



NEC3 Engineering & Construction Contract

Between **ESKOM HOLDINGS SOC Ltd**
(Reg No. 2002/015527/30)

and **[Insert at award stage]**
(Reg No. _____)

for **Excitation System Replacement for Kusile & Medupi
Power Station for a Period of 5 years**

Contents:	No of pages
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CONTRACT No. 46000.....

Part C1: Agreements & Contract Data

Contents:	No of pages
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[to be inserted from Returnable Documents at award stage]	
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C1.1 Form of Offer & Acceptance

Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

Excitation System Replacement for Kusile and Medupi Power Station

The tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Contractor* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

Options A	The offered total of the Prices exclusive of VAT is	R [●]
	Sub total	R [●]
	Value Added Tax @ 15% is	R [●]
	The offered total of the amount due inclusive of VAT is ¹	R [●]
	(in words) [●]	

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Contractor* in the *conditions of contract* identified in the Contract Data.

Signature(s)

Name(s)

Capacity

**For the
tenderer:**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Tenderer's CIDB registration number (if applicable)

¹ This total is required by the *Employer* for budgeting purposes only. Actual amounts due will be assessed in terms of the *conditions of contract*.

Acceptance

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the Employer and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Scope of Work: Works Information
Part C4	Site Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy signed between them of this document, including the Schedule of Deviations (if any).

Unless the tenderer (now *Contractor*) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s)

Name(s)

Capacity

**for the
Employer**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Note: If a tenderer wishes to submit alternative tenders, use another copy of this Form of Offer and Acceptance.

Schedule of Deviations to be completed by the *Employer* prior to contract award

Note:

1. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1	[•]	[•]
2	[•]	[•]
3	[•]	[•]
4	[•]	[•]
5	[•]	[•]
6	[•]	[•]
7	[•]	[•]

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the tenderer:

For the Employer

Signature _____

Name _____

Capacity _____

On behalf of _____
(Insert name and address of organisation)

Name & signature of witness _____

Date _____

C1.2 ECC3 Contract Data

Part one - Data provided by the *Employer*

Clause	Statement	Data
1	General	
	The <i>conditions of contract</i> are the core clauses and the clauses for main Option	
		A: Priced contract with activity schedule
	dispute resolution Option	W1: Dispute resolution procedure
	and secondary Options	
		X1: Price adjustment for inflation
		X2: Changes in the law
		X3: Multiple currencies
		X5: Sectional Completion
		X7: Delay damages
		X13: Performance Bond
		X15: Limitation of <i>Contractor's</i> liability for design to reasonable skill and care
		X16: Retention
		X17: Low performance damages
		X18: Limitation of liability
		Z: <i>Additional conditions of contract</i>
	of the NEC3 Engineering and Construction Contract, April 2013 (ECC3)	
10.1	The <i>Employer</i> is (Name):	Eskom Holdings SOC Ltd (reg no: 2002/015527/30), a state-owned company incorporated in terms of the company laws of the Republic of South Africa
	Address	Registered office at Megawatt Park, Maxwell Drive, Sandton, Johannesburg
10.1	The <i>Project Manager</i> is: (Name)	Justice Mphahlele
	Address	Medupi Power Station, Steenbokpan Road, Lephalale, 0555
	Tel	+27 14 762 6961
	e-mail	mphahlkj@eskom.co.za
10.1	The <i>Supervisor</i> is: (Name) TBA	[•]

	Address	[•]
	Tel No.	[•]
	Fax No.	[•]
	e-mail	[•]
11.2(13)	The <i>works</i> are	Design, Procure, Install and Commission the AVR Excitation System Replacement at Kusile and Medupi Power Station
11.2(14)	The following matters will be included in the Risk Register	<ul style="list-style-type: none"> • Construction hazards, working with machinery. • Labour Strike and Community Unrest impacting access to site. • Substantial procurement of materials when required. • Disease outbreak impact on labour force. • Access existing areas. • Unavailability of Generation plant due to electricity demand (plant not made available to work in). • Interface and integration of the works with the running plant and other Contractors. • Increment weather conditions (rain, wind, hailstorm, heatwave) • Construction hazards for Electrical work.
11.2(15)	The <i>boundaries of the site</i> are	<ul style="list-style-type: none"> • Kusile Power Station Excitation system and interfacing plants. • Medupi Power Station Excitation system and interfacing plants.
11.2(16)	The Site Information is in	Part 4: Site Information
11.2(19)	The Works Information is in	Part 3: Scope of Work and all documents and drawings to which it makes reference.
12.2	The <i>law of the contract</i> is the law of	the Republic of South Africa
13.1	The <i>language of this contract</i> is	English
13.3	The <i>period for reply</i> is	Seven (7) calendar days and 24 hours for emergencies.
2	The <i>Contractor's</i> main responsibilities	Data required by this section of the core clauses is provided by the <i>Contractor</i> in Part 2 and terms in italics used in this section are identified elsewhere in this Contract Data.
3	Time	
11.2(3)	The <i>completion date</i> for the whole of the <i>works</i> is	08 May 2030
11.2(9)	The <i>key dates</i> and the <i>conditions</i> to be met are:	Condition to be met key date

	1	Design submissions for Medupi and Kusile Power Stations	4 x months post contract award
	2	Material delivery for Medupi and Kusile Power Stations	6 x months post design acceptance
	3	Units x 12	Planned Outage Dates
		Medupi Unit 1 Installation completion	2027/03/08 to 2027/04/18
		Kusile Unit 1 Installation Completion	2027/03/11 to 2027/04/09
		Medupi Unit 2 Installation completion	2028/03/05 to 2028/04/15
		Kusile Unit 2 Installation Completion	2027/03/08 to 2027/05/30
		Medupi Unit 3 Installation completion	2028/04/28 to 2028/06/08
		Kusile Unit 3 Installation Completion	2027/01/02 to 2027/01/31
		Medupi Unit 4 Installation completion	2027/08/10 to 2027/09/20
		Kusile Unit 4 Installation Completion	2027/04/20 to 2027/06/03
		Medupi Unit 5 Installation completion	2027/11/16 to 2028/04/13
		Kusile Unit 5 Installation Completion	2028/08/10 to 2028/09/24
		Medupi Unit 6 Installation completion	2029/12/18 to 2030/03/17
		Kusile Unit 6 Installation Completion	2030/02/01 to 2030/03/03
		Safety Clearance and Commissioning	2 x Weeks before Unit Return To Service
		Handover	1 x Week before Unit Return To Service

30.1	The <i>access dates</i> are:	<table><tr><th>Part of the Site</th><th>Date</th></tr><tr><td>1</td><td>Access to Kusile Power Station</td><td>2 x weeks post contract award</td></tr><tr><td>2</td><td>Access to Medupi Power Station</td><td>2 x weeks post contract award</td></tr><tr><td>3</td><td>Site Possession</td><td></td></tr><tr><td></td><td>Medupi Power Station</td><td>As per Medupi Outage Schedule</td></tr><tr><td></td><td>Kusile Power Station</td><td>As per Kusile Outage Schedule</td></tr></table>	Part of the Site	Date	1	Access to Kusile Power Station	2 x weeks post contract award	2	Access to Medupi Power Station	2 x weeks post contract award	3	Site Possession			Medupi Power Station	As per Medupi Outage Schedule		Kusile Power Station	As per Kusile Outage Schedule
Part of the Site	Date																		
1	Access to Kusile Power Station	2 x weeks post contract award																	
2	Access to Medupi Power Station	2 x weeks post contract award																	
3	Site Possession																		
	Medupi Power Station	As per Medupi Outage Schedule																	
	Kusile Power Station	As per Kusile Outage Schedule																	
31.1	The <i>Contractor</i> is to submit a first programme for acceptance within	Two (2) weeks post Contract Date.																	
31.2	The <i>starting date</i> is	TBA																	
32.2	The <i>Contractor</i> submits revised programmes at intervals no longer than	Two (2) weeks.																	
35.1	The <i>Employer</i> will take over the Works at the Completion of each Unit.																		
4	Testing and Defects																		
42.2	The <i>defects date</i> is	Fifty – Two (52) weeks after Completion of the each Unit.																	
43.2	The <i>defect correction period</i> is	Two (2) weeks																	
	except that the <i>defect correction period</i> for	Emergency is Twenty – Four (24) hours																	
	and the <i>defect correction period</i> for	Load Loss is Twenty – Four (24) hours																	
5	Payment																		
50.1	The <i>assessment interval</i> is	between the20 th day of each successive month.																	
51.1	The <i>currency of this contract</i> is the	South African Rand.																	
51.2	The period within which payments are made is	Thirty (30) calendar days after the receipt of an invoice																	
51.4	The <i>interest rate</i> is	the publicly quoted prime rate of interest (calculated on a 365 day year) charged from time to time by the Standard Bank of South Africa Limited (as certified, in the event of any dispute, by any manager of such bank, whose appointment it shall not be necessary to prove) for amounts due in Rands and (ii) the LIBOR rate applicable at the time for																	

amounts due in other currencies. LIBOR is the 6 month London Interbank Offered Rate quoted under the caption "Money Rates" in The Wall Street Journal for the applicable currency or if no rate is quoted for the currency in question then the rate for United States Dollars, and if no such rate appears in The Wall Street Journal then the rate as quoted by the Reuters Monitor Money Rates Service (or such service as may replace the Reuters Monitor Money Rates Service) on the due date for the payment in question, adjusted *mutatis mutandis* every 6 months thereafter and as certified, in the event of any dispute, by any manager employed in the foreign exchange department of The Standard Bank of South Africa Limited, whose appointment it shall not be necessary to prove.

6 Compensation events

60.1(13)	<p>The place where weather is to be recorded is:</p> <p>The <i>weather measurements</i> to be recorded for each calendar month are,</p> <p>The <i>weather measurements</i> are supplied by</p> <p>The <i>weather data</i> are the records of past <i>weather measurements</i> for each calendar month which were recorded at:</p> <p>and which are available from:</p>	<p>At Kusile & Medupi Power Station</p> <p>the cumulative rainfall (mm)</p> <p>the number of days with rainfall more than 10 mm</p> <p>the number of days with minimum air temperature less than 0 degrees Celsius</p> <p>the number of days with snow lying at 09:00 hours South African Time</p> <p>and these measurements:</p> <p>South African Weather Services</p> <p>Lephalale and Kusile Power Station</p> <p>The South African Weather Services</p>
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7	Title	There is no reference to Contract Data in this section of the core clauses and terms in italics used in this section are identified elsewhere in this Contract Data.
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8 Risks and insurance

80.1	These are additional <i>Employer's</i> risks	<p>1. Theft, vandalism, and damage to works after takeover.</p> <p>2. Damage to the works after takeover but before the defects certificate.</p>
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9	Termination	There is no reference to Contract Data in this section of the core clauses and terms in italics
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		used in this section are identified elsewhere in this Contract Data.		
10	Data for main Option clause			
A	Priced contract with activity schedule	There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.		
11	Data for Option W1			
W1.1	The <i>Adjudicator</i> is	the person selected from the ICE-SA Division (or its successor body) of the South African Institution of Civil Engineering Panel of Adjudicators by the Party intending to refer a dispute to him. (see www.ice-sa.org.za). If the Parties do not agree on an Adjudicator the Adjudicator will be appointed by the Arbitration Foundation of Southern Africa (AFSA).		
	Address	[•] TBA		
	Tel No.	[•]		
	Fax No.	[•]		
	e-mail	[•]		
W1.2(3)	The <i>Adjudicator nominating body</i> is:	the Chairman of ICE-SA a joint Division of the South African Institution of Civil Engineering and the London Institution of Civil Engineers. (See www.ice-sa.org.za) or its successor body.		
W1.4(2)	The <i>tribunal</i> is:	arbitration.		
W1.4(5)	The <i>arbitration procedure</i> is	the latest edition of Rules for the Conduct of Arbitrations published by The Association of Arbitrators (Southern Africa) or its successor body.		
	The place where arbitration is to be held is	The Republic of South Africa		
	The person or organisation who will choose an arbitrator	the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.		
	- if the Parties cannot agree a choice or - if the arbitration procedure does not state who selects an arbitrator, is			
12	Data for secondary Option clauses			
X1	Price adjustment for inflation			
X1.1(a)	The <i>base date</i> for indices is	Month prior enquiry closing date		
X1.1(c)	The proportions used to calculate the Price Adjustment Factor are:	proporti on	linked to index for	Index prepared by

	0. 05	CPI – Table D3	SEIFSA
	0. 55	Material (Electrical Engineering Materials) – Table G1	SEIFSA
	0. 20	Labour – Table C3	SEIFSA
	0. 05	Transport – Table L2a	SEIFSA
	0.15	non-adjustable	
	Total	1.00	

X2	Changes in the law	There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.	
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X3	Multiple currencies		
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X3.1	The <i>exchange rates</i> are those published in	To be agreed with the <i>Employer</i> and <i>Contractor</i> during Negotiations - in accordance with an alternative payment method agreed with the <i>Employer</i> before the Contract Date.	
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X5	Sectional Completion		
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X5.1	The <i>completion date</i> for each <i>section</i> of the <i>works</i> is:	Section	Description	Completion date
		1	Design Completion	4 x months post contract award
		2	Material Delivery	6 x months post design acceptance
		3	Medupi Unit 1 Installation completion	2027/03/08 to 2027/04/18
			Kusile Unit 1 Installation Completion	2027/03/11 to 2027/04/09
			Medupi Unit 2 Installation completion	2028/03/05 to 2028/04/15
			Kusile Unit 2 Installation Completion	2027/03/08 to 2027/05/30
			Medupi Unit 3 Installation	2028/04/28 to 2028/06/08

	completion	
	Kusile Unit 3 Installation Completion	2027/01/02 to 2027/01/31
	Medupi Unit 4 Installation completion	2027/08/10 to 2027/09/20
	Kusile Unit 4 Installation Completion	2027/04/20 to 2027/06/03
	Medupi Unit 5 Installation completion	2027/11/16 to 2028/04/13
	Kusile Unit 5 Installation Completion	2028/08/10 to 2028/09/24
	Medupi Unit 6 Installation completion	2029/12/18 to 2030/03/17
	Kusile Unit 6 Installation Completion	2030/02/01 to 2030/03/03
	The total delay damages payable by the Contractor does not exceed: 10% of the contract value	
X13	Performance bond	
X13.1	The amount of the performance bond is	10% of the total of the Prices
X15	Limitation of the Contractor's liability for his design to reasonable skill & care	There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.
X16	Retention	
X16.1	The <i>retention free amount</i> is	R0.00
	The <i>retention percentage</i> is	5% of the total Price for each invoice amount.
X17	Low performance damages	
X17.1	The amounts for low performance damages are:	
	Amount	Performance level
	5% of the Total Contract Value	1.Manufacturing and Factory Acceptance Tests (FATs) before scheduled/planned Unit outage.
	5% of the Total Contract Value	2. All grid code related test and results shall be accepted by the Employers in conjunction national transmission company

			of South Africa (NTCSA).
		5% of the Total Contract Value	3. Any defects in the performance of the excitation system, the Contractor shall then be liable for the complete retesting for all or affected parts and associated costs thereof. This shall also apply for any defects discovered during the defects period.
		5% of the Total Contract Value	4. Training of operating maintenance and engineering personnel shall be fully completed.
		30% of the Total Contract Value	5. For failure to integrate with the existing system
X18	Limitation of liability		
X18.1	The <i>Contractor's</i> liability to the <i>Employer</i> for indirect or consequential loss is limited to:	R0.0 (zero Rand)	
X18.2	For any one event, the <i>Contractor's</i> liability to the <i>Employer</i> for loss of or damage to the <i>Employer's</i> property is limited to:	the amount of the deductibles relevant to the event	
X18.3	The <i>Contractor's</i> liability for Defects due to his design which are not listed on the Defects Certificate is limited to	The greater of <ul style="list-style-type: none"> the total of the Prices at the Contract Date and the amounts excluded and unrecoverable from the <i>Employer's</i> assets policy for correcting the Defect (other than the resulting physical damage which is not excluded) plus the applicable deductible as at contract date. 	
X18.4	The <i>Contractor's</i> total liability to the <i>Employer</i> for all matters arising under or in connection with this contract, other than excluded matters, is limited to:	the total of the Prices other than for the additional excluded matters. The <i>Contractor's</i> total liability for the additional excluded matters is not limited. The additional excluded matters are amounts for which the <i>Contractor</i> is liable under this contract for <ul style="list-style-type: none"> Defects due to his design which arise before the Defects Certificate is issued, Defects due to manufacture and fabrication outside the Site, loss of or damage to property (other than the <i>works</i>, Plant and Materials), <ul style="list-style-type: none"> death of or injury to a person and infringement of an intellectual property right. 	

X18.5	The <i>end of liability date</i> is	<p>(i) 10 years after the <i>defects date</i> for latent Defects and</p> <p>(ii) the date on which the liability in question prescribes in accordance with the Prescription Act No. 68 of 1969 (as amended or in terms of any replacement legislation) for any other matter.</p> <p>A latent Defect is a Defect which would not have been discovered on reasonable inspection by the <i>Employer</i> or the <i>Supervisor</i> before the <i>defects date</i>, without requiring any inspection not ordinarily carried out by the <i>Employer</i> or the <i>Supervisor</i> during that period.</p> <p>If the <i>Employer</i> or the <i>Supervisor</i> do undertake any inspection over and above the reasonable inspection, this does not place a greater responsibility on the <i>Employer</i> or the <i>Supervisor</i> to have discovered the Defect.</p>
Z	The <i>Additional conditions of contract</i> are	Z1 to Z15 always apply.
Z1	Cession delegation and assignment	
Z1.1	The <i>Contractor</i> does not cede, delegate or assign any of its rights or obligations to any person without the written consent of the <i>Employer</i> .	
Z1.2	Notwithstanding the above, the <i>Employer</i> may on written notice to the <i>Contractor</i> cede and delegate its rights and obligations under this contract to any of its subsidiaries or any of its present divisions or operations which may be converted into separate legal entities as a result of the restructuring of the Electricity Supply Industry.	
Z2	Joint ventures	
Z2.1	If the <i>Contractor</i> constitutes a joint venture, consortium or other unincorporated grouping of two or more persons or organisations then these persons or organisations are deemed to be jointly and severally liable to the <i>Employer</i> for the performance of this contract.	
Z2.2	Unless already notified to the <i>Employer</i> , the persons or organisations notify the <i>Project Manager</i> within two weeks of the Contract Date of the key person who has the authority to bind the <i>Contractor</i> on their behalf.	
Z2.3	The <i>Contractor</i> does not alter the composition of the joint venture, consortium or other unincorporated grouping of two or more persons without the consent of the <i>Employer</i> having been given to the <i>Contractor</i> in writing.	
Z3	Change of Broad Based Black Economic Empowerment (B-BBEE) status	
Z3.1	Where a change in the <i>Contractor's</i> legal status, ownership or any other change to his business composition or business dealings results in a change to the <i>Contractor's</i> B-BBEE status, the <i>Contractor</i> notifies the <i>Employer</i> within seven days of the change.	
Z3.2	The <i>Contractor</i> is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the <i>Project Manager</i> within thirty days of the notification or as otherwise instructed by the <i>Project Manager</i> .	

- Z3.3 Where, as a result, the *Contractor's* B-BBEE status has decreased since the Contract Date the *Employer* may either re-negotiate this contract or alternatively, terminate the *Contractor's* obligation to Provide the Works.
- Z3.4 Failure by the *Contractor* to notify the *Employer* of a change in its B-BBEE status may constitute a reason for termination. If the *Employer* terminates in terms of this clause, the procedures on termination are P1, P2 and P3 as stated in clause 92, and the amount due is A1 and A3 as stated in clause 93.

Z4 Confidentiality

- Z4.1 The *Contractor* does not disclose or make any information arising from or in connection with this contract available to Others. This undertaking does not, however, apply to information which at the time of disclosure or thereafter, without default on the part of the *Contractor*, enters the public domain or to information which was already in the possession of the *Contractor* at the time of disclosure (evidenced by written records in existence at that time). Should the *Contractor* disclose information to Others in terms of clause 25.1, the *Contractor* ensures that the provisions of this clause are complied with by the recipient.
- Z4.2 If the *Contractor* is uncertain about whether any such information is confidential, it is to be regarded as such until notified otherwise by the *Project Manager*.
- Z4.3 In the event that the *Contractor* is, at any time, required by law to disclose any such information which is required to be kept confidential, the *Contractor*, to the extent permitted by law prior to disclosure, notifies the *Employer* so that an appropriate protection order and/or any other action can be taken if possible, prior to any disclosure. In the event that such protective order is not, or cannot, be obtained, then the *Contractor* may disclose that portion of the information which it is required to be disclosed by law and uses reasonable efforts to obtain assurances that confidential treatment will be afforded to the information so disclosed.
- Z4.4 The taking of images (whether photographs, video footage or otherwise) of the *works* or any portion thereof, in the course of Providing the Works and after Completion, requires the prior written consent of the *Project Manager*. All rights in and to all such images vests exclusively in the *Employer*.
- Z4.5 The *Contractor* ensures that all his subcontractors abide by the undertakings in this clause.

Z5 Waiver and estoppel: Add to core clause 12.3:

- Z5.1 Any extension, concession, waiver or relaxation of any action stated in this contract by the Parties, the *Project Manager*, the *Supervisor*, or the *Adjudicator* does not constitute a waiver of rights, and does not give rise to an estoppel unless the Parties agree otherwise and confirm such agreement in writing.

Z6 Health, safety and the environment: Add to core clause 27.4

- Z6.1 The *Contractor* undertakes to take all reasonable precautions to maintain the health and safety of persons in and about the execution of the *works*. Without limitation the *Contractor*:
- accepts that the *Employer* may appoint him as the "Principal Contractor" (as defined and provided for under the Construction Regulations 2014 (promulgated under the Occupational Health & Safety Act 85 of 1993) ("the Construction Regulations") for the Site;
 - warrants that the total of the Prices as at the Contract Date includes a sufficient amount for proper compliance with the Construction Regulations, all applicable health & safety laws and regulations and the health and safety rules, guidelines and procedures provided for in this contract and generally for the proper maintenance of health & safety in and about the execution of *works*; and

- undertakes, in and about the execution of the *works*, to comply with the Construction Regulations and with all applicable health & safety laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his Subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.

Z6.2 The *Contractor*, in and about the execution of the *works*, complies with all applicable environmental laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his Subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.

Z7 Provision of a Tax Invoice and interest. Add to core clause 51

- Z7.1 Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice in accordance with the *Employer's* procedures stated in the Works Information, showing the amount due for payment equal to that stated in the payment certificate.
- Z7.2 If the *Contractor* does not provide a tax invoice in the form and by the time required by this contract, the time by when the *Employer* is to make a payment is extended by a period equal in time to the delayed submission of the correct tax invoice. Interest due by the *Employer* in terms of core clause 51.2 is then calculated from the delayed date by when payment is to be made.
- Z7.3 The *Contractor* (if registered in South Africa in terms of the companies Act) is required to comply with the requirements of the Value Added Tax Act, no 89 of 1991 (as amended) and to include the *Employer's* VAT number 4740101508 on each invoice he submits for payment.

Z8 Notifying compensation events

- Z8.1 Delete from the last sentence in core clause 61.3, "unless the *Project Manager* should have notified the event to the *Contractor* but did not".

Z9 *Employer's* limitation of liability

- Z9.1 The *Employer's* liability to the *Contractor* for the *Contractor's* indirect or consequential loss is limited to R0.00 (zero Rand)
- Z9.2 The *Contractor's* entitlement under the indemnity in 83.1 is provided for in 60.1(14) and the *Employer's* liability under the indemnity is limited.

Z10 Termination: Add to core clause 91.1, at the second main bullet point, fourth sub-bullet point, after the words "against it":

- Z10.1 or had a business rescue order granted against it.

Z11 Addition to secondary Option X7 Delay damages (if applicable in this contract)

- Z11.1 If the amount due for the *Contractor's* payment of delay damages reaches the limits stated in this Contract Data for Option X7 or Options X5 and X7 used together, the *Employer* may terminate the *Contractor's* obligation to Provide the Works using the same procedures and payment on termination as those applied for reasons R1 to R15 or R18 stated in the Termination Table.

Z12 Ethics

For the purposes of this Z-clause, the following definitions apply:

Affected Party	means, as the context requires, any party, irrespective of whether it is the <i>Contractor</i> or a third party, such party's employees, agents, or Subcontractors or Subcontractor's employees, or any one or more of all of these parties' relatives or friends,
Coercive Action	means to harm or threaten to harm, directly or indirectly, an Affected Party or the property of an Affected Party, or to otherwise influence or attempt to influence an Affected Party to act unlawfully or illegally,
Collusive Action	means where two or more parties co-operate to achieve an unlawful or illegal purpose, including to influence an Affected Party to act unlawfully or illegally,
Committing Party	means, as the context requires, the <i>Contractor</i> , or any member thereof in the case of a joint venture, or its employees, agents, or Subcontractor or the Subcontractor's employees,
Corrupt Action	means the offering, giving, taking, or soliciting, directly or indirectly, of a good or service to unlawfully or illegally influence the actions of an Affected Party,
Fraudulent Action	means any unlawfully or illegally intentional act or omission that misleads, or attempts to mislead, an Affected Party, in order to obtain a financial or other benefit or to avoid an obligation or incurring an obligation,
Obstructive Action	means a Committing Party unlawfully or illegally destroying, falsifying, altering or concealing information or making false statements to materially impede an investigation into allegations of Prohibited Action, and
Prohibited Action	means any one or more of a Coercive Action, Collusive Action Corrupt Action, Fraudulent Action or Obstructive Action.

Z12.1 A Committing Party may not take any Prohibited Action during the course of the procurement of this contract or in execution thereof.

Z12.2 The *Employer* may terminate the *Contractor's* obligation to Provide the Services if a Committing Party has taken such Prohibited Action and the *Contractor* did not take timely and appropriate action to prevent or remedy the situation, without limiting any other rights or remedies the *Employer* has. It is not required that the Committing Party had to have been found guilty, in court or in any other similar process, of such Prohibited Action before the *Employer* can terminate the *Contractor's* obligation to Provide the Services for this reason.

Z12.3 If the *Employer* terminates the *Contractor's* obligation to Provide the Services for this reason, the amounts due on termination are those intended in core clauses 92.1 and 92.2.

Z12.4 A Committing Party co-operates fully with any investigation pursuant to alleged Prohibited Action. Where the *Employer* does not have a contractual bond with the Committing Party, the *Contractor* ensures that the Committing Party co-operates fully with an investigation.

Z13 Insurance

Z 13.1 Replace core clause 84 with the following:

Insurance cover 84

84.1 When requested by a Party, the other Party provides certificates from his insurer or broker stating that the insurances required by this contract are in force.

84.2 The *Contractor* provides the insurances stated in the Insurance Table A.

84.3 The insurances provide cover for events which are at the *Contractor's* risk from the *starting date* until the earlier of Completion and the date of the termination certificate.

INSURANCE TABLE A

Insurance against	Minimum amount of cover or minimum limit of indemnity
Loss of or damage to the works, Plant and Materials	The replacement cost where not covered by the <i>Employer's</i> insurance The <i>Employer's</i> policy deductible, as Contract Date, where covered by the <i>Employer's</i> insurance
Loss of or damage to Equipment	The replacement cost
Liability for loss of or damage to property (except the works, Plant and Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the <i>Contractor</i>) caused by activity in connection with this contract	<u>Loss of or damage to property</u> <u>Employer's property</u> The replacement cost where not covered by the <i>Employer's</i> insurance The <i>Employer's</i> policy deductible, as Contract Date, where covered by the <i>Employer's</i> insurance. <u>Other property</u> The replacement cost. <u>Bodily injury to or death of a person</u> The amount required by applicable law
Liability for death of or bodily injury to employees of the <i>Contractor</i> arising out of and in the course of their employment in connection with this contract	The amount required by the applicable law

Z 13.2

Replace core clause 87 with the following:

The *Employer* provides the insurances stated in the Insurance Table B.

INSURANCE TABLE B

Insurance against or name of policy	Minimum amount of cover or minimum limit of indemnity
Assets All Risk	Per the insurance policy document
Contract Works insurance	Per the insurance policy document
Environmental Liability	Per the insurance policy document
General and Public Liability	Per the insurance policy document
Transportation (Marine)	Per the insurance policy document
Motor Fleet and Mobile Plant	Per the insurance policy document

Terrorism	Per the insurance policy document
Cyber Liability	Per the insurance policy document
Nuclear Material Damage and Business Interruption	Per the insurance policy document
Nuclear Material Damage Terrorism	Per the insurance policy document

Z14 Nuclear Liability

- Z14.1 The *Employer* is the operator of the Koeberg Nuclear Power Station (KNPS), a nuclear installation, as designated by the National Nuclear Regulator of the Republic of South Africa, and is the holder of a nuclear licence in respect of the KNPS.
- Z14.2 The *Employer* is solely responsible for and indemnifies the *Contractor* or any other person against any and all liabilities which the *Contractor* or any person may incur arising out of or resulting from nuclear damage, as defined in Act 47 of 1999, save to the extent that any liabilities are incurred due to the unlawful intent of the *Contractor* or any other person or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.
- Z14.3 Subject to clause Z14.4 below, the *Employer* waives all rights of recourse, arising from the aforesaid, save to the extent that any claims arise or liability is incurred due or attributable to the unlawful intent of the *Contractor* or any other person, or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.
- Z14.4 The *Employer* does not waive its rights provided for in section 30 (7) of Act 47 of 1999, or any replacement section dealing with the same subject matter.
- Z14.5 The protection afforded by the provisions hereof shall be in effect until the KNPS is decommissioned.

Z15 Asbestos

For the purposes of this Z-clause, the following definitions apply:

AAIA	means approved asbestos inspection authority.
ACM	means asbestos containing materials.
AL	means action level, i.e. a level of 50% of the OEL, i.e. 0.1 regulated asbestos fibres per ml of air measured over a 4 hour period. The value at which proactive actions is required in order to control asbestos exposure to prevent exceeding the OEL.
Ambient Air	means breathable air in area of work with specific reference to breathing zone, which is defined to be a virtual area within a radius of approximately 30cm from the nose inlet.
Compliance Monitoring	means compliance sampling used to assess whether or not the personal exposure of workers to regulated asbestos fibres is in compliance with the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.

OEL	means occupational exposure limit.
Parallel Measurements	means measurements performed in parallel, yet separately, to existing measurements to verify validity of results.
Safe Levels	means airborne asbestos exposure levels conforming to the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.
Standard	means the <i>Employer's</i> Asbestos Standard 32-303: Requirements for Safe Processing, Handling, Storing, Disposal and Phase-out of Asbestos and Asbestos Containing Material, Equipment and Articles.
SANAS	means the South African National Accreditation System.
TWA	means the average exposure, within a given workplace, to airborne asbestos fibres, normalised to the baseline of a 4 hour continuous period, also applicable to short term exposures, i.e. 10-minute TWA.

- Z15.1 The *Employer* ensures that the Ambient Air in the area where the *Contractor* will Provide the Services conforms to the acceptable prescribed South African standard for asbestos, as per the regulations published in GNR 155 of 10 February 2002, under the Occupational Health and Safety Act, 1993 (Act 85 of 1993) ("Asbestos Regulations"). The OEL for asbestos is 0.2 regulated asbestos fibres per millilitre of air as a 4-hour TWA, averaged over any continuous period of four hours, and the short term exposure limit of 0.6 regulated asbestos fibres per millilitre of air as a 10-minute TWA, averaged over any 10 minutes, measured in accordance with HSG248 and monitored according to HSG173 and OESSM.
- Z15.2 Upon written request by the *Contractor*, the *Employer* certifies that these conditions prevail. All measurements and reporting are effected by an independent, competent, and certified occupational hygiene inspection body, i.e. a SANAS accredited and Department of Employment and Labour approved AAIA. The *Contractor* may perform Parallel Measurements and related control measures at the *Contractor's* expense. For the purposes of compliance the results generated from Parallel Measurements are evaluated only against South African statutory limits as detailed in clause Z15.1. Control measures conform to the requirements stipulated in the AAIA-approved asbestos work plan.
- Z15.3 The *Employer* manages asbestos and ACM according to the Standard.
- Z15.4 In the event that any asbestos is identified while Providing the Services, a risk assessment is conducted and if so required, with reference to possible exposure to an airborne concentration of above the AL for asbestos, immediate control measures are implemented and relevant air monitoring conducted in order to declare the area safe.
- Z15.5 The *Contractor's* personnel are entitled to stop working and leave the contaminated area forthwith until such time that the area of concern is declared safe by either Compliance Monitoring or an AAIA approved control measure intervention, for example, per the emergency asbestos work plan, if applicable.
- Z15.6 The *Contractor* continues to Provide the Services, without additional control measures presented, on presentation of Safe Levels. The contractually agreed dates to Provide the Services, including the Completion Date, are adjusted accordingly. The contractually agreed dates are extended by the notification periods required by regulations 3 and 21 of the Asbestos Regulations, 2001.
- Z15.7 Any removal and disposal of asbestos, asbestos containing materials and waste, is done by a registered asbestos contractor, instructed by the *Employer* at the *Employer's* expense, and conducted in line with South African legislation.

C1.2 Contract Data

Part two - Data provided by the *Contractor*

[Instructions to the contract compiler: (delete this notes before issue to tenderers with an enquiry)

Whenever a cell is shaded in the left hand column it denotes this data is optional. If not required select and delete the whole row, otherwise insert the required Data.]

Notes to a tendering contractor:

1. Please read both the NEC3 Engineering and Construction Contract (April 2013) and the relevant parts of its Guidance Notes (ECC3-GN)² in order to understand the implications of this Data which the tenderer is required to complete. An example of the completed Data is provided on pages 156 to 158 of the ECC3 (April 2013) Guidance Notes.
2. The number of the clause which requires the data is shown in the left hand column for each statement however other clauses may also use the same data
3. Where a form field like this [] appears, data is required to be inserted relevant to the option selected. Click on the form field **once** and type in the data. Otherwise complete by hand and in ink.

Completion of the data in full, according to Options chosen, is essential to create a complete contract.

Clause	Statement	Data
10.1	The <i>Contractor</i> is (Name): Address Tel No. Fax No.	
11.2(8)	The <i>direct fee percentage</i> is The <i>subcontracted fee percentage</i> is	% %
11.2(18)	The <i>working areas</i> are the Site and	
24.1	The <i>Contractor's</i> key persons are: 1 Name: Job: Responsibilities: Qualifications: Experience: 2 Name: Job Responsibilities: Qualifications: Experience:	

² Available from Engineering Contract Strategies Tel 011 803 3008, Fax 011 803 3009 or see www.ecs.co.za

		CV's (and further key persons data including CVs) are appended to Tender Schedule entitled _____.		
11.2(3)	The <i>completion date</i> for the whole of the works is			
11.2(14)	The following matters will be included in the Risk Register			
11.2(19)	The Works Information for the <i>Contractor's</i> design is in:			
31.1	The programme identified in the Contract Data is			
A	Priced contract with activity schedule			
11.2(20)	The <i>activity schedule</i> is in	(in figures) (in words), excluding VAT		
11.2(30)	The tendered total of the Prices is			
	Data for Schedules of Cost Components	Note "SCC" means Schedule of Cost Components starting on page 60, and "SSCC" means Shorter Schedule of Cost Components starting on page 63 of ECC3 (April 2013).		
A	Priced contract with activity schedule	Data for the Shorter Schedule of Cost Components		
41 in SSCC	The percentage for people overheads is:	%		
21 in SSCC	The published list of Equipment is the last edition of the list published by The percentage for adjustment for Equipment in the published list is	Minus %		
22 in SSCC	The rates of other Equipment are:	Equipment	Size or capacity	Rate
61 in SSCC	The hourly rates for Defined Cost of design outside the Working Areas are Note: Hourly rates are estimated 'cost to company of the employee' and not selling rates. Please insert another schedule if foreign resources may also be used	Category of employee	Hourly rate	

62 in SSCC	The percentage for design overheads is	%
63 in SSCC	The categories of design employees whose travelling expenses to and from the Working Areas are included in Defined Cost are:	

C1.3 Forms of Securities

Pro formas for Bonds & Guarantees

For use with the NEC3 Engineering & Construction Contract

[Note to contract compiler:

Once it has been decided which securities are required for this contract delete from this file the ones not required, revise the notes below accordingly and delete this note.]

The *conditions of contract* stated in the Contract Data Part 1 include the following Secondary Options:

Option X4: Parent company guarantee
Option X13: Performance Bond
Option X14: Advanced payment to the *Contractor*

Each of these secondary Options requires a bond or guarantee "in the form set out in the Works Information". Pro forma documents for these bonds and guarantees are provided here for convenience but are to be treated as part of the Works Information.

Option X16: Retention (not used with Option F)

The *Contractor* may provide a Retention Money Guarantee in the form stated here. When the *Employer* receives and accepts a Retention Money Guarantee exactly in the form stated he will instruct the *Project Manager* not to assess any amount be retained in terms of secondary Option X16.

The organisation providing the bond / guarantee does so by copying the pro forma document onto his letterhead without any change to the text or format and completing the required details. The completed document is then given to the *Employer* within the time stated in the contract.

Pro forma Parent Company Guarantee (for use with Option X4)

(to be reproduced exactly as shown below on the letterhead of the Contractor's Parent Company)

Eskom Holdings SOC Ltd
Megawatt Park
Maxwell Drive
Sandton
Johannesburg

Date:

Dear Sirs,

Parent Company Guarantee for Contract No

With reference to the above numbered contract made or to be made between

Eskom Holdings SOC Ltd

(the *Employer*) and

{Insert registered name and address of the Contractor}

(the *Contractor*), for

{Insert details of the works from the Contract Data}

(the *works*).

I/We the undersigned

on behalf of the *Contractor's*
parent company

of physical address

and duly authorised thereto do hereby unconditionally guarantee to the *Employer* that the *Contractor* shall Provide the Works in accordance with the above numbered Contract.

1. If for any reason the *Contractor* fails to Provide the Works, we hereby agree to cause to Provide the Works at no additional cost to the *Employer*.
2. If we fail to comply with the terms of this Deed of Guarantee, the *Employer* may itself procure such performance (whether or not the Agreement be formally determined). The *Employer* is to notify us and we shall indemnify the *Employer* for any additional cost or expense it incurs.
3. Our liability shall be as primary obligor and not merely as surety and shall not be impaired or discharged by reason of any arrangement or change in relationship made between the *Contractor* and the *Employer* and/or between us and *Contractor*; nor any alteration in the obligations undertaken by the *Contractor* or in the terms of the Agreement; nor any indulgence, failure, delay by you as to any matter; nor any dissolution or liquidation or such other analogous event of the *Contractor*.
4. The *Employer* shall not be obliged before taking steps to enforce the terms of this Deed of Guarantee to obtain judgement against the *Contractor* in any court or other tribunal, to make or file any claim in liquidation (or analogous proceedings) or to seek any remedy or proceed first against the *Contractor*.
5. This Deed of Guarantee shall be governed by and construed in accordance with the laws of the Republic of South Africa and we hereby submit to the non-exclusive jurisdiction of the High Court of South Africa.

Signed at _____ on this _____ day of _____ 200_

Signature(s)	
Name(s) (printed)	
Position in parent company	
Signature of Witness(s)	
Name(s) (printed)	

Pro forma Performance Bond – Demand Guarantee (for use with Option X13)

(to be reproduced exactly as shown below on the letterhead of the Contractor's Parent Company)

**Eskom Holdings SOC Ltd
Megawatt Park
Maxwell Drive
Sandton
Johannesburg**

Date:

Dear Sirs

Reference No. [●] [Drafting Note: Bank reference number to be inserted]

Performance Bond – Demand Guarantee: [Drafting Note: Name of Contractor to be inserted]

Project [] Contract Reference: [Drafting Note: Contractor contract reference number to be inserted]

In this Guarantee the following words and expressions shall have the following meanings:-

“Bank” - means [●], [●] Branch, (Registration No. [●]); [Drafting Note: Name of Bank to be inserted]

“Bank’s Address” - means [●]; [Drafting Note: Bank’s physical address to be inserted]

“Contract” – means the written agreement relating to the Project, entered into between Eskom and the Contractor, on or about the [●] day of [●] 200[●] (Contract Reference No. [.] as amended, varied, restated, novated or substituted from time to time; [Drafting Note: Signature Date and Contract reference number to be inserted])

“Contractor” – means [●] a company registered in accordance with the laws of [●] under Registration Number [●]. [Drafting Note: Name and details of Contractor to be inserted]

“Eskom” - means Eskom Holdings SOC Ltd, a company registered in accordance with the laws of the Republic of South Africa under Registration Number 2002/015527/30].

“Expiry Date” - means the date on which the Defects Certificate is issued in terms of the Contract.

“Guaranteed Sum” - means the sum of R [●] ([●] Rand);

“Project” - means [insert if applicable.].

At the instance of the Contractor, we the undersigned _____ and _____, in our respective capacities as _____ and _____ of the Bank, and duly authorized thereto, confirm that we hold the Guaranteed Sum at the disposal of Eskom, as security for the proper performance by the Contractor of all of its obligations in terms of and arising from the Contract and hereby undertake to pay to Eskom, on written demand from Eskom received prior to the Expiry Date, any sum or sums not exceeding in total the Guaranteed Sum.

A demand for payment under this guarantee shall be made in writing at the Bank’s address and shall:

be signed on behalf of Eskom by a Group Executive, Divisional Executive, Senior General Manager, General Manager or its delegate;

state the amount claimed (“the Demand Amount”);

state that the Demand Amount is payable to Eskom in the circumstances contemplated in the Contract.

Notwithstanding the reference herein to the Contract the liability of the Bank in terms hereof is as principal and not as surety and the Bank's obligation/s to make payment:

is and shall be absolute provided demand is made in terms of this bond in all circumstances; and

is not, and shall not be construed to be, accessory or collateral on any basis whatsoever.

The Bank's obligations in terms of this Guarantee:

shall be restricted to the payment of money only and shall be limited to the maximum of the Guaranteed Sum; and

shall not be discharged and compliance with any demand for payment received by the Bank in terms hereof shall not be delayed, by the fact that a dispute may exist between Eskom and the Contractor.

Eskom shall be entitled to arrange its affairs with the Contractor in any manner which it sees fit, without advising us and without affecting our liability under this Guarantee. This includes, without limitation, any extensions, indulgences, release or compromise granted to the Contractor or any variation under or to the Contract.

Should Eskom cede its rights against the Contractor to a third party where such cession is permitted under the Contract, then Eskom shall be entitled to cede to such third party the rights of Eskom under this Guarantee on written notification to the Bank of such cession.

This Guarantee:

shall expire on the Expiry Date until which time it is irrevocable;

is, save as provided for in 0 above, personal to Eskom and is neither negotiable nor transferable;

shall be returned to the Bank upon the earlier of payment of the full Guaranteed Sum or expiry hereof;

shall be regarded as a liquid document for the purpose of obtaining a court order; and

shall be governed by and construed in accordance with the law of the Republic of South Africa and shall be subject to the jurisdiction of the Courts of the Republic of South Africa.

Any claim which arises or demand for payment received after expiry date will be invalid and unenforceable.

The Bank chooses domicilium citandi et executandi for all purposes in connection with this Guarantee at the Bank's Address.

Signed at _____

Date _____

For and behalf of the Bank

Bank Signatory: _____

Bank Signatory: _____

Witness: _____

Witness: _____

Bank's seal or stamp

Pro forma Advanced Payment Bond (for use with Option X14)

(to be reproduced exactly as shown below on the letterhead of the Bank providing the Bond)

Eskom Holdings Limited
Megawatt Park
Maxwell Drive
Sandton
Johannesburg

Date:

Dear Sirs,

Advanced Payment Bond for Contract No.

With reference to the above numbered contract made or to be made between

Eskom Holdings SOC Limited

(the *Employer*) and

{Insert registered name and address of the Contractor}

(the *Contractor*), for

{Insert details of the works from the Contract Data}

(the *works*).

I/We the undersigned

on behalf of the Surety

of physical address

and duly authorised thereto do hereby bind ourselves as Surety and co-principal debtors in solidum for the due and proper repayment by the *Contractor* to the *Employer* of the advanced payment made by the *Employer* to the *Contractor* under the Contract, and for all losses and expenses that may be suffered or incurred by the *Employer* as a result of non-payment by the *Contractor*, subject to the following conditions

1. The terms *Employer*, *Contractor*, and the *works* have the meaning as assigned to them by the *conditions of contract* listed in the Contract Data for the aforesaid Contract.
2. We renounce all benefits from the legal exceptions "Benefit of Excussion and Division", "No value received" "Revision of Accounts", "Cession of Action" and any other exceptions which might or could be pleaded against the validity of this bond, with the meaning and effect of which exceptions we declare ourselves to be fully acquainted.
3. The *Employer* has the absolute right to arrange his affairs with the *Contractor* in any manner which the *Employer* deems fit and without being advised thereof the Surety shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the Surety. Without derogating from the foregoing compromise, extension of the construction period, indulgence, release or variation of the *Contractor's* obligation shall not affect the validity of this Advance Payment bond.
4. This bond expires on the date when the Surety receives a notice from the *Project Manager* stating that the advanced payment has been repaid to the *Employer* in terms of the Contract, or liquidated by deductions from other payments due to the *Contractor*.
5. The amount of the bond shall be payable to the *Employer* upon the *Employer's* demand and no later than 7 days following the submission to the Surety of a certificate signed by the *Project Manager* stating the amount of the *Employer's* losses, damages and expenses incurred as a result of the non-

performance aforesaid. The signed certificate shall be deemed to be conclusive proof of the extent of the *Employer's* loss, damage and expense.

6. Our total liability hereunder shall not exceed the sum of (R) which is equal to the advance payment.
7. This Advanced Payment Bond is neither negotiable nor transferable and is governed by the laws of the Republic of South Africa.

Signed at _____ on this _____ day of _____ 200_

Signature(s)

Name(s) (printed)

Position in Surety company

Signature of Witness(s)

Name(s) (printed)

Pro forma Retention Money Guarantee (may be used when Option X16 applies)

(to be reproduced exactly as shown below on the letterhead of the Bank providing the Guarantee)

Eskom Holdings SOC Limited
Megawatt Park
Maxwell Drive
Sandton
Johannesburg

Date:

Dear Sirs

Reference No. [●] [Drafting Note: Bank reference number to be inserted]

Retention Money Guarantee: [Drafting Note: Name of Contractor to be inserted]

Project [] : Contract Reference: [Drafting Note: Contractor contract reference number to be inserted]

1. In this Guarantee the following words and expressions shall have the following meanings:-
 - 1.1 "Bank" - means [●], [●] Branch, (Registration No. [●]); [Drafting Note: Name of Bank to be inserted]
 - 1.2 "Bank's Address" - means [●]; [Drafting Note: Bank's physical address to be inserted]
 - 1.3 "Contract" – means the written agreement relating to the Project, entered into between Eskom and the Contractor, on or about the [●] day of [●] 200[●] (Contract Reference No. as amended, varied, restated, novated or substituted from time to time; [Drafting Note: Signature Date and Contract reference number to be inserted])
 - 1.4 "Contractor" – means [●] a company registered in accordance with the laws of [●] under Registration Number [●]. [Drafting Note: Name and details of Contractor to be inserted]
 - 1.5 "Eskom" - means Eskom Holdings SOC Limited, a company registered in accordance with the laws of the Republic of South Africa under Registration Number 2002/015527/30
 - 1.6 "Expiry Date" - means the date on which the Defects Certificate is issued in terms of the Contract.
 - 1.7 "Guaranteed Sum" - means the sum of R [●] ([●] Rand); [Drafting Note: Insert amount of Retention Money Guarantee.].
 - 1.8 "Project" - means the.....
2. At the instance of the Contractor, we the undersigned _____ and _____, in our respective capacities as _____ and _____ of the Bank, and duly authorized thereto, confirm that we hold the Guaranteed Sum at the disposal of Eskom, as security for the proper performance by the Contractor of all of its obligations in terms of and arising from the Contract and hereby undertake to pay to Eskom, on written demand from Eskom received prior to the Expiry Date, any sum or sums not exceeding in total the Guaranteed Sum.
3. A demand for payment under this guarantee shall be made in writing at the Bank's address and shall:
 - 3.1 be signed on behalf of Eskom by a director of Eskom or his authorised delegate.

- 3.2 state the amount claimed ("the Demand Amount");
- 3.3 state that the Contractor has failed to carry out his obligation(s) to rectify certain defect(s) for which he is responsible under the Contract (and the nature of such defect(s)) alternatively that the Demand Amount is payable to Eskom in the circumstances contemplated in the Contract.
4. Notwithstanding the reference herein to the Contract the liability of the Bank in terms hereof is as principal and not as surety and the Bank's obligation/s to make payment:
- 4.1 is and shall be absolute provided demand is made in terms of this bond in all circumstances; and
- 4.2 is not, and shall not be construed to be, accessory or collateral on any basis whatsoever.
5. The Bank's obligations in terms of this Guarantee:
- 5.1 shall be restricted to the payment of money only and shall be limited to the maximum of the Guaranteed Sum; and
- 5.2 shall not be discharged and compliance with any demand for payment received by the Bank in terms hereof shall not be delayed by the fact that a dispute may exist between Eskom and the Contractor.
6. Eskom shall be entitled to arrange its affairs with the Contractor in any manner which it sees fit, without advising us and without affecting our liability under this Guarantee. This includes, without limitation, any extensions, indulgences, release or compromise granted to the Contractor or any variation under or to the Contract.
7. Should Eskom cede its rights against the Contractor to a third party where such cession is permitted under the Contract, then Eskom shall be entitled to cede to such third party the rights of Eskom under this Guarantee on written notification to the Bank of such cession.
8. This Guarantee:
- 8.1 shall expire on the Expiry Date until which time it is irrevocable;
- 8.2 is, save as provided for in 0 above, personal to Eskom and is neither negotiable nor transferable;
- 8.3 shall be returned to the Bank upon the earlier of payment of the full Guaranteed Sum or expiry hereof;
- 8.4 shall be regarded as a liquid document for the purpose of obtaining a court order; and
- 8.5 shall be governed by and construed in accordance with the law of the Republic of South Africa and shall be subject to the jurisdiction of the Courts of the Republic of South Africa.
- 8.6 Any claim which arises or demand for payment received after expiry date will be invalid and unenforceable.
9. The Bank chooses domicilium citandi et executandi for all purposes in connection with this Guarantee at the Bank's Address.

Signed at _____

Date _____ Bank's seal or stamp

For and behalf of the Bank

Bank Signatory: _____

Bank Signatory: _____

Witness: _____

Witness: _____

Pro forma ASGI-SA Guarantee

(to be reproduced exactly as shown below on the letterhead of the Bank providing the Guarantee)

Eskom Holdings Limited
Megawatt Park
Maxwell Drive
Sandton
Johannesburg

Date:

Dear Sirs

Reference No. [●] [Drafting Note: Bank reference number to be inserted]

Pro-Forma ASGI-SA Guarantee: [Drafting Note: Name of Contractor to be inserted]

Project [] Contract Reference: [●] [Drafting Note: Contractor contract reference number to be inserted]

1. In this Guarantee the following words and expressions shall have the following meanings:-
 - 1.1 “Bank” - means [●], [●] Branch, (Registration No. [●]); [Drafting Note: Name of Bank to be inserted]
 - 1.2 “Bank’s Address” - means [●]; [Drafting Note: Bank’s physical address to be inserted]
 - 1.3 “Contract” – means the written agreement relating to the Project, entered into between the *Employer* and the *Contractor*, on or about the [●] day of [●] 200[●] (Contract Reference No. [●] as amended, varied, restated, novated or substituted from time to time; [Drafting Note: Signature Date and Contract reference number to be inserted]
 - 1.4 “Contractor” – means [●] a company registered in accordance with the laws of [●] under Registration Number [●]. [Drafting Note: Name and details of Contractor to be inserted]
 - 1.5 “Contractor’s ASGI-SA Obligations” – means the *Contractor’s* ASGI-SA Obligations under and as defined in the Contract.
 - 1.6 “Employer” - means Eskom Holdings Limited, a company registered in accordance with the laws of the Republic of South Africa under Registration Number 2002/015527/06.
 - 1.7 “Expiry Date” - means the [●] day of [●] 200[●]; [Drafting Note: anticipated date of issue of ASGI-SA Performance Certificate to be inserted.]
 - 1.8 “Guaranteed Sum” - means the sum of R [●] ([●] Rand);
 - 1.9 “Project” – means the
2. At the instance of the *Contractor*, we the undersigned _____ and _____, in our respective capacities as _____ and _____ of the Bank, and duly authorized thereto, confirm that we hold the Guaranteed Sum at the disposal of the *Employer*, as security for the proper performance by the *Contractor* of the *Contractor’s* ASGI-SA Obligations and hereby undertake to pay to the *Employer*, on written demand from the *Employer* received prior to the Expiry Date, any sum or sums not exceeding in total the Guaranteed Sum.
3. A demand for payment under this guarantee shall be made in writing at the Bank’s address and shall:
 - 3.1 state the amount claimed (“the Demand Amount”);
 - 3.2 state that the Demand Amount is payable to the *Employer* in the circumstances contemplated in

the Contract.

4. Notwithstanding the reference herein to the Contract the liability of the Bank in terms hereof is as principal and not as surety and the Bank's obligation/s to make payment:
 - 4.1 is and shall be absolute provided demand is made in terms of this bond in all circumstances; and
 - 4.2 is not, and shall not be construed to be, accessory or collateral on any basis whatsoever.
5. The Bank's obligations in terms of this Guarantee:
 - 5.1 shall be restricted to the payment of money only and shall be limited to the maximum of the Guaranteed Sum; and
 - 5.2 shall not be discharged and compliance with any demand for payment received by the Bank in terms hereof shall not be delayed, by the fact that a dispute may exist between the *Employer* and the *Contractor*.
6. The *Employer* shall be entitled to arrange its affairs with the *Contractor* in any manner which it sees fit, without advising us and without affecting our liability under this Guarantee. This includes, without limitation, any extensions, indulgences, release or compromise granted to the *Contractor* or any variation under or to the Contract.
7. Should the *Employer* cede its rights against the *Contractor* to a third party where such cession is permitted under the Contract, then the *Employer* shall be entitled to cede to such third party the rights of the *Employer* under this Guarantee on written notification to the Bank of such cession.
8. This Guarantee:
 - 8.1 shall expire on the Expiry Date until which time it is irrevocable;
 - 8.2 is, save as provided for in 0 above, personal to the *Employer* and is neither negotiable nor transferable;
 - 8.3 shall be returned to the Bank upon the earlier of payment of the full Guaranteed Sum or expiry hereof;
 - 8.4 shall be regarded as a liquid document for the purpose of obtaining a court order; and
 - 8.5 shall be governed by and construed in accordance with the law of the Republic of South Africa and shall be subject to the jurisdiction of the courts of the Republic of South Africa.
 - 8.6 Any claim which arises or demand for payment received after expiry date will be invalid and unenforceable.
9. The Bank chooses domicilium citandi et executandi for all purposes in connection with this Guarantee at the Bank's Address.

Signed at _____

Date _____

For and behalf of the Bank

Bank Signatory: _____

Bank Signatory: _____

Witness: _____

Witness: _____

Bank's seal or stamp

PART 2: PRICING DATA
ECC3 Option A

Document reference	Title	No of pages
C2.1	Pricing assumptions: Option A	2
C2.2	The <i>activity schedule</i>	1

C2.1 Pricing assumptions: Option A

How work is priced and assessed for payment

Clause 11 in NEC3 Engineering and Construction Contract, (ECC3) Option A states:

Identified and defined terms	11	
	11.2	(20) The Activity Schedule is the <i>activity schedule</i> unless later changed in accordance with this contract.

(27) The Price for Work Done to Date is the total of the Prices for

- each group of completed activities and
- each completed activity which is not in a group.

A completed activity is one which is without Defects which would either delay or be covered by immediately following work.

(30) The Prices are the lump sum prices for each of the activities on the Activity Schedule unless later changed in accordance with this contract.

This confirms that Option A is a lump sum form of contract where the work is broken down into activities, each of which is priced by the tendering contractor as a lump sum. Only completed activities are assessed for payment at each assessment date; no part payment is made if the activity is not completed by the assessment date.

Function of the Activity Schedule

Clause 54.1 in Option A states: "Information in the Activity Schedule is not Works Information or Site Information". This confirms that specifications and descriptions of the work or any constraints on how it is to be done are not included in the Activity Schedule but in the Works Information. This is further confirmed by Clause 20.1 which states, "The *Contractor* Provides the Works in accordance with the Works Information". Hence the *Contractor* does **not** Provide the Works in accordance with the Activity Schedule. The Activity Schedule is only a pricing document.

Link to the programme

Clause 31.4 states that "The *Contractor* provides information which shows how each activity on the Activity Schedule relates to the operations on each programme which he submits for acceptance". Ideally the tendering contractor will develop a high level programme first then resource each activity and thus arrive at the lump sum price for that activity both of which can be entered into the *activity schedule*.

Preparing the *activity schedule*

Generally it is the tendering contractor who prepares the *activity schedule* by breaking down the work described within the Works Information into suitable activities which can be well defined, shown on a programme and priced as a lump sum.

The *Employer*, in his Instructions to Tenderers or in a Tender Schedule, may have listed some items that he requires the *Contractor* to include in his *activity schedule* and be priced accordingly.

It is assumed that in preparing his *activity schedule* the *Contractor*:

- Has taken account of the guidance given in the ECC3 Guidance Notes pages 19 and 20;
- Understands the function of the Activity Schedule and how work is priced and paid for;
- Is aware of the need to link the Activity Schedule to activities shown on his programme;
- Has listed and priced activities in the *activity schedule* which are inclusive of everything necessary and incidental to Providing the Works in accordance with the Works Information, as it was at the time of tender, as well as correct any Defects not caused by an *Employer's* risk;
- Has priced work he decides not to show as a separate activity within the Prices of other listed activities in order to fulfil the obligation to complete the *works* for the tendered total of the Prices.
- Understands there is no adjustment to the lump sum Activity Schedule price if the amount, or quantity, of work within that activity later turns out to be different to that which the *Contractor* estimated at time of tender. The only basis for a change to the Prices is as a result of a compensation event.

C2.2 the *activity schedule*

Use this page as a cover page to the *Contractor's activity schedule*.

AVR - UPGRADE OF EXCITATION CONTROL SYSTEM AT KUSILE AND MEDUPI POWER STATION UNITS 1,2,3,4,5 & 6 FOR A PERIOD OF 5 YEARS					
Item no.	Description	Unit	Quantity	Rate	Total
100.00	<u>PRELIMINARY & GENERAL</u>				
	<u>Site Establishment</u>				
	Offices, Storage, Ablution facilities, Office equipment, etc				
102.00	Fixed -	Sum	2		
	<u>Transport</u>				
104.00	Employee transport	Per month	24		
105.00	4x4 LDV (Kilometres to cover both stations) 36 000km estimated for each	km	72 000		
	<u>Health and Safety Requirements (Medicals, Safety file, induction, PPE, etc)</u>				
106.00	Time Related -	Per Year	10		
	<u>Accommodation</u>				
107.00	Time Related -	Per month	24		
	<u>Site De-establishment</u>				
108.00	Fixed -	Sum	2		
	PRELIMINARY & GENERAL TOTAL				
200	<u>DELIVERY COSTS</u>				
201	<u>FREIGHT CHARGES</u>				
202	Airfreight, Sea freight, Road transport, Wharfage, etc (charges including custom duties, insurance, etc)	Sum	2		
	DELIVERY COSTS TOTAL				
300	DEMOLITIONS AND ALTERATIONS				
302	Decommission and remove existing excitation components and cabling to a designated area as indicated by the Employer (Termination schedules and cabling block diagrams)	Per Unit	12		
304	Fire sealing of all cable entry points and floor slots unit	Each	12		
305	Connection of earth conductors for switchgear assembly to existing earth	Each	12		
	DEMOLITIONS AND ALTERATIONS TOTAL				
400	DESIGN AND APPROVAL OF EQUIPMENT				
	(Design to include all calculations and specifications)				

	of this new equipment). The system needs to provide safe and reliable operation for a minimum of 15 years				
401	Design and submission for approval by Employer	Once off	2		
500	MANUFACTURING OF EQUIPMENT				
501	Procure, Manufacturing, Acceptance approval of equipment and Instal new Excitation Control System (Panel wiring diagrams with number, KKS, component description etc)	Per Unit	12		
	MANUFACTURING OF EQUIPMENT TOTAL				
700	PRELIMINARY COMMISIONING				
701	Preliminary System and PSS settings for commissioning	Per Unit	12		
	PRELIMINARY COMMISIONING TOTAL				
800	FINAL COMMISIONING				
801	Complete Commissioning of AVR Excitation Control System - All Units	Per Unit	12		
	FINAL COMMISIONING TOTAL				
900	TRAINING				
901	Formal training of Engineering, Maintenance and Operating personnel	Once off	2		
	TRAINING TOTAL				
1000	TESTING				
	Testing of all power cables				
1001	Function testing	per unit	12		
1002	Factory Acceptance test	per unit	12		
1003	Site acceptance test	per unit	12		
1004	Cold commissioning test	per unit	12		
1005	Hot commissioning test	per unit	12		
1006	Post commissioning optimisation	per unit	12		
1009	Grid code compliance test	per unit	12		
1010	Guarantee test	per unit	12		
	TESTING TOTAL				
SECTIONS	DESCRIPTION				SUMMARY
100	PRELIMINARIES & GENERAL				
200	FREIGHT CHARGES				
300	DEMOLITIONS AND ALTERATIONS				
400	DESIGN AND APPROVAL OF EQUIPMENT				
500	MANUFACTURING OF EQUIPMENT				
700	PRELIMINARY COMMISSIONING				
800	FINAL COMMISSIONING				
900	TRAINING				
1000	TESTING				

PART 3: SCOPE OF WORK

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C3.2	<i>Contractor's Works Information</i>	1
	Total number of pages	26

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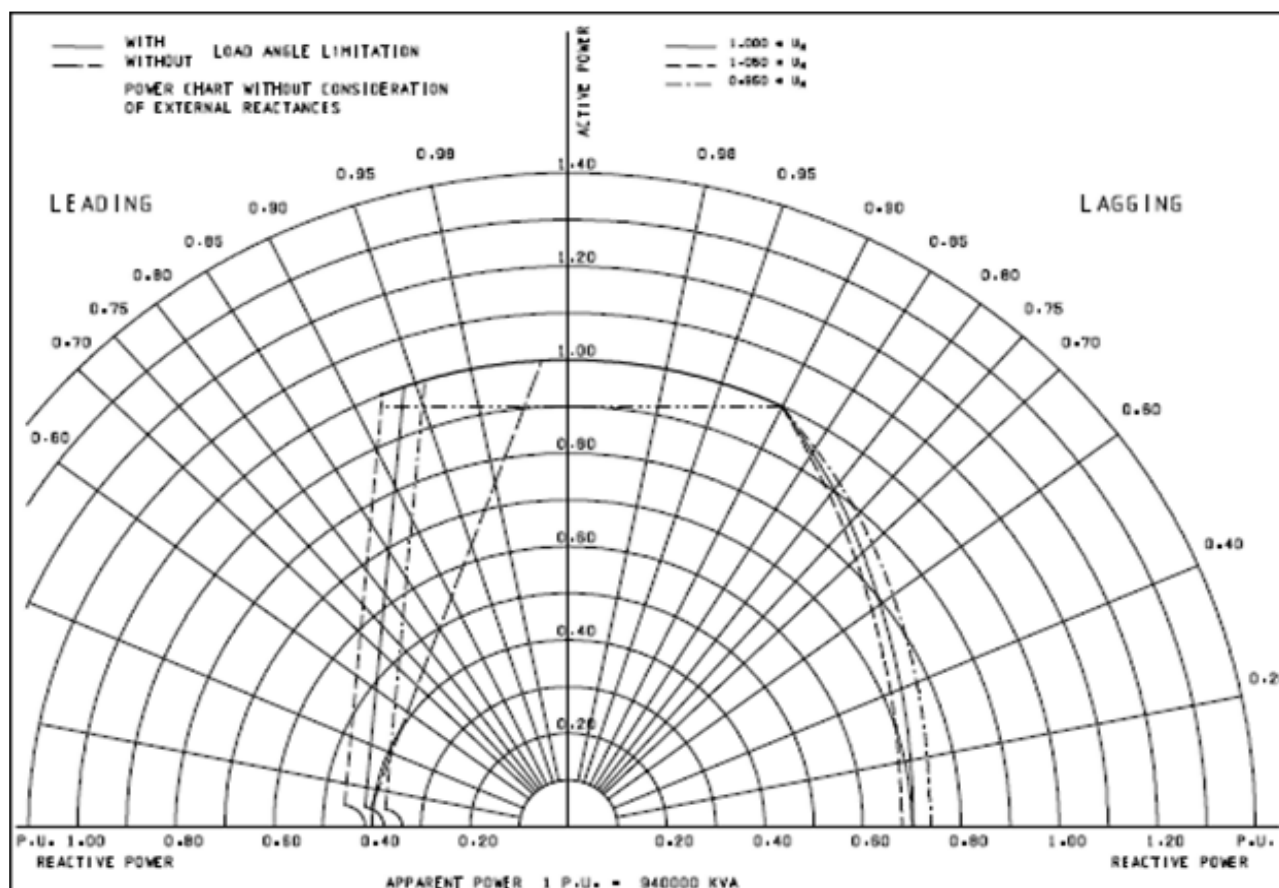
Description of the works

Executive overview

The excitation system forms part of the export system of the power station unit and is a critical component to the working mechanism of the generator. Kusile and Medupi Power Stations has six 940 MVA synchronous generators each which are connected to the national grid. The purpose of their excitation systems is to control the stator voltage of a generator.

The present excitation system at Kusile and Medupi Power Stations is of the static type, which means that the main winding output of the generator is used to supply voltage to the excitation system. This is then rectified and supplied to the rotor windings via the brush gear. The AVR automatically adapts the excitation to meet the requirements of the generator. It varies the field current to meet the demand which allows the generator to be adequately controlled and operated anywhere within the generator capability diagram as shown in Figure 1. Failure of the excitation system results in a Unit trip.

Kusile and Power Stations are fitted with an excitation system at each of its six Units originally manufactured by ALSTOM, now GE. The life expectancy of these systems are 15 years. Although the life expectancy of these systems has not been reached, some of the internal components have become obsolete, making spares a big challenge for the station. Also, recent failures on the excitation system indicates that the system is unreliable and requires an immediate replacement to keep the Unit in operation. Replacement of this system will ensure better reliability of the export system thus reducing UCLF.



The Works is inclusive of all activities necessary for the provision of a fully functional static excitation system and interfaces that meet the Eskom Excitation System Standard (240-155615284) and all national and international standards therein, including IEEE and SANS/IEC Standards.

Employer's objectives and purpose of the works

The objective and purpose of the Works is to implement and commission a reliable static excitation system for Kusile and Medupi Power Stations.

Interpretation and terminology

The following abbreviations are used in this Works Information:

Abbreviation	Meaning given to the abbreviation
AC	Alternating Current
AFC	Approved for construction
AVR	Automatic Voltage Regulator
C&I	Control and Instrumentation
CT	Current Transformer
DC	Direct Current
DCS	Distributed Control System
ECN	Engineering Change Notification
ECS	Excitation Control System
EDWL	Engineering Design Work Lead
FAT	Factory Acceptance Test
FCR	Field Current Regulator
GCB	Generator Circuit Breaker
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning
HVCB	High Voltage Circuit Breaker
IEC	International Electro technical Commission
IED	Intelligent Electronic Device
LCD	Liquid Crystal Display
LDE	Lead Discipline Engineer
LED	Light Emitting Diode
LPS	Low Pressure Services
NTP	Network Time Protocol
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
PI	Proportional-Integral
PID	Proportional-Integral-Derivative
PSS	Power System Stabiliser
QCP	Quality Control Plan
ROC	Required Operational Capability

SANS	South African National Standards
SAT	Site Acceptance Tests
SCADA	Supervisory Control and Data Acquisition
SHEQ	Safety, Health, Environment, Quality
Sntp	Simple Network Time Protocol
SRD	Stakeholders Requirement Definition
SSME	Support Subject Matter Expert
VDSS	Vendor Document Submittal Schedule
VT	Voltage Transformer

Management and start up.

Management meetings

Meetings will be held monthly between the *Project Manager* and the *Contractor* and any person instructed by the *Project Manager* to attend. The *Contractor* is represented at each meeting by the appropriate member of the staff. Additional Ad hoc meetings may also be called to address urgent issues. The *Project Manager* will, as and when necessary. Require the *Contractor* to attend meetings with Other *Contractors* on the Project.

This requirement does not constitute a compensation event.

The venue for these meetings is determined by the *Project Manager*. The *Project Manager* writes the minutes of meetings and circulates them to attendees within five working days.

Any action of the *Project Manager* and the *Contractor* implied in the minutes of meetings is confirmed by a separate formal communication between the *Project Manager* and the *Contractor*.

The *Contractor* reports the overall progress, and as a minimum requirement, the following are addressed:

- Contractor's* current activity, progress, and planned finished dates.
- Contractor's* planned start and finish dates for the works.
- Contractor* and *Project Manager's* program agenda, current and projected manpower by class.
- Health, Safety, and Quality issues.
- The progress of any Other relevant activities.
- Discussion on any technical and commercial issues.
- Problem areas of concern.

Regular meetings of a general nature may be convened and chaired by the *Project Manager* as follows:

Title and purpose	Approximate time & interval	Location	Attendance by:
Risk register and compensation events	Weekly on <u>TBA</u> at <u>TBA</u>	TBA	Relevant appointed members of a Risk or and Compensation event committee that will include <i>Contractor's</i> PM, Construction Manager, Engineering Manager, Quality Manager, Safety Manager, and Environmental Manager.
Overall contract progress and feedback	Monthly		<i>Employer, Contractor, Supervisor, and Others</i> as determined by the Project Manager.
Planning Meetings	Weekly		<i>Employer, Contractor, Supervisor,</i>

			Planner, and Others as determined by the Project Manager.
Integration meetings with Others	Weekly		<i>Employer, Contractor, Supervisor, Planners, and Others as determined by the Project Manager.</i>
Safety Meetings	Monthly		<i>Employer, Contractor, Supervisor, Safety Officers, and Others as determined by the Project Manager.</i>

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the works. Records of these meetings shall be submitted to the *Project Manager* by the person convening the meeting within five days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

Documentation control

All correspondence is to be addressed to the *Project Manager* and all correspondence should be marked in sequential order. All contractual communications will be in the form of properly compiled letters or forms attached to e-mails and not as a message in the e-mail itself.

All technical documentation to comply with the latest 240-54179170, Technical Documentation Classification and Designation Standard.

All project hand over shall be managed as per 240-65459834, Project Documentation Deliverable Requirement Specification.

Refer to Eskom Excitation Standard Section 3.5 for detailed documentation control requirements.

Health and safety risk management

OHS requirements

The Contractor/Supplier shall at all times comply with the Eskom's Occupational Health and Safety (OHS), legal and other requirements as amended for the duration of the contract. In addition, the Contractor shall comply with the requirements contained in the OHS Specification/requirements. Eskom reserves the right to terminate the contract, if the *Contractor* has built up a history of poor performance or non-conformance in relation to matters of occupational health and safety and legal compliance. No work may begin until the Health and Safety file has been approved by the individual Business Unit's OHS personnel. For the length of the contract, the contractor shall adhere to the respective Business Unit's OHS, legal, and other requirements, as amended.

Continuous Improvement

- Contractors are required to conduct the following as part of the continuous improvement initiatives:
- Visible Felt Leadership by top management
- Identify critical tasks and monitor those tasks through Planned Job Observations
- Behavioural based safety, if the contractor does not have its own procedure, Eskom procedure can be used as a guide
- Contractor 16.1 shall present the lost time injury (LTI) incidents at Business Unit / Power station General Managers meeting within 7 days of the incident.

Contractor/supplier Management Key Performance Indicators (KPI's)

- Maintain Health and Safety file and compliance to the health and safety plan
- Always maintain good housekeeping
- Implement and monitor near miss programme
- Comply to BSO, Visible Felt Leadership and Planned Job Observation programmes
- Zero Fatalities
- At any given point, the OHS performance must be within the lost time injury (LTI) tolerance level as amended
- All incident investigations shall be completed within 30 days of the occurrence of an incident.
- Close audit findings as per the recommended time frames
- Close Non-conformance as per the recommended time frames

Contract completion and sign off

On completion of the project, Eskom team (led by the Contract custodian/ *Project Manager*) involved in the project together with the *Contractor* shall conduct the final audit/inspections to identify the gaps prior to the contractor leaving site or completing the project. Before the final invoice is paid/processed, the Contract custodian/*Project Manager* shall ensure that the below requirements are met:

- Close all incidents and audit findings.
- Clean the respective yard and ensure good housekeeping where the contractor was working.
- Contractor shall submit safety statistics and a safety file to Eskom BU Safety department for closeout and filling.
- Completion of a closeout report (Annexure D form as per 32-726) to close the contractual work.
- Once the above issues have been addressed, the Contract custodian/*Project Manager* shall verify and sign off prior to releasing the final payment.

OHS 37(2) Agreement

The function of the 37(2) Agreement is primarily to indemnify Eskom from any acts or omissions by its contractors/suppliers and its employees in contravention of the OHS Act. This means that contractors/suppliers are deemed to be employers, their employees are not deemed to be employees of Eskom and acknowledges that is solely responsible for its employees, its appointed contractors, agents and the like, while performing work for or on behalf of Eskom. Every site where the contractor is performing work, a 37(2) agreement shall be signed by the site contract custodian and the contractor/supplier representative 16(1)/2 appointee.

Compensation of injuries and diseases (COLD)

Eskom is required by law to ensure that their contractors/suppliers have registered with the compensation fund and are in good standing. The Main contractor and all his/her appointed contractors shall be registered with an appropriate compensation fund and have available a valid letter of good standing (LoG) from such commissioner. The obligation lies with the contractors to ensure that the LoG remain valid throughout the contract period. A copy of the LoG must be filed in the contractor OHS files.

Note: Contractors without the valid letter of good standing shall not be permitted to work on Eskom Generation site or project. Contractors must obtain the letter of good standing prior to expiry of the existing one.

Legal and Other Requirements

The Contractor will be required to comply with the following legal and other requirements throughout the duration of the contract:

- Occupational Health and Safety Act 85 of 1993
- Contract and Contractor OHS Management (32-726)
- Eskom Life Saving Rules
- Eskom OHS Specification

- Eskom SHEQ Induction
- COIDA Act
- Eskom Incident Management Procedure (32-95)

Environmental constraints and management

The Contractor shall control his activities and processes in accordance with:

- Kusile Power Station Environmental Requirements for Contractors and Suppliers Specification - 240-106963417 and,
- Medupi Power Station Environmental Requirements for Contractors and Suppliers Specification - 240-90508511.

Quality assurance requirements

It is important for all Eskom contractors to meet the minimum requirements of ISO 9001 Quality Management System to maintain high standards of products or services rendered to Eskom.

It is therefore important that the contractor demonstrate commitment to the development, implementation and maintenance of its Quality Management System that complies with the ISO 9001:2015 requirements.

This work falls under Category 2 of the Quality Requirements. The supplier is therefore required to submit the following documents and evidence:

SECTION A: Quality Management System Requirements ISO 9001

(Option 1) Valid certification of Quality Management System by an ISO accredited body

OR

(Option 2) Objective evidence of documented QMS that is not certified but complies with ISO 9001:

A.1 QMS Manual or a document that defines and describes the QMS and its scope.

A.2 Quality Policy Approved by top management.

A.3 Quality Objectives Approved by top management.

A.4 Control of documented information (i.e. document and record control)

A.5 Documented information for Control of nonconforming outputs

A.6 Documented information for Nonconformity and Corrective action

A.7 Documented information for Internal audit

SECTION B: Evidence of QMS in operation

B.1 Documented information for defined roles, responsibilities and authorities.

B.2 Documented information for Control of Externally Provided Processes, Products and Services

B.3 Latest copy of an internal management system audit report

B.5 Records of Management Review meetings (minutes, attendance registers etc.)

SECTION C: Contract Quality Plan Requirements

Draft Contract Quality Plan specific to the scope of work

SECTION D: Quality Control Plan Requirements

QCP /Checklist/ ITP (Quality Control Plans) as per Scope of Works

SECTION E:

E.1 Completed and Signed Form A

Programming constraints

The *Employer* provides the Key Dates as set out in clause 11.2.9 of the Contract Data of the *Employer*, the access dates in clause 30.1 of the Contract Data by the Employer; the interface points identified by the *Contractor* in the *Contractor's* Works Information, and requirements set out in the Works Information.

The *Contractor* submits as part of its tender response a Level 3 programme which becomes the first Accepted Programme that contains the following as a minimum:

- a) The Key Dates
- b) The access dates from clause 30.1 of the Contract Data by the Employer.
- c) The details on how the *Contractor* intends to achieve the Key Dates and the access dates.
- d) Interface with Others.
- e) Interface with the Employer.
- f) The date of Site establishment.
- g) Show all the critical paths.
- h) The Contractor must ensure that their programme contains sufficient float in order for the Contractor to add interface and alignment with the Employer's requirements and,
- i) Other factors, information, methodologies, details, and dates which the Contractor believes are necessary for the achievement of the interface with Others; Key Dates, Completion Dates, and access dates.

The Contractor submits a revised programme during the Contract in accordance with time period provided in clause 32.2. This revised programme must contain the following:

- a) All information required as stated above.
- b) The services and work (programs) of all his Subcontractors and Suppliers.
- c) The design schedule, where applicable.
- d) The construction schedule.
- e) The planning schedule.
- f) The construction and manufacturing schedule.

The Contractor submits an updated programme every 2 weeks during execution. The updated programme is not a revised programme submitted in terms of clause 32 of the Contract. Notwithstanding anything to the contrary in the contract, Works Information or expressed at any meeting or in any minute of a meeting, the Accepted Programme is not altered by the Employer's involvement in discussing the updated programme. All references to the requirements for a revised programme will be inferred as references to the requirements for an updated programme.

The Contractor must ensure that the Key Dates and interfaces with the Employer and Others are incorporated into the Accepted Programme. To improve integration and interfaces with the Others and the Employer, the Contractor participates in the integration meetings with the Employer and Others as required by the Employer. The information obtained from these integration meetings are incorporated into the revised programmes submitted to the Project Manager. The Contractor ensures that all dates, including Key Dates, between the Contractor, the Employer, and Others are aligned in the revised programme

Where project execution periods fall during or after public holidays or the annual builders' holidays, festive season, Easter or any Other public holiday recognised by the Public Holidays Act number 36 of 1994, the Contractor plans his schedule, workforce and resources to ensure the Key Dates and Completion Date is met.

Computerised Planning

The Employer has adopted Primavera Project Planner for all planning, progress monitoring, and reporting on the Project. The Contractor applies it for the planning and control of the works in line with the accepted WBS. The Employer does not accept any programmes, progress reports or Other required data and information in PDF or any Other form except Primavera Project Planner.

The Employer will have a Master Programme which incorporates the Contractor's and Others' programmes. The Contractor submits updated electronic progress reports as required by the Project Manager, which requirement is not a compensation event. The updated progress report shows the logic, and all filters and layouts used in the programme

Planning Methodology and Programme Levels

All planning is done based on the CPM. The Contractor's planning methodology incorporates the compatibility, alignment, and interface with Others on the Project. The Accepted Programme shows the actual critical path clearly.

The Accepted Programme and progress reports layout takes into account the approved WBS, reflecting the manner the works are to be performed and how control data are to be summarised, reported, and monitored. The Contractor's Accepted Programme and progress reports include sufficient detail and input to allow for dynamic Integrated project control, allowing the Employer to achieve the requirements of the Project.

Timer Reporting

The Contractor extracts and provides a one-month "look-ahead window" from the Accepted Programme, showing activities per tank. It furthermore shows Key Dates and the activities of the Employer and Others, which are scheduled for Completion within the next reporting period in a case where there are interfaces

Reporting on Remaining Duration

The method for reporting on activities in progress is by remaining duration, i.e., the time, in working days, needed to complete the activity from the report date. Once an activity has started, the remaining duration is assessed for each update.

Automatic reduction of the remaining duration as the report date moves forward is not accepted.

Actual Dates

When completion of any activity is confirmed by quoting document numbers, these numbers are given in remarks and are appended, e.g. suborders, drawings, inspection certificates, delivery notes, etc. The actual starting and completion dates of all activities is reported.

Progress Reporting during Provision of the Works

The Contractor submits its progress reports on the last day of each month, and if the last day is not a working day, the preceding working day, or more often as required by the Project Manager. This requirement does not constitute a compensation event.

The Contractor submits, together with the progress reports, a written report containing the following: Statement and report on work where delay against the Accepted Programme has occurred (if any), together with the reasons why delay has occurred and a plan denoting the action to be taken and the period of time necessary to recover such delay; any impact that the delay may have on Others or an indication of Others affected by the delay.

Statement and report on those Works that are currently ahead of the programme, any impact on the progress of Others or an indication of Others affected by the delay.

The Impact of any programming changes arising is reflected in the revised forecast rate of payment schedules and resource schedules.

Progress Report

The Employer, the Contractor, and Of/Jets meet daily to report the overall progress of erection activities, which identifies the following:

- a) any SHE-related incidents and remedial actions or plans.
- b) progress of the previous day's work
- c) resources.
- d) any deliveries of Plant, Material, and Equipment.
- e) the scheduled date of delivery of Plant, Material, and Equipment.
- f) Interface, alignment, and compatibility with the Employer and Others.
- g) Contractor's current activities progress and planned finish dates.
- h) Contractor's planned start and finish dates for work.
- i) Planned effort for activities.
- j) Actual effort for activities.

k) Remaining duration for activities.

Percentage progress for activities

Weekly Progress Report

The Contractor submits weekly progress reports to the Project Manager. This report is used as a tool for the day-to-day management of the Contract. Contents of a weekly report include the following items:

- a) Programme summary narrative.
- b) Progress and performance summaries.
- c) Schedule rolling horizon.
- d) Completion and Key Date status.

Monthly Progress Report

The Contractor submits to the Project Manager a written monthly report as provided for in paragraph 2.6 above. The report contains the following information as a minimum requirement:

- a) Executive summary (narrative identifying major movement within the reporting period).
- b) Revised Programme indicating, actual progress of work against the last Accepted Programme.
- c) A one-month look-ahead work window.
- d) Activities completed during the current reporting period per discipline, including the activities of the Employer and Others.
- e) Activities in progress during the current reporting period per discipline, including the activities of the Employer and Others.
- f) Activities undertaken during the next reporting period per discipline, including the activities of the Employer and Others.
- g) Status overview by unit, by plant area, by phase.
- h) Key issues/ Items of concern and corrective actions.
- i) Progress curves and tabular progress reports.
- j) Cost and Cash flow.
- k) Cost curve 'S-curve'.
- l) Early warning log.
- m) Compensation event log.
- n) General planning report (computer-generated).
- o) Critical activities report.
- p) Key event report (computer-generated).
- q) Report selecting all of the activities of the Employer and Other – (computer generated).
- r) Updated bar charts.
- s) Updated resource schedule and histogram (if changed).
- t) Updated activity schedule.
- u) Forecast rate of payment schedule upated with actual progress.
- v) Statement and report on Works ahead and behind schedule.
- w) Skills development progress report (if applicable).

Planner Requirements

The Contractor's planner is experienced, qualified and must be dedicated to the Contract to perform the planning and programming requirements in accordance with this section. During execution. The Contractor must provide a full-time planner on Site.

Contractor's management, supervision and key people

The *Contractor* is to submit an operational plan, including an organogram, for approval and acceptance by the *Project Manager*.

Below is the list of key persons. The *Contractor* should on his organogram include the below-listed key persons as a minimum:

- a) Dedicated *Project Manager*.
- b) Dedicated Project Planner.
- c) Dedicated Site Manager.

- d) Dedicated Construction Supervisors
- e) Dedicated Quality Manager.
- f) Dedicated Quality Control Supervisor.
- g) Dedicated Site Safety Manager.
- h) Dedicated Site Safety Representative.
- i) Dedicated Engineer.

For the purpose of this Contract, “dedicated” means that the person is allocated only to this Contract, full time, must not be working on any other contract, must be available at Site as and when required, must be available at Site full time during the construction phase, must respond promptly to instructions.

In the *Contractor's* tender response, the *Contractor* states how many of the key people are required for this Contract. The *Contractor's* pricing for this provision of this activity must be stated in such a way that the *Employer* is able to assess the number of dedicated persons, their job function, and the extent of their availability. If the *Employer* finds that their key people are not a dedicated resource, the *Employer* makes a pro rata deduction from the Prices

Invoicing and payment

At each assessment interval, the *Contractor* submits to the *Employer* a forecast rate of invoicing that includes all the expected payments by the *Employer* to the *Contractor* on a month-by-month basis. The invoice needs to have all support documentation attached to the invoice, rental sheets per *Contractor's* equipment registers, and any other relevant information and signed by both parties.

Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice showing the amount due for payment equal to that stated in the *Project Manager's* payment certificate.

The *Contractor* shall address the tax invoice to Eskom Holdings SOC Ltd and include on each invoice the following information:

Name and address of the *Contractor* and the *Project Manager*;

The contract number and title;

Contractor's VAT registration number;

The *Employer's* VAT registration number 4740101508;

Description of service provided for each item invoiced based on the Price List;

Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;

(add other as required)

Add procedures for invoice submission and payment (e. g. electronic payment instructions)

Contract change management

Contract change management shall be done as per the NEC3 ECC compensation event process.

Provision of bonds and guarantees

The form in which a bond or guarantee required by the *conditions of contract* (if any) is to be provided by the *Contractor* is given in Part 1 Agreements and Contract Data, document C1.3, Sureties.

The *Employer* may withhold payment of amounts due to the *Contractor* until the bond or guarantee required in terms of this contract has been received and accepted by the person notified to the *Contractor* by the *Project Manager* to receive and accept such bond or guarantee. Such withholding of payment due to the *Contractor* does not affect the *Employer's* right to termination stated in this contract.

Training workshops and technology transfer

1. Training provided by the *Contractor* shall be applicable to the actual equipment supplied for the *Works*. Generalised training based on similar equipment or plant shall not be acceptable.
2. Advanced training shall also be provided for during commissioning activities and is of such a standard that experienced staff are able to perform routine maintenance testing as well as grid code related time domain as well as frequency domain tests of the system after such training has been obtained.
3. All training provided shall also be properly documented.
4. Formal theoretical training for engineering personnel shall be provided before the detail design phase. This shall include the following as a minimum:
 - a. Examples and interpretation of design drawings.
 - b. Demonstration of the plant laptop and associated software commissioning tools.
 - c. Training on how to view logics, configs, settings, etc. on the plant laptop.
 - d. Hardware and associated design philosophies.
 - e. Software and associated design philosophies.
 - f. Interfacing design philosophies and process flows.
 - g. HMI software.
 - h. Examples of previous panels built.
5. On site operator training shall include the following as a minimum:
 - a. Basic machine capability diagram overview and the effect of the excitation system limiters.
 - b. Role of the excitation control system during mode changes.
 - c. Basic overview of the AVR, FCR and PSS functionality.
 - d. Local HMI and control desk functions and practical exposure.
 - e. Alarm response protocols and practical exposure.
 - f. Reset protocols and practical exposure.
 - g. Isolations of the excitation equipment and practical exposure.
6. On site basic maintenance training shall include the following as a minimum:
 - a. Training for basic maintenance shall include the operating training as per previous section.
 - b. OEM maintenance procedures.
 - c. Introduction to system drawings.
 - d. Hardware components overview.
 - e. Practical training for basic routine tasks (filters changes, inspections, cleaning, etc.)
 - f. Field breaker maintenance and inspections and practical exposure.
 - g. Practical training for basic fault finding.
7. On site advanced maintenance training shall include the following as a minimum:
 - a. This training shall also include operator and basic maintenance training as stipulated.
 - b. Hardware and design philosophy.
 - c. Software and design philosophy.
 - d. Excitation control system settings and configurations.
 - e. Protection IED settings and configurations.
 - f. Software downloads, uploads and backups.

- g. Fault and event recorder configurations.
 - h. Commissioning training.
 - i. Detailed practical training as per section to follow.
8. The following items shall be practically demonstrated as part of the advanced maintenance training:
- a. Setup and use of the plant commissioning laptop.
 - b. Excitation control system settings and configuration changes.
 - c. Protection IED settings and configuration changes.
 - d. Transducers testing and configuration.
 - e. Software downloads, uploads and backups on all configurable devices.
 - f. Firmware updates.
 - g. Fault and event recorder analysis and downloads.
 - h. Removal, installation and configuration of electronic control modules.
 - i. Excitation system AVR and FCR mode step responses.
 - j. Excitation limiter tests for every applied limiter.
 - k. Excitation system frequency scan testing as well as any setup and temporary configurations.
 - l. Setup of any internal recorders for commissioning purposes.
 - m. Converter dummy-load setup and testing.
 - n. Field flashing operation tests.
 - o. VT fuse fail operation tests.
 - p. Crowbar operation testing.
 - q. Advanced fault finding and troubleshooting demonstrations.

Engineering and the *Contractor's* design

Employer's design

Each of the twelve Kusile and Medupi Units have an identical static excitation system installed. The whole excitation system consists of the Generator brushgear, the excitation transformer, the DC and AC busbar and ducting and the excitation cubicle. In the static excitation system installed, the power for providing field excitation is supplied from the generator output terminals. The excitation transformer is connected to the output terminals of the generator to step down the voltage to the excitation panel.

At the present situation the focus will be on the replacement of the excitation cubicle with all its components. All other equipment will be replaced if interfacing with the new cubicle is not possible.

The currently installed excitation cubicle is an Alstom EM5 cubicle. The system consists of two identical digital voltage regulators, Channel 1 and Channel 2, both with an integrated FCR (Field Current Regulator). Each regulator has its own power supply and its own digital thyristor-firing module. A failure of the active regulator causes the system to change over to the standby regulator. The cubical have an interface with the DCS for monitoring and control purposes. The excitation cubicle has the following specifications:

Table 1: Excitation Cubicle Specifications

Cubicle Type	EM5
Regulation structure	2/2
Bridge type	KSDK220F125E24-I
Number of rectifier bridges	5
Rated field current	6090 A
No load field current	1942 A
Maximum field current during normal excitation	6699 A
Field current during ceiling excitation (10 sec.)	9744 A
Rated excitation voltage	657 V
Protection index of switch gear and rectifier compartments	IP 31
Protection index of regulator compartment	IP 31

The Excitation cubicle for all the Units is housed in an independent access-controlled excitation room situated on the 0m level of the Unit. The room has a dedicated HVAC system currently installed. Appendix A shows the general arrangement of the excitation panel and Appendix B shows the arrangement of the excitation room.

The Employer will make existing plant interface information available to the Contractor. The Employer supplies KKS codes to the Contractor for completion of the interfacing and IO lists. See Drawing List Clause 0.

Parts of the *works* which the *Contractor* is to design

1. The Contractor provides all the design services for the works, including design of plant, materials layout, all interfaces, additional cabling requirements and any modification required for the HVAC system. These will include but not limited to general arrangement, single lines, ac and dc key diagrams, cabling terminations, cable block diagrams, cable schedules and input-output (I/O) lists.

2. The Contractors' design interfaces with the Generator Protection panels and the unit DCS. There is also an interface with the HVAC control system.
3. The Contractor provides and designs the communication network for the works, including the HMI, switches and fibre optic cables.

Detail Design Phase

The detail design will be required from the Contractor. The detailed design package consists of:

1. The final drawings (electrical and mechanical) of the complete excitation system to be submitted
2. General layout drawing of the panels,
3. Single line diagram of the solution,
4. Block diagram of the system,
5. Panel internal wiring drawing,
6. Termination and cable schedules,
7. Manuals
8. Software program and the necessary software to review the program, this should include all licence required for the full use of the software.
9. PSS Study Report (Design Report)
10. Transfer functions of the system in the time and frequency domain
11. All specifications of the proposed equipment to be used
12. A complete factory acceptance testing procedure
13. A complete on-site inspection check list
14. An erection check list
15. A complete cold commissioning procedure
16. A complete site acceptance testing procedure
17. A complete hot commissioning testing procedure
18. Maintenance Plan must be in line with station maintenance and outage strategy.
19. A complete recommended spares list

Interface Requirements

General

1. The Contractor allows enough time to achieve proper interfacing between all the Employer's Engineers and the Contractor. The Contractor is involved in clarifications and technical queries regarding interfacing and be actively involved during interfacing sessions.
2. The following systems will be affected:
 - a) Generator Protection
 - b) Excitation transformer protection and monitoring
 - c) Synchroniser
 - d) Generator Parameters
 - e) Generator CTs and VTs

- f) Excitation transformer AC busbars
- g) Station and Unit AC/DC supplies
- h) Local Plant HMI
- i) Floor plans, cable entries and dimensions
- j) KKS requirements
- k) Control Room DCS
- l) Control room electrical operating desk
- m) South African Grid Code requirements
- n) Excitation Room HVAC
- o) Earth Switch

Interface Details

1. All alarms, events and analogues generated from the excitation system must be available for display locally as well as relayed for display to the station DCS system. The interface shall provide data in the form of a value and time and that replicates the exact attributes and values from the generated source.
2. The Contractor shall provide all networking components and cabling for all internal network requirements. This includes network switches, network interface cards, device driver software and software licenses.
3. The Contractor provides any fibre optic cables, connections, splices, splice boxes and fibre optic fly leads between the control system, recording equipment and DCS system where required.
4. The following communications setup requirements must be met:
 - a) No single point of failure for internal control communication for Excitation System
5. Interface principle between the excitation system and external plant is:
 - a) All control signals are hardwired. The excitation system has high impedance opto-couplers to interface with these signals. "Wetting voltage" (24VDC) is from the Unit Control System. No control is done via the communication link.
 - b) All trip signals are hardwired. No tripping is done via the communication link.
 - c) All alarm signals are via communication link to the DCS system, except the alarms that have been strategically selected to be hardwired.
 - d) Status information is hardwired only for a few selected signals. All other status information is sent via communication link to the DCS system.
 - e) Analog quantities are hardwired 4-20mA for only a few selected analog quantities. The rest are published via communication link to the DCS system.
 - f) All I/O interfaces are wired two wires per signal. If needed, bridging is only allowed on the terminal rails and not on the I/O cards or devices themselves.
 - g) All hardwired ECS binary inputs are wetted by its own wetting supply. All external plant binary I/O supply's dry contacts only.

Functional Requirements

The functional requirements of the excitation system should comply with the latest approved revision of 240-155615284 Generation Excitation System Standard. The section to follow will present the specific requirements and interfaces of the current installed excitation system.

The following are descriptions of devices that are to be built into the *Works* or that the *Works* is capable of doing:

1. The control system needs to be digital. This includes sampling of analogue values up to the generation of firing pulses.
2. All settings need to be digital. Analog to digital conversion of potentiometers as setting adjusters shall not be allowed.
3. The control system must not introduce voltage oscillations and the machine terminal voltage is to remain within the limits.
4. The voltage regulator must be continuously acting with adjustments for all gains and time constants, with no dead-band or zone of insensitivity.
5. The regulator must be easily operated, maintained and repaired; ensuring continuous operation of the unit by means of redundancy.
6. Regulator redundancy is provided in the form of two identical automatic voltage-regulating channels, Channel 1 and Channel 2. Both these channels need to be able to act as master while the other follows. This includes the converters if a 1+1 or N-1 configuration is chosen.
7. To minimise the risk of common mode failure, the two channels must not share any power supplies or input or output cards.
8. The voltage control system shall consist of at least a lag-lead-lead-lag controller (similar to a PID controller). The frequency response characteristic shall be adjustable. The variable parameters shall be considered as settings applied to the AVR.
9. Both channels shall include a field current regulator of the proportional plus integral type and constantly following their respective voltage-regulating channels.
10. Each channel shall make provision for a test function, where control of the field current can be done manually without being reliant on any feedback signal from the control system.
 - a. This mode shall be available for test purposes only, software interlocking shall be required to activate this function.
 - b. The control system must prevent the test mode from being engaged by the operator under normal operating conditions.
 - c. The test mode allows for open circuit and short circuit tests to be carried out on the synchronous generator as well as feed-back loop checks of the excitation control system prior to engaging any of the regulation loops.
11. Voltage sensing circuits in the voltage-regulating mode shall respond to the three-phase line-to-line machine terminal voltage. Sensing of only one line-to-line or a line-to-neutral voltage is not acceptable.
12. The machines shall be capable of operating in parallel with stable reactive power. Cross-connection of ECS circuits between machines shall not be acceptable.
13. The regulator must ensure that there are no oscillatory operations before synchronising, on load and after load rejection.
14. All control and communication cables are the responsibility of the Contractor. The Contractor shall provide detailed cable requirements to interface with all other systems as required. Correct terminations on both panel and plant side thereof are done by the Contractor and witnessed by the Employer to ensure correct terminations are done.
15. The system shall have a built-in sequence of events recorder with all logged data time stamped at the source when data originates within the excitation system. All binary inputs originating from external sources are time stamped when the inputs on the I/O cards are activated.

16. An excitation-on interlock must be provided by the unit control system to prevent excitation from being switched on either from remote or local.
17. A field flashing circuit is part of the works to allow reliable excitation build-up upon initial excitation. The field flashing current is supplied from a 400 VAC supply. The field flashing must be able to handle three consecutive field flashing attempts based on the longest field flashing time. The Contractor provides options for both and states the source requirements thereof. The final field flashing arrangement will be finalised during the design phases of the project.
18. Bi-stable relays are used for any status/signal used within the excitation control system that are used for critical plant conditions (e.g. interlocking). Upon loss of auxiliary supply to the relay, the status/signal (i.e., field breaker status, etc.) value may not change except when so intended (i.e. DC fail indication)
19. The excitation control shall start up in Auto mode (Voltage regulator Mode) and preferably to Channel 1 when the power is recycled, provided all the signal that may cause a transfer is healthy. It is therefore important that the boot sequence is set-up correctly to allow proper settling of disturbance signals before the channel and modes selection are applied.

Control and Monitoring Requirements

1. The control circuit shall be of a digital system to allow versatility thereby minimising hardware configuration when changes are required. It shall have extended ability for self-diagnosis, testing and fault finding.
2. The Supplier shall provide a reliable, easy-to-use data input facility which will facilitate local operation in terms of controlling, testing, displaying as well as resetting of alarms. This shall be in the form of a local control panel or industrial PC permanently installed at the excitation control panel.
3. The supplier shall provide three notebook computers with the appropriate operating system as an easy-to-use data input facility which will also facilitate local operation in terms of controlling, testing, commissioning, displaying as well as resetting of alarms. It shall also be used for configuration changes and download of configuration for back-ups as well as data logger and any oscillography data for further analysis.
4. The following input signals from the external plant are required as digital inputs to the excitations system. All external binary signals are dry contacts.

Table 2: AVR Binary inputs

Signal to Excitation	Comments
Excitation ON	FCB closes and excitation switches on. Field flashing will also be initiated by the excitation from this command if field flashing is required.
Excitation OFF	Excitation system switch pulses off while FCB stays closed. This command cannot be executed by the excitation while the machine is online/ synchronised to the network.
Excitation ON permissive	A permissive signal from the DCS to allow excitation to be switched on. This shall, as a minimum, include speed>95% *typ)
Excitation Trip Main1	Conditions Main 1 trip. The FCB is also directly tripped from M1.
Excitation Trip Main2	Conditions Main 2 trip. The FCB is also directly tripped from M2.
Excitation OFF Main1	Only switches off excitation, FCB remains closed (FCB may open depending on plant philosophy)
Excitation OFF Main2	Only switches off excitation, FCB remains closed (FCB may open depending on plant philosophy)
Set-point raise block	Gen protection blocks set point raise when V/Hz is detected.

Excitation Active Mode set point raise and lower	Raise and lower signal from control desk/HMI via C&I Unit control system to change the set point of the active mode that is selected.
Force Channel Changeover	Forces a channel changeover in the event of sustained field over current
Channel 1 ON	Selects regulation channel 1
Channel 2 ON	Selects regulation channel 2
PSS ON	Selects PSS to ON
PSS OFF	Selects PSS to OFF
Alarm acknowledge	Acknowledges excitation system alarms and reset alarm if alarm condition has cleared
AVR Mode ON	Ensure regulation is selected to AVR mode when doing any run-up (project specific requirement)
Voltage set-point raise	Set-point raise pulses from Unit Control or Synchroniser
Voltage set-point lower	Set-point lower pulses from Unit Control or Synchroniser
HV yard Breaker closed	HV yard breaker status for excitation off interlocking and superimposed regulator and FCR.
HV yard Breaker open	HV yard breaker status for excitation off interlocking and superimposed regulator and FCR.
Gen Breaker closed	Gen breaker status where applicable.
Gen Breaker open	Gen breaker status where applicable.
Generator Protection	Generator Protection
Alarm acknowledge	Alarm acknowledge from the control room
Reference value AVR Decrease	Reference value decrease from the control room
Reference value AVR Increase	Reference value increase from the control room
PSS Inhibition	
Q annulment	
Voltage Control	
Tan Phi (power factor) regulator	
Q regulator selector	
Note: All signals are preliminary and will be finalised during the detail design phase	

5. The following remote hardwired digital outputs from the excitation are required. All outputs are dry contacts:

Table 3: Binary output signals from the ES per channel

Signal from Excitation	Comments
Excitation is ON	Confirms that excitation is ON
Excitation is OFF	Confirms that excitation is OFF
AVR mode ready	AVR mode selected and no auto fault
AVR mode active	Excitation is on and AVR mode active

Set-point Max AVR	Local and remote indication of AVR Set-point at maximum position
Set-point Min AVR	Local and remote indication of AVR Set-point at minimum position
FCB is open	FCB is open
FCB is open	Fields switch drop out philosophy, hardwired from FCB auxiliary contact
FCB is closed	FCB is closed
Excitation ready	All local conditions are ready to switch on excitation: Not in local, AVR mode selected, all doors closed, field flashing supply healthy, etc.
Channel 1 is ON	Regulation channel 1 selected
Channel 2 is ON	Regulation channel 2 selected
Excitation system tripped	Excitation has tripped, status indication to DCS and other systems.
Excitation system tripped to Main 1	Excitation System trip command to Main 1 Gen Protection (2 x N/O contacts per channel)
Excitation system tripped to Main 2	Excitation System trip command to Main 2 Gen Protection (2 x N/O contacts per channel)
Common alarm	Hardwired alarm; most other alarms may be communicated via communication bus.
Over-excitation alarm	Hardwired alarm, to enable unit operator to act on plant condition
Under-excitation alarm	Hardwired alarm, to enable unit operator to act on plant condition
Gen breaker closed	Hardwired command to close generator breaker
Note: All signals are preliminary and will be finalised during the detail design phase	

6. The following shows analogue signal parameters from the EC to the Unit Control System along with the typical signal requirements. All EC installations must make provision for any additional spare capacity.

Table 4: Typical Analogue signals from the ES to the Unit Control System

Signal from Excitation	Signal type
Generator field current	4-20mA
Generator field voltage	4-20mA
Rotor temperature	4-20mA
Converter temperature cubicle	4-20mA
Spare	4-20mA
Spare	4-20mA
Spare	4-20mA

7. Local controls include:
- Channel changeover/select from Channel 1 to Channel 2 and vice versa.
 - Regulation mode selection. (AVR/FCR)
 - Field breaker close/open commands
 - Excitation ON/OFF.
 - Set-point raise and lower of the active channel.
 - Local alarm acknowledge.

- g. Local alarm resetting.
- h. Power System Stabiliser (PSS) ON/OFF (the default position of the PSS is on).
- i. Local/remote selection via HMI shall be password protected or via external key switch

The contractor is responsible for the design of the following in addition to the Works specified in the previous sections:

Alarm and status indications

1. Alarms that have been initiated by the ECS while in service are not to reset automatically when the alarm condition clears. These alarms shall only be cleared by accepting or resetting the system.
2. All alarms and statuses which are sent to the plant DCS shall also be available on the local HMI.
3. As a minimum, the following alarms are made available on the Employer's DCS via communication link:
 - a. AVR Manuel ON
 - b. PSU failure Ch1
 - c. PSU failure Ch2
 - d. AVR AC Supply fail
 - e. AVR DC Supply fail
 - f. AVR Channel 1 fault
 - g. AVR Channel 2 fault
 - h. Converter Bridge x fault: (temp high, pulse loss, fan fail, fuse fail, tripped, etc.)
 - i. Over excitation limiter active
 - j. Under excitation limiter active
 - k. Excitation transformer temperature high alarm (per phase)
 - l. Excitation transformer temperature very high alarm (per phase)
 - m. Rotor temperature high alarm
 - n. Excitation Transformer status (healthy/trip)
4. As a minimum, the following statuses are made available to the Employer's DCS via communication link:
 - a. AVR Channel 1 selected.
 - b. AVR Channel 2 selected.
 - c. Field Breaker open
 - d. Field Breaker closed
 - e. PSS ON
 - f. PSS OFF
 - g. Set point minimum reached
 - h. Set point maximum reached
5. As a minimum, the following local alarms are made available on the ECS HMI:
 - a. Channel 1 AVR not ready
 - b. Channel 2 AVR not ready

- c. Channel 1 AC/DC power supply faulty
 - d. Channel 2 AC/DC power supply faulty
 - e. Channel 1 24 VDC supply faulty
 - f. Channel 2 24 VDC supply faulty
 - g. Channel 1 synchronising voltage failure
 - h. Channel 2 synchronising voltage failure
 - i. Converter Bridge * temp high alarm
 - j. Converter Bridge * temp high trip
 - k. Converter Bridge * air flow low alarm
 - l. Over excitation limiter active
 - m. Under excitation limiter active
 - n. field over voltage
 - o. Rotor temperature alarm level 1 and 2
 - p. Emergency change over initiated
 - q. Conduction monitoring alarm and trip condition indicating which bridge/bridges and element are faulty.
6. As a minimum, the following local statuses are made available on the AVR HMI:
- a. Active channel in operation (Channel 1 or Channel 2)
 - b. Active mode in operation (Auto/Manual)
 - c. Excitation OFF
 - d. Excitation ON
 - e. Field breaker is closed
 - f. Field breaker is open
 - g. PSS ON
 - h. PSS OFF
 - i. Local operation selected
 - j. Remote operation selected
7. Additional alarms/statuses of the plant that the Contractor deems necessary are to be provided and will be reviewed by the design team. The Contractor will be responsible for any upgrades to the DCS and the necessary wiring due to the additional alarm/statuses.

Local analogue indication requirements

- 1. Permanent indication of all machine quantities is required.
- 2. The following panel mounted indicating instruments are provided:
 - a. Generator stator voltage
 - b. Generator stator current
 - c. Generator active power
 - d. Generator Power factor
 - e. Generator reactive power

- f. Generator field current
 - g. Generator field voltage
3. All the indicating instruments are analog instruments with sizes, accuracy, full-scale deflection angle etc. If a LCD panel with analog instruments is provided, its time response emulates that of true analog indications. Bar graph type displays are not allowed.
 4. Instrument displays are consistent, i.e. all instruments have the same face size, similar scale markings and the same full-scale deflection angle.
 5. Transducers/isolating amplifiers for all quantities are provided by the Contractor.
 6. Requirements for the transducers to be specified by the Employer and Contractor.
 7. Requirements for the indicating instruments to be specified by the Employer and the Contractor.

Engineering and Special tools

1. Notebook PCs are generally not regarded as special tools but the Contractor has to provide at least three such devices and these are available during FAT. Notebook PCs are dedicated to the ECS and due to driver compatibility issues and rigorous testing by the Contractors to choose the right hardware, they are regarded as special tools for this project. Notebooks are to be supplied with licensed operating system software and disks. The Contractor provides a fully functional engineering tool to commission and modify all intelligent electronic devices supplied as part of the Works. The engineering tool includes the necessary software and hardware required to access the intelligent electronic devices.
2. There are a minimum of two special tools for all other special tools supplied to this project.

Field flashing

1. Field flashing is a requirement and attention to the breaking capacity of the field flashing contactor is given especially if the supply voltage is higher than the rated field voltage for open circuit conditions. This is to prevent over excitation that can lead to over voltages on the machine.
2. Protection with the aid of a timer is used to stop the field flashing should the machine not self-excite within a predetermined time.
3. The Contractor indicates exactly the application of field flashing and proves that it can withstand all the requirements in the proposed arrangement. Options for both AC and DC field flashing to be provided.
4. The existing field flashing supply comes from the 400V AC supply.

Power supplies

1. The main source of auxiliary power is supplied by the excitation transformer and dry type auxiliary transformers. This is to allow the excitation system to be as autonomous as possible.
2. The power supply transformers are adequately sized to allow the primary source of control power to be derived from this source.
3. Suitable filtering is installed so that the connected power supply modules are not affected by any commutation interference from the power electronics.
4. The Employer provides protection in the form of fuses/circuit breakers for all station supplies at the supply points.
5. The dual outlet wall socket supply in the ECS panels has earth leakage protection as required by SANS10142-1 and complies with the 16A, 250V South African socket outlet requirements.
6. The secondary source of power for internal power supplies comes from one 220VDC supplies from the Essential DC board. VA requirement of the supply is provided by the Contractor. This supply needs to be moved to a clean DC supply.
7. This 220VDC supply is also used as a tripping supply.

8. Two independent power supplies per channel supply the control system's "Channel 1" and "Channel 2" as a primary source of power.
9. Please note that power can only be diode decoupled after galvanic isolation of the primary sources i.e. only the secondary side of the power supplies. Diode decoupling on the primary side is completely unacceptable.
10. The following supplies are currently available for the ECS panel:
 - a. 400V 4 wire AC supply
 - b. 220V AC supply from non-essential boards
 - c. 200V DC Unit supplies

LV Control Transformers

1. All new transformers supplied are of the dry type.
2. The use of toxic insulation materials is not allowed.
3. The leakage flux produced by any magnetic component is kept as low as possible to avoid heating of its mountings and surrounding components.

Converter Bridges

1. The converter bridges shall have a N-1 redundancy.
2. Each rectifier element is permanently marked with its make, rating and manufacturer's type number.
3. The plant and material are rated to achieve continuous maximum field forcing excitation even under N-1 configuration.
4. The Contractor ensures that all Plant and Material is rated to withstand the highest possible surge current and surge over-voltage.
5. The surge calculations are submitted to the Project Manager for acceptance.
6. The converters are rated to be installed and operated with forced air cooling in an environment with an ambient temperature of 40°C.
7. Air is taken in from the bottom of the panel and exhausted at the top.
8. When the panel have fans for cooling of the bridges quick and easy maintenance is required to minimise system downtime as well as to improve the quality of the work. The Contractor shall propose a replacement system; the feasibility of this shall be reviewed and approved by the Employer.
9. The contractor shall furthermore display the type of monitoring and control used for the cooling mechanism.
10. Proper filtering with easily removable filter elements for cleaning is provided. It is known that the filters get clogged up quite frequently due to PF and dust, filter design caters for these environmental conditions. Quick replacement is required to minimise contaminants to enter the cubicles while filter changes take place.
11. The cooling fan motor assembly shall be readily available in South Africa.
12. Each converter has fan redundancy in the design. To ensure that all fans are operative, fans selection/change-over is performed and monitored immediately after initial excitation to give the assurance that the redundant fans are operational/serviceable. This automated check is a prerequisite for the excitation system ready signal to the control system to allow the synchroniser to be switched on.
13. The cooling fans have separate internal supply transformers for the "main" fans and the "back-up fans". Each fan set also have an external test supply input and can be selected to either main supply or test supply.

14. The panels fit the existing floor space occupied by the existing excitation panels. Should more floor space be required, the Contractor ensures that load carrying ability of the floor is not exceeded. The height, width and total length of the installed panels are designed to fit the available space. Any additional space requirements are clarified with the Employer during the basic design phase.
15. The Contractor provides the dimensions on the drawings and confirms the position indicated as acceptable.
16. The panels are exposed to high and low temperatures, high and low humidity and therefore be rated as IP54CH in terms of SANS IEC60529.
17. No water-cooled converter stacks are allowed.
18. If any part of the cooling systems fails, an alarm is activated both locally and remotely.
19. Temperature monitoring of the converters are supplied as well as air flow sensors.
20. Each cubicle door for the cubicles installed has a lockable handle to open and close the door.
21. The locking mechanism for the handle is external to the handle to accept padlocks.
22. Each excitation cubicle door is equipped with a high quality limit switch. These switches are required as an interlock for all doors to be closed before excitation can be switched on and generates an alarm in the event list. Post excitation on, these switches only generates an alarm in the event list and does not trip the excitation system.
23. The polarity on the slip rings needs to be swapped around about every 18 to 36 months. The converter or field breaker cubicles make provision for short pieces of bus bars to be used as polarity change links. It is possible to make these changes without dismantling any part of the cubicle or other parts of the bus bar or field breaker. These links are also easily accessible within the panel.
24. A new shunt for field current measurement is fitted to the DC bus bars in the converter/field breaker cubicles.
25. Studs or bolts that are part of insulators used to support bus bar or shunts do not form part of any conduction path bolted joint. Insulators only support the conductors for mechanical rigidity and insulation purposes.
26. All bus bar support insulators are rigid enough to withstand the electro-mechanical forces of the bus bar and or cabling under short circuit conditions. Design calculation of any cable or bus bar supports are provided to the Project Manager for approval.
27. All cubicles are adequately earthed to the station earth. The station earthing point is provided by the Employer. The Contractor supplies the earth connection material and connects the panels to the supplied earthing point.
28. A converter test supply during outages related maintenance is required inside the panel. This can be in parallel with the flashing circuit supply. Feedback from this supply needs to go to the controllers. Any connection to a test must also isolate the normal supply to prevent back energising of the excitation transformer.
29. Any communication breakdown to the bridges should not limit the performance of the other bridges and the control should indicate the position of the communication breakdown.

Protection device requirements

1. All protective relays/IEDs and circuits comply with 32-333 and 240-64685228.
2. The relays/IEDs do not malfunction should the DC auxiliary supplies be switched on and off permanently or repeatedly at a random rate.
3. Refer to specification 32-333/240-64685228 for the required apparatus performance under electrical disturbances.

Wiring and Wiring Identification

1. All current and voltage transformer circuits are wired with colour coded multi-strand 2,5mm² PVC wire.

2. The control and voltage transformer circuits are wired such that the voltage drop does not exceed 1,5% under any conditions.
3. The AC circuits are wired with multi-strand 2,5mm² black PVC wire and DC panel wiring and bus wiring are wired with 1.5mm² grey multi-strand PVC wire.
4. For easy wiring code identification wire colours are as follows:
 - a. Black for AC circuits
 - b. Grey for DC circuits
 - c. CT and VT wiring are coloured as per the phase - red, white, blue and black (neutral).
5. Bus wiring is terminated on one side of the terminals only. This leaves one side of the terminals free for individual panel use only. If more than two wires are required to be connected on the bus wiring side of the terminal, an extra set of terminals is placed next to the first two, with bridge pieces (note: multi-strand wire bridge piece with lugs) to provide connection points.
6. Alphanumeric ferrule codes are to be provided on all wires. All panel wiring is marked with Grafoplast wiring markers or equivalent (subject to Project Manager acceptance).
7. Wires are marked on both ends with the same number. A wire adopting its termination point in a terminal rail as its wire number is not acceptable. When one wire has to move from one terminal to another the complete philosophy fails.
8. Alphanumeric ferrule codes are provided on all wire ends shown on the standard current transformer and voltage transformer circuits and on all bus wires.
9. Ferrules with wire identification numbers read from left to right (the right way up) on vertical terminal strips and from top to bottom in all other cases. Ferruling will be of the type that can be removed or changed without disconnecting or cutting wires.
10. Stripping of insulation is done in such a way that conductors are not damaged. The stripping tool is of the type that permits the length of the strip to be pre-set.
11. The crimping tool does not release the termination during normal operating until the crimp is correctly formed. The crimping tool is regularly inspected for correctly forming the crimp and the pressure of the release mechanism. The crimping tool must not damage the wiring and lug insulation. Note: No "pin" crimping allowed.
12. All wire ends are terminated using crimp type lugs. Not more than two conductors are connected to any single side of a terminal.
13. For control wiring each wire tail is of sufficient length to reach the allocated equipment plus an additional length of 50mm to facilitate changes in wiring. The slack appears as close as possible to the component in the form of a loop.
14. Wiring presents a neat appearance and is braced and placed in PVC trunking to prevent vibration and the possibility of forces being exerted on termination arrangements. Where only a few wires have to be braced (excluding panel doors) "wash line" supports are used, no stick-on plastic bracing supports is allowed.
15. Wires to plant and material on swing doors are so arranged as to give a twisting motion and not a bending motion to wires.
16. Wires passing through holes in compartments are protected by means of neoprene grommets. Bevelling of sheet steel is not acceptable as a substitute.
17. No panel wiring must be joined other than via a terminal.
18. Dielectric (insulation withstand) test of all wiring is conducted using 1kV to earth for 60 seconds with all electronic equipment's disconnected.

Terminals

Materials and Construction

Moulding materials are self-extinguishing, or resistant to flame propagation, substantially non-hygroscopic, and do not carbonise when tested for tracking.

The mouldings are dimensionally stable and have high impact strength.

The materials used are to be of the flexible type to avoid cracking of terminals.

Mouldings are mechanically robust, of flexible material and withstand the maximum possible torque that may be applied to the terminal screws.

Terminals where pressure is applied to the moulding when tightening the terminal screw or nut are not acceptable.

Steel parts, other than stainless steel, are plated and passivated.

Current carrying parts are non-ferrous and plated. All plating is compatible with other parts of terminations and lugs.

Screws into steel are steel, stainless steel or phosphor bronze. Steel screws are plated and passivated.

All plating complies with the standards BS 1706 and BS 1182 parts 1, 2 and 5.

Tapped holes have not less than 1 full thread.

Separate terminals are provided on each unit for incoming and outgoing connections and their contact pressure is independent of each other.

Terminal covers or shrouds and barriers, are of insulation material, self-extinguishing or resistant to flame propagation, mechanically robust and preferably clip into the moulding.

Mounting

The terminals are spring retained on the assembly rail complying with DIN EN 50045 and when mounted and wired in service is close fitting to avoid the accumulation of foreign matter between adjacent terminals.

End barriers or shields are provided for open sided patterns.

It is possible to replace any terminal in an assembly without dismantling adjacent units; it is permissible, however, to loosen any clamping device.

Screw retention of any component from the rear of the mounting rail is not acceptable.

All terminal blocks are readily accessible.

Power Terminals

Terminals for external power cables up to and including 16 mm² are of the screw clamp insertion type or stud type complete with bolts, nuts, washers and locking devices.

Terminals for external power cables above 16 mm² are of the stud type complete with bolts, nuts, washers and locking devices.

Drilled solid copper bars are provided for terminating all external power cables 35 mm² and above also where three or more cables in parallel are specified.

The arrangement is suitable for accepting cable lugs on conductors up to 630mm² and is complete with bolts, nuts, washers and locking devices.

Control Terminals

The terminals are of the rail mounted screw clamp spring loaded insertion type where terminations or lugs are compressed between two plates by means of terminal screws.

Terminals are spring loaded such that the action of the springs is independent of the action of the terminal screws.

Terminal screws are captive within the mouldings and their heads do not project above the mouldings when fully released.

Each terminal accepts up to two hooked blade type lugs.

Terminal entries are shrouded such that no current carrying metal is exposed when hooked blade lugs are fitted.

Springs are aged and withstand corrosion that might affect performance during their working life. Springs do not carry current (i.e. Springs on each side of terminal is not connected to one another).

Cross connection facilities are provided for connecting two or more adjacent terminal ways without interfering with the terminal openings.

Where used in current transformer circuits, the terminals are capable of accepting hooked blade lugs (4mm wide) on 2.5 and 4mm² wire.

The terminals are sized to provide for pre-insulated lugs to fit after being crimped with the 'flat' crimp lying parallel with the rail.

The insulation impulse level and isolation requirements between individual terminals are to be guaranteed.

Stud Type

Two terminal studs are provided for each "way" and are of sufficient length to accommodate two ring tongue terminations in addition to a full nut and a locking device.

Loose links, where provided, are secured by a nut and washers, and are of tin-plated copper or brass.

Barriers are provided between terminal "ways".

These barriers project at least 1 mm above the studs.

Screw Clamp Insertion Type

The terminals are rail mounted and comply with the requirements as laid down for the control terminals with the exception that they are not spring loaded.

Component Terminals

All types of commonly used terminals are permitted according to ESI Standard 12-1 or agreed by the Employer.

However, the type of terminal in which the screw bears directly onto the termination or the conductor (i.e. "pinches the conductor") is not acceptable.

Unit DCS Interface Terminals

Screw type corrosion protected disconnect test terminals (blade type) are used for the protection and control interface to the DCS system.

The terminals are suitable to accommodate 0.5 mm² UVG type cables.

The terminals are separately mounted in the panels and are not mixed with other voltages and terminals.

Control Lugs

1. All Control lugs are of the compression type.
2. Cable lugs and ferrules comply with NRS 028:1991.

Power Lugs

1. Crimping of power lugs is in accordance with BS 4579 Part 1.
2. Crimping tools are re-calibrated according to their manufacturer specifications.
3. The crimped area is equal to the conductor square area.
4. Documented proof of conformance to IEC 1218-1 specification requirements for tensile force heat cycling, resistance and temperature measurement may be requested by the Employer.

Hardware

1. The equipment does not mal-operate if the DC auxiliary supplies are switched on or off permanently or repeatedly at a random rate for periods of no longer than 500ms.

Operating Indicators

1. Operation indicators, e.g. alarm and trip annunciation, operate immediately when the protection functions operate.
2. Indicating lamps are of the LED type and are easily replaceable from the front of the panel without the use of special tools.
3. The voltage of the lamps is as per the circuit served.
4. The mounting of the lamp and resistor facilitates adequate ventilation.
5. Visual indication of alarms might also be served via scrollable LCD display or other type of visual display.

Test Facilities

1. The Contractor is responsible for factory and routine testing in conjunction with the Employer's representative.
2. Commissioning is carried out by means of microprocessor protection relay test equipment, accessing the incoming current and voltage quantities to the relays via associated current test blocks and voltage test blocks.
3. Test blocks are provided for all current and voltage quantities.
4. Testing and interrogation of the protection equipment is done via means of communication ports in the front of the panels.

Instrument Transformers

1. Voltage transformers
 - a. The Employer's standard VT secondary voltages are 110 V phase-to-phase and 63.5 V phase to neutral.
2. Current transformers
 - a. The Employer's standard CT secondary currents are 1 amp.
 - b. Main and interposing CT ratios will be shown in drawings provided by the Employer.

Fuse links and carriers

1. Fuses are of the BS 88 or equivalent industrial high breaking capacity type.

2. Fuse links and fuse bases for bolted connections are used for power fuse applications.
3. Fuse links and fuse bases with blade contacts are not acceptable for this application.
4. All other fuses for DC and AC supply and VT fuses and fuse holders are of the type NFS or equivalent.
5. No screw type fuse holders are permitted.

Earthing requirements

1. The apparatus is adequately earthed.
2. All non-current carrying conductive parts including the entire panel frame, all removable covers, relays, meters, gland plates, etc., are effectively connected to the earthing conductor by means of their mounting arrangement on the panel or by a separate earthing conductor.
3. This is done in such a way that the touch potential at any point on the panel due to a full phase to phase or phase to earth fault is limited to earth potential.
4. The earthing conductor is connected to the station earth mat at the designated earthing point of the panel.
5. The earthing conductor is pre-drilled to allow for connection to the station earth mat.
6. Should additional earthing conductor be required to meet the above requirements and specifications, the Contractor provides and installs such material.

Grid Code Requirements

1. The latest version of the SAGC shall be obtained from the NERSA website (www.nersa.org). All requirements shall comply to the latest grid codes.
2. Each of the requirements stated shall be provided for each unit/machine individually with the associated unit number cross referenced to any test reports, raw data, stability studies, validation reports, open and closed loop frequency responses, etc. For example, one excitation system's test result/simulations shall not be used to validate all excitation systems.
3. The *Contractor* shall be responsible for all required resources to provide the required grid code tests, recordings and reports.
4. All grid code tests shall be performed in the presence of the SO representatives of NTCSA.
5. The *Contractor* shall provide preliminary stability study reports with simulated model responses of the excitation systems for each unit.
6. The *Contractor* shall provide final as built stability study and validation reports with as built simulated model responses and validations of the excitation systems for each unit based on the actual test data and final settings.
7. The *Contractor* shall provide all preliminary settings, calculations and detailed Laplace models for each excitation system.
8. All performance requirements, preliminary settings and study reports shall be reviewed, influenced and accepted by the Transmission System Operator representatives of NTCSA.
9. The *Contractor* shall facilitate the required processes with the NTCSA to establish the latest performance criteria and requirements.
10. The *Contractor* shall facilitate the required processes for acceptances from NTCSA for all preliminary and final reports for settings, testing and validations.

11. All commissioning test procedures shall be compiled by the *Contractor* and submitted for further reviews and acceptances for the *Employer* and the Transmission System Operator representatives of NTCSA. The tests for performance verifications and grid code testing shall clearly state the required equipment setup, plant conditions, temporary settings/configs if applicable, sequences for testing, etc.
12. The *Contractor* shall perform special tests for machine and network parameter verifications. These shall include the determination of the machine direct and quadrature reactance and time constants, inertia constant of the rotating mass and the external network impedance.
13. The *Contractor* shall perform onsite time domain and frequency domain tests and all applicable functions shall be optimally tuned for each unit.
14. Once the site testing is completed the affected simulations shall be redone with the actual parameters as obtained from site for each unit.
15. The *Contractor* shall demonstrate how the final stable gain of the PSS is determined by means of site testing.
16. The *Contractor* shall demonstrate dynamic step responses for all configured limiters including with PSS on and PSS off.
17. Alternative methods for parameter identification, i.e., Adaptive PSS, Extended Kalman Filter, Digital Twin, Real Time Digital Simulators, etc. may also be proposed by the *Contractor* and shall be subjected to final review and acceptance by the System Operator.
18. The *Contractor* shall ensure that the new excitation systems for each machine is fully tuned and optimised during the live commissioning activities.
19. The *Contractor* shall provide the raw data for all tests as performed on site for each channel.
20. The *Contractor* shall ensure that the raw data and quality thereof is presented in the required format as determined by the latest requirements from Transmission System Operator representatives of NTCSA.
21. The latest performance criteria (sampling rates, bandwidth, etc.) for any external and/or internal recording equipment, associated analogue input/output signals configured as well as signal generating equipment shall be the responsibility of the *Contractor* to ensure formal acceptance is obtained by the Transmission System Operator representatives of NTCSA before any final testing is conducted.
22. The *Contractor* shall provide comprehensive test reports with documented responses for all tests conducted and for each unit.
23. All test recordings shall be handed over and stored in a well-structured manner on a portable storage medium (i.e. flash-drive) and each test recording shall be clearly labelled in their respective itemised folders.
24. All settings, configurations, alarm and tripping matrixes shall be configured as per recommendations by the *Contractor* and shall reviewed by the *Employer* for final acceptances.
25. All final and applied settings and configurations shall be provided in an editable Word format to the *Employer*.
26. All processed data as used in the validation reports shall be provided by the *Contractor*.
27. Where limiters are tested, the response of each configurable limiter shall be recorded and displayed in conjunction with a binary signal high activation stating the associated limiter description clearly on the plots.

28. The *Contractor's* resources shall participate in all the generator reactive capability tests as performed during final live commissioning and shall ensure that all excitation equipment is within their respective thermal capabilities while performing the tests.
29. Once final live commissioning is completed, all grid code related test data, test reports and validation reports shall be provided to the Transmission System Operator representatives of NTCSA for further reviews and validations.
30. In case the representatives of NTCSA notes any defects on the grid code data/reports provided or any performance criteria not satisfied, the *Contractor* shall then be liable for the complete retesting, optimisations, recording, processing, revalidations, updated reports, etc. for all or affected parts and associated costs thereof.
31. Grid code compliance shall only be final once the NTCSA representatives have formally provided acceptance for all the requirements stated. The *Contractor* shall ensure that the process for obtaining full compliance and acceptance for each unit is facilitated until completion.

Stability Studies and Validation Reports

The stability study and validation reports shall be provided by the Contractor and shall include the following as a minimum for each Unit.

1. Cover page stating the relevant details, signatories (incl SO acceptances from NTCSA).
2. Detailed information regarding the excitation system and regulators installed i.e., detailed models, type, PSS, etc.
3. Single line diagrams shall be included of the generating plant as well as the excitation system main components.
4. The primary plant, synchronous generator parameters and grid data (ie MVA, kV, Ifn, reactance, time constants, etc) shall be included in a table form.
5. Preliminary and final settings in table form.
6. Any relevant transducer time constants, scaling and ratios.
7. Validations of the machine/rotating mass inertia constants.
8. Any grid related data, grid reactances and damping ranges as obtained from the System Operators of NTCSA.
9. Computer simulation models/block diagrams of the individual control loops (as used to perform the actual study) with their respective parameter tables.
10. OEM parameter translation tables used in the studies & validations where applicable.
11. The gain stability range shall be provided and discussed based on findings from the site test data.
12. Generator open circuit saturation (incl. air gap line) and short circuit curves as tested on site with the applicable calculations derived from this data.
13. The active and reactive power load rejection recordings (both AVR and FCR mode) with the associated derived machine parameters.
14. Frequency domain simulations and site test plots. The plots (simulated vs site measurements) shall be displayed on top of one another and each shall be displayed separately on individual plots. Plots shall include the following as a minimum:
 - Offline closed loop AVR frequency response.
 - Offline open loop AVR frequency response.
 - Online uncompensated frequency response.
 - Online power damping frequency response with PSS ON and OFF. These two plots shall be projected on top of one another to clearly indicate the positive damping range.
15. Time domain simulations and site test plots. The plots (simulated vs site measurements) shall be displayed on top of one another, and each shall be displayed separately on individual plots. Plots shall include the following as a minimum:
 - All configured Limiters (i.e., SCL, FCL, PQ, etc.)
 - AVR ceiling voltage responses.
 - AVR rise time, overshoot, settling times and settling bands.

- AVR dynamic behaviour with machine online with both PSS on and PSS off.
- AVR simulated dynamic behaviour of the excitation system during system voltage disturbances as per GCR9 (Fault ride-through analysis).
- AVR dynamic behaviour during active and reactive power load rejections.
- The simulated versus actual performance results clearly stated in a table form.
- Frequency response simulations indicating plots for both the gain and phase. The gain shall be plotted on a separate graph as opposed to the phase characteristics.
- Any other relevant site tests, information and calculations affecting the mathematical model structure of the studies & validations.
- Detailed evaluation paragraphs for each simulation and test performed.
- Any correction factors applied and/or assumptions made during any analysis and/or validations shall be clearly stated and the reasoning.
- Definitions and clear descriptions of each signal as recorded for both raw and processed data.
- The report shall also include a section where the final conclusion shall be documented and compliance status to Grid Code.

Technical documentation after final hot commissioning

1. The *Contractor* shall provide comprehensive setting documents in MS Word that reflects the final settings as commissioned that are applied to all configurable components, devices, relays, and IEDs of the excitation system installed at Kusile and Medupi Power Stations.
2. The *Contractor* shall compile and submit detailed commissioning reports of all tests conducted during site commissioning. The reports shall be based on review and acceptance by the *Employer*.
3. Any test report issued, regardless of the project phase, shall be well constructed, fully signed off, fully descriptive of each test, completed with all test results, all pass criteria stated where applicable and shall have the relevant evaluation and conclusion paragraphs. Test sheets with only numerical data and graphs shall not be accepted.
4. The *Contractor* shall provide all relevant as built grid code test and validation reports after final hot commissioning.
5. All detail design drawings shall be provided in an As Built state.
6. All workplans and QCPs shall be signed off and fully completed.
7. All hardcopy implementation checklists and method statements/procedures shall be handed over and fully completed and signed.
8. All defect registers shall be fully cleared and signed off.
9. All training registers shall be fully signed off and completed.
10. All raw test data for each test conducted shall be handed over in well-structured and descriptive folders.
11. All test reports shall be subjected to reviews and acceptances by the *Employer* prior to finalisation.

Control and Instrumentation Works**Existing system description**

The Contractor shall review and maintain the existing alarm signals during concept, detail design, supply and installation of new excitation system. All alarm signals are via communication link to the DCS system except the alarms that have been strategically selected to be hardwired. The performance standards and technical requirements for the DCS are set out below:

1. 240-57859210 Alarm system Performance of Digital Control Systems for Fossil Plant Standard
2. 240-56355466 Alarm Management System Guideline
3. 240-56355728 Human Machine Interface Design Requirement Standard
4. 240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard
5. 240-55410927 Cyber Security Standard for Operational Technology
6. SANS 61850 Communication network and Systems for Power Utility Automation
7. SANS 60794 Optical Fibre Cables

The Contractor shall study these standards and procedures to understand the requirements and constraints pertaining the interfacing of excitation system to the DCS. Where applicability of these standards and procedures is not clear the Contractor shall query such with Engineer before undertaking Works.

The Contractor shall submit the following documentation for approval by the Engineer:

1. Distributed Control System interfacing drawings and interface to the local control system (HMI).
2. Detailed signal list.
3. Loop Test Plans.
4. General Arrangement drawings.
5. Alarm list.
6. Electrical schematic diagrams showing the interface to the DCS.
7. Ensure sufficient alarm management, where alarms shall be prioritised and rationalised to achieve the following:
 - a) Minimal false and nuisance alarms.
 - b) Distinguish between operational and maintenance alarms.
 - c) Allow for easy operator navigation and understanding of alarms.
8. Complete the following documentation and submit for approval
 - a) Signals list
 - b) Alarm Schedule – including alarm priority, recommended operator response and response times.
 - c) Termination Diagrams to the DCS
9. The list of the existing DCS signals interfacing with excitation system, on both Siemens and ALSTOM Systems, is found in APPENDIX A

Part of the Works of which the Contractor is to design

The Contractor's scope of work includes detail design, manufacture or procure, factory acceptance testing (FAT), supply, delivery, off-loading, installation, site acceptance testing (SAT), hot commissioning (Including Grid Code Require tests) and handover the following works namely:

1. The Contractor to design, supply, install and commission the ECS
2. The Contractor to ensure that the HMI is updated as per the project requirements

Standardisation

The design of the ECS, Control Panel and HMI updates shall ensure standardisation for simplified operation and maintenance and reduce lifecycle costs. The system shall apply a uniform approach across the units for the ECS and the control panel architecture, basic functional characteristics, system interfaces and documentation.

Contract Plant

The Contractor shall supply, install and commission his works as detailed in these specifications

Contract documents and information

The Contractor shall supply documentation and information as per the VDSS.

Design Services and Engineering Responsibilities for Control Systems

The Contractor is responsible for obtaining all relevant information, via the Employer, of systems outside his supply where it affects his works as detailed in these specifications

Erection/installation and Commissioning of Control and Instrumentation Plant

The Contractor shall ensure that the performance of the works is optimized by providing all necessary assistance and test equipment to the Employer.

The installation shall comply with the requirements of the following:

- a) 240-57859210 Alarm system Performance of Digital Control Systems for Fossil Plant Standard
- b) 240-56355466 Alarm Management System Guideline
- c) 240-56355728 Human Machine Interface Design Requirement Standard
- d) 240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard
- e) 240-55410927 Cyber Security Standard for Operational Technology
- f) SANS 61850 Communication network and Systems for Power Utility Automation
- g) SANS 60794 Optical Fibre Cables

Scope of Supply

The Contractor shall be responsible for the engineering, procurement, delivery to site, installation, commissioning, testing and rectification work during the Defects Notification Period of the control system for his works as detailed in the specifications

Commissioning and Maintenance Spares List

The Contractor shall provide a complete recommended spares list for all equipment forming part of the works for maintaining the ECS and the control panel

Procedure for submission and acceptance of Contractor's design

The Contractor is to supply detailed design drawings and information to be first reviewed and approved by the Employer before the Contractor can commence with installation. These design documents should indicate exactly how the upgrade above will be designed, installed, tested and commissioned

Other requirements of the Contractor's design

1. The modifications should not influence the current performance negatively of the control system in anyway.
2. Maintainability characteristics to be sufficient for sustaining required availability of 98% – maintenance should thus only have to be performed when the system is not in use.
3. Adequate space to be provided to allow for the execution of required maintenance on the newly installed components/systems.
4. The same equipment must be employed across all units at Kusile Power Station.

HVAC Works

The Contractor shall review, modify, and provide HVAC for excitation a concept, detail design, supply and installation of equipment its associated ducting, and air conditioning to control the ambient conditions. The performance standards and technical requirements for the HVAC Works are set out in the following specifications:

1. 240-102547991 General Specifications for HVAC Systems Standard
2. 240-70164623 Eskom Heating Ventilation and Air Conditioning (HVAC) Design Guideline

The Contractor shall study these standards and procedures to understand the requirements and constraints pertaining execution of the HVAC Works. Where applicability of these standards and procedures is not clear the Contractor shall query such with Engineer before undertaking Works that are the subject of these documents.

1. The current HVAC installation shall be reviewed for compatibility and effectiveness with the new excitation system.
2. Heat load calculations shall be completed and produced for the room environment with the cooling capacities required.
3. The HVAC design is to operate hand in hand with the cooling/heat extraction methodology of the excitation panel. The final HVAC system capability shall be such that the cooling capacity has an extra 10% sized into it.
4. The contractor shall produce 2 options for the HVAC system which is to be approved by the Engineer.

The Contractor shall submit the following documentation for approval by the Engineer:

1. Control drawings showing zoning, fire interface and connection and smoke extract functionality.
2. Detailed equipment list.
3. Inspection Test Plans.
4. General Arrangement drawings.
5. Alarm list (template supplied by the Employer)
6. Air, chilled water and Cooling water P&IDs including control loops where applicable.
7. Electrical schematic diagrams
8. Ensure sufficient alarm management, where alarms shall be prioritised and rationalised to achieve the following:
 - a) Minimal false and nuisance alarms.
 - b) Distinguish between operational and maintenance alarms.
 - c) Allow for easy operator navigation and understanding of alarms.
9. Provide electrical works as indicated in the Works HVAC specification.
10. Provide Operation & Maintenance Manuals and Training Manuals
11. Complete Aux power schedule for all permanent power requirements
12. Local Control Panel/ Network Control panel that shows the plant status shall be provided showing critical parameters of the system performance and room conditions. The control panel will be linked with the DCS system reporting alarms and shall have trending capabilities.
13. Provisions to be made for the automatic shutdown of the HVAC system when the unit is off, and an automatic start when unit is on load.
14. Complete the following documentation and submit for approval:
 - a) Virtual Signals List
 - b) Alarm Schedule – including alarm priority, recommended operator response and response times.
 - c) Drive and Actuator Schedule

- d) Instrument Schedule
- e) Cable Schedule
- f) General Arrangements of cubicles.
- g) Hook Up Diagrams.
- h) Panel Interface List
- i) Termination Diagrams.

15. The contractor shall provide training on the operations and maintenance of the HVAC system supplied inclusive of fault finding, general operations etc.

Structural Works

1. The Contractor takes full professional accountability and liability for the existing structure for the loads induced by all equipment relocated to the equipment room
2. The Contractor provides the following to the Project Manager for review and acceptance:
 - Consolidated detailed design report signed by a Professional Civil/Structural Engineer with structural engineering projects experience which includes:
 - Survey drawings, existing infrastructure assessment report, design criteria/parameters, specifications and standards that were used, loadings, assumptions, calculations and results including detailed design calculations, design models, sources of information and any record of other information associated with the completed works.
 - Detailed drawings for construction. Drawings are also submitted in CAD formats (Bentley Microsoft DGN).
3. All submitted drawings to be signed by a Professional Civil/Structural Engineer with ECSA registration number stated on drawing. The Professional Civil Engineer must hold BSc /BEng Civil Engineering qualification as minimum requirements with proven experience on design and construction supervision of structural engineering projects.
4. All structural designs to be in accordance with 240-56364545 - Structural Design and Engineering Standard.

Production of As-Built information required for the design

1. The Contractor is required to produce as-built structural drawings of the floor structure to the extent required for the structural analysis to determine whether the new equipment will be adequately supported.
2. As-built drawings indicate floor beam sizes, connection details, concrete and reinforcement details as well as positions of existing equipment supported by floor.

Analysis of Existing Equipment floor Structure

1. The Contractor conducts an analysis of the floor structure for the imposed load of the new equipment in accordance with the standards referenced in the Works Information.
2. The Contractor is responsible for the design of any modifications for the strengthening of the floor if required.
3. The Contractor is mandated in terms of Construction Regulations 2014: Duties of Designer, 6(1) g to fulfil the duties described therein for the detailed designs done by the Contractor for the instances where structural modifications are required to the existing structure.
4. The Contractor's Designer is responsible for any technical queries that may arise during the works and conducts the necessary level of construction monitoring required to certify that the works are constructed in accordance with the design and provides a Certificate signed by a Professional Engineer in this regard.
5. The Contractor submits the detailed design report and construction drawings for acceptance before any construction can take place.

Procedure for submission and acceptance of *Contractor's* design

1. The detailed design report should be submitted in a soft copy format. Drawings shall be submitted in Bentley MicroStation format and text documentation can be in the latest version of Microsoft Word for ease of review.
2. The detailed design must be presented to the Project Manager for acceptance prior to manufacturing and factory acceptance testing.
3. The Contractor is the Design Authority as defined in the Design Review Procedure (240-53113685). The Contractor is responsible for following this design procedure and conducting all the design reviews as specified in this procedure. The Contractor is responsible for conducting the following design reviews
4. Design Freeze Review
5. Integrated Design Review
6. Construction Completion Review
7. Acceptance Testing Review
8. The Contractor takes note of the Employer's Engineering Change Procedure (240-53114026). An engineering change includes any proposed change originating from engineering, contractors project management or construction management.

Other requirements of the *Contractor's* design

The Contractor is responsible for all system interfaces which forms part of the Works. The Employer will provide the relevant information defining the system interfaces. The Contractor caters for all the defined interfaces.

Use of *Contractor's* design

The Employer may use the Contractors design for any purpose in relation to the excitation system and excitation control systems at the Employers installations.

Design of Equipment

The Contractor shall adhere to 240- 155615284 when designing the new Excitation panel.

Equipment required to be included in the *works*

N/A.

As-built drawings, operating manuals and maintenance schedules

The Contractor is responsible for the compilation and the supply of all the documentation required during the various project stages and to provide the documentation programmed to link with the milestone dates. Documentation and drawings are programmed for delivery to meet the milestone dates and in accordance with the agreed VDSS. At Take-over the Contractor provides two full sets of as-built documentation to the Employer. All documentation, including reports, manuals, etc. is in the English language.

Material Certificates

The Contractor provides a copy of the Materials Test certificates as per EN 10204 for all components to be included in the Data Books this requirement is reflected in all Contractor Purchase orders specifying the appropriate type aligned to the Employer requirement for, Control of Plant Construction Repair and Maintenance Welding Activities Standard 240-56241933, Rev 1.

Final Databook

The Contractor is responsible for the provision of a final data book.

The final data book is broken down in two main categories:

1. Technical category
2. Cost and planning category

The document contains all the relevant documentation, designs, drawings, Plant and Materials certificates, NDE tests and results etc. which were applicable during the contract. The Contractor ensures that all relevant documentation is traceable and cross referenced where applicable.

All planning, scheduling, bar charts, milestones, detailed cost breakdown information, packing and transport are included in the final document.

The content is laid out in a logical manner with main and sub-sections where all the relevant documentation is grouped.

The contents are presented in a hard cover file or files.

The data packages are prepared on a daily basis for all completed work.

Two hard copies and one soft copy of the Data Book are handed to the Employer for acceptance.

Manuals

The Contractor supplies the following manuals:

1. Operating manual
2. Maintenance manual

The manuals conform to the specifications set out in this works and are submitted to the Employer for acceptance.

Types of Documentation to be handed over to the Employer:

1. Operational Documentation:
 - a. Operating Procedures.
 - b. Emergency operating procedures.
 - c. Operating Training Information.
 - d. Routine Inspection and Test Procedures.
 - e. Re-commissioning Procedures.
2. Maintenance and Engineering Documentation:
 - a. Technical Specification Sheets for different equipment to be compiled, inclusive of the KKS Codes relevant to the different equipment.
 - b. Routine Inspection Specification.
 - c. Service Interval Specification
 - d. Bill of Material, Material Number and Supplier.
 - e. Equipment lists
 - f. Maintenance Plans per system
 - g. Overhaul Procedures and Specifications.
 - h. Test Procedures and Specifications.
 - i. Special Tool Requirements.
 - j. Drawings applicable to Plant.

The manuals, which are in English, are complete with:

1. The power station name and order number
2. An index
3. A list of reference drawings
4. Details of all the components
5. General arrangements drawings
6. Installation drawings and instructions
7. Detailed parts lists which must be accompanied by exploded view type drawings clearly detailing the part and uniquely identifying it
8. Technical descriptions of the equipment and components parts with KKS coding.
9. Spare parts ordering information
10. Detailed specifications of the recommended maintenance and test equipment for testing, commissioning, fault finding and routine maintenance of all equipment covered by this specification
11. Routine maintenance schedules are to be provided in detail for each component and a complete description of the operation and use of the test equipment offered.

As a minimum the Contractor supplies the following:

1. 2 x electronic copies for each manual indexed PDF format
2. 1 x maintenance software for each manual
3. 5 x hard covered operating manuals
4. 5 x hard covered maintenance manuals

Any special instructions pertaining to the storage of spare parts or to their shelf life is included in the manual and is specifically pointed out in writing with the delivery of the equipment. All drawings required for component locations, dismantling and re-assembly for maintenance are included in the manual. The Contractor identifies all special tools that are required for maintaining and operating the equipment and includes a schedule of the identified tools and spares in the manual. The Contractor prepares maintenance plans that specify when, at what frequency and how maintenance tasks must be performed on specific systems. The Contractor submits maintenance plans according to this generic maintenance plan as far as possible. Each maintenance plan includes tasks for condition monitoring, failure finding surveillance tasks and descriptions for each task. Each maintenance plan includes inspection schedules.

Procurement

People

Minimum requirements of people employed on the Site

Eskom Holdings Limited's requirements regarding employment of unskilled or semi-skilled workers are as follows:

Kusile Power Station requires that during recruitment of unskilled or semi-skilled labour, the Contractor or its subsidiaries should make every effort to employ minimum target as per SDL&I requirements. The Contractor shall under no circumstances be allowed to recruit labourer(s) at Kusile Power Station main security gate. The Contractor's employees shall undergo security screening/clearance obtainable from SAPS or MIE or any accredited institution.

Subcontracting

Preferred subcontractors

The Contractor may sub-contract specialised work and shall not subcontract more than a 25% of the value of the contract to any other entity that does not have an equal or higher B-BBEE status level of a contributor than the supplier concerned unless the contract is subcontracted to an EME that has the capability and ability to execute the subcontract work.

Limitations on subcontracting

The *Contractor* may sub-contract specialised work and shall not subcontract more than a 25% of the value of the contract to any other entity that does not have an equal or higher B-BBEE status level of a contributor than the supplier concerned unless the contract is subcontracted to an EME that has the capability and ability to execute the subcontract work.

Plant and Materials

Quality

1. Quality shall be in line with the requirements stated in section 4.1.
2. The *Contractor* shall define the level of QA/QC or inspection imposed on his subcontractors and suppliers.
3. The programming of inspections, hold and witness points on relevant QCPs shall be agreed between the *Employer* and the *Contractor* prior to undertaking of any work.

Guarantee Inspection

1. The Contractor plans for a follow up inspection of the excitation system including excitation transformers of all units at a time suitable to the Employer, before the defects date
2. The *Contractor* shall inspect all units and shall provide the *Employer* with an inspection report
3. Any further repairs and/or tests required due to inspection findings shall be performed by the Contractor

Product Support

1. The *Contractor* shall provide a detailed product life cycle plan.
2. Before any product enters a phase where support becomes limited, the *Contractor* shall ensure to update the *Employer* with the required contingency plans.
3. The *Contractor* shall clearly state, in writing, the warrantee period on their product and the components covered.
4. The warrantee period stated for the equipment shall take effect after final hot commissioning is completed for all units.
5. The warrantee period for spares shall take effect after inspections, acceptance and delivery to Kusile and Medupi Power Stations.
6. During and beyond the warrantee periods, any faulty modules shall be fully investigated by the *Contractor* and a failure report shall be provided to the *Employer* stating the reason for failure and the required remedial actions.

7. The *Contractor* shall provide a plan on how maintenance, repairs and engineering support may be provided during the lifetime of the equipment.
8. Any equipment, spares, components, etc. which becomes obsolete during the duration of the *Works* shall be replaced by the *Contractor*. The *Contractor* shall be liable for all costs involved.

Defects Correction

1. The *Contractor* shall be responsible for investigations, technical support, reporting, and resolutions of all excitation system related faults, trips and mal operations for the duration of the *Works*.
2. Any defect that requires a firmware update which results in the complete or partial recommissioning of the excitation system shall be for the *Contractor's* expense.
3. All defects corrected, where applicable, shall be proven by means of proper testing and reports.
4. Any defects noted during FATs shall be completely resolved before delivery to site.
5. The *Contractor* shall repair any defects noted during the guarantee inspection.
6. If at any time the defects discovered causes wiring and/or component changes, the *Employer* shall instruct the *Contractor* to redo all or part of the wiring circuit verification checks ("blue-lining" point to-point) including affected functional tests. A substantial number of defects may result that the *Contractor* performs a complete rework of the entire panel(s) wiring point-to-point checks and function tests.
7. Any time when software and/or hardware changes are applied to a device due to defects, this device and affected components thereof shall then be completely retested or parts thereof. The *Employer* shall reserve the right to decide to what extend the device shall be retested.

Plant & Materials provided "free issue" by the *Employer*

All other plant and materials shall be provided by the *Contractor*.

***Contractor's* procurement of Plant and Materials**

1. The *Contractor* shall provide a list of all suppliers used to supply plant and materials for the *Works* including the components that have been supplied by each supplier.
2. The *Contractor* shall ensure that all materials, equipment and plant is adequately transported and delivered to the *Works* prior to the start of any *Works*.
3. The *Contractor* shall be responsible for the safe and secure storage of all equipment and materials delivered to site.
4. The *Contractor* shall indicate the type of transport used and mitigation measures in place to protect the equipment and materials from any possible damage for example vandalism, damaged roads, rain, hail, sun/heat exposure, excessive vibrations, etc.
5. The *Contractor* shall submit a completed pre-delivery checklist to ensure all prerequisites have been complied with for the equipment to be shipped to site. The Project Manager shall sign off on the checklist prior of equipment to be shipped to site.
6. The *Contractor* shall be responsible for offloading and movement of equipment and materials onsite.
7. All cabling shall be inspected and tested by the *Contractor* upon delivery to Kusile and Medupi Power Stations

Spares and consumables

1. A list of minimum spares is defined in the Schedules for the *Contractor* to supply.
2. In addition to the minimum required spares as stated in the schedule, the *Contractor* shall provide at least one spare part for each component which, in case of failure, renders the system inoperable, or can cause a safety risk to plant or personnel, or can cause deterioration/subsequent damage to any other components if the component that failed is not repaired in time.
3. All spares shall be delivered to site before final hot commissioning of the first unit start.
4. All spares shall be tested, configured and certified fit for use for each unit by the *Contractor*. Thereafter the spares shall be correctly repackaged, labelled and preserved by the *Contractor* until final handover of spares is completed.
5. All maintenance spares required for routine maintenance as per the *Contractor's* maintenance schedule shall be provided by the *Contractor* for the duration of the *Works*.
6. The *Contractor* shall ensure that all required critical spares are at hand for during commissioning activities as to prevent any failure of any one component leading to delays of more than one day during testing activities. These commissioning spares remain the *Contractor's* property.

Tests and inspections before delivery

Factory Acceptance Testing

1. FATs shall be conducted on all equipment to prove the functionality and integrity thereof prior to final shipping to site to ensure that it meets the *Employer's* requirements including any other standards, specifications and guidelines.
2. Factory testing shall undergo the following stages in chronological order:
 - a. Pre-FAT tests (preliminary selective communications signal tests and interfacing)
 - b. Panel steelwork and equipment verifications performed by the *Contractor*.
 - c. Panel wiring point-to-point tests performed by the *Contractor*.
 - d. Panel equipment and wiring point-to-point verification checks performed by the *Employer*.
 - e. Equipment functional tests performed by the *Contractor*.
 - f. Equipment repeated functional verification tests witnessed by the *Employer*.
3. The *Contractor* shall complete all required tests and verifications checks before inviting the *Employer's* team to witness any verification checks and tests at various stages
4. The *Contractor* shall afford the opportunity to the *Employer's* team to perform routine inspections as and when required on all equipment
5. The *Contractor* shall afford the opportunity to the *Employer's* team perform complete panel wiring verification checks as required (also known as blue-lining) on all completed wiring.
6. The *Contractor* shall make all required resources available for when the *Employer's* team perform verification checks and tests during FATs.
7. The tests to be demonstrated to the *Employer* for the excitation system shall be as per the details in the Schedules.
8. The *Contractor* shall perform all required routine and type tests where reports and/or certification is not available.

9. The *Contractor* shall inform the *Employer* of any equipment which requires to be specifically manufactured and tested during the life of the contract.
10. If any type tests are conducted on any equipment, routine tests shall be repeated afterwards.
11. The *Contractor* shall be fully responsible for any tests, logistics, costs and certification of any equipment to be tested.
12. Manufacturing may be at the *Contractor's* premises, local or abroad, while the factory acceptance testing shall be carried out in South Africa at a properly equipped testing facility. Local engineering and panel construction support shall be available should panel steelwork, wiring or software configuration changes be required due to defects.
13. Before FAT start, the *Contractor* shall provide the communication signal types and addresses for each signal type. The *Contractor* shall provide a temporary test setup to ensure that these signal types can be integrated to the *Employer's* SCADA.
14. During FAT the *Contractor* shall demonstrate that the communications interface and final selected signal lists to be published on the *Employer's* network is functional, reliable and secure.
15. The *Contractor* shall demonstrate a "dummy-load" test for each excitation system during functional test verifications as witnessed by the *Employer*. The *Contractor* shall provide the required temporary source to the converter AC input and the temporary test load connected on the DC output side. The test shall prove the correct firing of all thyristors for the completed assembly and the DC output waveforms shall be recorded.
16. All protection IEDs (i.e., overcurrent, rotor earth fault, etc.) shall be fully tested by the *Contractor* and the output characteristics shall be detailed by means of graphical representations in conjunction with the associated data recorded in table format. A comprehensive functional test report shall be provided for each protection IED installed.
17. The *Employer* reserves the right to temporary suspend FAT in case an unacceptable number of defects have been discovered during verification tests and checks. In such case the *Contractor* shall immediately repair all defects noted and/or perform complete retesting or rechecks where required.
18. All defect registers during FATs shall be kept as live document and shall be updated every time a defect has been noted.
19. All FAT documentation shall be subjected to full review and acceptance before any FATs commence.
20. Before FATs start, the *Contractor* shall provide all required FAT documentation and pre-checks which shall include the following as a minimum:
 - a. Test plan (schedule, resources, contact details, detailed activities, etc).
 - b. Two sets of hardcopy FAT drawings in separate files.
 - c. A set of blue-lined drawings as performed by the *Contractor* to prove wiring point-to-point checks were performed initially by the *Contractor*.
 - d. Equipment lists blue-lined by the *Contractor* as proof that all equipment has been checked and verified to reflect the correct specifications, type, revisions, part numbers, etc.
 - e. Test checklist as proof that the system functionality has been tested successfully prior to inviting the *Employer's* team.
 - f. Signed off defects lists as noted by the relevant *Contractor(s)*, subcontractor(s), etc.
 - g. Preliminary setting documents

- h. Reviewed and accepted FAT test procedures.
 - i. Applicable check sheets.
 - j. Signed off QCP/ITP documentation.
21. After completion of FAT the Contractor shall provide comprehensive signed off FAT reports for each test(s).
22. All latest and/or updated configuration files, settings, drawings, backup files, etc. shall be provided by the Contractor once the relevant FAT is completed.
23. After each FAT a completion certificate shall be issued by the Contractor, and if accepted, shall be signed by the Project Manager for acceptance.

Marking Plant and Materials outside the Working Areas

None.

Contractor's Equipment (including temporary works).

The contractor shall be fully responsible for any equipment, design, certification, safety and integrity thereof as required for the completion of the Works.

Construction

Temporary works, Site services & construction constraints

Contractor's Equipment

1. The *Contractor* shall provide the Project Manager with a complete list of equipment that does not permanently form part of the *Works* before delivery to site.
2. Any equipment may be subjected to full inspection by the *Employer* prior to use.
3. Any equipment used by the *Contractor* shall conform to the applicable safety standards and shall be maintained in a safe and proper working condition for the duration of the *Works*.
4. The *Contractor* shall provide all test equipment required for the *Works* and shall maintain all test equipment to the required accuracy.
5. The type and class of equipment used shall be subjected to the acceptance by the Project Manager.
6. All the *Contractor's* test and measuring equipment shall be accompanied by valid calibration certificates from an approved authority.
7. The Project Manager may at any stage during the contract require such equipment be checked by an approved ILAC laboratory or the South African Bureau of Standards.
8. Any equipment used for lifting shall be tested and certified by the *Contractor* and shall be subjected to acceptance by the Project Manager and further inspections by the *Employer*.
9. Any noise or heat generated by the *Contractor's* equipment for the *Works* shall be contained, mitigated, assessed, etc. in line with the *Employers* safety requirements before any such work starts. Any additional screens, dust covers, PPE, etc. shall be provided by the *Contractor*.
10. The *Employer* shall have the right to stop the *Contractor's* use of any equipment, that in the *Employer's* opinion, does not conform to the foregoing requirements.

Equipment provided by the *Employer*

1. A load tested and certified crane is available in the station main machine hall. It shall be the *Contractor's* responsibility to ensure that all necessary arrangements and preparations are made for the use of this crane.
2. The *Employer* shall provide a qualified crane operator. The crane shall be operated by the *Employer* only.

Site services and facilities

1. All power supply outlet sockets are provided in terms of existing availability and location.
2. Water supply points are provided in terms of existing availability and location.
3. All ablution facilities available on site may be used by the *Contractor*.
4. The Project Manager shall allocate a dedicated area at the Kusile and Medupi Power Stations for the storage and disposal of all scrap generated by the *Works*. The *Employer* shall dispose of all scrap.
5. The *Contractor* shall evaluate the suitability of the foregoing and shall ensure to put measures in place to address any shortcomings.

Facilities provided by the *Contractor*

1. The *Contractor* shall provide for any additional lighting where required for the *Works*.
2. The *Contractor* shall be responsible for the safe storage and security of any plant and equipment delivered to site. The total footprint required, for example the storage of containers, shall be provided to the Project Manager for allocation of the required space and placement location thereof.
3. The *Contractor* shall be responsible for any temporary offices for the *Contractor's* resources and associated sub-contractors.
4. The *Contractor* shall move all scrap generated by the *Works* to the dedicated areas provided on site at Kusile and Medupi Power Stations.
5. The *Contractor* shall provide any additional mobile cranes and lifting equipment where required for the *Works*.
6. The *Contractor* shall ensure to clean and restore all affected areas once all *Works* are completed.
7. The *Contractor* shall provide everything else necessary for providing the *Works*.

Existing premises, inspection of adjoining properties and checking work of Others

None

Survey control and setting out of the *works*

1. The *Contractor* shall be responsible to survey the *Works* to ensure that the excitation system, excitation transformers and relevant cabling can be installed in the space allocated.
2. The *Employer* shall review any civil work changes performed by the *Contractor* on floor plans where applicable regarding the type of concrete used, core spacing, paint and weight distribution.

Excavations and associated water control

1. If any core drilling is required for the *Works*, the *Contractor* shall be responsible to control and contain the cooling water used for any drilling and contain dust formation. No water or associated waste shall be allowed to contaminate any part of the *Employer's* plant or surroundings

Underground services, other existing services, cable and pipe trenches and covers

None

Control of noise, dust, water and waste

None

Sequences of construction or installation

1. All activities shall be performed according to the accepted programme and pre-approved method statements finalised during the implementation phase.

Giving notice of work to be covered up

None

Hook ups to existing works

None

Completion, testing, commissioning and correction of Defects**Work to be done by the Completion Date**

On or before the Completion Date the *Contractor* shall have done everything required to Provide the Works. The *Project Manager* cannot certify Completion until all the work has been done and is also free of Defects which would have, in his opinion, prevented the *Employer* from using the *works* and Others from doing their work.

Implementation Approval

The *Contractor* shall provide the following for implementation approval:

1. Completed & signed FAT test reports.
2. Completed & signed FAT defects lists.
3. QCP and Workplan as per the *Employer's* templates detailing the site execution activities in chronological order.
4. Site execution daily schedule for the *Works* in both .pdf and MS Project.
5. Site execution schedules with resources assigned for each activity fully accepted and integrated into the overall project execution schedule of the *Employer*. The *Contractor* shall make their resources available for site execution scheduling integration activities.
6. The *Contractor* shall provide method statements with detailed instructions using the *Employer's* template. All *Works* whether once off or repetitive shall be formally documented in the procedure inclusive of any associated check sheets and recording sheets used for quality control purposes. Each of these procedures shall have a section for acceptance by the responsible person. At minimum, the following detailed procedures shall be supplied by the *Contractor*:
 - a. Decommissioning of equipment.
 - b. Preparation work i.e., floor preparations, civils, panel modifications, etc.
 - c. Installation of equipment.
 - d. Testing of equipment (prior to LV power up).

- e. Testing of equipment (once LV is powered up).
 - f. Dummy-load testing.
 - g. Final hot commissioning testing.
 - h. Any other special test procedures i.e., PSS testing and tuning, etc.
- 7. All hot commissioning procedures shall be reviewed, influenced and accepted by the System Operator (SO) from National Transmission Company South Africa (NTCSA).
 - 8. Cable termination schedules shall be provided and compiled on the latest template as provided by the *Employer*.
 - 9. Two identical sets of the latest detail design drawings shall be provided in two separate files.
 - 10. All relevant ITP/QCPs shall be signed at the relevant step.
 - 11. All latest settings documents shall be reviewed and accepted by all relevant stakeholders including the SO from NTCSA. A fully reviewed and accepted stability study report shall be provided including proof of acceptance by the SO from NTCSA.
 - 12. All type test and routine test reports for all equipment shall be provided. The reports shall clearly indicate the details of the tests conducted, recordings obtained, the standards to which the applicable equipment was tested and stated if it passed or failed.
 - 13. All equipment, materials, containers, cabling, tools, etc. delivered to site (Kusile and Medupi) and proof thereof by means of inspection and/or test check sheets.

Use of the *works* before Completion has been certified

The *Employer* shall use the newly installed excitation system for commissioning and testing purposes prior to the completion date.

The Project Manager shall take over the Works after successful completion.

Materials facilities and samples for tests and inspections

- 1. The *Contractor* shall be responsible to provide all necessary equipment, materials and labour to carry out the tests to the *Employer's* satisfaction.
- 2. The *Contractor* may be requested to provide any samples to the *Employer* as and when required for further testing and inspections. In the Schedules it also states which devices shall be introduced to the list of pre-approved electronic devices.
- 3. The equipment provided by the *Contractor* for during FATs and/or site testing at Kusile and Medupi Power Stations shall include the following, but not be limited to:
 - a. Phase rotation measurement equipment.
 - b. HiPot testing equipment during FATs.
 - c. High voltage testing equipment i.e., to prove the crowbar BOD.
 - d. VLF testing equipment for HV cabling utilised.
 - e. CT testing devices for polarities, loop resistances and magnetisation curves i.e., CPC100, CT analyser, etc.
 - f. Analogue injection testing equipment i.e., Omicron CMC356, etc.
 - g. Transducer injections and testing equipment.
 - h. Insulation resistance testing equipment.

- i. Test equipment to perform micro-ohm/ducor testing on breakers.
- j. Micro-ohm test equipment i.e., to test earth bonding resistances.
- k. Temperature probe testing equipment i.e., to test TRFR PT100's, etc.
- l. Multimeters.
- m. Hand Tools.
- n. Scope meters/oscilloscopes.
- o. Power converter test load for dummy load testing during FATs and site testing.
- p. 3 phase AC power source to converters for during dummy load tests at FATs.
- q. Frequency generator to perform frequency scan/bode plot tests.
- r. Thermal imaging camera for during site tests.
- s. Recorders to capture raw commissioning data.
- t. Any other commissioning tools deemed necessary for the *Works*

Commissioning

1. Refer to the schedules for the minimum tests which shall be provided for and demonstrated by the *Contractor*.
2. All site tests shall be conducted by the *Contractor* and in the presence of the *Employer*.
3. All tests shall be conducted by the *Contractor* in line with the associated standards, codes, OEM test protocols and *Employer* specific requirements.
4. Final hot commissioning and testing proceeds only after:
 - a. All applicable procedures/method statements have been completed and signed off.
 - b. All QCPs/ITPs have been signed up to the relevant step.
 - c. All Defects have been cleared which may prevent the *Employer* from using the *Works* safely and reliably and shall not prevent Others from doing their work.
 - d. All relevant safety clearances, erection checklists and check sheets have been signed off.
5. The *Contractor* shall provide the required qualified resources for commissioning and other testing activities for the *Works* and these resources shall be fully trained, certified and have the relevant excitation system experience. Proof of the foregoing requirements may be requested at any time.
6. The *Contractor* shall design and apply all temporary settings required for the excitation system commissioning activities.
7. All settings and configurations applied shall be fully verified again before final hot commissioning starts.
8. All tests and recordings shall be performed on each channel and each converter as agreed to beforehand before the start of any commissioning activities.
9. Detailed method statements shall be provided by the *Contractor* for review and acceptance by the *Employer* for all test activities. Both the *Contractor's* and *Employer's* test requirements shall be captured by these method statements.
10. The *Contractor* shall perform all optimisations as and when required for the duration of the *Works*.

11. The excitation system shall be fully tuned and optimised by the *Contractor* for each unit by the time when final hot commissioning ends. The *Contractor* shall arrange for all required resources to meet this requirement.
12. Testing shall be conducted in four phases:
 - a. Phase 1 pre-commissioning tests: Checks and tests applicable during the installation phase when the panel is not yet powered up.
 - b. Phase 2 pre-commissioning tests: Checks and tests applicable once safety clearance is issued and the LV supplies are powered up supplying the panel equipment.
 - c. Phase 3 pre-commissioning tests: A dummy load test is performed once the converters are supplied by the test supply and once the source of the test supply is ready.
 - d. Phase 4 final hot commissioning: Final tests once the unit is at 3000rpm during offline and online conditions. The complete grid code tests are also performed during this phase.
13. The *Contractor* shall monitor the excitation system components and record thermal images of excitation related power equipment and transformers including during maximum reactive power capability tests.
14. The *Contractor's* commissioning resources shall be present on site for the whole duration of final hot commissioning for each unit from the start date to until the commissioning end date

Start-up procedures required to put the *works* into operation

Due to various scope being executed on site by different parties, the *Employer* shall compile an overall integrated commissioning procedure for the purpose of logical integration of all projects' final hot commissioning requirements. The excitation *Contractor's* resources shall partake in all required final hot commissioning activities as and when required in line with the overall integrated commissioning procedure. The *Contractor* shall review and provide input to the overall integrated commissioning procedure and timelines. All required plant preparations not part of the *Contractor's* scope of work shall be performed by the *Employer* to ensure the machine is ready for final hot commissioning

Take over procedures

Take over shall be facilitated by the Project Manager once all testing, inspections, commissioning and optimisation are completed successfully and after the last day of final hot commissioning.

Access given by the *Employer* for correction of Defects

Access shall be granted to the Contractor as and when required for defect correction. Refer to Clause 0

Performance tests after Completion

Once final hot commissioning is completed, all grid code related test data, test reports and validation reports shall be provided to the SO representatives of NTCSA for further reviews and validations. In case the representatives of NTCSA notes any non-compliances or defects in the performance of the excitation system, the *Contractor* shall then be liable for the complete retesting for all or affected parts and associated costs thereof. This shall also apply for any defects discovered during the defects period.

Refer section 6 and Grid code standards

Training and technology transfer

Refer to Clause 0.

Operational maintenance after Completion

None.

Plant and Materials standards and workmanship**Excitation System works**

Title	Date or revision
240-155615284 Generation Excitation System Standard	LATEST
240-64685228, Generic specification for protective intelligent electronic devices (IEDs)	LATEST
240-71432150, Plant labelling standard	LATEST
240-93576498, KKS coding standard	LATEST
240-56227589, List of approved electronic devices to be used on Eskom power stations	LATEST
240-56227443, Requirements for Control and Power Cables for Power Stations Standard	LATEST
240-56359083, Metering and Measurement Systems for Power Stations in Generation Standard	LATEST
240-128353314, Drawing Numbering System Standard	LATEST
240-56356396, Earthing and Lightning Protection Standard	LATEST
240-64636794, Standard for wiring and cable marking in substations	LATEST
IEEE 421.2, IEEE Guide for Identification, Testing, and Evaluation of the Dynamic Performance of Excitation Control Systems	LATEST
IEEE 421.5, IEEE Recommended Practice for Excitation System Models for Power System Stability Studies	LATEST
IEEE 421.1, IEEE Standard Definitions for Excitation Systems for Synchronous Machines	LATEST
The South African Grid Code, Network Code	LATEST
The South African Grid Code, Information Exchange Code	LATEST

Control and Instrumentation works

Title	Date or revision
240-57859210 Alarm system Performance of Digital Control Systems for Fossil Plant Standard	LATEST
240-56355466 Alarm Management System Guideline	LATEST
240-56355728 Human Machine Interface Design Requirement Standard	LATEST
240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard	LATEST
240-55410927 Cyber Security Standard for Operational Technology	LATEST
SANS 61850 Communication network and Systems for Power Utility Automation	LATEST
SANS 60794 Optical Fibre Cables	LATEST

HVAC works

Title	Date or revision
240-102547991 General Specifications for HVAC Systems Standard	LATEST
240-70164623 Eskom Heating Ventilation and Air Conditioning (HVAC) Design Guideline	LATEST

Civil engineering and structural works

Title	Date or revision
240-56364545 Structural design and engineering standard	LATEST
203-770 Kusile concrete specification	LATEST
203-1239 Kusile architectural specification	LATEST

SANS 10160 Basis of structural design and actions for buildings and industrial structures	LATEST
SANS 10100-1 The structural use of concrete. Part 1, Design	LATEST
SANS 10100-2 The structural use of concrete. Part 2, Materials and execution of work	LATEST
SANS 282 Bending dimensions and scheduling of steel reinforcement for concrete	LATEST
SANS 920 Steel bars for concrete reinforcement	LATEST
SANS 1024 Welded steel fabric for reinforcement of concrete	LATEST
SANS 10144 Detailing of steel reinforcement for concrete	LATEST
SANS 2001 Series Construction works	LATEST
SANS 1200 Series Standardised specification for civil engineering construction (except parts superseded by SANS 2001)	LATEST
SANS 3001 SERIES CIVIL ENGINEERING TEST METHODS	LATEST
SANS 10109-1 Concrete floors Part 1: Bases to concrete floors	LATEST
SANS 10109-2 Concrete floors Part 2: Finishes to concrete floors	LATEST
SANS 1090 Aggregates from natural sources - Fine aggregates for plaster and mortar	LATEST
SANS 10313 Protection of structures against lightning	LATEST
SANS 121 Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods	LATEST
SANS 53584 Products and systems for the protection and repair of concrete structures – Test methods – Determination of creep in compression for repair products	LATEST

List of drawings

Drawings issued by the *Employer*

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both Works Information and Site Information.

Drawing number	Revision	Title
KUS/16/S/MKC-- --EA/001	B	Kusile Excitation Cubicle General Layout
KUS/16/M/SAT-- --S01/GA/016	B	Kusile Excitation Room General Layout
KUS/16/E/SAT-- --S01/MM/002	C	Kusile HVAC Design Documents
KUS/16/S/MKC-----/LM/012	B	Kusile Plant Interface Schedule
KUS/16/S/MKC ---- SD/001	A	Kusile Excitation General Schematic
MDI_16_S_MKC-----/WD/001-L		Medupi Excitation Wiring diagram
0.84/1442	10	Medupi Excitation transformer Outline drawings
0.84/1674	D	Medupi Excitation Equipment
0.84/1441	B	Medupi Excitation General Schematic
0.84/6665	X	Medupi Excitation Cubicle General Layout
0.84/37804	E	Exciter Room Plan & Section
0.84/34421	1	Medupi Excitation Room Arrangement of Air Con. Unit and Excitation cabinets.
0.84/43109	D	Excitation Room HVAC (P&ID)

MED/16/S/MKC-----/LM/012 Or MDI_CORES	X	Medupi Plant Interface Schedule