section of the standard specifications.

PROJECT SPECIFICATION –

MECHANICAL, ELECTRICAL AND CIVIL WORKS

VARIATIONS TO STANDARDISED / PARTICULAR SPECIFICATIONS

PSA GENERAL (SANS 1200 A)

PSA 1 Contractual Requirements (Sub-clause 8.3.1 and 8.4.1)

PSA 1.1 Provision of guarantees. No separate payment will be made for costs incurred in connection with the provision of guarantees as they are deemed to be included in the tendered prices.

PSA 2 Housing Of Employees (Sub-clause 8.3.2.2(d))

Housing of employees on the site of the Works will not be permitted. A night watchman only will be permitted at the Contractor's camp area.

PSA 3 Toilet Facilities (Sub-clause 8.3.2.2 (e))

The Contractor shall provide and maintain all necessary toilets, changing and washing facilities at his construction site. As waterborne toilet facilities are not available, suitable chemical type toilet facilities shall be provided and maintained.

PSA 4 Water Supply (Sub-clause 8.3.2.2 (g))

The Contractor shall make his own arrangements for his construction water supply requirements as necessary and bear all costs in connection therewith. No potable water or municipal water will be provided by the Employer.

PSA 5 Electrical Power Supply (Sub-clause 8.3.2.2 (g))

The Employer will only be able to make a single phase, 220-volt, 13-amp power supply available to the Contractor for domestic purposes. The contractor shall be liable for all costs associated with transferring power to the required locations, the provision of a meter and the cost of power consumed.

The Contractor shall make his own arrangements for his construction power supply requirements as necessary and bear all costs in connection therewith.

PSA 6 Telephone Connection (Sub-Clause 8.3.2.2(g))

Contractors shall make their own arrangements with the appropriate authorities for the provision of the necessary telephone services and shall bear all costs connected therewith.

PSA 7 Camp Area

A suitable area will be made available to the Contractor for his camp, the location of which will be indicated to tenderers at the site inspection. The Contractor shall provide a suitable fence around his camp in order to define its boundaries clearly.

Tenderers shall allow for all costs associated with their camp including fencing, etc.

Housing of employees on the site of the Works or in the camp area will not be permitted. The Contractor shall make his own arrangement for the housing of his employees.

PSA 8 QA/QC Data Pack

PSA 8.1 QA\QC Data Book

The Contractor shall build and maintain a quality data book which shall as a minimum have the following sections:

a) Final Acceptance, Hand-over forms and Punch Lists
b) Approved Quality Control Plans
c) Drawings
d) General Arrangement Drawings
e) As built drawings
f) Concrete cube test results,
g) Concrete mix design,
h) Material certificates (civil layer works etc.),
i) Electrical certificates of compliance, where applicable
j) Commissioning Reports
k) Corrosion Protection Inspection Certificates
l) Paint / galvanising thickness tests
m) The data book shall be compiled in a hard cover (2 sets) file suitably indexed as well as an electronic copy (pdf) on disk.

PSA 8.2 Quality Control Procedures

A detailed Quality Control Plan (QCP) is to be submitted, **before any work may commence**, for approval of hold, witness, and inspection, points. The quality plan shall be tailored to comply with the EMPLOYER's specific requirements. A sample of the proposed plan is to accompany the tender.

The Quality Control Plans shall as a minimum have the following activities:

a) Documentation
b) Fabrication Drawing Approval
c) Approve QCP
d) Material test certificates (civil works)
e) Material Identification
f) Welders Certificate Approval
g) Dimensional Check
h) NDE
i) Magnetic Particle Inspection
j) Corrosion Protection
k) Cable test certificates
l) Final Inspection

The Contractor shall ensure that all his sub-contractors have obtained a copy of this specification.

The Contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Engineer or his representative.

The Engineer may, at his discretion, require a Quality Audit of the Contractor or any of the sub-contractors to ensure that he has the capabilities, resources and quality control facilities to carry out the work to ensure compliance with this specification.

The Contractor shall have available the latest issue of each of the manufacturer's data sheets for the items / materials to be used, all Specifications and Codes of Practice relevant to the work to be carried out, including a copy of this specification, all of which shall be available to the Contractor's Quality Control Manager.

The Contractor shall:

1) supply a Quality Plan and Quality Program at the time of tendering, both of which are subject to acceptance by the Engineer.
2) maintain Quality Control records in accordance with the Quality Plan during execution of the contract. Such records shall be available to the Engineer or his Representative at each Quality Surveillance visit.
3) mark or securely label each special component (see drawings) with a unique identification tag, and
4) carry out such tests as are required to ensure compliance with the specification.

The cost of Quality Control shall be inclusive in the Contractor's tender price.

The Contractor shall advise the Engineer timeously, in writing, when and where the following processes will be carried out;

1) Completion of fettling or dressing prior to leaving the fabricator's works
2) Blast cleaning and application of the first or primer coat
3) After completion of all coats to be applied at the Contractor's works
4) At the commencement of repairs or overcoats of existing equipment to be carried out on site.

Failure of the Contractor to advise the Engineer of his program may result in rejection of the work. The cost of any such rejection shall be borne by the Contractor.

Quality Control Reports shall be updated regularly and a copy of all relevant reports shall accompany all payment certificates. No payments will be authorised by the Engineer unless a copy of an approval report has been received by him. The Engineer may withhold payment until a final report has been issued, giving approval to the components after installation on site and repair of damage to coating.

Proper and adequate quality control records shall be maintained by the Contractor for all stages of the work. These records shall be available for inspection by the Engineer or his representative at the time of Quality Surveillance. Incomplete, inaccurate or inadequate records shall be regarded as non-compliance with the specification, and the cost of surveillance will be back charged to the Contractor.

No variation from specification, or change of sub-contractor or materials to be used from those stated in the tender documents, will be permitted without written approval of the Engineer. Products equivalent to those specified may be submitted for approval and adequate information shall be supplied by the Contractor to Engineer in order to assess the claim of equivalence from the Contractor. Approval of alternative equipment shall valid only on a written instruction from the Engineer.

PSA 9 Safety Officer (Sub-clause 8.4.3)

The contractor will provide a full time suitably qualified safety officer/ supervisor for the duration of the contract in compliance with latest Construction Regulations added to the OHaS Act in 2003.

All costs associated with the Safety Officer shall be deemed to be included in the scheduled item provided.

PSA 10 Fire Watch Officer

Once petroleum products are stored in the tankage, the Contractor shall provide a full time Fire Watch Officer for the duration of hotwork on the contract who shall be approved by the Municipal Fire Department as being competent in the use of fire extinguishers, asbestos blankets and fire hoses.

The Fire Watch Officer shall be provided with protective clothing to NFPA Standards.

All costs associated with the provision, training and equipping of the firewatch shall be deemed to be included in the scheduled item provided.

PSA 11 Scaffolding, Staging and Accessibility

Where needed, safe, stable scaffolding shall be provided, erected, moved and subsequently dismantled by the Contractor and it shall be adequate in extent for surface preparation, painting and inspection.

The scaffolding shall comply with **BS EN 12811-1** or equivalent and **GEN 51 Part 9**, and be such that the operator can (and should) always be within 600 mm of the working surface. The scaffolding shall not be removed without the permission of the Engineer.

The Contractor shall provide the required illumination rated for the hazardous area.

PSA 12 Construction Manager

The contractor shall appoint a Construction Manager as required in the *Occupational Health and Safety Act, 1993 Construction Regulations, 2014*. There is however no need to allow for any specific professional qualifications related to the appointment of the Construction Manager. The appointee shall however be competent to occupy the position based on previous experience, knowledge and skills and the onus is on Total to accept or decline the appointment of the proposed candidate based on the evaluation of his experience.

The cost allowed for this shall be deemed to be included in the tendered rates.

PSC SITE CLEARANCE (SANS 1200 C)

PSC 1 Method of Measurement (Sub-clause 8.2.8)

Notwithstanding the provisions of Sub-clause 8.2.8 of SANS 1200 C, demolition of various structures will be measured and paid for in accordance with the items in the Schedule of Quantities. Volumes will be computed according to the net dimensions of the elements to be demolished with no allowance being made for bulking. Removal off site shall mean removal to a dump area recognised for such purposes by the local authority.

PSC 2 Ownership of Demolished Materials

Where items are to be demolished or dismantled and stockpiled on site, the items shall remain the property of the Employer.

Where items are to be demolished or dismantled and removed off site, the items shall become the property of the Contractor.

PSDA EARTHWORKS (SMALL WORKS) (SANS 1200 DA)

PSDA 1 Classification (Sub-clause 3.1)

Notwithstanding the provisions of Sub-clause 3.1 of SANS 1200 DA, the unit rate for excavation shall cover excavation in all materials other than hard rock.

PSDA 2 Excavation

PSDA 2.1 Measurement and Payment (Sub-clause 8.1.2)

No additional payment will be made for additional excavation beyond the net plan area of a structure for outside shuttering or working space. The cost of such additional excavation and backfilling shall be deemed to be included in the tendered rates.

PSDA 2.2 Excavation (Sub-clauses 8.3.1 and 8.3.2)

Notwithstanding the provisions of Sub-clauses 8.3.1 and 8.3.2 of SANS 1200 DA, no overhaul will be measured for excavation to waste. The Contractor shall make his own arrangements for the disposal of surplus and waste materials.

PSDA 3 Existing Services (Sub-clause 8.3.5)

The tendered rates shall include for excavation in the vicinity of existing services. (Refer to clause PS 5.1).

PSDB EARTHWORKS (PIPE TRENCHES) (SANS 1200 DB)

PSDB 1 Classification (Sub-clause 3.1)

Notwithstanding the provisions of Sub-clause 3.1 of SANS 1200 DB, the unit rate for excavation shall cover excavation in all materials other than hard rock.

PSDB 2 Excavation (Sub-clause 8.1.4)

Notwithstanding the provisions of sub-clause 8.1.4 of SANS 1200 DB, no overhaul will be measured for excavation to waste. The Contractor shall make his own arrangements for the disposal of surplus and waste materials.

PSDB 3 Existing Services (Sub-clause 8.3.5)

This clause is amended by clause *PS6.1*

PSDB 4 Trench Widths (Sub-clause 8.2.3)

Where trench excavation widths are specified in the Schedule of Quantities, these are calculated from the pipe diameters and spacing of pipes as shown on the drawings plus the side allowance for each of the outer pipes in accordance with clause 8.2.3 of SANS 1200 DB.

PSDB 5 Reinstatement of Trenches (Sub-clause 8.3.6)

Workmanship and materials required in the reinstatement of trenches shall comply in all respects with the requirements of the SANS 1200 specifications.

Reinstatement of concrete paving shall comprise:

a) Minimum 150 mm slab (or greater thickness to match the existing paving) of 30 MPa/19 mm concrete, wood floated, with reinforcing mesh Ref 245.
b) 150 mm cement stabilised subbase having an unconfined compressive strength of 1.5 to 3 MPa at 7 days.
c) 150 mm unstabilised G5 subbase compacted to 98% Mod AASHTO density. (98% for sand)

It is required that, where pipes cross roadways, the crossing shall be completed in half widths and adequate barriers and warning signs shall be provided. The costs involved shall be allowed for in the tendered rates.

Measurement and payment for reinstatement of pipe trenches shall be per square meter and based on the trench width specified in PSDB 4.

PSG CONCRETE (STRUCTURAL) (SANS 1200 G)

PSG 1 Cement

PSG 1.1 Specification (Sub-clause 3.2.1)

Subject to the provisions of 3.2.2 cement shall comply with the relevant requirements of SANS 471.

PSG 1.2 Alternative Types of Cement (Sub-clause 3.2.2)

Use of any type of cement other than that referred to in 3.2.1 shall only be permitted when specifically authorised in writing by the Engineer.

PSG 1.3 Durability (Sub-clause 5.5.1.5)

The maximum water / cement ratio for all concrete works shall be as per Table 5 of Sub-clause 5.5.1.5 for severe conditions.

PSG 2 Curing (Sub-clause 5.5.8)

Curing shall be in accordance with the requirements of Sub-clause 5.5.8(e).

PSG 3 Reinforcement (Sub-clause 8.1.2)

Notwithstanding the provisions of sub-clause 8.1.2 of SANS 1200 G, all round steel bar reinforcement will be measured and paid for by mass per reinforcing bar diameter.

PSG 4 Mesh Reinforcement (Sub-clause 8.1.2)

Notwithstanding the provisions of sub-clause 8.1.2 of SANS 1200 G, welded mesh reinforcement will be measured and paid for per square meter based on the nett area of mesh placed.

PSG 5 Formwork (Sub-clause 8.1.1)

All exposed concrete corners shall have a 25 mm x 25 mm chamfer. The unit rates tendered for formwork shall include for the provision of such chamfers.

PSG 6 Blinding Concrete

Notwithstanding the provisions of Clause 8.1.3.1(c) blinding concrete will be measured to the plan size of the structure resting on the blinding. No separate payment shall be made for any formwork to the edge of the blinding layer.

PSG 7 Paving

PSG 7.1 Earthworks under paving

a) Subgrade

Following the bulk excavation to approximate level to accept the specified paving, the selected fill material from stockpile on site is to be placed in 150mm layers to a total depth of 500mm and compacted to 98% Mod AASHTO density. The imported G5 material is to be compacted to 98% Mod AASHTO density to a depth of 150mm. Thereafter the subgrade is to be neatly trimmed to final level. Care should be taken to avoid unnecessary disturbance of the compacted material.

PSG 8 Joint Sealing

Joints shall be sealed as detailed on the drawings. The sealant shall be applied strictly in accordance with the manufacturer's recommendations. In particular, the Contractor shall observe the specific requirements relating to joint preparation, priming and sealant mixing. It should be noted that the moisture content of the concrete prior to the application of the primer should not exceed 5%.

PSH STRUCTURAL STEELWORK (SANS 1200 H)

PSH 1 Material

Steel shall be mild steel to SANS 50025 – Grade S355JR.

PSH 2 Alternative Sections

Alternative sections will be accepted (after consultation with the Engineer), to suit available supplies, provided there is no loss of strength or stiffness or, where relevant, appearance.

PSH 3 Drawings and Shop Details (Sub-clause 5.1.2)

The Contractor shall provide shop details and shall allow for all costs associated with the provision of drawings as specified in his tendered rates.

All shop drawings shall be submitted to the engineer for comment prior to commencing manufacturing/fabrication of that part of the works. Shop drawings will be checked for member types and design intent. Dimensional accuracy will not be checked as this remains the contractor's responsibility. The Engineer undertakes to respond to such requests for approval within two working days.

PSH 4 Welding

Welding shall be done by qualified welders to the satisfaction of the engineer. Site welding shall not be done without the prior approval of the engineer.

All welding shall be fully continuous fillet. Minimum weld size is 6mm. All welding to be in accordance with SANS 44 and SANS 455. Welding is to be executed and evaluated in accordance with AWS D1.1 using E70XX electrode. All welding to be done prior to protection of steelwork.

PSH 5 Erection Bolts

All erection bolts used are to be manufactured to SANS 1700.

- All structural bolts shall be grade 8.8.
- All drill-in anchor bolts shall be grade 8.8.
- All cast-in holding down bolts shall be grade 4.8.

Only genuine hot dip galvanized fasteners (including nuts and washers), to SANS 10684, may be used Electroplated fasteners are not acceptable.

Chemical anchor bolts are to be “Hilti” with “HVU” capsule and “HAS-U HDG” anchor rods (or similar approved).

Holding down bolts (either cast-in, or drill-in) that secure base plates of masts, are to be installed with “Nylock” nuts, or else double-nuts.

PSH 6 Payment

Notwithstanding the various payment clauses contained in Clause 8.3, payment shall be as stated in the Schedule of Quantities and shall include for supply, fabrication, corrosion protection, delivery to site, erection including all structural bolts, unless measured separately.

PSH 7 Connections

As far as practically possible, connections are to be bolted so as to minimise the amount of site welding required. Bolted connections to receive a minimum of 2 M12 bolts, unless otherwise specified. Details of any splices to be submitted to the Engineer for approval prior to erection.

All costs for splice details are for the Contractors account.

PSH 8 Open Mesh Flooring and Frames

Open mesh flooring shall be banded all round its edges and at any cut-outs for pipes etc.

PSHC CORROSION PROTECTION OF STRUCTURAL STEELWORK (SANS 1200 HC)

PSHC 1 Structural Steelwork

PSHC 1.1 Surface Preparation (Sub-clause 5.4.3.1)

All surfaces shall be abrasive blast cleaned to Swedish standard SIS 055900 of 1967 to SA 2½. The blast profile shall be between 40 and 75 microns.

PSHC 1.2 Coating System (Sub-clause 5.7)

All steelwork is to be hot dip galvanized in accordance with SANS 121 (ISO 1461), or SANS 32 & SANS 4998 where applicable. Any weld splatter or sharp projections shall be removed prior to galvanizing. all galvanized sections shall be straight and without any twist when delivered to site.

Only genuine hot dip galvanized fasteners, to SANS 10684, may be used (electroplated fasteners are not acceptable).

Steel items are to be detailed by the workshop detailer so as to provide the necessary venting, filling and drainage holes appropriate for hot dip galvanizing.

Hot dip galvanized Standard Barriers/bollards shall be prepared and painted to SANS 12944 with a paint system that is suitable for a galvanized substrate, for a C5-I corrosivity category. The paint specification shall be forwarded to the engineer for approval. A paint guarantee of 5 years shall be provided. Top coat colours to be 150mm wide black-&-yellow stripes at 45 degrees. After erection any abrasions to paintwork shall be repaired in accordance with the manufacturer's instructions. The protruding heads of all nuts and bolts shall be degreased and coated as per the preceding requirments.

The costs of performing all the above shall be included in the tendered rates.

All sundry steel items shall be hot dip galvanized, such as, but not limited to: clamps, brackets, conduits, & cover plates (all screws shall be Grade 316 stainless steel).

PSHC 2 Open Mesh Flooring

Open mesh flooring and the seating angles cast into the concrete shall be hot dip galvanised.

PSHC 3 Holding Down Bolts, Nuts and Washers

All holding down bolts, nuts and washers shall be at least hot dip galvanised with the threads sufficiently undercut prior to galvanising. Washers shall be provided with every nut. All sleeve anchors shall be galvanised. An approved molybdenum disulphide anti-seize compound shall be used on all bolts and nuts.

PSX ELECTRICAL

PSX2.1 Applicable Standards and Particular Specifications

Although not bound in nor issued with the document, the following standardised specifications shall form part of the contract document.

Act 84 of 1993	:	Occupational Health and Safety Act and Regulations
SANS 950	:	Non-metallic conduit
SANS 1200 LC	:	Cable ducts
SANS 1507	:	Electric Cables … for Fixed Installations
SANS 10142-1	:	The Wiring of Premises
SANS 10313	:	The protection of structures against lightning.
SANS 60529	:	Degrees of protection provided by enclosures (IP Code)
SANS 61386-21	:	Rigid conduit Systems

PSX2.2 Installation Guidelines

(a) Any work which has been completed by the CONTRACTOR and which does not meet with the requirements of this Code of Practice, will not be accepted by the Client. It will be for the CONTRACTOR'S account to rectify the work.

(b) The CONTRACTOR shall ensure that all relevant local and statutory requirements are complied with and that all personnel in his employ are fully conversant with these requirements.

(c) The CONTRACTOR shall obtain approval from the Client before power is switched on.

(d) "Master Installation Electrician" means a person who has been registered as a master installation electrician in terms Occupational Health and Safety Act, Electrical Installation Regulations and who has been approved by the chief inspector for the verification and certification of the construction, testing and inspection of any electrical installation.

PSX3.4 Instrument, Panel and Junction Box Labels

PSX3.4.1 General

(a) The labels shall be manufactured from White laminated Gravoply, Trafolite or equivalent as approved by THE CLIENT, with Black lettering unless otherwise stated.

(b) All engraving shall be centred unless otherwise stated.

PSX3.4.2 Junction Boxes

(a) All junction boxes shall be labelled with labels detailing the area number and junction box signal type followed by the number as indicated on the Junction Box Schedule.

PSX4 Cabling

PSX4.2 General Cable Installation Requirements

(a) Where the specification states that the CONTRACTOR shall "cable" or "install cable/cabling" this involves the following:

(b) On site measurements of cable length before cutting off cable drum.

(c) Terminating, glanding, making off.

(d) All cables shall be installed in one length. No intermediate jointing of cable will be permitted.

(e) The CONTRACTOR shall take special note that the cable schedules must only be used as a guide. The CONTRACTOR shall be responsible for determining correct cable lengths.

(f) All wiring shall be neatly installed and strapped or saddled in position to the panel or supporting steelwork. All strapping on horizontal supports shall be by means of proprietary cable straps. In addition, for vertical cable supports metal strapping (Bandit) or clamps must be installed at least every 1500mm.

(g) Unless otherwise approved by the CLIENT, all conductors shall be terminated by means of crimped lugs using the correct type and size of lug for the different terminations. Crimped boot lace ferrules are required for smaller wires.

(h) All cables to be labelled on either end.

PSX4.4 Cable Testing

PSX4.4.1 General

(a) Immediately after cables are laid and before connection, all cables shall be checked for polarity, continuity and insulation resistance using proper test equipment. The CONTRACTOR shall furnish the Engineer with test certificates for ALL cables.

(b) Underground cables shall be tested before backfilling commences.

(c) The CONTRACTOR shall check the electrical supply to ensure that the correct supply, AC or DC, and the correct voltage is being fed to the instrument before it is commissioned.

PSX4.4.4 Test Details (Power and Control Cables)

Use a 500V D.C. Megger for 600/1000V cables and a 2500V DC Megger for 6kV/11kV cables to measure the following cable parameters:-

(a)	Phase - phase	-	greater than 90 Mohm
(b)	Phase - neutral	-	greater than 90 Mohm
(c)	Phase - earth and/or armouring	-	greater than 90 Mohm
(d)	Neutral to earth	-	greater than 90 Mohm

In addition, check for continuity of every conductor. All values to be recorded on the Cable Test Certificates.

PSX4.6 Cable Terminations

All cables shall be tested in accordance with SANS 1507

PSX4.6.2 As a rule, the following gland types (CCG or equivalent) will be used.

Gland Type	Cable Type	Location	Area Classification
CW	PVC SWA	Outdoor use Neoprene Shroud)	Safe

NOTE: Where other types of glands and cables are required, the Engineer will advise accordingly.

PSX4.7 Cable Routes

The routing of cables is dictated by the sleeve and cable ladder positions. Consequently, the CONTRACTOR is to liaise with the ENGINEER to ensure that sleeves, cable racks and manholes are located in the correct positions and that the cables are installed in the correct positions.

PSX4.7.1 Trenching

(a) Where the CONTRACTOR is responsible for trenching, he must adhere to this detail specification.

(b) The CONTRACTOR shall take and accept all responsibility for the character of the ground and an extra over price will be allowed if rock, debris, rubble, boulders, loose stones, running sand, water, mud, etc, are encountered; at the rates as specified in the Schedule of Quantities.

(c) Cable trenches are to be closed as follows:

(d) Fill with rock free river sand to a depth of 150mm, if required.

(e) Backfill with graded material and make good the surface.

(f) Cable trenches to be marked with approved cable markers every 30 metres and at every change of direction.

(g) All waste material shall be removed from the site and transported to an approved tip outside the depot.

PSX4.7.2 Electrical Cable Sleeves

(a) Where the supplying only, installation only or the supply and installation of sleeves is called for in the project specification, the following requirements shall apply.

(b) The Electrical Contractors shall install draw-wires in all cable sleeves and at least one draw wire must remain in each sleeve at the completion of the contract.

(c) Sleeves shall be P.A.C. "Kableflex" and nominally 110-mm diameter for power and signal cables, unless otherwise indicated.

(d) Unless otherwise specified, sleeves shall be laid at a depth of 600mm.

(e) The radius of the bends used in the sleeves shall not be less than six times the diameter of the sleeve, (twelve times for XLPE cables) and the sleeve not be less than twice the sum of the cable diameters unless otherwise specified.

(f) The sleeves shall extend at least 1m beyond each side of the road crossings and shall be effectively sealed at the ends. As a minimum one power and one signal sleeve shall be provided at each crossing.

(g) Both ends of all sleeved crossings shall be marked by means of cable markers as elsewhere specified, labelled "Cable Sleeve".

PSX4.7.3 Cable Sleeve Manholes

Where the Electrical CONTRACTOR is responsible for the supply of all material and the construction of cable sleeve manholes along the various cable routes, reference is to be made to the applicable detailed construction drawing and quantities specified in the Schedule of Quantities.

PSX5 Electrical Equipment and Installation

PSX5.3 Conduit

(a) All conduits shall carry the SANS mark of quality and approval.

(b) Galvanised and painted, "Bosal" conduit shall be used to support individual cables on all vertical and horizontal straight runs within the SITE.

(c) Above ground conduit shall be hot-dipped galvanised steel except final connections to thermocouple heads and solenoids, which shall be flexible.

(d) All conduit runs shall be installed with a minimum number of bends and offsets. Generally a run of conduit containing low voltage wire shall have a maximum pulling distance of 30 metres and contain not more than 3½ quarter bends, (315 degrees total) including offsets and bends located immediately adjacent to the pull location. On runs over 30 metres, this shall be reduced to 2 quarter bends (180 degrees total).

(e) Where bends or offsets are required, they shall be made with suitable conduit bending equipment. Uniform circular cross-section of the conduit shall be maintained at such bends. No single bend shall be greater than 90 degrees.

(f) Couplings or other fittings shall not be installed in the curved portion of bends. Where unions are required because of bends they shall be installed at least one joint from the bend.

(g) Pull fittings, including 90-degree elbow fittings, shall have cast covers and shall be of adequate size so that the cable can be installed without bending it on a radius less than six times the cable diameter. Exposed threads of fittings shall be painted after installation to protect against corrosion.

(h) All pull boxes and fittings shall be installed so that covers are easily removed.

(i) Conduits shall be cut square and reamed with a taper reamer. Rigid metallic conduit joints shall be threaded, cleaned out and made up tightly with a suitable thread compound. The compound must be a lubricant, which will provide corrosion protection and permit the joint to be disassembled at a future date. Thread compound shall not interfere with earthing continuity of conduit system.

(j) All conduit shall be terminated with insulated or brass bushings to prevent damage to wire during pulling operations, except in enclosures where their design is adequate to prevent insulation damage.

(k) Conduit seals must be placed in each conduit run in a classified (hazardous) area entering enclosures. The seal shall be no further than 450mm from the enclosure. In each conduit run

of 50mm or larger conduit, seals shall be placed not only at the above enclosures, but also at junction boxes and fittings containing terminals, splices or taps and the seal shall be within 450mm of the box or fitting. When a conduit run, within the classified area, between two enclosures is 900mm or less in length, one seal midway between the two could be 450mm or less from either enclosure, and one seal may serve for both enclosures.

(l) Conduits to be sealed with Green Henley Plastic Compound (GEC/ Alsthom); a fire resistant putty.

PSX5.20 Certificate of Completion

(a) Before completion of the contract any damage, which may have been incurred during the installation, shall be repaired and made good.

(b) The appropriate Certificate of Compliance as stipulated by the OHSA act shall acknowledge practical completion of works and the commencement of the period during which the appropriate contractor will be responsible for any defect.

PSX7.13 Wiring Colours

Main Circuit	
L1	red
L2	white
L3	blue
N	black
230V L	brown
230V N	blue
PE	green/yellow
HQE	green