

	<b>PROJECT SPECIFIC HEALTH &amp; SAFETY SPECIFICATION</b>	Template Identifier	ER00000-00- P00#1.2-02	Rev	2
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		Authorisation Date	July 2014		
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<b>ASSET DESIGN</b> <b>1.2. PROJECT SPECIFIC HEALTH &amp; SAFETY SPECIFICATION AND RISK ASSESSMENT</b>				
Project Description:	UMKOMAAS SUBSTATION 22/11-kV SUBSTATION UPGRADE TO 88/22/11-kV – UMGENI WATER DIRECT CUSTOMET			
Project No.'s:	ID	148367973B	WBS	C.DE04169
Document Identifier:	PW	ER00779-00-P01#1.2-00	Rev	0
Operating Unit	Kwa-Zulu Natal Operating Unit			
Section:	Asset Creation – Network Engineering and Design			
Department:	Asset Design (Substations)			
Project Category:	Direct Customer			
PLCM Phase:	Detail Design			

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Date:			
Signature:			

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## FOREWARD

This document is the Project Specific Health and Safety Specification for the Umkomaas **88/22/11-kV Substation Upgrade**. This document is to be read in conjunction with the Detailed Specification for the Civil and Electrical works.

## TEMPLATE REVISION HISTORY

REV	Date	Template Compiled by	Comment
1	July 2014	J. K. Raghbir (Pr. Eng)	Previous Health and Safety Specification compiled by Richard Krusekopf. New ISO template used. Previous document template with ER00000-00-P00#1.2-00 number was Detailed Specification template and is now replaced with Health and Safety Specification
2	Sept 2014	J. K. Raghbir (Pr. Eng)	Only one Senior Design Engineer authorisation signature required.

## DOCUMENT REVISION HISTORY

REV	Date	Compiler	Comment

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## 1. INTRODUCTION

This document must be read in conjunction with the Detailed Specification, Project Risk Analysis (Annexure 2) and the Occupational Health and Safety Act and Regulations. This document must also be communicated to all relevant construction staff and displayed in appropriate positions at the construction site, the site office and the associated staff accommodation facilities.

In terms of the Construction Regulations forming part of the Occupational Health and Safety Act, the principal contractor is sensitized to the following requirements:

- a) Within the stipulated time of the contract being awarded, the contractor must submit a certificate of good standing with the Workmen's Compensation Commission.
- b) Within the stipulated time of the contract being awarded, the contractor must also submit an Occupational Health and Safety Plan to the client for approval, which amongst others, must deal with the mitigation of the anticipated project specific onerous site conditions that are likely to be encountered.
- c) Shall stop any contractor from executing construction work which is not in accordance with the principal contractors health and safety plan in 2 above or which poses a threat to the health and safety of persons.

The following activities have been identified as Potential Risks and / or pertaining to the Health and Safety of the people employed to work on the specified site and / or to people in general in close proximity to the work site.

- Supervision of Construction Works
- Risk Assessment
- Erecting of Steelwork and Plant
- Stringing of Conductor
- Working at Elevated Levels
- Excavation Work
- Demolishing and Dismantling
- Construction Vehicles and Mobile Plant
- Electrical Installations and Plant
- House keeping on Construction Sites
- Fire Precautions on Construction Sites
- Construction welfare facilities
- Working in "Live" HV & MV Substations
- Security on Site

**Adherence to Eskom's "Life Saving Rules" shall be mandatory at all times.**

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## 2. SUPERVISION OF CONSTRUCTION WORKS

In accordance with the Construction Regulations, the contractor is required to appoint a full time construction supervisor.

Amongst Other Things, the Contractor must ensure;

- That a method statement is established for the project and each individual activity.
- That a competent person is appointed as **full time** construction supervisor in writing.
- The contractor may appoint additional competent employees, in writing, to assist the construction supervisor, provided the relevant conditions of the Construction Regulations are met.
- The construction supervisor **may not** supervise work on any other site unless the relevant conditions of the Construction Regulations are met.
- That relevant PPE is worn at all times.

## 3. RISK ASSESSMENT

In accordance with the Construction Regulations, every contractor is required to carry out a risk assessment prior to and during any construction work. These risk assessments must be included into the Health and Safety Plan

The Contractor must ensure;

- That prior to and during the construction work, a risk assessment must be performed by a competent person, appointed in writing.
- That the risk assessment forms part of the Health and Safety Plan.
- That the Project Risk Assessment contained in the Project Package is included in their risk assessment.

## 4. ERECTING OF STEELWORK AND PLANT

In terms of the contract, the contractor may be required to assemble and erect various items of steelwork including lattice steelwork on site. Furthermore, the contractor will be required to assemble and erect items of plant or equipment, the majority of which will be supported by the steelwork. The majority of this work will require the contractor to work at an elevated level and the use of various lifting devices including cranes or mobile lifting devices.

Examples of such activity include column and beam steelwork, general equipment supports, lightning/lighting masts, A-frame structures, and items of plant such as breakers, isolators, CT's, VT's, etc. The weight of steelwork is included in the Bill of Materials and/or drawings. Eg. An 18kN 132kV 15m beam weighs 1508kg. Weights of plant equipment is included on the manufacturers drawings.

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The Contractor must ensure;

- That he understands the scope of work and that he has all relevant documentation and drawings.
- That he is competent in all the activities as defined in the contract and scope of work.
- That he familiarises himself with any “live” conductors and/or plant in the working area. He must ensure adequate safe working space while erecting is taking place.

## **5. STRINGING OF CONDUCTOR**

In terms of the contract, the contractor may be required to assemble and string various sections of overhead conductor, including long-rod insulator strings in and around the substation. The contractor may be required to string conductor under various tensions and should be familiar with the relevant techniques required.

The contractor may also be required to terminate these conductors using both compression ends and bolted ends and should be familiar with the required techniques. The majority of this work will require the contractor to work at an elevated level and the use of various lifting devices including cranes or mobile lifting devices.

Over-tensioning is dangerous and must be avoided.

The Contractor must ensure;

- That he understands the scope of work and that he has all relevant documentation and drawings.
- That he is competent in all the activities as defined in the contract and scope of work.
- That all conductor stringing (busbars, etc.) shall be completed in accordance with the Conductor Tables (Sags & Tension Charts) included under Section 1.9 of Part 1 of the Project Package.
- The responsibility for the stringing of closing spans may be unclear. Contractors are to clarify this issue prior to carrying out any such work.

## **6. WORKING AT ELEVATED LEVELS**

In terms of the contract, the contractor may be required to work at elevated heights. Examples of such activity include that associated with the construction of the substation building, the erection of steel lattice columns/beams, erection of steel supports and equipment, stringing of busbars and other conductors, construction of buildings, banks and retaining walls, etc. These activities may require that scaffolding, ladders and other devices or means (climbing) are used to access the elevated structure, plant or activity.

The Contractor must ensure;

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- That all work undertaken above ground level will be supervised by a competent person appointed in writing.
- That all applicable staff will be issued with and be satisfactorily trained in the use of a FAS (Fall Arrest System) to be worn and applied for all related work activity requiring the use of such a system.
- That no work will be performed at ground level, directly beneath workmen engaged in work at elevated levels.
- That all equipment used in conjunction with, or to support that being undertaken at elevated levels, shall be inspected prior to its use, to ensure all is in good working order and in a serviceable condition to perform the function for which it has been designed to do.
- That all scaffolding and other equipment used to access elevated levels is accredited by an authorized person in writing.

## **7. EXCAVATION WORK**

The scope of work detailed under this project, requires the contractor, as part of the contract, undertake certain excavations that either hazardous or more than 1 meter in depth. Examples include the lattice steel column foundations, the oil containment tank, substation earthmat trenches and MV cable trenches, manholes and the construction of banks or retaining walls, etc.

The contractor's employees, as part of the contract, will more than likely also be required to work with certain mechanical excavation equipment that has the potential to inflict bodily injury. There is also likely to be excessive noise and dust present during the excavation process. Plastic orange netting, supported on ridged poles or posts, is the only acceptable form of barricading for excavations.

### The Contractor must ensure;

- That all excavation work is carried out under the supervision of a competent person who has been appointed in writing.
- That the necessary safety precautions regarding hazardous excavations are strictly adhered, ie. adequately shored and barricaded (esp.
- That those employees working at, or in close proximity to such activity, must be supplied with suitable and effective dust and hearing protection.
- That all excavation work takes into account all safety clearances to live equipment.

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## 8. DEMOLISHING AND DISMANTLING

Where the scope of work deems it necessary to dismantle or demolish certain buildings, plant or structures, or sections of these and their foundations, due care must be exercised when carrying out these activities.

Examples include dismantling redundant steel lattice columns and beams, redundant equipment and support steelwork, busbars, conductors and insulators, redundant switch rooms, working with MV and LV cables. Invariably these buildings or plant are located within an energized or operational substation yard and every precaution must be taken when carrying out this activity.

Demolishing and dismantling may include

- Excavation work
- Working at elevated levels.
- Working in a “live” yard or in close proximity to “live” equipment or cables.
- Working with construction vehicles and mobile plant.

The Contractor must ensure;

- That all demolition and dismantling work is carried out under the supervision of a competent person who has been appointed in writing.
- That a risk assessment and method, compiled by a competent person, are in place prior to demolishing or dismantling any plant, structure or building.
- That where asbestos or lead are encountered, the relevant Asbestos or Lead Regulations are complied with.

## 9. CONSTRUCTION VEHICLES AND MOBILE PLANT

During the construction phase of the substation, various equipment and mobile plant will be employed and described as, but not limited to: all terrain vehicles, vehicle mounted cranes, hole boring machine, compressor, tractor back-hoe, compaction roller, dumper, hydraulic crimpers, concrete mixer, hydraulic and mechanical winches, etc.

The Contractor must ensure;

- That the use of construction equipment and mobile plant will be restricted for the use of trained and authorized operators only and will be supervised by a competent person appointed in writing.
- That all vehicles and mobile plant are regularly maintained and in good working order and that all lifting equipment test certificates are current.
- That all vehicles and mobile plant are inspected daily prior to use by a competent and authorized persons.

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- That all construction vehicles shall comply with the requirements of the Provincial Administration Road Ordinance and those stipulated in the Road Traffic Act.
- That all mobile plant shall conform to the Occupational, Health and Safety Act (85 of 1993).
- That the construction site is arranged and managed, to ensure that as far as is reasonably possible and practicable, all pedestrians and vehicles can move and work in a safe environment without risk to personnel or equipment on the construction site.

## **10. ELECTRICAL INSTALLATIONS AND PLANT**

For the duration of the project, the contractor shall, in addition to the Construction Regulations, also ensure compliance with the Electrical Installations Regulations and the Electrical Machinery Regulations.

Construction activities at substations may include installing electrical plant or cables and installation of or extension to earthmats. Contractors should ensure that all hidden or buried services are located prior to carrying out any excavation work and where this is not possible, that insulated protective equipment is provided. Contractors are reminded of the risks associated with working on installed earthing systems.

The Contractor must ensure;

- That a Responsible Person, duly authorised, is appointed in writing for the site and shall supervise all operations.
- That the Responsible Person has performed a risk assessment and confirmed that the equipment to be worked on is isolated and earthed.
- That the Responsible Person has ensured that equipment to be worked on is effectively barricaded and safe to work on.
- That a responsible person, duly authorized, is appointed in writing to undertake all testing and commissioning work of plant.
- That an authorized person is appointed in writing to issue a certificate of compliance for the LV installation.

## **11. HOUSE KEEPING ON CONSTRUCTION SITE**

Throughout the duration of the construction activity at the applicable substation site, all practicable measures shall be employed to ensure good house keeping practices are adopted. These requirements shall extend to those for Stacking and Storage and must be read in conjunction with the Environmental Regulations for Workplaces. These activities will be monitored and maintained by a competent person/s appointed in writing

The Contractor must ensure;

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- Suitable house keeping methods are continuously being implemented on the site, including but not limited to, provision for the correct storage of all materials and equipment, the regular removal of scrap, waste and debris at appropriate intervals.
- Environmental policies will be strictly adhered to for the duration of the project.
- Adequate, safe and secure storage areas shall be established, demarcated, maintained and controlled accordingly.

## **12. FIRE PRECAUTIONS ON CONSTRUCTION SITE**

Throughout the duration of the construction activity at the applicable substation site, suitable precautionary measures shall be implemented to ensure the risk of a fire and/or fire hazard occurring is prevented. These measures shall be enforced by a competent person appointed in writing.

The Contractor must ensure;

- All appropriate measures are taken to avoid the risks of fire.
- No open fires shall be permitted on the construction site whatsoever.
- Suitable and sufficient fire extinguishing equipment shall be available on site at all times.
- A sufficient number of site employees are trained in the use of fire fighting equipment.
- All emergency related procedures are displayed at the construction and accommodation sites and all applicable personnel are aware of these.
- All relevant emergency appointments (fire wardens, evacuation officials, etc.) are completed in writing and displayed accordingly.
- Adequate, safe and secure storage areas shall be established, demarcated, maintained and controlled accordingly for flammable liquids, solids and gasses.

## **13. CONSTRUCTION WELFARE FACILITIES**

During the construction phase of the substation project, the contractors staff and associated employees will be housed in accordance with the relevant policies and procedures governing this practice for the duration of the project. These facilities will be inspected and maintained by a competent person appointed in writing. Eskom will not allow transporting of staff in the back of open vehicles. All staff must be seated whilst being transported in vehicles designed for the purpose.

The Contractor must ensure;

- Suitable and habitable accommodation, in accordance with all related policies and procedures governing this issue, shall be provided for all relevant construction staff.
- No accommodation facilities need be provided for the locally employed contract workers, ie. casual labour.

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- Cooking, washing and eating facilities shall be provided for all relevant construction staff and these facilities cleaned daily to ensure compliance with the Occupational Health and Safety Act.
- Only approved cleaning materials shall be issued for the cleaning of these facilities.
- Adequate transport shall be made available to transport employees to and from their home bases, during those periods when construction staff are 'off site'.
- Chemical toilets shall be provided and serviced to ensure same comply with the requirements of the Occupational, Health and Safety Act.

#### **14. WORKING IN “LIVE” HV & MV SUBSTATIONS**

For the duration of the project, the contractor shall, in addition to the Construction Regulations, also ensure compliance with the Electrical Installations Regulations and the Electrical Machinery Regulations. Construction activities at substations may include installing electrical plant within a “live” yard or in close proximity to “live” plant or cables and installation of or extension to earthmats.

The Contractor must ensure;

- That a Responsible Person, duly authorized, is appointed in writing for the site and shall supervise all operations.
- That the Responsible Person has performed a risk assessment and confirmed that the equipment to be worked on is isolated and earthed.
- That the Responsible Person has ensured that equipment to be worked on is effectively barricaded and safe to work on.
- That the Responsible Person issues the necessary work permit/s (per activity) and has completed a Workers Register.
- That the Responsible Person, on completion of the work, withdraws all staff from the work area and signs off the Workers Register and Work Permit/s.

#### **15. WORKING ON THE EXISTING SUBSTATION EARTHMAT**

The primary hazards when construction work is being carried out on the substation earthmat is the occurrence of step and touch potentials arising from earth fault currents. There are various sources of step and touch potentials within the existing substation. These may include, but not limited to, transformer star points, NEC/R neutral points, surge arrestors earth points, equipment steelwork, cable screening, etc.

The ability of the earth mat to contain touch and step potentials in a substation is a function of:

- a) The single phase fault level of the substation
- b) The earthmat conductor cross sectional area

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- c) The quality of the earthmat joints
- d) The resistance of the earth mat to the general mass of the earth.

The Contractor must:

- Ensure that appropriate risk treatment and mitigation strategies are in place when construction work is being carried out on an existing substation earthmat.
- Conduct an assessment of the earth mat integrity prior to construction by performing an earthing continuity test to identify any defects in the earth mat.
- Conduct a visual inspection of the earthmat to determine the suitability of the conductor to handle earth fault currents and the quality of the earthmat joints.
- Inspect all earthing connections to equipment and structures in the substation prior to the commencement of the project. Identify any deficiency and apply procedure 34-1434: *Procedure to follow when the integrity of earth continuity conductors connecting apparatus to the earth mat is suspect.*
- Identify standing currents in the earthmat by conducting a daily inspection of the IDMT and SEF relays for any activity.
- During the placement of new conductors added to the earth mat, temporary bonds designed for that purpose shall be used to bond the old and new components at frequent intervals. These bonds should remain in place until the two components have been bonded permanently.
- Staff trenching and handling the earth conductors shall wear non-conductive (rubber) standard industrial type safety gloves and non-conductive rubber boots.
- Any person that interacts with the old and new earthmat components shall bond themselves to both components while positioned on an equipotential foot mat. The contractor shall provide a method statement on creating this equipotential zone.
- As soon as possible after the earth mat work is completed, that section of the earth mat must be covered with soil and crusher stone as prescribed.
- Ensure that at least one earth bond to the integrated (old and new) earth mat is always connected permanently.

## 16. SECURITY ON SITE

The security of the site and materials storage yard will be provided by Eskom and arranged by the Project Manager for the duration of the project. This shall usually be provided by guards on a 12/24 hour basis. Some substation sites may, in addition, be fitted with electronic access control and surveillance equipment.

The Contractor must ensure:

- That a Responsible Person, duly authorized and appointed in writing for the site, shall ensure the co-operation of all his staff with the site security requirements.

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- That the site is adequately barricaded to prevent unauthorized access and that site access is controlled so that only employees authorized in writing are permitted on site.
- That Eskom property (typically new and used materials) is not removed from site unless authorized in writing by the Project Manager.

## 17. CONTRACTOR HEALTH AND SAFETY GATEKEEPERS

Refer to Contractor's Health and Safety contract documents for gatekeepers:

- Health and Safety Plan
- Constructability Plan
- Appointments and Authorisations (Valid and in writing)
- Resources Schedule ( Site Specific)
- Fall Protection Plan
- Risk Assessment
- On Job Observation
- Critical Task Procedure

18. SUBSTATION PROJECT RISK ANALYSIS							
Portion of route affected:				Analysis No:		Date:	
Final Rating =	Risk Rating				Effect on Cost	Effect on Time	Proposed Action Plan / Comments
	0	1	2	3			
<i>Risk Factors Description</i>	Zero	Low	Med	High			
<b>ENVIRONMENTAL RISKS (to be identified by Environmentalist and/or Surveyor)</b>							
<b>Weather</b>							
Rainfall		X					
Winds		X					
Heat Stroke		X					
Snow / Hail		X					
Floods		X					
Fire		X					
<b>Agricultural Activity</b>							
Cultivated Lands	X						
Sugarcane (size)	X						
Maize Crops	X						
Other Crops (veg,)	X						
Timber (age)	X						
Livestock (cattle)		X					
Irrigation Equip	X						

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<b>Natural Features</b>							
Grasslands	X						
Bush	X						
Indigenous trees	X						
Wetlands	X						
Rocks / Boulders	X						
Dongas	X						
Dams	X						
Rivers / Streams	X						
Bridges	X						
<b>Wild Life</b>							
Birds		X					
Game	X						
Animals		X					
Snakes		X					
Dogs (hunting)		X					
<b>Human Aspects</b>							
Housing		X					
Local Population		X					
Schools / Clinics		X					
Archaeological Sites	X						
Vehicle Access		X					
<b>ENGINEERING RISKS (to be identified by Surveyor or Project Engineer)</b>							
Legal Access site	X						
Statutory Approval	X						
Incorrect Survey		X					
Drawings Quality		X					
Materials Delay		X					PM/COW
Materials Quality		X					PM/COW
Materials Incorrect		X					PM/COW
Vandalism of Materials		X					
Security of Site		X					
Appropriate Equipment		X					
Machinery Failure		X					
Existing Cables			X				Existing cables in yard. Caution to be exercised when excavating.
Induction (from other power lines)			X				Existing HV Lines that run past the substation. Caution to be exercised
Proximity (to other power lines)			X				

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<b>1.2. Health &amp; Safety Specification Umkomaas 88/22/11-kV Substation Upgrade</b>	<b>Template Identifier</b>	<b>ER00000-00-P00#1.2-02</b>	<b>Rev</b>	<b>2</b>
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Telkom Lines	X						
Water Pipes		X					
Main / Farm Roads		X					
Motor Vehicles / Traffic		X					
Rail Crossings	X						
Damaged / Rusted Pylons		X					
Damaged / Rusted Hardware		X					
Damaged / Rotten Poles	X						
Damaged Conductors		X					
Personnel skill level		X					
Correct method application		X					
<b>OTHER RISKS (to be identified by Surveyor or Project Engineer)</b>							
Hi-jacking		X					
Theft		X					
Communications – radio		X					
Communications – telephone		X					
<b>Risk scoring method:</b> If risks are identified then the maximum score = 60. When all the scores are added up on a specific project and the total = 45, then the project is considered to be in a “high risk / sensitive area”. If however the total score is only 25, then the project is considered to be in a “low risk / non-sensitive area”.							

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