NEC3 Engineering & Construction Contract

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

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

for **Kriel Power Station Automatic Voltage Regulator Upgrade for Unit 1,2,3&5**

Contents:		**No of pages**
Part C1	**Agreements & Contract Data**	
Part C2	**Pricing Data**	**[●]**
Part C3	**Scope of Work**	**[●]**
Part C4	**Site Information**	**[●]**

CONTRACT No. **[Insert at award stage]**

Part C1: Agreements & Contract Data

Contents:		No of pages
C1.1	**Form of Offer and Acceptance**	**[●]**
	[to be inserted from Returnable Documents at award stage]	
C1.2a	**Contract Data provided by the *Employer***	**[●]**
C1.2b	**Contract Data provided by the *Contractor***	**[●]**
	[to be inserted from Returnable Documents at award stage]	
C1.3	**Proforma Guarantees**	**[●]**

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:

Kriel Power Station Automatic Voltage Regulator Upgrade for Unit 1,2,3&5

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 B, C or D	The offered total of the Prices exclusive of VAT is	**R [●]**
Option E or F	The first forecast of the total Defined Cost plus the Fee 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)*	*(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 *conditions of contract* 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
		X7: Delay damages
		X16: Retention
		X18: Limitation of liability
		Z: *Additional conditions of contract*
	of the NEC3 Engineering and Construction Contract, April 2013 (ECC3)	
10.1	The *Employer* 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 *Project Manager* is: (Name)	Kgomotso Ngweye
	Address	Kriel Power Station Private Bag x5009 Kriel 2271
	Tel	017 615 2450
	Fax	086 667 1588
	e-mail	**Kgomotso.ngweye@eskom.co.za**
10.1	The *Supervisor* is: (Name)	Ted Magwaza
	Address	Kriel Power Station Private Bag x5009 Kriel 2271

	Tel No.	017 615 2972
	Fax No.	
	e-mail	MagwazCT@eskom.co.za
11.2(13)	The *works* are	The following will apply to the Upgrade of the Kriel Power Station Automatic Voltage Regulator at unit 1,2,3&5 - The Contractor provides all the design services for the works, including design of plant, materials layout, all interfaces and additional cabling requirements. These include but are not limited to general arrangement, single lines, AC and DC key diagrams, cabling terminations, cable block diagrams, cable schedules and input-output (10) lists. - Manufacturing is at the Contractor's premises, local or abroad, while the factory acceptance testing is to be carried out in South Africa at a properly equipped testing facility. Local engineering and panel construction support shall be available should panel/ software configuration changes be required. - A complete design in accordance with the Employer's specifications as listed in the works information (Part 3).
11.2(14)	The following matters will be included in the Risk Register	1 Approval of drawings by CoE and Eskom internal process (SCCC) 2 Unavailability of plant 3 Interface to the current T3000 system
11.2(15)	The *boundaries of the site* are	Unit 1,2,3&5 Automatic Voltage Regulator at Kriel Power Station
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 *law of the contract* is the law of	**the Republic of South Africa**
13.1	The *language of this contract* is	**English**
13.3	The *period for reply* is	**2 days**
2	**The *Contractor's* main responsibilities**	**Data required by this section of the core clauses is provided by the *Contractor* in Part 2 and terms in italics used in this section are**

		identified elsewhere in this Contract Data.		
3	**Time**			
11.2(3)	The *completion date* for the whole of the *works* is	**256 days from the contract start date**		
11.2(9)	The *key date*s and the *condition*s to be met are:	***Condition* to be met**		***key date***
		1	Detail design and reviews	1 month
		2	Manufacturing at the Contractor's premises,	12 months
		3	Decommission and remove existing excitation system	1 month
		4	Installation of the new AVR	2 months
		5	Commissioning	1 month
30.1	The *access dates* are:	**Part of the Site**		**Date**
		1	**Site establishment**	To be agreed at contract award
		2	**Unit 12 decommissioning and installation**	**Based on outage schedule[●]**
		3	**Unit 24 decommissioning and installation**	**[●]**
		4	**Unit 35 decommissioning and installation**	
		5	**Unit 56 decommissioning and installation**	
31.1	The *Contractor* is to submit a first programme for acceptance within	From within 2 weeks of Contract signature		
31.2	The *starting date* is	As soon as possible after contract award		
32.2	The *Contractor* submits revised programmes at intervals no longer than	One week		
35.1	The *Employer* is not willing to take over the *works* before the Completion Date.	[No data needed if this statement is included]		
4	**Testing and Defects**			
42.2	The *defects date* is	52 weeks after Completion of each unit		
43.2	The *defect correction period* is	one week		
	except that the *defect correction period* for	Failure of equipment during commissioning is 2 days		
	and the *defect correction period* for	Failure of the whole system is 1 day		

5	**Payment**	
50.1	The *assessment interval* is	25th of each month as per the assessment
51.1	The *currency of this contract* is the	South African Rand.
51.2	The period within which payments are made is	4 weeks from receipt of a valid invoice
51.4	The *interest rate* 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)	The place where weather is to be recorded is:	Bethal South African Weather Bureau
	The *weather measurements* to be recorded for each calendar month are,	the cumulative rainfall (mm) the number of days with rainfall more than 10 mm the number of days with minimum air temperature less than 0 degrees Celsius the number of days with snow lying at 09:00 hours South African Time **and these measurements:**
	The *weather measurements* are supplied by	South African Weather Bureau
	The *weather data* are the records of past *weather measurements* for each calendar month which were recorded at:	Bethal
	and which are available from:	the South African Weather Bureau and included in

		Annexure A to this Contract Data provided by the *Employer*
60.1(13)	Assumed values for the ten year return *weather data* for each *weather measurement* for each calendar month are:	**As stated in Annexure A to this Contract Data provided by the *Employer*.** **Note: If this arrangement is used, delete the rows above for 60.1(13) and delete this note.**
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.**
8	**Risks and insurance**	
80.1	These are additional *Employer*'s risks	**1. Material Handling (crane and operator)** **2. Labour Unrest** **3. Covid 19 restrictions** **4. Outage Movements**
84	**Insurance cover**	

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 minim limit of indemnity
Loss of or damage to the *works*, Plant and Materials	The replacement cost where not covered by the *Employer*'s insuranc The *Employer*'s policy deductible, as Contract Date, where covered by the *Employer*'s 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 *Contractor*) caused by activity in connection with this contract	Loss of or damage to property *Employer*'s property The replacement cost where not covered by the *Employer*'s insuranc The *Employer*'s policy deductible, as Contract Date, where covered by the *Employer*'s insurance

	Other property The replacement cost **Bodily injury to or death of a person** The amount required by applicable law
Liability for death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract	The amount required by the applicable law

87 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

9 Termination

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.

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 *Adjudicator* 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).**
W1.2(3)	The *Adjudicator nominating body* 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 *tribunal* is:	**arbitration.**
W1.4(5)	The *arbitration procedure* 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	**South Africa**
	The person or organisation who will choose an arbitrator - if the Parties cannot agree a choice or - if the arbitration procedure does not state who selects an arbitrator, is	**the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.**

12 Data for secondary Option clauses

X1	**Price adjustment for inflation**	
X1.1(a)	The *base date* for indices is	**[●].**
X1.1(c)	The proportions used to calculate the Price Adjustment Factor are:	**proportion** / **linked to index for** / **Index prepared by**

Proportion	**Table Used**	**Index Used**
35%	Labour - Table C3	Seifsa C3
5%	Transport - Table L2	Seifsa L2
45%	Electrical engineering - Table G-1	Seifsa G1

	15%	**non-adjustable**
Total	**100**	

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.**
X7	**Delay damages**	
X7.1	Delay damages for Completion of the whole of the *works* are	**R10 000 per day up to a limit of 10% of the contract value**

X16	**Retention**	
X16.1	The *retention free amount* is	**Zero**
	The *retention percentage* is	**10%**
X18	**Limitation of liability**	
X18.1	The *Contractor*'s liability to the *Employer* for indirect or consequential loss is limited to:	**R0.0 (zero Rand)**
X18.2	For any one event, the *Contractor*'s liability to the *Employer* for loss of or damage to the *Employer*'s property is limited to:	**the amount of the deductibles relevant to the event**
X18.3	The *Contractor*'s liability for Defects due to his design which are not listed on the Defects Certificate is limited to	**The greater of** **the total of the Prices at the Contract Date and** **1. the amounts excluded and unrecoverable from the *Employer*'s 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 *Contractor*'s total liability to the *Employer* 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 *Contractor's* total liability for the additional excluded matters is not limited.** **The additional excluded matters are amounts for which the *Contractor* is liable under this contract for** **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 *works*, Plant and Materials),** **death of or injury to a person and** **infringement of an intellectual property right.**
X18.5	The *end of liability date* is	**(i) 5 years after the *defects date* for latent Defects and** **(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.** **A latent Defect is a Defect which would not have been discovered on reasonable inspection by the *Employer* or the *Supervisor* before the *defects date*, without requiring any inspection not ordinarily carried out by the *Employer* or the *Supervisor* during that period. If the *Employer* or the *Supervisor* do undertake**

		any inspection over and above the reasonable inspection, this does not place a greater responsibility on the *Employer* or the *Supervisor* to have discovered the Defect.
Z	**The *Additional conditions of contract* are**	**Z1 to Z15 always apply.**

Z1 Cession delegation and assignment

Z1.1 The *Contractor* does not cede, delegate or assign any of its rights or obligations to any person without the written consent of the *Employer.*

Z1.2 Notwithstanding the above, the *Employer* may on written notice to the *Contractor* 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 *Contractor* 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 *Employer* for the performance of this contract.

Z2.2 Unless already notified to the *Employer*, the persons or organisations notify the *Project Manager* within two weeks of the Contract Date of the key person who has the authority to bind the *Contractor* on their behalf.

Z2.3 The *Contractor* does not alter the composition of the joint venture, consortium or other unincorporated grouping of two or more persons without the consent of the *Employer* having been given to the *Contractor* in writing.

Z3 Change of Broad Based Black Economic Empowerment (B-BBEE) status

Z3.1 Where a change in the *Contractor's* legal status, ownership or any other change to his business composition or business dealings results in a change to the *Contractor*'s B-BBEE status, the *Contractor* notifies the *Employer* within seven days of the change.

Z3.2 The *Contractor* is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the *Project Manager* within thirty days of the notification or as otherwise instructed by the *Project Manager*.

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 *Contractor* 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 means, as the context requires, the *Contractor*, or any member thereof in the case of a

Party	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 minim limit of indemnity
Loss of or damage to the *works*, Plant and Materials	The replacement cost where not covered by the *Employer*'s insuranc

	The *Employer*'s policy deductible, as at Contract Date, where covered by the *Employer*'s 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 *Contractor*) caused by activity in connection with this contract	**Loss of or damage to property** *Employer*'s property The replacement cost where not covered by the *Employer*'s insurance The *Employer*'s policy deductible, as at Contract Date, where covered by the *Employer*'s insurance Other property The replacement cost **Bodily injury to or death of a person** The amount required by applicable law
Liability for death of or bodily injury to employees of the *Contractor* 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 l 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 bbreathable 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 ccompliance 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 ooccupational exposure limit.

Parallel Measurements means mmeasurements 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 *Employer*'s 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.

Annexure A: One-in-ten-year-return *weather data* obtained from SA Weather Bureau for [weather station]

If any one of these *weather measurements* recorded within a calendar month, before the Completion Date for the whole of the *works* and at the place stated in this Contract Data is shown to be more adverse than the amount stated below then the *Contractor* may notify a compensation event.

	Weather measurement				
Month	Cumulative rainfall (mm)	Number of days with rain more than 10mm	Number of days with min air temp < 0 deg.C	Number of days with snow lying at 08:00 CAT	[Other measurements if applicable]
January			**0**	**0**	
February	**50.9**	**1**	**0**	**0**	
March	**256.2**	**2**	**0**	**0**	
April	**2**	**0**	**0**	**0**	
May	**31.5**	**0**	**0**	**0**	
June	**0.8**	**0**	**20**	**0**	
July	**0.6**	**0**	**23**	**0**	
August	**2.2**	**0**	**6**	**0**	
September	**8.8**	**0**	**6**	**0**	
October	**65.3**	**0**	**0**	**0**	
November	**62.2**	**0**	**0**	**0**	
December	**58.8**	**0**	**0**	**0**	

Only the difference between the more adverse recorded weather and the equivalent measurement given above is taken into account in assessing a compensation event.

C1.2 Contract Data

Part two - Data provided by the *Contractor*

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

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

Clause	Statement	Data
10.1	The *Contractor* is (Name): Address Tel No. Fax No.	
11.2(8)	The *direct fee percentage* is The *subcontracted fee percentage* is	_____**%** _____**%**
11.2(18)	The *working areas* are the Site and	
24.1	The *Contractor's* key persons are: 1 Name: Job: Responsibilities: Qualifications: Experience: 2 Name: Job Responsibilities: Qualifications: Experience:	**CV's (and further key persons data including CVs) are appended to Tender Schedule**
11.2(3)	The *completion date* for the whole of the *works* is	

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

11.2(14)	The following matters will be included in the Risk Register			
11.2(19)	The Works Information for the *Contractor*'s design is in:			
31.1	The programme identified in the Contract Data is			
A	**Priced contract with activity schedule**			
11.2(21)	The *bill of quantities* is in			
11.2(31)	The tendered total of the Prices is	**R** **(in figures)** **(in words), excluding VAT**		
	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:	
	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**	
62 in SCC & SSCC	The percentage for design overheads is	_____**%**
63 in SCC & SSCC	The categories of design employees whose travelling expenses to and from the Working Areas are included as a cost of design of the *works* and Equipment done outside the Working Areas are:	

PART 2: PRICING DATA
ECC3 Option A

Document reference	Title	No of pages
C2.1	Pricing assumptions: Option A	
C2.2	The *activity schedule*	

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 *activity schedule* 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.

An activity schedule could have the following format:

Item No.	**Programme Reference**	**Activity description**	**Price**

C2.2 the *activity schedule*

Item No	Description	Unit	Quantity	Rate	Total
100	**Preliminary & General**	-	-	-	
101	**Site establishment (Fixed)** (Office, Storage, ablution facilities, hoarding, Office equipment, etc)	Sum	1		
102	**Site Administration (Time Related)** (Office, Storage, ablution facilities, Office equipment, etc)	Sum	1		
103	**Site Management (Time Related)** (Management of the site, communication, etc)	Sum	1		
104	**Transport (Time Related)**	Sum	1		
105	**Health and Safety Requirements (Fixed)** (Medicals, Safety file, induction, PPE, etc)	Sum	1		
106	**Health and Safety Requirements (Time Related)** (Medicals, Safety file, induction, PPE, etc)	Sum	1		
107	**Accommodation (Time Related)**	Sum	1		
108	**Site de-establishment (Fixed)**	Sum	1		
	Preliminary & General Total excluding VAT				
200	**DELIVERY COSTS**				
201	**FREIGHT CHARGES**				
201.1	Airfreight, sea freight, road transport, wharfage, charges including custom duties, insurance, etc	Sum	1		
	DELIVERY COSTS Total excl VAT				
300	**DEMOLITIONS AND ALTERATIONS**				
301	Scanning for rebar and core drilling for cable access -	Each	4		
302	Decommission and remove existing excitation components and cabling to a designated area as indicated by the Employer (Termination schedules and cabling block diagrams)	Each	4		
303	Design calculations of de-excitation equipment	Each	4		
304	Fire sealing of all cable entry points and floor slots	Each	4		
305	Connection of earth conductors for switchgear assembly to existing earth	Each	4		
	DEMOLITIONS AND ALTERATIONS Total excl VAT				
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 Project Leader	Each	1		
	DESIGN AND APPROVAL OF EQUIPMENT Total excl VAT				

500	**MANUFACTURING OF EQUIPMENT**				
501	Manufacturing and acceptance approval of equipment - Unit 1	Sum	1		
	MANUFACTURING OF EQUIPMENT Total excl VAT				
600	**MATERIAL PROCUREMENT AND INSTALLATION**				
601	Procure and install new Excitation Control System (Panel internal wiring diagrams with numbers, KKS, component description, etc)	Sum	1		
	MATERIAL PROCUREMENT AND INSTALLATION Total excl VAT				
700	**PRELIMINARY COMMISIONING**				
701	Preliminary system and PSS settings for commissioning	Each	4		
	PRELIMINARY COMMISIONING Total excl VAT				
800	**FINAL COMMISIONING**				
801	Complete commissioning of AVR Excitation Control System	Each	4		
	FINAL COMMISIONING Total excl VAT				
900	**TRAINING**				
901	Formal training of Engineering, Maintenance and operating personnel	Item	1		
	FINAL COMMISIONING Total excl VAT				
1000	**TESTING**				
	Testing of all power cables				
1001	Function testing	Each	4		
1002	Factory test	Each	4		
1003	Acceptance test	Each	4		
1004	Site acceptance test	Each	4		
1005	Cold commissioning test	Each	4		
1006	Hot commissioning test	Each	4		
1007	Post commissioning optimisation	Each	4		
1008	Grid code compliance test	Each	4		
1009	Guarantee test	Each	4		
	TESTING Total excl VAT				
	Total of All Cost excl VAT				

PART 3: SCOPE OF WORK

Also refer to Scope of Work document number EEP1059

Document reference	Title	No of pages
	This cover page	1
C3.1	*Employer*'s Works Information	
C3.2	*Contractor*'s Works Information	
	Total number of pages	

C3.1: EMPLOYER'S WORKS INFORMATION

Contents

When the document is complete, insert a 'Table of Contents'. To do this go to: Insert, → Reference, → Index and tables → Table of Contents. Three levels and the title (but not the subtitle) may be shown if the formats used in this template are retained.

1. Description of the works

1.1 Executive overview

The upgrade of the Kriel Power Station excitation system project includes and mainly concerns the replacement/ upgrade of the excitation controllers for unit 1, 2, 32, 4, 5 and 56. This will be limited to the excitation system panels, and will exclude the excitation transformers, busbars, generator stator current CTs, generator VTs, slip ring as well as the brushgear. The scope therefore includes but is not limited to the engineering, design, manufacturing, testing, delivery to site, offloading, erection, installation, commissioning as well as training of Eskom Engineering, Maintenance and Operating personnel; this work also includes cabling.

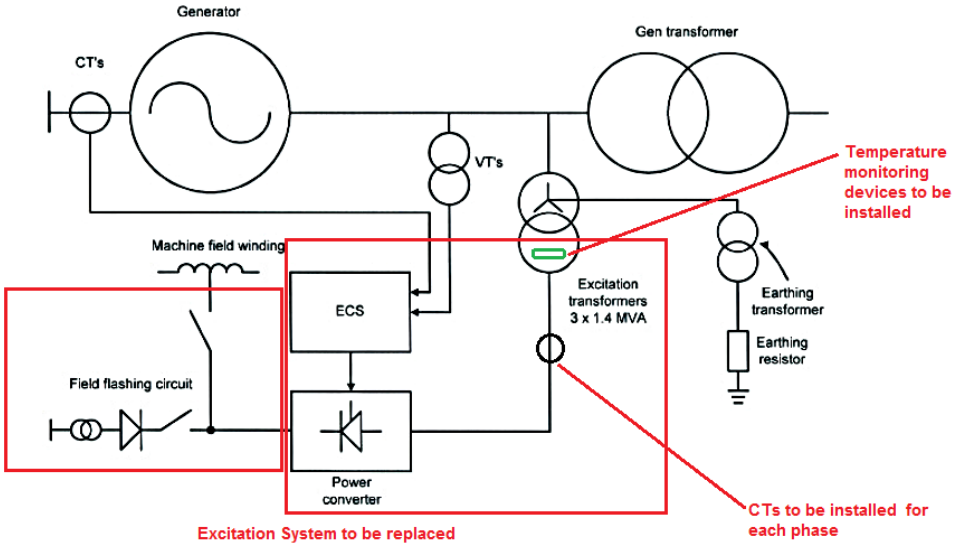


Figure 1: Project boundary

1.1.1 Scope

Refer to Scope of Work Document number EEP1059 clause 1.1.1

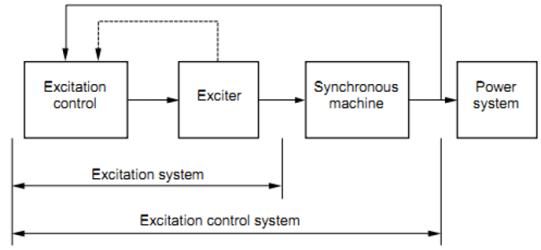
1.2 *Employer*'s objectives and purpose of the *works*

The purpose of this works is to install a new excitation system in each of the four units at Kriel Power station. This new system needs to provide safe and reliable operation for a minimum of 15 years.

1.3 Interpretation and terminology

The following definitions apply:

Definition	Meaning given to the definition

Excitation Control	Control of excitation system modifying the excitation power, responding to signals characteristic of the state of the system encompassing the synchronous machine, its exciter, and the network to which it is connected [IEC 60034-16-1 definition 2.3]. Usually a single integrated assembly, it includes the automatic voltage regulator (AVR), field current regulator (FCR), excitation limiters that contribute to the machine capability, and even protection functions. IEEE defines this functionality as that of the “synchronous machine regulator”.
Excitation System	Equipment providing the field current of a machine, including all regulating and control elements, as well as field discharge or suppression equipment and protective devices [IEC 60034-16-1 definition 2.1]
Excitation system	Feedback control system that includes the synchronous machine operating in the power system and its excitation system [IEC 60034-16-1 definition 2.4]. 
Generator transformer	The 18kV/ 400kV step up transformer that connects the generator to the transmission system.
Machine	The term ‘machine’ is used throughout this document and is understood to refer to the main synchronous generator.
Unit Control System	This is a distributed control system (DCS) with a computerised control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system, but there is no central operator supervisory control

The following abbreviations are used in this Works Information:

Abbreviation	**Meaning given to the abbreviation**
AC	Alternating Current
AKZ	Anlangen Kenn Zeichnung
AVR	Automatic Voltage Regulator
UNIT CONTROL SYSTEM	Control and Instrumentation
CT	Current Transformer
DC	Direct Current
DCS	Distributed Control System
EMDAS	Energy Management Data Acquisition System
ES	Excitation system

ESVD	Excitation System Validation and Documentation
FAT	Factory Acceptance Test
FCR	Field Current Regulator
GCB	Generator Circuit Breaker
IPB	Isolated Phase Busbar
HMI	Human Machine Interface
HV	High Voltage > 1000 V AC/DC
HVCB	High Voltage Circuit Breaker
IEC	International Electro Technical Commission
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LV	Low Voltage < 1000 V AC/DC
OEM	Original Equipment Manufacturer
PC	Personal Computer
PID	Proportional-Integral-Derivative
PSS	Power System Stabiliser
QCP	Quality Control Plan
QMP	Quality Management Plan
RTS	Return to Service
SAT	Site Acceptance Test
VDSS	Vendor Documental Submittal Schedule
VT	Voltage Transformer

2 Management and start up.

2.1.1 The *Contractor*'s plan for the *works*

The *Contractor* will submit a plan to the *Project Manager* for acceptance within the period stated in the service agreement.

2.1.2 Management meetings

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	Discussions to take place	Kriel Soweto VC	*Contractor*, *Project*

compensation events	as soon as a risk is notified	Boardroom/ Ms teams	*Manager,* Co-ordinator and Contracts Supervisor
Overall contract progress and feedback	Weekly basis during installation Wednesdays 10:00-11:30	Kriel Soweto VC Boardroom/ Ms teams	*Project Manager*, *Contractor*, Co-ordinator and Contracts supervisor
Daily feedback Progress	Daily 09:00am	Project manager or Coordinator's Office outage board room/Ms Teams	*Project Manager,* Co-ordinator and Contract Supervisors
Daily Safety Toolbox Talks	Daily before work starts on site with signed attendance registers by *Contractor's* employees and signed off minutes by the *Contractor*'s Site Manager	*Contractor*s Yard	*Contractor* and his employees
Contractor Monthly Safety Meeting	Once a month on Wednesdays during Contractors SHEQ meeting 14:00-16:00	KwaNala Hall	Project Site Manager Safety Officers,

If the *Contractor* can't attend any meeting his feedback should be formally communicated through to the *Project Manager.*

The *Contractor* will provide a detailed feedback report on a daily basis during Outages providing accurate feedback on the status of *service* carried out by the *Contractor*. This report should indicate accurate progress of *service* and if any constraints are experienced, the *Contractor* to communicate with the *Project Manager* and mitigate the risks with action plans.

Meetings of a specialist nature may be convened as specified elsewhere in this Service Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *service*. 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.

2.2 Documentation control

2.2.1 Document Management

Refer to Scope of Work Document number EEP1059 clause 2.2.1 Document Management

2.2.2 Document Identification

Refer to Scope of Work Document number EEP1059 clause 2.2.2 Document Identification

2.2.3 Document Submission

Refer to Scope of Work Document number EEP1059 clause 2.2.3 Document Submission

2.2.4 DRAWINGS FORMAT AND LAYOUT

The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 Engineering drawing Standard. Drawings issued to Eskom will be a minimum of one hardcopy and an electronic copy. All *Contractor*s are required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in .pdf format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted. Drawings issued to Eskom may not be "Right Protected" or encrypted.

2.2.5 Operating

- Procedures and manuals for the operation of all modified systems shall be provided/ updated by the *Contractor*.

2.2.6 Maintenance

- Manuals for the maintenance of all modified systems shall be provided/ updated by the *Contractor*.
- A list of recommended spares and their technical specifications are to be provided.
- A list of special tools and drawings are to be provided. Drawings are to be provided as both hard and soft copies.

2.2.7 Engineering

- A system operating description is to be provided.
- Technical manuals detailing the implemented modifications are to be provided.
- All OEM datasheets are to be provided.
- All existing P&ID's, layout, general arrangement, line diagrams, logic diagrams and associated technical documentation affected by the modifications are to be updated to reflect the new/modified systems. Drawings are to be provided as both hard and soft copies (3 hard copies per drawing).
- All new drawings and documentation to be uploaded and registered on the Kriel Power Station Documentation System by the *Employer*.
- The *Contractor* provides all applicable documentation listed in the Vendor Documentation Submission Schedule in Appendix A for acceptance by the *Employer*.
- All functional logic diagrams are submitted by the *Contractor* to the Project Manager for acceptance before activation of logic on the control.

2.2.8 As Built Drawings And Documents

It will be the responsibility of the *Contractor* to revise the drawings and to update all the existing documentation to reflect the "as build" status of the Kriel units and forwards these drawings to the Project Manager 15 working days prior the Completion Date.

2.3 Health and safety risk management

The *Contractor* undertakes to take all reasonable precautions to maintain the health and safety of persons in and about the execution of the *service*. Without limitation the *Contractor*:

- accepts that the *Employer* may appoint him as the "Principal *Contractor*" (as defined and provided for under the Construction Regulations 2003 (promulgated under the Occupational Health & Safety Act 85 of 1993) ("the Construction Regulations") for the Affected Property;
- 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 the *service*; and
- undertakes, in and about the execution of the *service*, 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.

The *Contractor*, in and about the execution of the *service*, 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.

Radiographic Examinations

When radiographic tests are carried out in the plant the danger area is barricaded. Workers are made aware of this fact and the Radiographic technicians ensure that no person is within or enter the danger area prior to commencing of or during the tests by public announcement according to the procedure.

2.4 Environmental constraints and management

All spillages (whether oil, grease, diesel, chemical, etc.) are prevented at all times and where accidents occurred in line with any spillages, immediate remedial actions are taken to clean-up the affected area using the appropriate spill-cleaning chemicals/absorbents.

It is the responsibility of the *Contractor* to ensure that the *Contractor* obtains copies of the Environmental Policy of oil spillages,

The non-adherence to the rules will result in a non-conformance, hence immediate termination of the contract.

Rules are as follows:

1. Provide sufficient storage containers, labelled depicting general or hazardous waste and store in a designated storage area.
2. No hazardous waste may be stored for a period of more than 90 days at Kriel Power Station premises.
3. Ensure that all hazardous waste is disposed of at a licensed class H disposal site. A copy of the hazardous waste disposal certificate is submitted to the *Project Manager*.
4. Ensure that all other general waste is disposed of at the local municipal waste dump.
5. Ensure that your site complies with the general good housekeeping practices

2.5 Quality assurance requirements

- The *Contractor* shall adhere to the Eskom Supplier Quality Management Specification, 240-105658000.
- QCP's shall be supplied by the *Contractor* for all work to be done.
- No work shall commence before the QCP's have been approved by the *Employer*.
- The QCP's shall make provision for Hold and Witness point to be included by the *Employer*'s representative.
- There shall be signature pages in the QCP's that captures the detail of the people who is authorised to sign off activities on the QCP's.

2.5.1 Quality Plans

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The Quality Plan manages the overall quality of the project's main activities/milestones. It lists detailed activities in order of execution where each activity is described and references the associated work packages or specifications with witness-, hold- and verification points. The QCPs make provision for signatures indicating completion by the *Contractor* and acceptance by the *Employer* at the end of each activity.

2.5.2 Work Packages

For all site related work the *Contractor* is required to submit a work package before any type of work can commence on Eskom plant. The required format of the work package is accordance with template 167A/158-A and a signed copy is provided by the *Contractor* after the *Employer* has reviewed and accepted the Work Package as final prior to any work.

2.6 Programming constraints

2.7 Contractor's management, supervision and key people

The *Contractor* to provide a key list of personnel who will carry out the work on site with their qualifications attached. A company organogram will be needed by the *Project Manager* to communicate accordingly to comply with the NEC3 Engineering and Construction Contract communication structures. *Contractor* to refer to Kriel Power Station *Contractor* SHE Requirements RSR0001

The *Contractor* makes arrangements for the use of the available workshop Equipment and Site specific tools.

The *Contractor* does not modify any plant or materials unless accepted by the *Employer* prior to implementation.
The *Contractor* notifies the *Employer* at least two days in advance of a Hold or Witness point on the *Works*.

The *Contractor* informs the *Employer* of any defect found and notify the *Employer* at least two days in advance of a Hold or Witness point on the Works.

The *Contractor* does not operate any Equipment on Site, unless specific authorisation is obtained from the *Employer*.

2.7.1 Plant Safety Regulations Permits

It is the sole responsibility of the *Contractor* to ensure at all times there is an authorised Responsible Person to take out permits for the execution of the *service*. The *Employer* will provide all training necessary for the selected *Contractor's* personnel to be authorised on Eskom Plant Safety Regulation.

2.8 Invoicing and payment

Within one week of receiving a payment certificate from the *Service 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* payment certificate.

The *Contractor* shall address the tax invoice to:

Eskom Holdings SOC Ltd
Reg. No. 2002/015527/30
Accounts Payable
Email to: Invoiceseskomlocal@eskom.co.za

The *Contractor* keeps records of all invoices submitted and paid up to the end of the project, as well as details of Actual Costs.
All invoices are hand delivered to the Kriel Finance Department (Account payables) 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

Contractor is required to follow the correct process to ensure the payment is effected in accordance with contractual payment terms.

Contractor is required to follow the correct process to ensure payment is effected in accordance with contractual payment terms:

2.8.1 Service related invoices

a) Once the *service* have been delivered/completed both parties have to agree that the *service* has been delivered/completed successfully prior to invoicing
b) An assessment payment certificate must be completed between the *Contractor* and *Service Manager* according to the *service* performed. Both parties have to sign the assessment/certificate
c) A copy of assessment/payment certificate must be obtained by the *Contractor* to enable the creation of an invoice and to prevent any discrepancies. A copy of the assessment/payment certificate must be attached to the original invoice
d) *Service Manager* performs a service entry and Goods Receipt on the SAP system. (Assessment/Payment Certificate issued as a source document for Service Entry Goods Receipt)
e) *Service Manager* will the forward the Service entry and Goods Receipt Note number to the *Contractor* within 3 working days after the service has been rendered and the Assessment/Payment certificate signed
f) *Contractor* must forward the original invoices together with a copy of the Assessment/Payment certificate to the Eskom Documentation Centre.

2.8.2 Goods Delivered Invoices

a) Once the Goods are delivered, the *Service Manager* preforms a Goods Receipt on the SAP system. (The delivery note is used as source document for Goods Receipt. The invoice should not be used as a delivery note)
b) *Service Manager* will then forward the Goods Receipt note to the Vendor immediately or within 3 working days after the Goods are delivered.
c) Vendors must then forward the Invoices together with a copy of the Assessment/Payment certificate to the Eskom Documentation Centre

2.8.3 Invoices linked to commodity prices

a) The requirements are the same as for Goods Delivered Invoices.
b) Invoices which are linked to commodity prices will result in CPA (Contract Price Adjustment).
c) Attach a copy of the material invoice that has been previously paid to the CPA invoice, as well as the calculation sheet and all indices attached other than SEIFSA.
d) The relevant Eskom Department will then complete the CPA calculation sheet and forwards it to the Eskom Documentation Centre.

2.8.4 Retention Invoices

a) The requirements are the same as for Goods Delivered and service related Invoices.
b) Where Retention is applicable on the contract, the Eskom SAP system will automatically create the Retention, and the amount deducted from the invoiced amount.
c) Invoices related to retentions release require a defect or completion certificate and a retention release certificate from the *Project Manager* and must be attached to the original invoice. The original invoice for the retention to be released must be accompanied by the approved and signed completion/defect certificate and retention release certificate and forwarded by the *Project Manager* to the Documentation Centre to effect payment.

2.8.5 Foreign exchange Invoices

a) The requirements are the same as for Goods Delivered and *service* related Invoices.
b) The following has to be attached to the Invoice before it will be processed: Commercial invoice. Bill of entry (SAD500), SARS release notification, Customs worksheet, Bill of Lading or Airway Bill and approved Exchange Control Approval (EXCON).

2.8.6 General Information related to Eskom Invoices

a) *Contractor* must ensure that the Service Entry and Goods Receipt Note number appears on the invoice. (It can be printed or hand written on the invoice).
b) Eskom Purchase Order number must appear on invoice.
c) Invoices must be VAT compliant in line with the VAT Act requirements.
d) Invoices submitted must reflect the bank account details. A once off copy of the banking details may be forwarded to the Documentation Centre and it will be attached to each scanned invoice.
e) Invoices must be original or certified as an original in line with the VAT Act. No electronic invoices will be accepted.
f) Eskom's correct name "**Eskom Holdings SOC Limited**" must appear on the invoice.
g) The Eskom VAT registration number: **4740 101 508** must appear on the invoice.
h) No pro-forma invoices will be accepted.
i) *Contractor* cannot be utilized by Eskom for more than 3 times without a contract being established.

Note:
1. Invoices must be delivered to the Eskom Documentation Centre, as this will speed up the payment process and ensure that invoices are not lost and payments delayed. There is no need for *Project Manager* to sign invoices as they perform Goods Receipt in the system. The assessment certificate and Goods Receipt serves as the approval of payment.
2. Eskom Documentation Centre will review invoices according to a checklist and on completion scan the documentation into Accounts Payable processing system (Documentation can only be scanned where the Purchase order no. and Goods Receipt Note no. is reflected on the invoice, and the invoice complies with the VAT Act).
3. Invoices are processed and released for payment by Accounts Payable Section only where the source documentation is 100% correct)

2.9 Insurance provided by the *Employer*

As stated in Contract Data

2.10 Contract change management

Contract change management is managed in accordance with clause 6 of the core clauses in ECC3. In summary, in the event that the *Employer*/*Contractor* notices a change, an event register is issued. If the event/change has cost implications then a quotation is submitted with the event register. The *Project Manager* assesses the quotation and gives an instruction in writing to the *Contractor*.

2.11 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.

2.12 Records of Defined Cost, payments & assessments of compensation events to be kept by the *Contractor*

In order to substantiate the Defined Cost of Compensation Events, the *Employer* may require the *Contractor* to keep records of amounts paid by him for people employed by the *Contractor*, Plant and Materials, work subcontracted by the *Contractor* and Equipment.

The *Contractor*'s Site Manager will complete the site daily log and this will be submitted to the *Project Manager* for his signature before 12 am of the following morning barring weekends. The Friday and weekend logs will be submitted before 12 am Mondays. The log will include but not be limited to the following:

- Date and day.
- Weather.
- Site Conditions.
- Work Done.
- People who are employed by the *Contractor*
- Work sub-contracted by the *Contractor*
- Any incidents during that period.

Any communication and documentation during this service agreement to be filed in the contract file. This file is in the possession of the *Project Manager* at all times.

2.13 Training workshops and technology transfer

Formal training is conducted as part of this contract before completion of the works. The *Contractor* trains the *Employer*'s personnel as per details in section 5.2.9. The *Contractor* is responsible for providing a training register in order to keep as proof of training provided. The signed off training register by all participants is also to be supplied by the *Employer*.

The *Contractor* should create a programme for training on the plant for the *Employer's* nominated employees if required from the *Project Manager*

This training should be relevant for the *Employer's* employees to perform front line fault finding or maintenance

3.Engineering and the *Contractor*'s design

3.1 Employer's design

3.1.1 Operating philosophy

Refer to Scope of Work Document number EEP1059 clause 3.1.1 Operating philosophy

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

3.2.1 Functional Requirements for the *Works*

Refer to Scope of Work Document number EEP1059 clause 3.2.1 **Functional Requirements for the *Works***

3.2.2 Interface requirements

3.2.2.1 General

1) The *Contractor* allows enough time in order 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 CT's and VT's
   f) Excitation transformer AC converter supply
   g) Station and unit AC/DC supplies
   h) Local plant HMI
   i) Floor plans, cable entries and dimensions
   j) AKZ requirements
   k) Control room DCS
   l) Control room operating desk
   m) Grid Code requirements

3.2.2.2 Interface details

Refer to Scope of Work Document number EEP1059 clause 3.2.2.2 interface details

3.2.3 Control and Monitoring Requirements

Refer to Scope of Work Document number EEP1059 clause 3.2.3 Control and Monitoring Requirements

3.2.4 Alarm and status indications

Refer to Scope of Work Document number EEP1059 clause 3.2.4 Alarm and status indications

3.2.5 Local analog 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 reactive power
   e. Generator field current
   f. 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*.

3.2.6 Software and licensing

1. The *Contractor* provides the latest version of all proprietary or open source software and licenses where applicable, including PC operating systems and licenses. The *Employer* cannot accept hardware with the *Contractor*s corporate operating system software.
2. The firmware, software and licensing updates are provided to the *Employer* for the duration of the support period of the specific equipment. The support period required for the equipment far outlasts any operating systems life expectancy. The *Contractor* therefore puts contingency plans in place when operating systems become obsolete to ensure that their own applications are either migrated to a new platform and that the necessary software drivers are compatible with new hardware as well. The *Employer* is responsible for maintaining the operating system licences throughout the lifetime.
3. All required software, including operating systems and device drivers with their respective licenses and installation files, in order to do maintenance and configuration changes and system recovery, are supplied by the *Contractor*.

3.2.7 Special hardware requirements

~~1.~~ All computer based systems have a solid state drive installed that is utilised by no more than 50% of the full capacity.

~~2.~~1.

~~3.~~2. An equivalent solid state drive is replicated after final commissioning to serve as a one-to-one replacement in the case of an SSD failure.

~~4.~~3. All hardware needed to connect with the system needs to be pre-configured and supplied by the *Contractor.*

~~5.~~4. All required software, including operating systems and device drivers with their respective licenses and installation files, in order to do maintenance and configuration changes and system recovery, are supplied by the *Contractor* and form part of the *Works*

3.2.8 Engineering and special tools

1. The *Contractor* provides any special tools, test handles or keys that are required for maintenance or affecting adjustments.
2. A detailed list of tools is supplied by the *Contractor* to the *Project Manager* before delivery.
3. Should any special interfaces for connection to PCs be required it is regarded as special tools.
4. Notebook PCs are generally not regarded as special tools but the *Contractor* has to provide at least **two** such devices and these are available during FAT. Notebook PCs are dedicated to the ES 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.
5. If proprietary software is used, five licensed copies of such software are provided as part of the special tools requirement for the project.
6. There are a minimum of two special tools for all other special tools supplied to this project.

3.2.9 Fault/ transient recorder

Refer to Scope of Work Document number EEP1059 clause 3.2.9 Fault/transient recorder

3.2.10 Follower circuits

1. Circuits in the inactive channel follow the operation of the active channel, such that when a sudden changeover is carried out from the active to the inactive channel, the transient change and steady change in the machine terminal voltage is within limits, as specified by the *Employer*.
2. Figure 6 below explains the steady state and transient changes

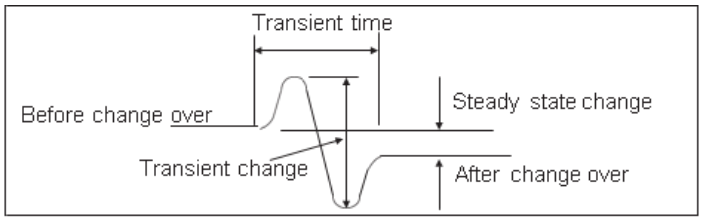


Figure ~~3~~6: Transient and steady state change

3.2.11 Limiter and protection requirements

The limiters listed below form part of each automatic channel and their limits are adjustable. Upon intervention of the limiters on the voltage regulator, no sudden changes in excitation levels are observed nor should it be oscillatory.

3.2.11.1 Flux limiter

1. The flux (V/Hz) derived from the output terminal voltage is used to control the E~~C~~S output to operate within the flux levels specified.
2. The limiter is supplemented with an adjustable time delay as specified by the *Employer*.
3. The limiter characteristic is user selectable between inverse time characteristics and definite time.

3.2.11.2 Under Excitation limiter

Under excitation limiter refers to a collection of limiters ensuring that enough excitation is delivered to the machine to maintain synchronism with the system

3.2.11.2.1 Load angle limiter or P-Q limiter

1. The control circuit calculates the synchronous machine's active and reactive power to control the operation of the machine within the safe operating pre-set limits by influencing the excitation as per *Employer's* specification in the technical schedule.
2. The limiter characteristic on the operating capability chart of the synchronous machine have adjustable MVArs offset and slope parameters or a piece-wise linear P-Q type limit.
3. The limiter is dependent on the machine stator terminal voltage and automatically changes its characteristics to maintain a constant margin of safety with the generator protection.

3.2.11.3 Over excitation limiter

Over excitation limiter also is collective to limiters that prevent over excitation.

3.2.11.3.1 Maximum field current limiter

1. The maximum field current limiter is measuring, supervising and controlling the main generator field current if it exceeds set thresholds.
2. The maximum field current limiter limits the machine rotor field current within the permissible levels as specified by the Employer in the technical schedule and Grid Code.
3. The limiter has a maximum level parameter, which is not exceeded at any time and another parameter, which is either fixed time adjustable or dependent on the I^2t heating characteristics of the rotor.
4. This is a maximum continuous permissible setting, which acts on the regulator circuit and has priority over all other regulating or limiter functions as long as it is active.
5. When the thermal capacity of the field winding has been fully consumed, the limiter will restrict the field current to the maximum continuous rated value. As time passes the cooling effect of the field winding is emulated by a cooling down algorithm or back integration function to calculate the thermal capacity of the field winding for a subsequent field forcing event. Once the total thermal capacity has been reached, a new full field forcing window will be available.
6. In addition, it provides for a binary input to switch over to a second set of settings if any additional limitation needs to be imposed. This limitation could for instance originate from an external H2 alarm condition, Stator Coolant temperature or rotor ground fault alarm. Any condition that the *Employer* requires to switch to this second parameter set needs to be captured individually but the action for the switch over to the second parameter set is the same i.e. any one condition activation needs to switch over to the second parameter set. This signal is latched and can only be changed back via human/operator intervention. A sustained alarm status will be generated for any of these conditions by the excitation system.

3.2.1~~2~~1.4 Protection requirements

The protection of the excitation system is highly selective in its functioning and offers the correct discrimination. The following protection is provided:

1. Protection of the converters against over current and DC short circuit.
2. Over temperature of converters are permanently monitored.
3. The excitation transformer is also fitted with a redundant set of temperature sensors (PT100). Provision is made by the new ES to accept these signals and act accordingly. All temperature trips are time delayed to ensure stability.
4. Detection of internal arcing in the power electronics cubicles with the exception of DC field breaker cubicle. Internal arc tripping is supervised by a settable over current function measured on the HV side of the excitation transformer.
5. Protection of the converters against AC and DC over voltages.
6. Protection of the field winding against over voltages.
7. Rotor temperature monitoring is calculated using the field voltage and current as primary variables. This value is displayed on the local control panel as well as be transmitted to the unit control system via 4-20mA signal. It has two warning stages available as external alarms.
8. All protection relays to be used are either part of 240-56227589(latest revision) (available on request) or are tested by the *Employer* for compliance to its requirements. The cost of testing is for the account of the *Contractor*.
8. Detection of internal arcing in the ES busbar cubicles is to be provided.
9.
10. Internal arc detection devices uses an overcurrent check from the HV side of the excitation transformer to supervise any arc detection and does not issue a trip unless an over current condition has been confirmed via a settable threshold. It is appreciated that the excitation

arrangement is such that the power source cannot be isolated via a breaker, but having this protection can reduce damage and improve safety under arcing conditions. HRC fuses, when used can dramatically reduce the arc energy. When fuses are used as input protection

3.2.12 Power System Stabiliser

1. The PSS is of the 2B type as specified by IEEE 421.5–2005.
2. The PSS includes an adjustable filter on the speed signal to further reduce the potential of exciting shaft torsional modes.
3. Both phase and gain settings are variable.
4. A mechanical load change does not affect the voltage control of the E~~C~~S.
5. The PSS includes limiters, which prevent the excessive degradation of the excitation voltage.
6. These limits are adjustable and cannot be exceeded under any circumstances.
7. The PSS has active power level detection and can switch the stabiliser on and off when above or below a certain setting respectively.
8. The PSS also monitors the machine voltage and switches itself off when this exceeds the specified values and after a time delay as specified by the *Employer*.
9. On recovery of the machine voltage, the PSS switches back on after a set time delay.
10. In addition, the PSS is switched on/off from the remote Unit control desk.
11. The *Contractor* supplies the preliminary PSS settings and model before commissioning as well as the final optimised settings during commissioning.
12. The PSS indication to the control room is linked to whether it has been selected to the on position or not (PSS enabled or disabled). The active state of the PSS is power system dependant and indications to the control room can be confusing when PSS status indication appears and disappears haphazardly if the status is linked to the PSS “stabilizing” signal.
13. The selection of FCR mode de-selects the PSS (switches it off) and does not automatically switch on when AVR mode is activated. Switching the PSS on, is then a conscious action by operating personnel.
14. The PSS must however be automatically selected when the E~~C~~S is in AVR mode at start-up/initial excitation.

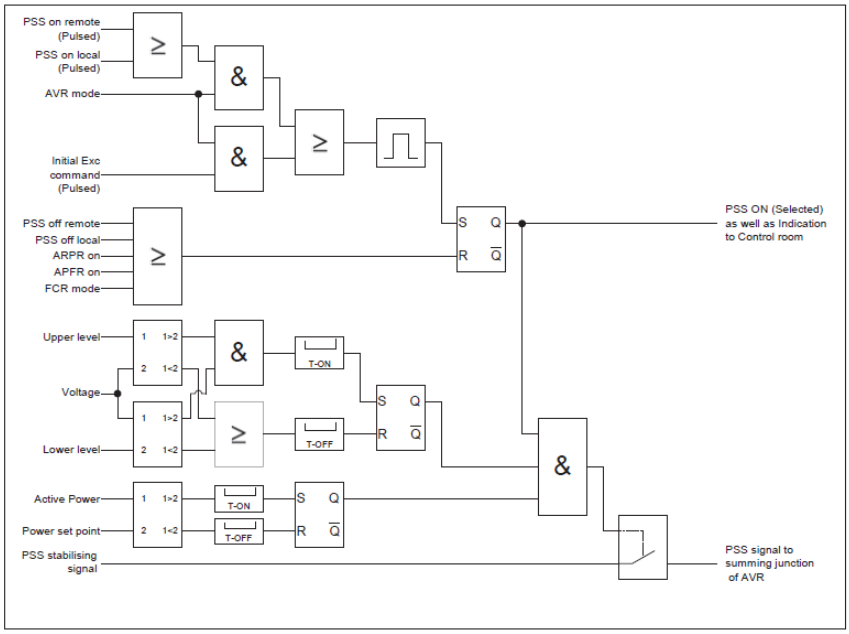


Table 47: PSS switch on logic

3.2.13 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.
4. The existing field flashing supply comes from the 400V AC supply.

Table 4: Field flashing circuit details

CIRCUIT	PROTECTION DEVICE TYPE	MCCB /MCB SIZE	AC VOLTAGE	ENTRY POSITION	CABLE SIZE	CABLE CORES	EST CABLE LENGTH	CIRCUIT TYPE
AVR FIELD FLASHING BREAKER	MCCB	80 A	400 V	BOTTOM	16 mm2	3	105 m	FIXED

3.2.14 Initial excitation and soft start

1. Although this requirement is not strictly speaking a limiter, it is a form of superimposed regulation.
2. Provision is made so that initial excitation is activated from an operator or control system command from the unit control desk that is also interlocked with a speed signal from the control system.
3. A soft start function prevents the machine voltage from rising at a rate faster than that specified by the *Employer*.
4. The time to reach the pre-set machine voltage is adjustable.
5. The flux limiter has priority over the soft start function.
6. Although the soft start or ramp function is primarily to prevent stator voltage over swing, the lack thereof has caused bridge failures on start-up for the *Employer*. An additional requirement is that under such start-up condition the field voltage never exceeds nominal field voltage. It would be even better if it never exceeds open circuit field voltage thereby creating a natural stator voltage rise with no overshoot.
7. An acceptable alternative is to use the field current regulator as ramp function during starting to ensure slow build-up of excitation in the machine.

3.2.15 Field suppression requirements

1. The field suppression circuit is accomplished by means of an electronic crowbar system.
2. The field suppression circuit is designed to dissipate the magnetic energy stored in the exciter field as rapidly as possible and is capable of handling the highest exciter field currents possible under fault conditions while in service, without undue temperature rise or damage.
3. The discharge resistor and associated components comply with the latest revision of IEEE 421.6.
4. The de-excitation process ensures minimum wear on the field circuit breaker.
5. Overlapping time between inverter operation and field breaker tripping signal is adjustable at least in the range as specified by the *Employer*.

3.2.16 Field Breaker control

1. The field breaker control is to be carried out by the ECS when selected to “remote”.
2. With the field breaker control selected to “local”, only local electrical control is permitted. Only electrical operation of the field circuit breaker is permitted and no operation from the control interfaces is allowed once the unit is synchronised to the grid.
3. Auxiliary contacts are provided for status monitoring and interlocking functions. Each field breaker has one tripping and closing coil.
4. The field circuit breaker should not be allowed to re-close after a breaker trip within a specified time.

3.2.17 Power Supplies

Refer to Scope of Work Document number EEP1059 clause 3.2.17 Power supplies

3.2.18 LV Control Transformer

Refer to Scope of Work Document number EEP1059 clause 3.2.18 Auxiliary Transformers

3.2.19 Converter Bridges

Refer to Scope of Work Document number EEP1059 clause 3.2.19 Converter Bridges

3.2.20 Excitation Regulator panel

Refer to Scope of Work Document number EEP1059 clause 3.2.20 **Excitation Regulator panel**

3.2.21 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.

3.2.22 Civil requirements

Refer to Scope of Work Document number EEP1059 clause 3.2.22 **Civil Requirements**

3.2.23 Excitation transformer requirements

Refer to Scope of Work Document number EEP1059 clause 3.2.23 **Excitation transformer requirements**

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

The Detail design is submitted in a hard copy and soft copy format. Drawings to be submitted in Bentley Micro-station version 8 format and text documentation to be at least in PDF or Microsoft Word 365 is the preferred format for ease of review and commenting. The Employer reviews the submitted designs and provides comments back to the Contractor within 21 working days. After approval of the Detail design, the Contractor proceeds with manufacturing of the system based on the approved designs.

3.3.1 Design phases

The process requires two distinct design phases:

3.3.1.1 Basic design

1. Full system technical and functional descriptions
2. Transfer functions of the system in the time and frequency domain
3. System philosophies finalised
4. Single line diagram of the proposed solution.
5. Block diagram of the system and system plant interface points
6. General layout drawings and cubicle dimensions to allow the *Employer* to evaluate if the installation can be accommodated, both in terms of rigging and space.
7. Approval of the final cubicle layout and designs
8. Floor plans and dimensions and all civil requirements
9. Bill of proposed materials/components including datasheets of all components
10. Type tests of components and/or assembly
11. Test certificates and datasheets of cabling
12. Samples of the termination schedules
13. Cable racking routes and additional racking identified
14. Pre-FAT communications integrity checks/tests
15. Conceptual proposal is submitted by the *Contractor* outlining the product offered, the features and how it will be applied to the Drakensberg plant setup.
16. A reference list is submitted indicating similar applications to plant.

3.3.1.2 Detail design

1. The final drawings (electrical and mechanical) of the complete excitation system including plant interfaces updated on the excitation drawings.
2. Panel internal wiring diagrams with numbers, AKZ, component descriptions, etc.
3. Termination schedules and cabling block diagrams
4. Cable racking designs for any additional racking.
5. Software program files and the necessary software to review the program
6. All calculations and specifications of the proposed equipment
7. Design calculations of all power cable requirements.
8. List of all cables to be installed (Cabling Schedule)
9. Design calculation of excitation transformer sizes (electrically and physically)
10. Design calculations of de-excitation equipment
11. Field suppression design
12. AC & DC short circuit calculations
13. Preliminary system and PSS settings for commissioning
14. Factory acceptance testing procedures

3.3.2 Implementation Approval

1. Completed & signed off FAT defects lists
2. Two identical sets of marked up drawings to be used for site installation.
3. Completed & signed of FAT test reports
4. Long lead items delivered to site, especially cabling
5. Site establishment completed. (containers, tools, scaffolding, printers, etc on site)
6. A complete on-site inspection check list to be completed right after delivery (Panels & cabling checks)
7. Authorised site acceptance testing procedures
    a. Panel decommissioning work package
        a. Cabling decommissioning work package
        a. Panel installation work package
        b. Cabling installation & testing work package
        c. Cable racking work package
        d. Civils work package
8. A complete cold commissioning testing procedure (Live loop checks & function tests with machine at standstill)
9. A complete hot commissioning testing procedure (Function tests with machine running). The *Employer* will integrate the program to the overall commissioning program.
10. All relevant QCP steps signed off by the *Contractor* where applicable at the time.

3.4 Other requirements of the *Contractor*'s design

1. All plant and materials shall be new
2. All electrical installations shall be carried out by a qualified electrician.
3. The new electrical cabling is certified by the *Contractor*'s electrician issuing a certificate of compliance (COC) before it is allowed to be connected.
4. All components comply with the Eskom standard 240-64685228 as well as associated international standards, unless otherwise stated.

3.4.1 Configuration management

1. Kriel Power Station subscribes to the AKZ codification system
2. All AKZ numbers or codes shall be submitted to the Project Manager for approval.

3.4.2 Control cubicle requirements

1. The excitation control electronics shall be housed in separate self-contained cubicles.
2. Access to all electronic cards, control and indications shall be from the front of the panel. The exact mechanical layouts and cable slot dimensions shall be confirmed by the *Contractor* during the first site visit.
3. Rigging of equipment of all cubicles to the correct level and location to be done by the *Contractor*. The *Employer*s crane can be used.
4. The cubicles shall be designed to prevent the ingress of dust.
5. The cubicles shall be vermin-proofed.
6. Any additional safety measures to be provided by the *Contractor*.
7. All access doors and covers to live apparatus are adequately marked with warning signs to warn of live parts behind them.
8. All doors equipped with voltage and current carrying plant and materials are earthed to the main frame of the cubicles by means of a braided earth strap.
9. Internal panel lighting is provided with a door-mounted switch enabling the light ot switch on automatically when opening the door.

3.4.3 Wiring and wiring identification requirements

1. All wires to be provided with alphanumeric ferrule codes. All panel wiring to be marked with Graphoplast wiring markers or equivalent (subject to Project Manager acceptance).
2. Wires to be marked on both ends with the same number.
3. 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.
4. Ferrules with wire identification numbers read from left to right, and from top to bottom on vertical terminal strips.
5. For control wiring, each wire tail is of sufficient length to reach the allocated apparatus plus an additional length of 500mm to facilitate changes in wiring.
6. The slack is as close as possible to the component in the form of a loop.
7. Wiring is presented in a neat appearance, it is braced and placed in PVC trunking to prevent vibration and the possibility of forces being exerted on termination arrangements, no stick on plastic bracing supports can be used.
8. Wires to plant and material on swing doors are so arranged as to give a twisting motion and not a bending motion to wires. It is required that robust wiring looms at doors are used with clamps on both ends (Clamp on the door and a clamp inside the panel).
9. Where wiring is connected to current transformers, the termination shall be protected adequately.
10. Control and power panel wiring sheaths are coloured as follows:
    a. Black for single phase AC circuits.
    b. Grey for DC circuits.
    c. CT and VT wiring are colour coded as per the phase – red, white, blue and black (neutral).

d. Power 3 phase AC circuit wiring is colour coded as per the phase – red, white, blue and black (neutral).

11. Panel wire terminations to electronic cards from the back are permissible.
12. All cable cores are terminated on a terminal strip with panel wiring completing the circuit to the relevant interface.
13. Wiring in trunking occupies no more than 75% of the cross-sectional area of the trunking.
14. Any wiring connected to AC and DC busbars has an insulation withstand capability of 10 times the rated voltage with a minimum of 2.5 kV over one minute (IEC 60034-1 and IEC60255).

3.4.4 Panel/cubicle labelling

1. Eskom standard 240-62629353 – Specification for panel labelling, applies to panel labels.
2. Conductive labels or backing plates are not allowed on the inside of any electrical cubicles unless attached to components such as auxiliary transformers with rivets..
3. All warning labels on panels, doors or other structures are pre-approved before printing and application by the *Contractor*.

3.4.5 Fuse links and carriers

1. Fuses are of industrial high breaking capacity type as per IEC 60269.
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 high power circuits (converter bridges)
4. Fuse links and fuse bases with blade contacts are acceptable for small current circuits (e.g. VTs or power supplies)
5. All other fuses for DC and AC supply and VT fuses and fuse holders are of the F1 offset tag blade connector fuse
6. No screw type fuse holders are permitted.

3.4.6 MCBs

If MCBs used for stator voltage isolation have to be graded with VT fuses upstream. Proof of such grading is supplied to the Project Manager for acceptance. “Z-curve” MCB has proved to grade with fuses in most cases.

All MCBs shall have at least once auxiliary contact for status monitoring if it is dedicated to a channel. When an MCB is common to both channels dual auxiliary contacts are required.

3.4.7 Signalling lamps

1. Indicating lamps are of the LED type and are easily replaceable from the front of the panel without the use of special tools.
2. The voltage of the lamps is as per the circuit served.
3. The mounting of the lamp and resistor facilitates adequate ventilation.
4. Visual indication of alarms might also be served via scrollable LCD display or other type of visual display.

3.4.8 Auxiliary relays

1. Auxiliary relays comply with Specification 240-56227589.
2. Special notice should be taken if such auxiliary relays are to perform tripping functions. All relays should be of the demagnetising type.
3. All plug in type relays have bases where the termination of wires up to 1.5mm2 can be connected and up to a maximum of two wires per termination point.
4. Plug in relay bases do not cause wires entering the outermost terminals to interfere with an adjacent relay base.
5. All plug in type relays have metal, rust resistant retaining clips to prevent the relays from dislodging either accidentally or due to vibrations. Spacing between relay/relay bases are adequate to allow for individual relay removal without disturbing adjacent devices.
6. It is customary to use auxiliary relays with a mechanical forcing plunger. Such plungers are removed before final commissioning and the holes plugged with a suitable plug to prevent dust ingress into the relay contact area.
7. All auxiliary relay type tests or OEM certificates/specifications are submitted to the project manager for approval prior to ordering the components. Specifications include the contact’s DC breaking capability.

3.4.9 Output contacts

1. All output relays are to be fitted with self-resetting contacts.
2. Each tripping relay shall have at least two output contacts.
3. Contacts are rated in accordance with specification 32-333 (20MΩ at 500Vdc).
4. Output contacts of any relay, auxiliary or binary output card is able to carry the maximum load of the circuit it is used for without any damage.
5. In cases where large coils need to be energised with a high closing current but a much lower holding current, an “economising” resistor is typically inserted by the very same device through its own auxiliary contact. When such auxiliary contact fails to open to insert the resistor in series with the coil, a suitable MCB protects the initiating relays output contacts from being damaged. The preferred solution is rather to use an appropriate mini contactor as interposing device that can carry the closing current of the large coil continuously or a combination of the two.

3.4.10 Earthing requirements

1. The excitation 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 conductors be required to meet the above requirements and specifications, the *Contractor* provides and installs such material
7. All cable screens and spare cores are earthed one side only.

3.4.11 Shrouding

1. All exposed terminals and cable terminations including test block terminations are shrouded using a transparent non-flammable material to prevent accidental contact.
2. All transducers connected to any field winding/busbar or shunt shall have proper shrouding over the terminations to prevent accidental contact to the terminal and shall be clearly marked where high voltages or a high risk of accidentally earthing the measuring point exist.
3. Acrylic sheeting is unacceptable as a shrouding material. Non-flammable, transparent, poly-carbonate or poly-propylene is the preferred material.
4. All cover designs are submitted to and approved by the Project Manager.

3.4.12 Terminals

1. Neither insulation displacement type connectors nor spring type connecter without screws are allowed.
2. Provision is made for printed circuit boards to be modified if this is a preferred type connector by the *Contractor*.
3. The use of “fast-on” or push on connectors are not allowed on power circuits, voltage transformer circuits, current transformer circuits or earth connections.
4. The terminals are spring retained on the assembly rail complying with DIN EN 50045 and when mounted and wired in service, is closely fitted to avoid the accumulation of foreign matter between adjacent terminals.
5. End barriers or shields are provided for open sided patterns.
6. It is possible to replace any terminal in an assembly without dismantling adjacent units; it is permissible, however, to loosen any clamping device.
7. Screw retention of any component from the rear of the mounting rail is not acceptable.
8. All terminal blocks are readily accessible.
9. 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.
10. Terminals are spring loaded such that the actions of the springs are independent of the action of the terminal screws.
11. Terminal screws are captive within the mouldings and their heads do not project above the mouldings when fully released.
12. Each terminal accepts up to two hooked blade type lugs.
13. Terminal entries are shrouded such that no current carrying metal is exposed when hooked blade lugs are fitted.
14. Springs withstand corrosion that might affect performance during their working life.
15. Springs do not carry any current.
16. Cross connection required for connecting two or more adjacent terminals are via wire loops. OEM supplied bridge pieces screwed down by the cage clamp is submitted to the Project Manager prior to use. Bridging from the top of the terminal to connect adjacent terminals invariably requires terminal insulation to be mechanically modified and bridging materials are not plated after punching and bending and allows for high resistance connections to develop over time. Should this be a preferred connection method it is submitted for approval prior to use on this project.
17. When used in current transformer circuits, the terminals are capable of accepting hooked blade lugs on 6mm² wires.
18. The terminals are sized to provide for pre-insulated lugs to fit after being crimped with the ‘flat’ crimp lying parallel with the rail.

19. The insulation impulse level and isolation requirements between individual terminals are guaranteed.
20. For stud type terminals 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.
21. 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”.
22. These barriers project at least 3mm above the studs.
23. All types of commonly used terminals as shown on the drawing 18.48/5695 sheet 4. 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.
24. All control system interface terminals are spring loaded link type terminals.
25. Terminals are numbered sequentially from left to right.

3.4.13 Lugs

1. No bare wire connection to any terminal is allowed.
2. All lugs are of the compression type.
3. Control lugs and their application with different types of terminals are as detailed on the drawing 18.48/5695 sheet 4.
4. Crimping on power lugs is in accordance with IEC 61238-1..
5. Crimping tools are calibrated according to their manufacturer’s specifications. The crimped area is at least equal to 1.5 times the conductor square area.
6. Documented proof of conformance to IEC 61238-1 specification requirements for tensile force heat cycling, resistance and temperature measurement may be requested by the Project Manager.
7. Control wiring using bootlace ferrules are crimped with a crimping tool compressing the ferrule from four sides. Single sided indent type crimping is not allowed.
8. Push on/fast on lugs are not the preferred lug. Any use of push on lugs in the entire system are declared in the tender document for approval of the Project Manager. After judgment on merit and if allowed, only nickel plated steel lugs are allowed and no tin plated brass or copper lugs are allowed due to their inferior longevity and contact resistance.
9. All lugs crimped onto wires of 6mm2 and above are of the hex crimped type. Indent (dimple) type crimping is not permitted.

3.4.14 Noise emission and electromagnetic compatibility

1. The ECS shall not exceed the electrical noise interference limits as stated in 32-333.
2. The ECS is not damaged and does not mal-operate when operated under conditions described in 32-333.

3.4.15 Test points

1. For testing and commissioning purposes, the following signals are available as scaled analogue values for recording purposes with an instrument with a 1MΩ input impedance.
2. These signals are available in both channels.
3. At least six are to be available simultaneously.
4. The following analogue test points are provided for external measurements/recordings:
    a) Machine stator voltage
    b) Machine stator current
    c) Field voltage
    d) Field current
    e) Rectifier Control voltage
    f) Active power
    g) Reactive power
    h) Frequency
    i) PSS Output signal
5. Two additional, permanently mounted, fused measuring points for direct measurement of field voltage and field current are available. Due to the fact that shunts develop a very small voltage any resistance in series with the measuring point could lead to inaccurate results when fuses create high resistance connections. Fuses are therefore not recommended where measurement shunts are used in general. If commissioning measurements require direct access to the shunts from a remote location, then fuses are required that can be locked in the open position. Fuse holders need to be of

a high quality and have a wiping action when the fuse is inserted or the fuse holder is closed. One fuse per connection is required. (i.e. 2 fuses per filed voltage connection and two fuses per shunt connection) Fuses shall be of the HRC fuses rated to cater for the voltages in IEC 60034-1 table 16. Consider the use of high quality “operate behind close door”/extended operating handles like shown below. These disconnector can then be fused..

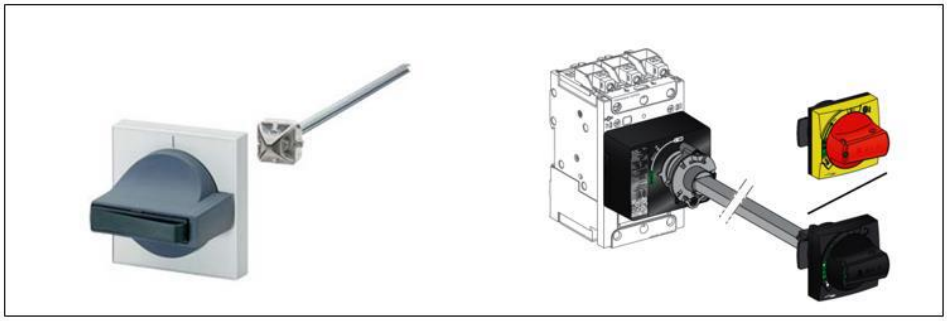


Figure 12: Fused switch disconnector (courtesy of Havells)

Shafts can be extended as shown in the examples above for example

3.4.16 Test blocks

1. Each channel is supplied with a set of voltage transformers and therefore each channel is supplied with its own test block situated at an easy accessible place for measurement and testing purposes on the front panel door.
2. Both channels shall be connected to different sets of current transformers as shown in Figure 13 below. All wiring interface to the CTs and VTs shall be provided by the Contractor; the CTs and VTs shall be tested by the Contractor before being used. The wiring must be arranged in such a way that each channel is supplied with its own test block situated at an easy accessible place for measurement and testing purposes on the front panel door. The removal of a test block on one channel does not influence the other channel.

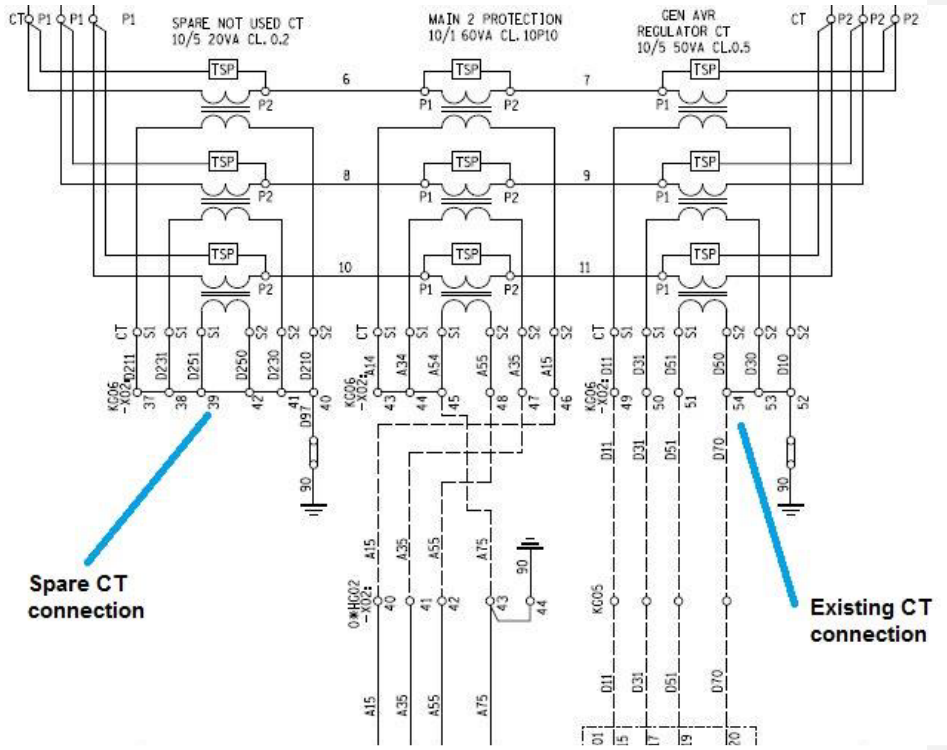


Figure 13: Excitation system CTs

3. The test block for the excitation transformer over current device is wired according to conventional protection circuits where the field side is shorted out when the test block cover is removed.

~~1.~~ Approved test blocks are in accordance with Specification 32-333

1. One test handle of each type of test block is provided as part of the testing equipment.

3.4.17 Cabling scope

The *Contractor* provides goods and services to meet the following requirements:

- Testing of all power cables,
- Replacement of damaged cables,
- Cable joining and termination,
- Cable numbering,
- Installation of cable racks from excitation equipment room to the Equipment room
- Decommission of existing ES
- Core drill if required by *Employer*.
- Fire sealing of all cable entry points and floor slots.
- Connection of earth conductors for switchgear assembly to existing earth.

3.4.18 Cabling requirements

1. The Contractor supplies and installs all cables required for the ES upgrade project.
2. Cabling to other systems must be specified, supplied and installed by the Cabling Contractor.
3. The Contractor may re-use the existing cabling.
4. Cables that are not long enough may not be joined. They should either be replaced or connected via a junction box; the Contractor provides and installs such material.
5. All electrical installations of 220V and above are carried out by a qualified electrician.
6. The new electrical cabling is done in accordance with the following standards:
   i. 240-56227443: Requirements for Control and Power cables for power station standard SANS 10142-1- Wiring Premises
7. The following templates issued by the Employer, must be used during the design and works section of the project. These are (but are not limited to):
   i. Template 240-56176097: Electrical Cable Schedule
   ii. Template 240-56227927: Electrical Load List Template
   iii. Template 240-77301384: Electrical LV Load Schedule Template
8. Cable schedules are supplied by the *Contractor* indicating the following minimum data:
   a) Cable number
   b) Cable type
   c) Cable length
   d) Plant/interface description
   e) Plant destination AKZ
   f) Core ferule numbers
   g) Route identification
9. After delivery of cabling to site, the cable drums must be inspected and the insulation tested by the *Contractor*. The results must be supplied to the *Employer* and it must be indicated whether the drum has passed or failed.

3.4.19 Cable installation

1. Cables may enter panels from the bottom only.
2. During installation of the cables, extreme care is to be exercised to avoid kinking or bending which may damage the cable insulation or sheath.
3. Cables which are accidentally damaged during installation are to be repaired or replaced to the satisfaction of the Employer. In no case is a cable, on which the outer sheath has been punctured, installed.
4. The Cabling Contractor is responsible for storage of all cable and is to suitably protect it from weather and damage during storage and handling.
5. The Cabling Contractor installs the cables onto the existing cable racks where applicable or where new racks are installed after approval of the project manager.
6. Power and control cable are not routed on the same rack.
7. No tee offs nor jointing of wiring is to be done, other than at the terminals.
8. The Contractor shall use optic fibre cables with metal armouring for fibre cables that are leaving the ES cubicles to another distant location.

3.4.20 Cable identification

1. All cables are identified by a cable number at termination points.
2. The Cabling Contractor applies to the Project Manager for cable numbers in Excel format indicating the following:
   i. Type of cable e.g. Armoured PVC
   ii. Number of conductors e.g. 2
   iii. Voltage e.g. 24V
   iv. Description of Purpose e.g. Eastern Substation 380V Main Distribution Board Supply B.
   v. Origin and destination

3.4.21 Cabinet and Junction Box Identification

1. All cabinets panels and junction boxes are identified by a permanent number fixed to the cabinet/box.
2. The Contractor applies to the Project Manager for cabinet/junction box numbers in Excel format indicating the following:
   a. Location: eg Unit 1 AVR room
   b. Number of cables e.g. 4
   c. Voltage e.g. 400V
   d. Description of Purpose e.g. Unit 1 AVR Converter 1.

3.4.22 Product support

1. The OEM clearly states, in writing, the warrantee period on their product and the components covered.
2. It is also be clearly stated in writing what the limitations in product support are beyond the specified warrantee period and what options there are to be considered as well as the cost involved regarding support beyond the warrantee period.
3. Beyond the warrantee period the *Contractor* still have the ability to do repairs on faulty components. If this is not possible then the *Contractor* provides an exchange policy to the *Employer* where faulty electronic modules can be exchanged and a discount provided by the *Employer* for the new component.
4. During and beyond the warrantee period the faulty modules are to be investigated by the *Contractor* and a failure report provided to the *Employer* stating the reason for failure.
5. The *Contractor* offers a 12-month guarantee on the supplied equipment from the date of commissioning. The *Contractor* offers a standard 12-month warranty on quality and workmanship.
6. The *Contractor* plans for a visual inspection at a time suitable to the *Employer*, approximately one year after completion.
7. The *Contractor* inspects each unit on or before the defects date and provides the *Employer* with an inspection report.
8. The *Contractor* liaises with the *Employer* three months prior to the defects date to confirm machine availability.
9. The *Contractor* corrects all defects identified before the defect's correction period

3.5 Use of *Contractor*'s design

The *Employer* may use the *Contractor*'s design for any purpose in relation to the excitation systems at Kriel Power Station.

3.6 Design of Equipment

None.

3.7 Equipment required to be included in the *works*

The *Contractor* shall provide all equipment needed for the works.

3.8 As-built drawings, operating manuals and maintenance schedules

3.8.1 General

1. The original as built approved version of all documents and drawings shall be handed to the *Employer*. The *Contractor* shall provide documentation in electronic media using Microsoft Office or "searchable" PDF format. The *Employer* allocates numbers to the documentation and drawings which the *Contractor* indicates on the documentation and drawings. The *Contractor* shall use pre-approved templates provided by the *Employer* for all documentation and drawings required.
2. The *Contractor* shall submit all technical documentation and drawings for acceptance to the *Employer* prior to manufacture. The *Contractor* submits two sets of hardcopy files plus an electronic copy of information on CD of all documentation indicated in the paragraphs to follow

3.8.2 Drawings

1. All drawings are created electronically and 100% compatible with Micro-station software in a DGN file format.
2. In conjunction with the electronic DGN copies, the *Contractor* shall provide a merged set of PDF copies upon first issue and each time drawing updates are required. All drawings shall be signed and revisions noted as per the *Employer*'s specifications.
3. The basic design is also to be submitted in this format to evaluate both the design and the electronic format.
4. The electronic file shall conform to the Eskom standard 240-86973501.
5. The detail design drawings have the pre-approved title blocks and borders as provided by the *Employer*.
6. Graphical symbols are used in accordance with the NRS002 standard.
7. All drawings shall be submitted to the Project Manager for acceptance.
8. The *Contractor* shall produce as built drawings within 4 weeks of each site acceptance test and submit them to the Project Manager for his acceptance.
9. The *Contractor* shall be produced in the following types of drawings:
    a. Cover sheet
    b. Index sheet
    c. List of symbols
    d. List of components with values, tolerances, ratings, type numbers, purchasing specification numbers, manufacturer and circuit reference numbers
    e. General layout drawing of the proposed panels and floor plan
    f. Singe line diagram
    g. Block diagram of the system
    h. Panel internal wiring drawings, including cross referencing and wire numbers
    i. Cable block diagrams with termination points
    j. Transfer functions of the system in the time and frequency domain.
10. The *Contractor* is liable for updating drawings until final commissioning when the *Employer* has signed off and approved the final "As Built" state of the drawings. After commissioning the Contactor shall supply two sets of drawing hardcopies in two separate files and in A3 format.

3.8.3 Technical, maintenance and operating manuals

1. All manuals shall be specific to Kriel Power Station.
2. Documentation includes transfer functions of each part of the regulation system.
3. The technical, maintenance and operating manuals also contain the information and course material of the training manuals.
4. All design information forming part of the Works Information is to be included in the manuals.
5. All documentation including drawings and operating and maintenance instruction manuals are uniquely identified and cross-referenced with all related documents.
6. The manuals are complete with:
    a. Power Station name and order number
    b. Content list
    c. List of reference drawings, and
    d. Details of all components
7. Manuals are of good quality prepared by suitably experienced personnel. The *Contractor* ensures that the manuals/files are complete with the following information represented as a minimum:
    a. Details and descriptions of all hardware and software

b. Design calculation sheets
c. Settings and configuration
d. Detailed product descriptions and features
e. System control philosophy
f. System parameters and models
g. Datasheets of all components used
h. Recommended spares lists
i. Operating, maintenance and testing requirements
j. Full system maintenance program
k. Installation procedures of each component
l. Isolation procedures
m. Alarm descriptions and responses
n. Type test certificates
o. Certificates of compliance to international standards
p. Routine test results reports
q. Commissioning test results reports
r. Training information
s. Technical tender submission information

8. Any special instructions pertaining to storage of spare parts or to their shelf life are included in the manual.
9. All drawings required for component location, dismantling, and re-assembly for maintenance is provided in the manual.
10. All special tools required for maintaining and operating the plant and material are identified in a schedule and described in the manual.
11. Manuals are produced such that a Synopsis is first presented, followed by a First Draft, then a pre-print proof and finally be the Final Manual.

3.8.4 Settings and device configurations

1. The *Contractor* shall provide the settings data for each and every configurable device supplied.
2. All settings, configurations, alarm and tripping matrixes are configured as per recommendation by the *Contractor* and are reviewed by the *Employer* for final acceptance.
3. The *Contractor* is responsible for the calculation of all settings and the calculations are provided to the *Employer* for acceptance. The applied settings within the excitation system are provided to the *Employer* by means of active Windows or configuration files containing the settings which can easily be copied to a work document.
4. The excitation system settings contain mathematical Laplace models of the individual control loops in the controllers including the PSS. The settings information also contains an overall mathematical Laplace model of the entire system. The *Contractor* provides detailed calculations showing how the settings for each of the systems were calculated. All system settings and data supplied comply with the *Employer*'s standards as listed and as per the South Africa Grid Code requirements.

4.Procurement

4.1People

4.1.1 Minimum requirements of people employed

It is the Contractor's sole responsibility to ensure all its employees have permits to perform work in the Republic of South Africa.

4.1.1.1 Supplier Development Localisation and Industrialisation (will become contractual requirements with contract award)

a) Training proposal: Training exposure within Electrical field (2x)
b) Sub-contracting proposal: Transportation from harbour to Kriel site

4.1.2 BBBEE and preferencing scheme

Where a change in the *Contractor's* legal status, ownership or any other change to his business composition or business dealings results in a change to the *Contractor*'s B-BBEE status, the *Contractor* notifies the *Employer* within seven days of the change.

The *Contractor* is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the *Employer* within thirty days of the notification or as otherwise instructed by the *Employer*.

Where, as a result, the *Contractor's* B-BBEE status has decreased since the *starting date* the *Employer* may either re-negotiate this contract or alternatively, terminate the *Contractor*'s obligation to provide the *service*.

Failure by the *Contractor* to notify the *Employer* of a change in its B-BBEE status may constitute a reason for termination will be dealt with according to the NEC3 TSC penalty/termination clauses

4.1.1 Accelerated Shared Growth Initiative – South Africa (ASGI-SA)

The Contractor complies with and fulfils the Contractor's obligations in respect of the Accelerated and Shared Growth Initiative - South Africa in accordance with and as provided for in the Contractor's ASGI-SA Compliance Schedule stated below
.
[Insert the agreed ASGI-SA Compliance Schedule here]

The Contractor shall keep accurate records and provide the Project Manager with reports on the Contractor's actual delivery against the above stated ASGI-SA criteria. [Elaborate on access to and format of records and frequency of submission etc.]

The Contractor's failure to comply with his ASGI-SA obligations constitutes substantial failure on the part of the Contractor to comply with his obligations under this contract.

4.2 Subcontracting

4.2.1 Preferred subcontractors

The *Employer* may list which subcontractors or suppliers the *Contractor* is required to enter into subcontracts with.

If the *Contractor* subcontracts work, he is responsible for providing the Service as if he had not subcontracted. This contract applies as if a Subcontractor's employees and equipment were the *Contractor's*.

4.2.2 Subcontract documentation, and assessment of subcontract tenders

When the *Contractor* uses a Subcontractor he needs to engage with him on a NEC basis. The Subcontractor needs adhere to all processes, policies and procedures of Eskom as service should be provided as if not subcontracted to Eskom.

All reporting will happen based on the NEC standard forms or as agreed upon in the Kick off meeting.

4.2.3 Limitations on subcontracting

The *Contractor* submits the name of each proposed Subcontractor to the *Service Manager* for acceptance. A reason for not accepting the Subcontractor is that the appointment will not allow the *Contractor* to Provide the Service.

The *Contractor* does not appoint a Subcontractor until the *Service Manager* accepted them.

4.2.4 Attendance on subcontractors

The Subcontractor should attend all morning feedback Outage meetings to provide accurate feedback on the progress of *service*. Assessment meetings between *Project Manager* and the *Contractor* should be avoided by the Subcontractor.

4.3 Plant and Materials

4.3.1 Quality

All inspections and testing to be performed in accordance with the Quality Control Procedure developed by the *Contractor*. The specified Materials and Equipment are to be new, unused, and free from defects and imperfections. Reconditioned Materials and/or Equipment are not regarded as new under any circumstances. The *Contractor* will not use Materials or Equipment which are generally recognised as being unsuitable or otherwise to be avoided for the purpose for which they are intended.
Only components of high reliability will be utilised, with a proven operating history, to enable the Plant to achieve required reliability and availability. Equipment design, engineering and manufacture will be done in accordance with the best modern practice applicable to high-grade products of the type to be furnished, so as to ensure the efficiency and reliability of the Works and the strength and suitability of the various parts for the Works.
Materials and equipment withstand ambient conditions and the variations of temperature arising under working conditions without distortion, deterioration or undue strains in any part. All parts and components are made accurately, and where practicable, to acceptable standards so as to facilitate replacement and repairs. Repair of defective material and/or equipment will be done only with the *Employer*'s approval and any such repair, if approved, will be carried out to the satisfaction of the *Employer*.
The *Contractor* ensures that co-ordinated and formally documented management system is in place for the assurance of quality. The *Employer* is to specify intervention (hold and witness) points during the manufacturing, installation and on site testing stages of the project. The *Contractor* issues preliminary notification of such intervention points by ten working days in advance to the *Employer*, and confirms such hold and witness points at least five working days prior to the activity.

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

None

4.3.3 *Contractor*'s procurement of Plant and Materials

None

4.3.4 Spares and consumables

The Contractor supplies the Employer with a detailed list of all spares required in order to maintain the new Excitation system. The list of spares is supplied three months before the delivery of the items for the installation. The Contractor further supplies all basic maintenance spares, in accordance with the Contractor's maintenance schedules, such as filters and fuses to the Employer before installation. The Contractor shall keep all critical spares at hand, as needed during commissioning, to prevent extended delays caused by failure of any of the components; these spares will remain the property of the Contractor. Furthermore, the Contractor shall provide a detailed spares management plan with projection on spares obsolescence and end of life management for electronic modules, power electronic devices and other assembly modules.

The complete recommended spares list includes the following details:

a) Description
b) Part number
c) Special storage requirements
d) Replacement part or routing maintenance part
e) Quantity
f) Cost
g) Lead time
h) Supplier full contact details and address.

4.4 Tests and inspections before delivery

4.4.1 Factory acceptance test (FAT)

~~2.~~1. The *Contractor* will perform pre-checks and tests before the *Employer* is notified to be involved with FAT.
~~3.~~2. Before FAT will commence, a complete Factory Acceptance Test Procedure will be submitted by the *Contractor* to the *Employer*. The *Employer* will review the procedure and make updates where necessary.
~~4.~~3. The *Contractor* supplies two copies of all test certificates and data sheets prior to the commencement of the factory testing.
~~5.~~4. The *Contractor* gives the *Employer* at least 10 working days' notice of the date on which the E~~C~~S is ready for inspection and testing when these tests are to be done in South Africa and two months' notice if it is to be done outside the border of South Africa.
~~6.~~5. The *Employer* is provided with access to the *Contractor*'s premises for the purpose of establishing compliance with the contractual requirements by means of inspections, surveillance's, audits and witnessing the performance of any tests.
~~7.~~6. Communications testing will be conducted during the basic design phase. This will also be regarded as a pre-FAT test.

1. This inspection entails a full system check (functional and wiring checks) to ensure compliance with this specification, contract drawings and other applicable standards.
2. Allowance is made in the delivery time to cater for this requirement.
3. The system functionality is to be demonstrated by the *Contractor* to the Project Manager/Supervisor during Factory Acceptance Tests at the *Contractor*'s facility for one E~~C~~S system. Only if non critical defects are picked-up that cannot be rectified before the first unit's commissioning, will additional FAT continue on subsequent units on the same basis.
4. A complete Factory Acceptance Testing procedure is included in the design package.
5. The following tests (checks) are conducted by the *Contractor* as a minimum requirement and witnessed by the Project Manager/Project Supervisor, lead Engineer and site representative:
    a. Dielectric test of current transformers, auxiliary wiring and control circuitry;
    b. Dielectric tests of power circuit, bus bars and cables.
    c. Current transformer test to prove the ratio, polarity, resistance and magnetising curves;
    d. Check the nameplates, connections, torque all bolts and nuts on power cabling that will not require loosing and refastening on site;
    e. Functional tests on circuitry, and the indication circuitry (checks include fuse ratings, labelling, ferrule numbers, crimping and tightness of all connections including lugs);
    f. Calibration checks of all voltmeters and ammeters to prove their operation and accuracy class;
    g. Power Supply checks
    h. Control Function Tests (Limiters, step responses, firing angles, control, etc)
    i. Alarms and indication checks
    j. Power electronics checks and tests
    k. Breaker/contactor tripping and closing under off-nominal voltages.
6. The Factory Acceptance Testing of the E~~C~~S is completed at the manufacturer's works and accepted by the Project Manager, before dispatching the complete unit to site.
7. A defects list needs to be kept as a live working document to capture any deviation from the works information. These could be simple wiring errors or more serious functional requirements that are not met.
8. The *Contractor* is given a reasonable time to rectify wiring without delaying the completion of the FAT. When more serious defects are encountered, the *Contractor* needs to inform the Project Manager immediately about it, with an estimated time to resolution and testing of the function/requirement.

4.5 Marking Plant and Materials outside the Working Areas

N/A

4.6 *Contractor*'s Equipment (including temporary works).

N/A

4.7 Cataloguing requirements by the *Contractor*

N/A

5.Construction

5.1 Temporary works, Site services & construction constraints

5.1.1 *Employer*'s Site entry and security control, permits, and Site regulations

1. Before work starts on Site, a Site inaugural meeting is held between the Contractor and the Employer, where details of the Works are discussed and clarified;
2. The Contractor's Site Supervisor is on Site for the entire duration of the Works.
3. General access to the power station is controlled and Site induction has to be completed before work will be allowed to start.
4. It is mandatory that the Contractor adheres to all security regulations in force during the period of the contract.
5. Before entry to the Site will be allowed, everyone will undergo an alcohol Breathalyzer test which needs to be passed. This is one of the five Life-saving Rules to which the Contractor is required to adhere to at all times.

5.1.2 Restrictions to access on Site, roads, walkways and barricades

1) The Contractor satisfies himself and comply with the Site conditions presented during induction.
2) The Contractor is required to comply with all Site restrictions pertaining to the Site's roads, walkways and barricades.

5.1.3 People restrictions on Site; hours of work, conduct and records

1. Normal working hours:
   a) Monday to Thursday: 07h00 – 16h15
   b) Fridays: 07h00 – 12h00

2. Outage working hours are as follows:
   a) Monday to Sundays: 07h00 – 18h30

5.1.4 Health and safety facilities on Site

The health and safety facilities on Site will be discussed in detail during the Site induction

5.1.5 Environmental controls, fauna & flora, dealing with objects of historical interest

N/A

5.1.6 Title to materials from demolition and excavation

The *Contractor* has no title to plant and/or materials resulting from him carrying out the *Works*.

5.1.7 Cooperating with and obtaining acceptance of Others

All activities are performed according to the Accepted Programme.

5.1.8 Publicity and progress photographs

No notice boards, advertising rights, media relations, and photography and progress photographs will be allowed without appropriate authorisation.

5.1.9 *Contractor*'s Equipment

1. The Contractor provides the Employer with a complete list of materials, tools, Equipment and or machinery before bringing it onto Site.
2. The Contractor provides and maintains all test and measuring Equipment required for all tests to the required accuracy. The accuracy of test Equipment is required to be better than ± 0.1 %.
3. The type and class of Equipment used is subject to the Acceptance by the Employer.

4. The Contractor's measuring Equipment is accompanied by valid calibration certificates from an approved authority.
5. The Project Manager may at any stage during the Contract require such Equipment to be checked by an approved laboratory or the South African Bureau of Standards.

5.1.10 Equipment provided by the *Employer*

None

5.1.11 Site services and facilities

5.1.11.1 Refuse Disposal

The Employer provides special colour coded bins as per the table below for refuse disposal. These bins are emptied by the Employer free of charge. The Contractor ensures that all workers under his control strictly adhere to the correct use of refuse bins as stated in the Plant.

Blue Bins	Scraps Metal Only
White Bins	Domestic Refuse
Yellow Bins	Asbestos Material
Brown Bins	Building Rubble
Red Bins	Oil or Chemical containing refuse.

5.1.11.2 Supply of Electricity

- Employer will make available to the Contractor 220/230-volt electrical supply free of charge from the closest existing point of supply.
- The Contractor is to make provision for the necessary extensions and plug points.
- All Electrical boards must be inspected and tested before connecting to a power supply and then a CoC must be issued by the Contractor
- The Contractor will adhere to the Electrical Installation Regulations of 1992

5.1.11.3 Medical Facilities

- The Contractor provides a First Aid service to his employees and subcontractor. In the case where these prove to be inadequate, like in the event of a serious injury, the Employer's Medical Centre and facilities are available.
- Outside the Employer's office hours, the Employer's First Aid Services are only available for serious injuries and life-threatening situations.
- The Employer is entitled, however, to recover the costs incurred, in the use of the above Employer's facilities, from the Contractor.

5.1.11.4 Toilet Facilities

The Employer provides the Contractor access to toilet facilities.
Temporary chemical toilets are provided by the Contractor where deemed necessary.

5.1.12 Facilities provided by the *Contractor*

- The *Contractor* shall provide, for his own use adequate size offices.
- A cleaning service must also be provided.
- Domestic rubbish will be removed free of charge.
- The *Contractor* shall dismantle and clear off site all such infrastructure at the discretion of the *Service Manager* on completion of the contract.
- No such dismantling and clearance work shall be carried out without prior approval by the *Service Manager.*
- Any electrical equipment or appliances used by the *Contractor* shall conform to the applicable South African Safety standards and Kriel standard PSR 010, and shall be maintained in safe and proper working condition.

- The *Employer* shall have the right to stop the *Contractor*'s use of any electrical equipment or appliance, which in the *Employer's* opinion does not conform to the foregoing.

5.1.12.1Site Location

- The boundary of the site is within the Power Station boundary fences.
- The *Contractor* is to mark the boundaries of his site clearly.
- The *Contractor* is to ensure that all his material and equipment is always within the boundaries of his site.
- A site for the *Contractor* will be provided if needed. (The exact position will be determined on site).
- The *Contractor* will ensure further treatment of the yard area to keep all neat and tidy at all times.
- The *Contractor* shall also include for such items as security, watch and access arrangements to his yard area.
- The *Contractor* shall not occupy any site area other than that located to him
- On completion of the service on Site, all areas allocated to the *Contractor* shall be re-instated to their former condition to the satisfaction of *Employer*

5.1.12.2 *Contractor*'s site requirements

- The *Contractor* supplies, installs, properly maintains, and removes all temporary construction facilities and utilities necessary for the complete performance of the *service*
  - Including the following:
  -
- The *Contractor's* yard should adhere to sound housekeeping, failing with this the *Employer* may use another *Contractor* to clean up the *Contractor's* yard. These costs will be carried by the *Contractor*.
- Any damage to installed lighting is repaired at the *Contractor*'s expense.
- The reticulation of electricity, water and any other services required by the *Contractor* from a supplied central distribution point.
- Hazardous Substances to be contained as per Eskom requirements.
- Transportation on and off site
- Telephone connections may be available, and the *Contractor* applies via the *Purchaser's Representative* for a connection. Connection fees and calls are for the *Contractor's* account.
- Compressed air and gases
- Maintenance of lay-down and storage areas
- Electric panels and distribution wiring for erection and within *Contractor*'s yard
- Security of *Contractor*'s yard
- Temporary lighting to ensure safe working conditions.

5.1.12.3 Accommodation

The provision of accommodation for *Contractor*'s personnel is the responsibility of the *Contractor*.
The *Contractor* or any of his employees or subcontractors is not allowed to use the *Employer's* dining facilities. The shop next to the main office building may be utilized by the *Contractors*.

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

N/A

5.1.14 Survey control and setting out of the *works*

N/A

5.1.15 Excavations and associated water control

N/A

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

1) The Contractor minimizes interference of any nature with regards to existing services, cable and pipe trench covers.

2) In the event that the Contractor damages one of the above, the penalty would be for the Contractor.

5.1.17 Control of noise, dust, water and waste

The *Contractor* ensures that all activities comply with the safety requirements.

5.1.18 Sequences of construction or installation

All activities are performed according to the Accepted Programme.

5.1.19 Giving notice of work to be covered up

All notices and warnings will follow the ECC3 requirements.

5.1.20 Hook ups to existing works

The floor & surrounding space is limited and the Contractor will assess the area properly in order to execute the works successfully and timeously

5.2 Completion, testing, commissioning and correction of Defects

5.2.1 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 except for the work listed below which may be done after the Completion Date but in any case before the dates stated. The *Project Manager* cannot certify Completion until all the work except that listed below 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.

	Item of work	**To be completed by**
	As built drawings of	Within days after Completion
	Performance testing of the *works* in use as specified in paragraph of this Works Information.	See performance testing requirements.

5.2.2 Use of the *works* before Completion has been certified

N/A

5.2.3 Materials facilities and samples for tests and inspections

All components will be in line with approved list of components as supplied by the *Employer*. Samples of components may be requested by the *Employer* for pre-approval where deemed necessary.

5.2.4 Commissioning

The activities forming part of live testing, live commissioning or power up of any component is not embarked on until the Project Manager's acceptance (safety clearance certificate) has been obtained for construction and erection work performed in this stage.

5.2.4.1 Commissioning documentation

Commissioning does not start until the following documents, which are required for the commissioning of the plant, is accepted by the Project Manager:

1. All relevant drawings as-built.

2. All relevant site acceptance test reports completed and signed.
3. All QCP's signed at the relevant steps.
4. Draft Technical Maintenance and Operating manuals supplied.
5. All installation related defects are cleared.
6. All safety clearance certificates signed.

5.2.4.2 Site acceptance tests

1. Site acceptance tests are carried out by the *Contractor* and witnessed by the Supervisor and/or *Employer*.
2. The test procedures are prepared by the *Contractor* and accepted by the Project Manager.
3. The purpose of the Site acceptance test is to ensure that all the Plant and Materials are correctly installed, checked and that no malfunction or damage occurred during the transportation and / or erection.
4. The *Contractor* provides all the test equipment for testing the individual functional units/components.
5. When the site acceptance tests are completed, the ES is safety cleared (safety clearance certificate) and the *Contractor* issues a COC for acceptance by the Project Manager.
6. The *Contractor* is the signatory to this certificate(240-156104699).

5.2.4.3 Cold / pre commissioning tests

1. Site cold commissioning tests are carried out by the *Contractor* and witnessed by the *Employer*.
2. The test procedures are prepared by the *Contractor* and accepted by the Project Manager.
3. The purpose of the cold commissioning is to ensure that all the Plant and Materials are correctly installed, prove live loops and test basic functions with the machine at standstill.
4. The *Contractor* provides all the test equipment for testing the individual functional units.

5.2.4.4 Hot commissioning

Hot commissioning starts after cold commissioning is complete.

1. The plant is commissioned by running the system fully manual and testing each piece of Plant and Material for full functionality in each mode of operation.
2. The *Contractor* in conjunction with the *Employer* performs the commissioning of the Excitation System and allows for the following tests to be completed:
    a. Full function tests as per this specification
    b. AVR ESVD testing online and offline
    c. GCR4 Grid Code compliance testing as per Grid Code requirements
3. Due to possible constraints from the *Employer*, the *Contractor* allows for his commissioning engineer to be available continuously during each hot commissioning activity.
4. The commissioning engineer is officially certified by the *Contractor* as being qualified and experienced to commission the excitation system and be able to make the necessary software updates as may be required onsite during hot commissioning.

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

The *Contractor* is on site when the first live operation of the plant commences. All switching to get the plant ready is done by the *Employer* to obtain the status for start-up as per agreed commissioning program.

5.2.6 Take over procedures

Take-over is when all testing, inspections and commissioning as specified in sections 5.2.1, 5.2.4, 5.2.5 are completed successfully.

5.2.7 Access given by the *Employer* for correction of Defects

Access will be granted to the Contractor for defects correction as per core clause 43.4 in ECC3

5.2.8 Performance tests after Completion

Commissioning results are sent to the system operator for evaluation and results can be requested to be readjusted to meet system requirements.

5.2.9 Training and technology transfer

5.2.9.1 General

1. The *Contractor* provides training on the Plant and Material and systems included as part of the *works* to the various categories of the *Employer's* technical staff for the duration of the *works*.
2. Training provided by the *Contractor* is directly applicable to the actual Plant and Material supplied for the works.
3. Generalised training based on similar Plant and Material is not acceptable.
4. Engineering training is provided prior to the Factory Acceptance Testing of the ECS.
5. All pre-FAT training is conducted at the *Contractor*'s local test facility and all operating and maintenance training is conducted at Kriel Power Station.
6. The local facilities for training provided by the *Employer* are a suitably sized air-conditioned room, to accommodate 35 trainees as well as trainee and trainer desks, an overhead projector and flipchart or white board.
7. The *Contractor* submits to the *Project Manager* for acceptance a detailed training programme as well as a prospectus for each course one month before each training session.
8. The number of participants that are to be trained is as indicated by the Project Manager.
9. The *Employer* bears the cost of salaries, accommodation, travelling expenses and other allowances of his personnel during the training, but all other training costs are borne by the *Contractor*.
10. The *Contractor* provides 3 additional (repeat) training courses as and when instructed by the *Project Manager*.
11. Practical hands-on training for each individual trainee forms an integral part of each of the following courses:
    a. Operating Training
    b. Maintenance Training
    c. Engineering / Commissioning Training
12. The Engineering / Commissioning training are of such a standard that experienced staff are able to commission and re-engineer some parts of the system after such training has been obtained.

5.2.1.1 Operating

The training includes the following aspects:

1. Familiarise with documentation including drawing configuration logic.
2. Operator interface familiarisation e.g. operational functions, alarms etc.

5.2.1.2 Maintenance

The training includes the following aspects:

1. Familiarisation with documentation (maintenance plan, procedures etc.)
2. Operator interface familiarisation e.g. operational functions, alarms etc.

3. Hardware familiarisation
4. Hardware maintenance
5. Maintenance of control and instrumentation
6. Remote interrogation and analysis of information from the E~~C~~S and data recorders

5.2.1.3 Engineering

The training includes the following aspects:

1. Familiarisation with documentation (maintenance plan, procedures etc.)
2. Operator interface familiarisation e.g. operational functions, alarms etc.
3. Hardware familiarisation
4. Hardware maintenance
5. Maintenance of control and instrumentation
6. Changes and addition of function blocks
7. Time stamping protocols
8. Interfacing to the future control system
9. Bus system fault finding and engineering
10. Full commissioning understanding

5.2.1.4 Training documentation

1. The *Contractor* incorporates all necessary technical data, design data literature and drawings into his training manuals.
2. The course material is in English and includes all third party documentation.
3. A copy of the training documentation is supplied for each trainee.
4. The supply of drafts, pre-print proofs and printed copies of training documentation is planned by the *Contractor* in such a way that the required training is complete before FAT of the unit commences.
5. Training manuals are continuously updated by the *Contractor* up to the date of issue of the Defects Certificate for the whole of the *works*.

5.2.10 Operational maintenance after Completion

None

6. Plant and Materials standards and workmanship

6.1 Investigation, survey and Site clearance

The Contractor surveys the site to identify all necessary work requirements for completion of the Works at basic design phase and provides these requirements to The Employer

6.2 Building works

N/A

6.3 Civil engineering and structural works

N/A

6.4 Electrical & mechanical engineering works

Doc Identifier	Description
ISO 9001	Quality Management Systems
32-727	Eskom Safety, Health, Environment and Quality (SHEQ) Policy
240-105658000	Supplier Quality Management: Specification
240-56227589	List of Approved Electronic Devices to be used on Eskom Power Stations
240-56227443	Requirements for Control and Power Cables for Power Stations Standard
240-53114026	Project Engineering Change Management
240-53114186	Document and Record Management Procedure
240-66920003	Project Handover Documentation Management Procedure
240-71432150	Plant Labelling Standard
240-86973501	Engineering Drawing Standard

6.5 Process control and IT works

As per clause 3.2 (Parts of the works which the Contractor is to design)

6.6 Other [as required]

7 List of drawings

7.1 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.

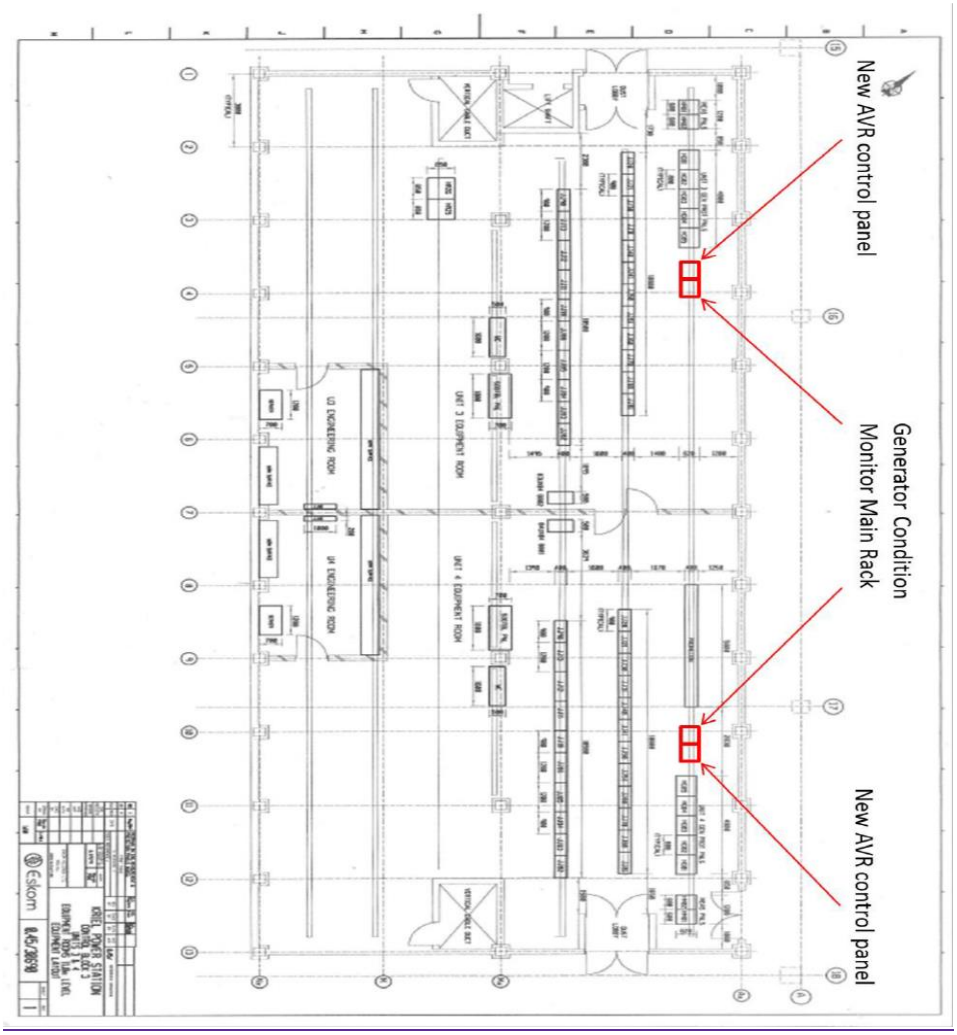
Drawing number	Revision	Title

8 Appendix A – Vendor Document Submittal Schedule

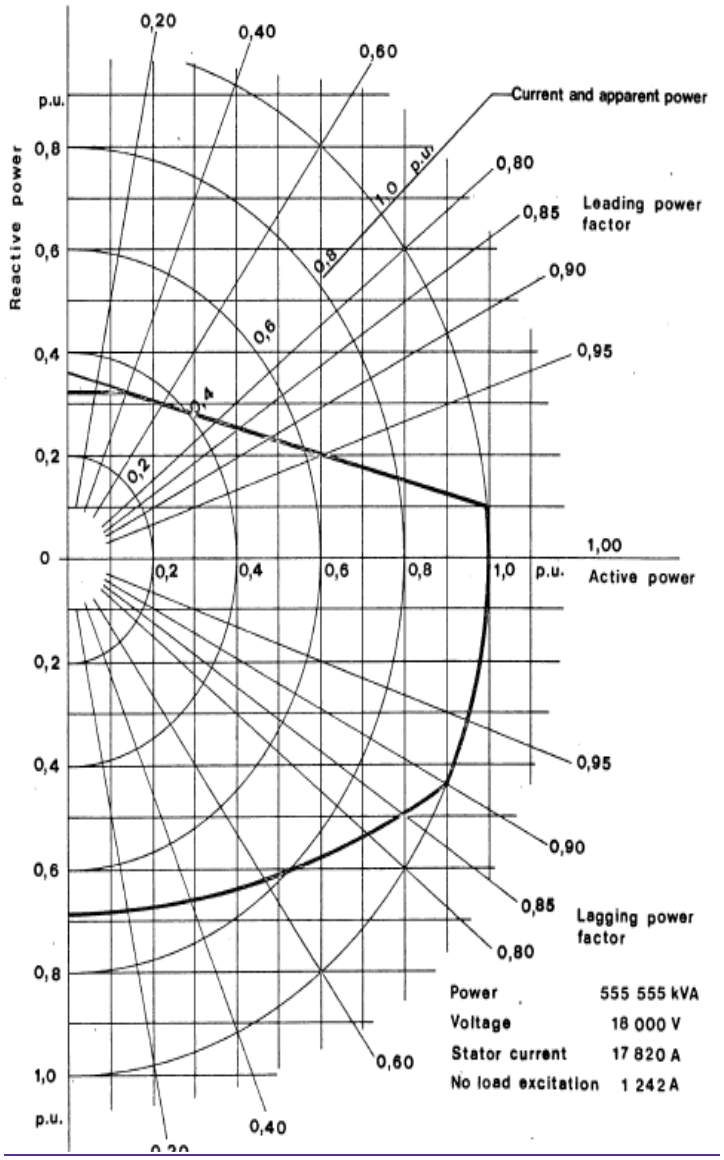
Refer to Scope of Work document number EEP1059 clause 8 Vendor Document Submittal Schedule

9 Appendix B: Power System and Interface Information

9.1 Equipment Room Floor Layout



9.2 Installed Kriel Generator Capability Diagram


Reactive power
p.u.
0,8
0,6
0,4
0,2
0
0,2
0,4
0,6
0,8
1,0
p.u.
1,00
Active power
0,20
0,40
0,60
Current and apparent power
1,0 p.u.
0,8
0,6
0,4
0,2
0,80
0,85
0,90
0,95
Leading power factor
0,95
0,90
0,85
0,80
Lagging power factor
0,60
0,40
0,20
Power 555 555 kVA
Voltage 18 000 V
Stator current 17 820 A
No load excitation 1 242 A

1.3 Excitation Transformer Data

Transformer Type	DTE 1400/24
Norms	IEC 60076-11
Nominal Power	1400 KVA
Insulation class	H
Temperature Rise	125 K
Frequency	50 Hz
Rated Primary Voltage	10392 V
Rated Secondary Voltage	605 V
Vector Group	Yd11
No load loss	3100 W
Load loss	11500 W
Short circuit voltage	6%
Total Weight	2865 kg

9.4 Unit 4,5 &6 Kriel Generator Data

Refer to Scope of Work document EEP1059 clause 9.4 Unit 4,5 &6 Kriel Generator Data

9.5 Unit 2 Kriel Generator Data

Refer to Scope of Work document EEP1059 clause 9.5 Unit 2 Kriel Generator Data

9.6 Generator Transformer Data

Refer to Scope of Work document EEP1059 clause 9.6 Generator Transformer Data

9.7 Fault Level on the 400 KV System

Refer to Scope of Work document EEP1059 clause 9.7 Fault Level on the 400 KV System

C3.2 CONTRACTOR'S WORKS INFORMATION

Will be completed as per the final agreement

Also refer to page 80 of Scope of Work for Schedules A and B

C4: Site Information

C4.1: Information about the *site* at time of tender which may affect the work in this contract

General

The Kriel Power Station is situated approximately half way between Bethal and Ogies on the R545, being just over 30 km from each town and 10 km north-west of Kriel town.

Climate

Kriel Power Station is situated in a summer rainfall area with an average annual precipitation of about 750-mm falling almost entirely during the months of October to April. The average rainfall per month generally exceeds 40 mm during this period, although drought periods do occur which can last for 20 days or longer. Drought periods occur most frequently during the months of October/November and March/April. January is statistically the highest rainfall month with an average monthly rainfall of about 130-mm. June has the lowest rainfall with an average monthly rainfall of about 7 mm.

Approximately 85% of the annual rainfall occurs in the summer months and heavy falls of 125 to 150 mm occasionally occur in a single day. The annual average number of thunderstorms is about 75. These storms are often violent with severe lightning and strong (but short-lived) gusty winds and are sometimes accompanied by hail. This region has among the highest hail frequencies in South Africa; about 4 to 7 occurrences (depending mainly on altitude) may be expected annually.

January is normally the hottest month with an average daily maximum temperature of 27°C with a mean daily temperature in winter being about 16°C. Winter average daily temperatures vary from 18, 5°C maximum to -1°C minimum. The extreme temperatures recorded range from 34, 7°C to minus 12, 4°C for the period 1920 - 1984. (Source: Weather Bureau, Pretoria)

Winds are generally light to moderate except during thunderstorms. Generally the prevailing wind directions are from the North West during the day and from the east at night. During daytime, the prevailing winds are from the north-western direction. During night-time, the prevailing winds are from the north-eastern direction. The highest recorded average wind speed is 17, 6 km/hour. The average wind velocity over the year is 14, 5 km/hour.

(Source: MSN weather & Weather 24, average records 2008 - 2009.)

Weather Data

THE ASSUMED 1 IN 10 YEAR RAINFALL FIGURES ARE:

Month	Cumulative rain (mm)	No of days with rainfall > 10mm
January	200	6
February	150	6
March	120	5
April	110	4
May	40	3
June	20	2
July	30	2
August	30	2
September	60	3
October	140	6
November	160	7

December	170	6

Relative Humidity

Records for Bethal (2008 - 2009)
The average relative humidity on an annual base are as follows:
08:00 = 80%
14:00 = 52%
20:00 = 73%

Prevailing Winds

Records for Bethal (2008 - 2009)
Winds are mostly north-westerly except for February and March when they are easterly to south-easterly. The highest wind speeds are recorded from the south-east: on average 14km/h.

Other Climatic Factors

Records for Bethal (2008 - 2009)
Thunder occurs mostly from November to January with average of 35.7 days annually.

a) Hail occurs mostly in December with average of 2.8 days annually.
b) Fog occurs mostly in the winter months with an average of 19 days annually.
c) Snow rarely occurs
d) Cloud coverage is highest in the summer months with annual average as follows:
   - 08:00 = 2.8/8
   - 14:00 = 3.8/8
   - 20:00 = 3.1/8

Evaporation for the area is in rage of 75mm to 190mm per month. The highest evaporation occurs in December, and the lowest in June.

Topography

The surface topography of the Kriel area is typical of the Mpumalanga Highveld consisting in the main of a gently undulating plateau. The flood plains of the local streams are at an average elevation of ± 1540 meters above mean sea level and drainage generally is a northerly direction.

Air Quality

The existing and potential sources of air pollution in Kriel area are the following:

- Kriel Power Station stack emissions
- Kriel Power Station dry dust (fly ash) handling plant
- Dust blow from the Eskom coal stock yard
- Dust blow from the roads in the area
- Seasonal dust blow caused by ploughing of farmlands, and dust blow off denuded fields
- Dust blow from dried out exposed surfaces of the wet ash dam.

However, Eskom utilises the majority of the top surface of the ash dam as an evaporation pan for polluted water, which means that the exposed surface is constantly wet. The sides of the ash dam have largely been rehabilitated, with the result that dust blow from the ash dam.

Access limitations

The contractor safety system file will be required as mitigation against safety hazards which must comply with requirements of Kriel Power Station. Arrangements must be made with Employer so that access can be gained without any restriction/ constraints to work onsite that may not be immediately apparent from an inspection of the site. Contractor will be required to do induction before access to site can be granted.