



NEC3 Engineering & Construction Contract

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

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

for **Drakensberg Blowdown Air Compressor**
Replacement

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

CONTRACT No.

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 <i>Employer</i>	[•]
C1.2b Contract Data provided by the <i>Contractor</i>	[•]
[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:

Drakensberg Blowdown Air Compressor Replacement

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:			
Name & signature of witness	<i>(Insert name and address of organisation)</i>	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			
Name & signature of witness	(Insert name and address of organisation)	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)

Eskom Holdings SOC Ltd
 Gx Peaking OU
 15 Pasita Street, Rosenpark
 Durbanville, 7550

Name & signature
 of witness

.....

.....

Date

.....

.....

C1.2 ECC3 Contract Data

Part one - Data provided by the *Employer*

[Instructions to the contract compiler: (delete these two notes in the final draft of a contract)]

- Please read the relevant clauses in the conditions of contract before you enter data. 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.
- Some ECC3 options are always selected by Eskom Holdings SOC Ltd. The remaining ECC3 options are identified by shading in the left hand column. In the event that the option is not required select and delete the whole row. Where the following symbol is used “[●]” - data is required to be inserted relevant to the specific option selected.]

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

Clause	Statement	Data
1	General	
	The <i>conditions of contract</i> are the core clauses and the clauses for main Option dispute resolution Option and secondary Options	<p>A: Priced contract with activity schedule</p> <p>W1: Dispute resolution procedure</p> <p>X1: Price adjustment for inflation</p> <p>X2: Changes in the law</p> <p>X5: Sectional Completion</p> <p>X7: Delay damages</p> <p>X15: Limitation of <i>Contractor's</i> liability for design to reasonable skill and care</p> <p>X16: Retention</p> <p>X18: Limitation of liability</p> <p>Z: <i>Additional conditions of contract</i></p>
	of the NEC3 Engineering and Construction Contract, April 2013 (ECC3)	
10.1	The <i>Employer</i> is:	Eskom Holdings SOC Ltd (reg no: 2002/015527/30), a state-owned company incorporated in terms of the company laws of the Republic of South Africa
	Address	Registered office at Megawatt Park, Maxwell Drive, Sandton, Johannesburg
10.1	The <i>Project Manager</i> is:	Aldrin Cloete

	Address	Eskom Holdings SOC Ltd Gx Peaking OU 15 Pasita Street, Rosenpark Durbanville, 7550
	Tel	+27 83 7001 444
	Fax	
	e-mail	aldrin.cloete@eskom.co.za
10.1	The <i>Supervisor</i> is: (Name)	Lindokuhle Hlatshwayo
	Address	Drakensberg Power Station GPS Coordinates 28°33'52"S 29°05'09"E
	Tel No.	+27 71 252 4523
	Fax No.	
	e-mail	hlatshtl@eskom.co.za
11.2(13)	The <i>works</i> are	Design, manufacture, factory acceptance testing, supply, delivery and offloading of the control system, installation, and commissioning of four air compressors and associated equipment
11.2(14)	The following matters will be included in the Risk Register	Daily toolbox talks Daily Safety meeting Workers register <ul style="list-style-type: none"> • Use of hand tools • Operating a crane • Cable termination • Installation and Commissioning of compressors • Cleaning • Use of A-frame ladders • Use of stairs • Use of lifts • Working with mobile equipment • Lifting
11.2(15)	The <i>boundaries of the site</i> are	Compressor area
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 to.
12.2	The <i>law of the contract</i> is the law of	the Republic of South Africa
13.1	The <i>language of this contract</i> is	English
13.3	The <i>period for reply</i> is	<ul style="list-style-type: none"> • 5 working days pre-implementation • 24 hours during implementation
2	The Contractor's main responsibilities	

3 Time											
11.2(3)	The <i>completion date</i> for the whole of the works is 31 July 2026										
11.2(9)	The <i>key dates</i> and the <i>conditions</i> to be met are: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th><i>Condition to be met</i></th> <th><i>key date</i></th> </tr> </thead> <tbody> <tr> <td>1 Design freeze</td> <td>10 July 2025</td> </tr> <tr> <td>2 Equipment Delivery to Drakensberg</td> <td>27 November 2025</td> </tr> <tr> <td>3 Reliability run of first unit</td> <td>19 December 2025</td> </tr> <tr> <td>4 Test and commissioning final unit</td> <td>22 July 2026</td> </tr> </tbody> </table>	<i>Condition to be met</i>	<i>key date</i>	1 Design freeze	10 July 2025	2 Equipment Delivery to Drakensberg	27 November 2025	3 Reliability run of first unit	19 December 2025	4 Test and commissioning final unit	22 July 2026
<i>Condition to be met</i>	<i>key date</i>										
1 Design freeze	10 July 2025										
2 Equipment Delivery to Drakensberg	27 November 2025										
3 Reliability run of first unit	19 December 2025										
4 Test and commissioning final unit	22 July 2026										
30.1	The <i>access dates</i> are: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Part of the Site</th> <th>Date</th> </tr> </thead> <tbody> <tr> <td>1 Compressor 1</td> <td>27 November 2025</td> </tr> <tr> <td>2 Compressor 2</td> <td>22 April 2026</td> </tr> <tr> <td>3 Compressor 3</td> <td>30 May 2026</td> </tr> <tr> <td>4 Compressor 4</td> <td>30 May 2026</td> </tr> </tbody> </table>	Part of the Site	Date	1 Compressor 1	27 November 2025	2 Compressor 2	22 April 2026	3 Compressor 3	30 May 2026	4 Compressor 4	30 May 2026
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1 Compressor 1	27 November 2025										
2 Compressor 2	22 April 2026										
3 Compressor 3	30 May 2026										
4 Compressor 4	30 May 2026										
31.1	The <i>Contractor</i> is to submit a first programme for acceptance within Two weeks of the Contract Date										
31.2	The <i>starting date</i> is 30 April 2025										
32.2	The <i>Contractor</i> submits revised programmes at intervals no longer than two weeks										
35.1	The <i>Employer</i> is not willing to take over the works before the Completion Date.										
4 Testing and Defects											
42.2	The <i>defects date</i> is 52 weeks after Completion of the whole of the works.										
43.2	The <i>defect correction period</i> is Two (2) weeks, unless otherwise agreed between the Project Manager and Contractor where the two week period is considered impractical.										
5 Payment											
50.1	The <i>assessment interval</i> is on successful test and commissioning of each unit										
51.1	The <i>currency of this contract</i> is the South African Rand										
51.2	The period within which payments are made is Thirty days (30) after receipt of acceptable Tax Invoice and all relevant supporting documentation										
51.4	The <i>interest rate</i> is the publicly quoted prime rate of interest (calculated on a 365 day year) charged from										

		<p>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</p> <p>(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.</p>
6	Compensation events	
60.1(13)	<p>The place where weather is to be recorded is:</p> <p>The <i>weather measurements</i> to be recorded for each calendar month are,</p> <p>The <i>weather measurements</i> are supplied by</p> <p>The <i>weather data</i> are the records of past <i>weather measurements</i> for each calendar month which were recorded at:</p> <p>and which are available from:</p>	<p>ROYAL NATIONAL PARK</p> <p>the cumulative rainfall (mm)</p> <p>the number of days with rainfall more than 10 mm</p> <p>the number of days with minimum air temperature less than 0 degrees Celsius</p> <p>the number of days with snow lying at 08:00 hours Central African Time</p> <p>and these measurements: None</p> <p>The Contractor to obtain the one in ten-year return weather data from ...</p> <p>ROYAL NATIONAL PARK</p> <p>the South African Weather Bureau and included in Annexure A to this Contract Data provided by the Employer</p>
60.1(13)	<p>Assumed values for the ten year return <i>weather data</i> for each <i>weather measurement</i> for each calendar month are:</p>	<p>As stated in Annexure A to this Contract Data provided by the Employer.</p> <p>Note: If this arrangement is used, delete the rows above for 60.1(13) and delete this note.</p>
7	Title	<p>Applicable as per Section 7 of the NEC 3 ECC (April 2013).</p>

8	Risks and insurance		
80.1	These are additional <i>Employer's</i> risks	Outage movement dates	
9	Termination		
		Applicable as per Section 9 of the NEC 3 ECC (April 2013).	
10	Data for main Option clause		
A	Priced contract with activity schedule	Refer to part 2: Pricing Data of this contract.	
11	Data for Option W1		
W1.1	The <i>Adjudicator</i> is	the person selected from the ICE-SA Division (or its successor body) of the South African Institution of Civil Engineering Panel of Adjudicators by the Party intending to refer a dispute to him. (see www.ice-sa.org.za). If the Parties do not agree on an Adjudicator the Adjudicator will be appointed by the Arbitration Foundation of Southern Africa (AFSA).	
W1.2(3)	The <i>Adjudicator nominating body</i> is:	the Chairman of ICE-SA a joint Division of the South African Institution of Civil Engineering and the London Institution of Civil Engineers. (See www.ice-sa.org.za) or its successor body.	
W1.4(2)	The <i>tribunal</i> is:	arbitration.	
W1.4(5)	The <i>arbitration procedure</i> is	the latest edition of Rules for the Conduct of Arbitrations published by The Association of Arbitrators (Southern Africa) or its successor body.	
	The place where arbitration is to be held is	Johannesburg, South Africa	
	The person or organisation who will choose an arbitrator	the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.	
	- if the Parties cannot agree a choice or		
	- if the arbitration procedure does not state who selects an arbitrator, is		
12	Data for secondary Option clauses		
X1	Price adjustment for inflation		
X1.1(a)	The <i>base date</i> for indices is	On the CPA formulae below	
X1.1(c)	The proportions used to calculate the Price Adjustment Factor are:	proportion	linked to index for
			Index prepared by
		0. [•]	[•]
		0. [•]	[•]
		0. [•]	[•]
		0. [•]	[•]
		0. [•]	[•]
		[•]	non-adjustable

		Total	1.00	
X2	Changes in the law	There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.		
X5	Sectional Completion			
X5.1	The <i>completion date</i> for each <i>section</i> of the <i>works</i> is:	Section	Description	Completion date
		1	Reliability run of Compressor 1	19 December 2025
		2	Reliability run of Compressor 2	30 June 2026
		3	Reliability run of Compressor 3	22 July 2026
		4	Reliability run of Compressor 4	22 July 2026
X5 & X7	Sectional Completion and delay damages used together			
X7.1 X5.1	Delay damages for late Completion of the <i>sections</i> of the <i>works</i> are:	section	Description	Amount per day
		1	Compressor 1	R10 000.00
		2	Compressor 2	R10 000.00
		3	Compressor 3	R10 000.00
		4	Compressor 4	R10 000.00
	Remainder of the <i>works</i>			
	The total delay damages payable by the <i>Contractor</i> does not exceed:	10% of the Contract Value		
X15	Limitation of the <i>Contractor's</i> liability for his design to reasonable skill & care	There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.		
X16	Retention			
X16.1	The <i>retention free amount</i> is	R0.00		
	The <i>retention percentage</i> is	10% of the Contract Value of which		
		<ul style="list-style-type: none"> • 5% is paid at Completion of the whole of the <i>works</i> • 5% is paid when the Defects Certificate is issued 		
X18	Limitation of liability			
X18.1	The <i>Contractor's</i> liability to the <i>Employer</i> for indirect or consequential loss is limited to:	R0.0 (zero Rand)		

X18.2	For any one event, the <i>Contractor's</i> liability to the <i>Employer</i> for loss of or damage to the <i>Employer's</i> property is limited to:	the amount of the deductibles relevant to the event
X18.3	The <i>Contractor's</i> liability for Defects due to his design which are not listed on the Defects Certificate is limited to	The greater of <ul style="list-style-type: none"> • the total of the Prices at the Contract Date and • the amounts excluded and unrecoverable from the <i>Employer's</i> assets policy for correcting the Defect (other than the resulting physical damage which is not excluded) plus the applicable deductible as at contract date.
X18.4	The <i>Contractor's</i> total liability to the <i>Employer</i> for all matters arising under or in connection with this contract, other than excluded matters, is limited to:	the total of the Prices other than for the additional excluded matters. The <i>Contractor's</i> total liability for the additional excluded matters is not limited. The additional excluded matters are amounts for which the <i>Contractor</i> is liable under this contract for <ul style="list-style-type: none"> • Defects due to his design which arise before the Defects Certificate is issued, • Defects due to manufacture and fabrication outside the Site, • loss of or damage to property (other than the <i>works</i>, Plant and Materials), • death of or injury to a person and • infringement of an intellectual property right.
X18.5	The <i>end of liability date</i> is	(i) five (5) years after the <i>defects date</i> 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 <i>Employer</i> or the <i>Supervisor</i> before the <i>defects date</i>, without requiring any inspection not ordinarily carried out by the <i>Employer</i> or the <i>Supervisor</i> during that period. If the <i>Employer</i> or the <i>Supervisor</i> do undertake any inspection over and above the reasonable inspection, this does not place a greater responsibility on the <i>Employer</i> or the <i>Supervisor</i> to have discovered the Defect.
Z	The <i>Additional conditions of contract</i> 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 <i>Contractor</i> (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 <i>Employer's</i> 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 <i>Project Manager</i> should have notified the event to the <i>Contractor</i> but did not".
Z9	<i>Employer's</i> limitation of liability
Z9.1	The <i>Employer's</i> liability to the <i>Contractor</i> for the <i>Contractor's</i> indirect or consequential loss is limited to R0.00 (zero Rand)
Z9.2	The <i>Contractor's</i> entitlement under the indemnity in 83.1 is provided for in 60.1(14) and the <i>Employer's</i> 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 <i>Contractor's</i> payment of delay damages reaches the limits stated in this Contract Data for Option X7 or Options X5 and X7 used together, the <i>Employer</i> may terminate the <i>Contractor's</i> obligation to Provide the Works using the same procedures and payment on termination as those applied for reasons R1 to R15 or R18 stated in the Termination Table.
Z12	Ethics
	For the purposes of this Z-clause, the following definitions apply:
Affected Party	means, as the context requires, any party, irrespective of whether it is the <i>Contractor</i> or a third party, such party's employees, agents, or Subcontractors or Subcontractor's employees, or any one or more of all of these parties' relatives or friends,
Coercive Action	means to harm or threaten to harm, directly or indirectly, an Affected Party or the property of an Affected Party, or to otherwise influence or attempt to influence an Affected Party to act unlawfully or illegally,
Collusive Action	means where two or more parties co-operate to achieve an unlawful or illegal purpose, including to influence an Affected Party to act unlawfully or illegally,
Committing Party	means, as the context requires, the <i>Contractor</i> , or any member thereof in the case of a joint venture, or its employees, agents, or Subcontractor or the Subcontractor's employees,
Corrupt Action	means the offering, giving, taking, or soliciting, directly or indirectly, of a good or service to unlawfully or illegally influence the actions of an Affected Party,
Fraudulent Action	means any unlawfully or illegally intentional act or omission that misleads, or attempts to mislead, an Affected Party, in order to obtain a financial or other benefit or to avoid an obligation or incurring an obligation,

Obstructive Action	means a Committing Party unlawfully or illegally destroying, falsifying, altering or concealing information or making false statements to materially impede an investigation into allegations of Prohibited Action, and
Prohibited Action	means any one or more of a Coercive Action, Collusive Action Corrupt Action, Fraudulent Action or Obstructive Action.
Z12.1	A Committing Party may not take any Prohibited Action during the course of the procurement of this contract or in execution thereof.
Z12.2	The <i>Employer</i> may terminate the <i>Contractor's</i> obligation to Provide the Services if a Committing Party has taken such Prohibited Action and the <i>Contractor</i> did not take timely and appropriate action to prevent or remedy the situation, without limiting any other rights or remedies the <i>Employer</i> 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 <i>Employer</i> can terminate the <i>Contractor's</i> obligation to Provide the Services for this reason.
Z12.3	If the <i>Employer</i> terminates the <i>Contractor's</i> 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 <i>Employer</i> does not have a contractual bond with the Committing Party, the <i>Contractor</i> ensures that the Committing Party co-operates fully with an investigation.
Z13	Insurance
Z 13.1	Replace core clause 84 with the following:

Insurance cover 84

- 84.1** When requested by a Party, the other Party provides certificates from his insurer or broker stating that the insurances required by this contract are in force.
- 84.2** The *Contractor* provides the insurances stated in the Insurance Table A.
- 84.3** The insurances provide cover for events which are at the *Contractor's* risk from the *starting date* until the earlier of Completion and the date of the termination certificate.

INSURANCE TABLE A

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

Z 13.2

Replace core clause 87 with the following:

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

INSURANCE TABLE B

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

Z15 Asbestos

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

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

ROYAL NATIONAL PARK

Month	Weather measurement				
	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]
JAN	359.6	12	0	No Data	
FEB	369.6	12	0	No Data	
MAR	286.7	9	0	No Data	
APR	129.5	5	0	No Data	
MAY	63.9	2	3	No Data	
JUN	44.8	2	16	No Data	
JUL	39.3	1	17	No Data	
AUG	82.8	3	7	No Data	
SEP	117.9	3	1	No Data	
OCT	177.7	7	0	No Data	
NOV	235.6	8	0	No Data	
DEC	330.8	9	0	No Data	

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

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

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

Notes to a tendering contractor:

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

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

Clause	Statement	Data
10.1	The 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:	

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

		CV's (and further key persons data including CVs) are appended to Tender Schedule entitled .		
11.2(3)	The <i>completion date</i> for the whole of the works is			
11.2(14)	The following matters will be included in the Risk Register			
11.2(19)	The Works Information for the <i>Contractor's</i> design is in:			
31.1	The programme identified in the Contract Data is			
A	Priced contract with activity schedule			
11.2(20)	The <i>activity schedule</i> is in	(in figures) (in words), excluding VAT		
11.2(30)	The tendered total of the Prices is			
	Data for Schedules of Cost Components	<i>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).</i>		
A	Priced contract with activity schedule	Data for the Shorter Schedule of Cost Components		
41 in SSCC	The percentage for people overheads is:	10%		
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	N/A Minus N/A %		
22 in SSCC	The rates of other Equipment are:	Equipment Mobile lifting equipment (per day) Crane	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 As detailed below	

62 in SSCC	The percentage for design overheads is	10%		
63 in SSCC	The categories of design employees whose travelling expenses to and from the Working Areas are included in Defined Cost are:	None		
	If Option C, D or E is used	Data for Schedule of Cost Components		
23 in SCC	The listed items of Equipment purchased for work on this contract, with an on cost charge, are:	Equipment	Time related charge	Per (time period)
24 in SCC	The rates of special Equipment are:	Equipment	Size or capacity	Rate
44 in SCC	The percentage for Working Areas overheads is:	: %		
51 in SCC	The hourly rates for Defined Cost of manufacture or fabrication 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	
52 in SCC	The percentage for manufacture and fabrication overheads is	%		

C1.3 Forms of Securities

Pro formas for Bonds & Guarantees

For use with the NEC3 Engineering & Construction Contract

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

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

Eskom Holdings SOC Ltd
Megawatt Park
Maxwell Drive
Sandton
Johannesburg

Date:

Dear Sirs

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

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

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

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

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

Signed at _____

Date _____

For and behalf of the Bank

Bank Signatory: _____

Bank Signatory: _____

Witness: _____

Witness: _____

Bank's seal or stamp

PART 2: PRICING DATA

ECC3 Option A

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

C2.1 Pricing assumptions: Option A

1. How work is priced and assessed for payment

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

Identified and defined terms	11	
	11.2	(20) The Activity Schedule is the <i>activity schedule</i> unless later changed in accordance with this contract.
		(27) The Price for Work Done to Date is the total of the Prices for
		<ul style="list-style-type: none">• 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.

2. 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.

3. 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*.

4. 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.	Activity Description	Price in Currency	
		ZAR	Month after award
1.	Submit General arrangement drawings		
2.	Final Design approved		
3.	C&I Interface Design approved		
4.	FAT for Compressors complete		
5.	Cataloguing		
6.	Submit Site execution documentation (quality management docs, checksheets, method statements, etc)		
7.	Safety File		
8.	C&I Interface Hardware Delivered Site		
9.	Compressors Delivered to Site 1A		
10.	Compressors Delivered to Site 1B		
11.	Compressors Delivered to Site 2A		
12.	Compressors Delivered to Site 2B		
13.	Install and Commissioning of Compressor 1A		
14.	Install and Commissioning of Compressor 1B		
15.	Install and Commissioning of Compressor 2A		
16.	Install and Commissioning of Compressor 2B		
17.	Submit as-built drawings of final Compressors		
18.	Cataloguing		
	TOTAL		

C2.2 the *activity schedule*

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

PART 3: SCOPE OF WORK

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

C3.1: EMPLOYER’S WORKS INFORMATION

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3.2.4	The <i>Contractor</i> provides loop/circuit diagrams, termination diagrams/schedule, assembly drawings, parts lists, signal lists, interface points, control logic, configuration settings, and overall system topology, allowing for enough time to be reviewed by the <i>Employer</i> as per section 3.3.2.	53
3.2.5	The <i>Contractor</i> provides 3x copies of As-Built Drawings and Operations and Maintenance Manuals.....	53
3.2.6	Undertake a full conformity assessment of pressure components as per SANS 347:2019 and OHS&A Pressure Equipment Regulation, 2009.	53
3.2.7	The <i>Contractor</i> provides all necessary nameplates, dimensional, material and test certificates for components per the classification performed to SANS 347, and per 240-154283718: Pressure Equipment Regulations Compliance Manual.	53
3.2.8	The <i>Contractor</i> provides a complete list of recommended/critical spares with datasheets, expected lead time and cost.	53
3.2.9	The <i>Contractor</i> provides a catalogue of spares for the <i>Works</i> . The <i>Employer</i> will supply the template for the cataloguing of spares for the <i>Contractor</i> to populate.....	54

3.2.10	The Contractor provides a detailed fault-finding and alarm response guide that includes:	54
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1 Description of the works

1.1 Executive overview

Drakensberg Pumped Storage Scheme is situated underground in the Northern Drakensberg Mountains in KwaZulu Natal, approximately 30km from the town of Bergville. The Blowdown air compressors have been in service since the station was commissioned between 1979 and 1981; there have been no refurbishments or replacements to the Blowdown Compressors, Control System or Switchgear since installation. The existing compressors and control system has been in operation for approximately 43 years and has surpassed its design life and the equipment has aged and become obsolete.

The scope of works requires the removal of the existing Ishikawa-Harima Heavy Industries (IHI) air compressors and the supply of a fully integrated functional solution that consists of the four air compressors with their associated systems as described in section 3.2 which promotes ease of maintenance and operation to maintain plant availability, reliability for at least another 25 years.

1.2 Employer's objectives and purpose of the works

1.2.1 Employer's objective

The *Employer's* objective is to procure and install four new air compressors with electrical motors that will replace the existing Ishikawa-Jima Harima Heavy Industries (IHI) reciprocating compressors and their associated equipment. A new OEM approved PLC-based control system, consisting of PLCs, associated I/O, and required power supplies is included in the replacement. The controls are designed and installed to be able to operate, control and monitor the new compressors. The control equipment is to be housed in new floor mounted control panels. A closed loop cooling water circuit, one for each compressor needs to be designed, supplied, and installed.

The *works* are to be completed in phases and within allocated time frames, to ensure continuous blowdown air availability to the generating units at Drakensberg Power Station.

1.2.2 Purpose of the works

The purpose of the *works* is to ensure that the blowdown system at Drakensberg Power Station has fully functional, maintainable, and fully automated air compressors to provide reliable compressed air while ensuring the safe operation and control of the system. Thereby ensuring that the station is always able to achieve all designated modes of operation.

All four units are equipped with an individual but interconnected blowdown air depression system which caters for the following modes:

- a) Start-up in pumping mode.
- b) Starting and running in synchronous condenser operation (SCO) mode in both generation and pumping directions of rotation.
- c) Changing from generating or pumping mode to SCO mode.

The required mode of operation is facilitated by injecting compressed air into the upper runner chamber, thus depressing the water level, and allowing the runner to rotate freely in air.

This works information specifies the *Contractor's* minimum requirements for engineering work, detail design, drawings, procurement, manufacture, quality control & assurance, supply, delivery, decommissioning, installation, commissioning, testing, and handing over of the complete and fully functional new compressor system.

1.3 Interpretation and terminology

The following definitions are used in this Works Information.

Definitions	The meaning given to the definition.
Availability	The state of an asset in which it is available and ready to be put to its designed or intended use.
As built	The <i>Project Manager</i> or Supervisor certifies that this drawing is checked against the actual wiring of the corresponding circuit in the Plant and Material as correct after final hot commissioning is completed.
Reliability	The ability of a component or system to perform its functions under stated conditions for a specific period.
Specification	The document/s forming part of the contract in which are described the methods of executing the various items of <i>works</i> to be done, and the nature and quality of the materials to be supplied and includes technical schedules and drawings attached thereto as well as all samples and patterns.
Synchronous Condenser Operation	It is a specific mode of operation which is performed by the generating units to regulate the voltage on transmission lines.

Table 1: Definitions

The following abbreviations are used in this Works Information:

Abbreviation	Meaning given to the abbreviation
AC	Alternating Current
ASME	American Society of Mechanical Engineers
BDC	Blowdown Compressor
CW	Cooling water
C&I	Control and Instrumentation
C&E	Control and Electrical
DI	Digital Input
DOL	Direct Online
DRP	Drakensberg Pumped Storage Scheme
FAT	Factory Acceptance Testing
GA	General Arrangement
HMI	Human Machine Interface
I/O	Input-output
KKS	Kraftwerk-Kenzeichnungs System
LCP	Local Control Panel
masl	Meters above Sea Level
NDT	Non-Destructive Testing
NTP	Network Time Protocol
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OHSA	Occupational Health and Safety Act
PLC	Programmable Logic Controller
PB	Push Button
P&ID	Piping and Instrumentation Diagram
PQP	Project Quality Plan
QA	Quality Assurance
QC	Quality Control
Rpm	Revolutions per minute
SANS	South African National Standards
SCO	Synchronous Condenser Operation
SCADA	Supervisory Control and Data Acquisition

Table 2: Abbreviations

2 Management and start up.

2.1 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 compensation events	As required	MSTEAMS or on-site	<i>Project Manager, Contractor, Project co-Ordinator, and relevant Engineer when required</i>
Overall contract progress and feedback	As required	MSTEAMS or on-site	<i>Project Manager, Contractor, Supervisor, and relevant Engineer when required</i>
Installation progress meetings	Daily	on-site	<i>Contractor, Supervisor, and relevant Engineer when required</i>

Table 3: Management meetings

- a) Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the works. Records of these meetings are submitted to the *Project Manager* by the person convening the meeting within five days of the meeting.
- b) All meetings are recorded using minutes or a register prepared and circulated by the person who convened the meeting.
- c) Meetings can be face to face or held on MSTEAMS and transcripts and/or recordings can be used for minutes compilation.
- d) Such minutes or registers shall not be used to confirm actions or instructions under the contract as these are done separately by the person identified in the conditions of the contract to carry out such actions or instructions.
- e) These meeting descriptions include, but are not limited to the following:
 - Design reviews & clarifications
 - Quality Control plan (QCP) or Inspection & Test plan (ITP)

2.2 Documentation control

- a) All documentation and drawings standards to comply with the latest with the revisions of the following;
 - Eskom’s Classification and Designation of Technical Documentation Standard 240-54179170
 - Eskom’s Engineering Drawing Standard – Common Requirements, 240-86973501
 - Eskom document and records management, 32-6
 - Eskom’s Documentation Management Standard, 32-644
- b) All drawings submitted to Eskom shall be compatible with the latest Bentley MicroStation version used at the time.
- c) All drawings must be issued in both native CADD format (.dgn) and PDF format.
- d) Drawings issued for review or final shall not be “write protected” or encrypted. Drawings should be fully editable when submitted for review and final issue.

- e) For the final "As built" drawings the Contractor shall insert all relevant signatories in the title block for final submission.
- f) One complete hard copy drawing set will be provided to Eskom (As-built).
- g) All contractual communications are through formal compiled letters or forms on the company's letterhead.
- h) The formal letters or forms are attached to emails and not as a message in the email itself.
- i) The receiver of the formal letters or forms signs off an acknowledgement of receipt of the communication and returns the acknowledgement of receipt to the sender of the formal communication.
- j) The documentation and drawings supplied are in South African English and SI units are used.
- k) The process for submission, acceptance and rejection of Contractor's designs is described in section 3.3.1.

2.3 Health and safety risk management

1. The *Contractor* shall comply with the health and safety requirements contained in OHS Specification/Requirements and the approved safety file. Eskom reserves the right to review the OHS Specification/Requirements to address the Operational risks and the Contractor shall comply with the latest OHS Specification/Requirements as amended at no cost.
2. The 37(2) agreement must be signed by Contractor and Employer representatives.
3. The *Contractor* OHS professional must conduct internal audits at planned intervals to monitor compliance with the contractual health and safety requirements.
4. The *Employer* or his representative will conduct inspections at planned intervals to monitor compliance with the contractual health and safety and legal requirements.
5. The *Contractor* may be selected during internal and/or external Drakensberg Power Station audits to verify compliance with legal and contractual OHS requirements. The Contract Manager/Service Manager will communicate this at relevant periods and the Contractor shall avail themselves for this audit.
6. In addition to the requirements of the applicable laws governing occupational health and safety, Drakensberg Power Station OHS requirements particular to the service and the Affected Property for this contract shall be adhered to for the duration of the contract.
7. The minimum requirements for the Contractor to gain access to Drakensberg Power Station include the but not limited to:
 - a. A Valid Medical fitness certificate
 - b. Police clearance from SAPS or accredited supplier/service provider linked to SAPS AFIS system not older than thirty (30) days.
 - c. Identification document (RSA ID or equivalent)
 - d. National Drivers Licence (applicable to drivers)
 - e. Adherence to the Eskom Life-saving rules.
 - f. Applicable risk-based PPE.
 - g. A Valid letter of good standing at all times (COIDA or equivalent). Access to the site to perform work will be denied should the Letter of good standing not be valid.

- h. The Contractor/supplier/consultant who is working alone and not eligible to register with the compensation fund shall provide Eskom with the member benefit statement of the insurance cover which includes life and disability cover to the minimum fund of R500 000.

Note: Induction will only be done after the above documents have been submitted and accepted by the *Employer*.

2.3.1 Key Performance Indicators

The *Contractor* ensures the management of the following Key Performance Indicators (KPIs) for the *Works*.

1. Maintain Health and Safety file and compliance with the health and safety plan, Eskom OHS specification and applicable legislation as amended.
2. Always maintain good housekeeping where the task is being executed and/or within the area of responsibility.
3. Implement and monitor near-miss reporting strategy/programme (reporting of near misses).
4. Develop and comply with Behavioural Safety Observation (BSO) and Planned Job Observation programmes (PJO).
5. Maintain Zero Fatalities for the duration of the contract.
6. At any given point, the OHS performance must be within the lost time injury (LTI) tolerance level as amended.
7. All incidents must be reported immediately or before the end of the shift in which the incident occurred.
8. All incident investigations shall be completed within 30 days of the occurrence of an incident.
9. Incident investigation recommendations shall be closed within the recommended time frame recorded in the Incident investigation report.
10. Close audit findings as per the Employer's procedure or audit report recommended time frames.
11. Close Non-conformance as per the recommended time frames.

Note: Monitoring of the above-mentioned KPIs will take place through regular audits and inspections.

2.3.2 Contract completion and sign-off

1. On completion of the *Works*, the parties will conduct the final meeting to identify the gaps before the contract closes out.
2. The *Contractor* ensures the below requirements are met before completion of the *Works*:
 - a. Close all incidents and audit findings.
 - b. Clean the respective yard and ensure good housekeeping where the *Contractor* was working.
 - c. The *Contractor* shall submit safety statistics and a safety file to the *Employer's* BU Safety department for closeout and filing.
 - d. Completion of a closeout report (Annexure D form as per 32-726) to close the contractual work.

2.4 Environmental constraints and management

- a) The *Contractor* complies with all National and Local legislation requirements as well as Eskom procedures and policy. Eskom's goal is to ensure zero harm to the environment and to ensure that any

possible impact is mitigated or managed. The Duty of Care and implementation of best practices is critical during operations, and full communication on environmental issues is required at all times.

- b) A method statement / operational plan for the management of waste material is to be developed and approved by an environmental practitioner before project initiation. All processes will be subject to environmental review throughout the contract.
- c) The method statement on waste management will need to include the identification of possible waste streams, temporary storage and disposal options for each waste type, and contingency plans in the case of any environmental incident. A Safety Data Sheet must be supplied for all chemical or hazardous / potentially hazardous material brought onto site.”
- d) The *Contractor's* attention is drawn to the fact that the Power Station is situated in a highly sensitive environmental area and that any incident that may result in an environmental impact must be brought to the attention of the *Project Manager* as soon as it is possible. The site is managed per the ISO 14401 certified management system, and the *Contractor* will be expected to manage all processes in line with environmentally sound principles.

2.5 Quality Assurance Requirements

- a) The *Contractor* complies version of the ISO 9001:2015 Quality Management System requirements.
- b) The *Contractor* defines the level of QA or inspection imposed on his subcontractors and suppliers.
- c) The *Contractor* prepares and submits fitment/installation procedures with quality check sheets as well as the Quality Control Plan. Quality acceptance criteria are included in these procedures.
- d) All technical design and implementation documentation and QCPs are submitted to the *Employer* for acceptance (14) days before the commencement of any Works or inspections allowing the *Employer* the opportunity to provide the necessary intervention points if required.
- e) The *Contractor* is made aware of the requirement that all documents or designs submitted for review to the *Project Manager* for acceptance, require a process of review.
- f) The *Contractor* documents all inspections as part of the quality assurance and control procedures. These documents are handed to the *Employer* as records.
- g) Submission of all quality requirements, to comply with section 3.7.1, Post Contract Award as stipulated in the Supplier Quality Management: Specification 240-105658000 to the *Employer* for acceptance at least thirty (30) days before the execution of the project.
- h) On completion of the project, the *Contractor* shall hand in all data books (Packs) before the Completion Certificate is issued.
- i) Where the Contractor maintains an official Quality Management System, details of the level of the Contractor's self-certification procedures shall be adopted concerning supplied materials and be accepted by the Supervisor before the commencement of work.
- j) Where no certified Quality Management System exists, the *Contractor* shall plan all quality management procedures, carry out all quality control testing as required and make available records of such testing for the *Supervisor's* acceptance.
- k) The *Contractor* will submit full details of the proposed quality management system and procedures for acceptance by the *Supervisor*, who shall have full access to all records, site trials and tests.

- l) The *Contractor* shall ensure that monitoring and measuring Equipment are calibrated and verified to confirm serviceability before usage, and records of such will be kept on Site.

2.5.1 Quality Control Plan

2.5.1.1 The Quality Plan manages the overall quality of the project's main activities and 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.

2.5.1.2 The *Contractor* is therefore required to ensure QCPs meet the following requirements as a minimum:

- a) The *Contractor* defines the level of QC or inspection imposed on his subcontractors and suppliers.
- b) The QCPs are to have provisions for signatures indicating Completion by the *Contractor* and acceptance by the *Employer* at the end of each activity.
- c) The *Contractor* has the necessary Equipment and qualified staff to carry out the quality control required to ensure compliance with the specification.
- d) The *Contractor* ensures that a complete Quality Control Plan (QCP) aligned with the Method Statement, and program for executing the work, is submitted to the *Project Manager* and *Supervisor* for review and acceptance before the Works can commence.
- e) The programming of inspections, hold and witness points are agreed between the *Employer* and the *Contractor* before undertaking any of the Works.
- f) During reviews of the QCP, the *Employer* provides the necessary intervention points, if required.

2.6 Programming constraints

- a) The *Contractor* submits a bar chart program (in MS Project format *.MPP or Primavera P6 format *.XER) detailing how the Works are executed within the stipulated dates, including weekends and public holidays.
- b) The *Contractor* submits the program, which indicates the start, Completion Date, duration, and dependencies of each activity.
- c) The *Contractor* notifies the *Employer* of any changes made to the updated program.
- d) The *Contractor* submits the program within two (2) weeks after the contract award.
- e) The program is updated and submitted weekly to the *Employer* for Acceptance.
- f) The program indicates each activity's start date, Completion Date, and duration.
- g) The program is updated and submitted every four (4) weeks during the manufacturing process.
- h) The program is updated daily during Site implementation or sooner, depending on the urgency of the matter.
- i) The *Contractor* submits the program, reflecting the agreed shift-sensitive durations per activity.
- j) Activities are not longer than a shift as defined by the *Employer*.
- k) Where activities are longer than a shift, they need to be broken down into shorter milestones.

2.7 Contractor's management, supervision and key people

- a) The *Contractor* provides a detailed organisational structure and resource plan, clearly indicating the lines of authority and communication in the working area as well as outside of the working area for the *works*.
- b) The *Contractor* provides a list of all sub-*Contractors*, detailing their roles.
- c) The *Contractor* does not modify any plant or materials unless accepted by the *Project Manager*, before implementation.
- d) The *Contractor* notifies the *Project Manager* at least two weeks in advance of a Hold or Witness point on the *works* within the boundaries of South Africa unless otherwise agreed with the *Project Manager*.
- e) The *Contractor* does not operate any equipment on Site unless specific authorisation is obtained from the *Employer*.

2.8 Invoicing and payment

- a) Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* submits a tax invoice to the *Employer*, showing the amount due for payment equal to that stated in the *Project Manager's* payment certificate.
- b) The *Project Manager* is to be copied in on all electronic invoices emailed.
- c) Failure to submit the invoice to the correct address could result in payment delays.
- d) The *Contractor's* Tax Invoices comply with the requirements as stated in clause Z7 of the Contract Data
- e) Invoices are submitted electronically to:
 - Local Eskom Invoices - invoiceseskomlocal@eskom.co.za
 - Foreign Eskom Invoices - invoiceseskomforeign@eskom.co.za
- f) The following details are required when submitting invoices and additional data:
 - i. The subject line on your email should only contain your vendor number
 - ii. Each invoice in PDF should be named with your invoice number only
 - iii. All electronic invoices are sent in PDF format only
 - iv. Attach the proof of delivery to your invoice
 - v. Where applicable, supporting documents are attached to the scanned PDF invoice as one attachment
 - vi. A copy of the signed assessment certificate
 - vii. CPA calculation sheet
 - viii. Retention Certificate where it is a retention invoice
 - ix. Any other appropriate documents, e.g.
 - For shipping invoices, please ensure the following documents are attached
 - Invoice (this should only reflect the shipping cost)
 - Commercial invoice
 - Delivery note

- Your shipping costs calculation is relevant to that invoice – not a generic calculation (The amount of the shipping costs calculation has to balance on the amount on the invoice.)
 - Forwarding agent's invoice
 - The customs document
- g) Please do not attach unnecessary documents as this will make the file too large.
- h) Other requirements:
- i. For foreign invoices, suppliers will still be required to physically deliver hard copies of original documents to the respective Document Management centres even though the invoices have been submitted electronically
 - ii. Ensure compliance with the tax requirements for submitting invoices electronically
 - iii. Each PDF should contain one credit note, one debit note or one credit note only. More than one invoice can be submitted per email
 - iv. Any CPA applicable is invoiced separately so that if there are issues on the CPA, the rest of the invoices can be paid while the CPA issues are resolved
- i) Include the following information on the Invoice:
- i. Name and address of the *Contractor* and the *Project Manager*
 - ii. The contract number and title
 - iii. *Contractor's* VAT registration number
 - iv. The *Employer's* VAT registration number 4740101508
 - v. The total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT
 - vi. *Contractor's* company registration number if applicable
 - vii. *Contractor's* banking details
 - viii. Name and address of the recipient
 - ix. Tax invoice number and date of issue
 - x. Description of goods/services provided
 - xi. Quantity or volume of goods/services
 - xii. Period time for which the Tax Invoice is being rendered
 - xiii. Relevant Task Order Number (commencing with a 45 prefix)
 - xiv. Relevant line-item number
 - xv. Statement whether value added tax is included or excluded.

2.9 Insurance provided by the *Employer*

Insurance by the *Employer* is managed per section 87 of the core clauses in ECC3.

2.10 Contract change management

- a) Contract change management is managed per section 6 of the core clauses in ECC3. In summary, if 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.

b) The *Project Manager* assesses the quotation and instructs in writing to the *Contractor*.

2.11 Provision of bonds and guarantees

- a) The form in which a bond or guarantee required by the conditions of the contract is to be provided by the *Contractor* is given in Part 1 Agreements and Contract Data, document C1.3, Sureties.
- b) The *Employer* may withhold payment of amounts due to the *Contractor* until the bond or guarantee provided 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.
- c) The *Contractor* provides the bonds and guarantees as agreed to within 2 weeks after the Contract Date.

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

To substantiate the Defined Cost of compensation events, the *Employer* requires the *Contractor* to keep records of amounts paid by him, in the following format:

Type of cost	Type of Record
People employed by the <i>Contractor</i> (labour)	Signed timesheets, payslips, data, costs, cell phone, etc
Accommodation	Paid invoices
Materials	Register of materials used.
Equipment	Register of Equipment used.
Plant	Running hours for the plant
Work subcontracted by the <i>Contractor</i>	Sub- <i>Contractor's</i> or third-party costs or invoices of payments made

Table 4: Records of Defined Cost

2.13 Training workshops and technology transfer

- a) The *Contractor* provides all necessary manuals, drawings, and notes concerning the operation and maintenance of the air compressor assembly including the control system.
- b) The *Contractor* provides the training pack to the *Employer* for acceptance.
- c) An instructor shall be provided by the *Contractor* to train the *Employer's* personnel on the documents as specified above and on how to operate and perform maintenance on the compressor assembly and accessories when required.
- d) The training shall take place at Drakensberg Power Station.
- e) All training material is to be included in the hand over data pack and proof of competence is provided per the *Contractor* Quality Management System.
- f) Training is arranged and provided for the power station personnel as per the below schedule.

- g) The *Contractor* liaises with the *Project Manager* and makes provision for travel and accommodation for each training session separately.
- h) Multiple sessions are provided for the convenience of shift workers as indicated in the table below.

Employee Group	Employees per group	Sessions required
Operations	8	3
Maintenance	8	3
Engineering	6	1

Table 5: Employee Training Groups

3 Engineering and the *Contractor's* design

3.1 *Employer's* design

3.1.1 Engineering Philosophy

- a) The project entails the design, supply, delivery, installation, and commissioning of four air compressors with a control system for operating and controlling the blowdown air compressors.
- b) The new compressors are electrically driven via flange mounted shaftless drip-proof motor, driving the compressor via a crankshaft extension.
- c) The compressors should be of the reciprocating type and water-cooled with carbon-filled PTFE piston rings for oil-free cylinder operation.
- d) The new compressors are required to be technically equivalent to the specifications under section 3.6 or better.
- e) During normal operation, the compressors are used to feed air storage receivers that are installed next to each of the four generating units.
- f) Each compressor has a capacity of 12 Nm³/min at 8000 kPa pressure feeding into the blowdown air reticulation system.
- g) The compressor's life expectancy is approximately 25 years, and the control system should have a life expectancy of about 12 years.
- h) The materials used in the design and manufacture of the new air compressors should be able to withstand the conditions under which they operate.

3.1.2 Maintenance Philosophy

- a) Routine maintenance of the compressors and control system is done per OEM requirements.
- b) The *Employer's* maintenance philosophy is that the new compressors require minimal maintenance and human intervention.
- c) The design of the compressors should be such that it facilitates easy access to the most common replaceable parts i.e., filters, oil, cylinder valves, relief valves, coolers, separators, oil pumps, etc. The same philosophy applies to the blowdown compressor control panels whereby minimal maintenance is required.
- d) All components installed in the panels must be easily accessible to allow for easy fault finding and replacement. Components should be hot-swappable and/ or of the plug-and-play type.
- e) The *Employer* implements all maintenance activities that must be performed at pre-determined intervals as well as attends to failures on the systems.
- f) Operational spares for 2 years of operation of each compressor are supplied as part of the works and delivered to the Employer's Stores at Drakensberg Power Station before commissioning of the compressors. It can be assumed that each compressor will operate for 2000H per year.
- g) Operational spares are the filters, valves, gaskets, seals and any other worn parts which are replaced on a routine according to the OEM's maintenance schedule, including oil to be changed after the wear-in period, as well as for routine oil changes the first 2 years.
- h) Compressor materials are selected carefully to minimize wear and therefore maintenance. Essential control system spares such as I/O cards of every type used, PLC and power supplies are

also to be supplied. Licenses and software will be provided for configuration tools for instruments, protection devices and PLCs.

3.1.3 Operating Philosophy

- a) The compressors perform intermittent and continuous duty. The main generator/motor operating modes determine the compressed air requirement and therefore the compressor running regime.
- b) The compressors would under normal conditions start about 12 times per day and run for approximately 0.5 hours per time, but frequently higher number of starts per day could also be required.
- c) The compressors can also be at standstill for extended periods while the units are in Standstill, Generating or Pumping mode.
- d) In automatic operation mode, each compressor is controlled and monitored by the control system. Starting and stopping of the compressor is dependent on the final delivery/system pressure reading received by a pressure transmitter and/or from an on-demand remote signal from a unit or coordination controller.
- e) In manual operation mode, the compressor can be operated from the Local Control Panel mounted adjacent to the blowdown compressor area as well as from the HMI in the control room.
- f) Manual starting and stopping of the compressor by an operator is interlocked with the final delivery pressure.
- g) The manual operation of the compressor is intended for testing purposes, for bolstering air supply during high demand and for refilling vessels after vessel inspections.
- h) The auto or manual operation can be selected on the LCP. For normal operation, the compressor must be selected to auto.
- i) Emergency stop functionality is available for each compressor, hardwired into the drive circuit and digital input of the PLC.

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

3.2.1 Scope of Work Overview

The document covers the specifications for the replacement of the blowdown air compressors with their electrical starter motors, control system and the associated equipment to provide a complete fully integrated with existing plant systems and functional solution.

The *Contractor* is responsible for the following scope:

- 3.2.1.1 Decommission and removal of existing IHI Compressors, control panels, cabling, pipework and associated equipment to enable installation of new compressors.
- 3.2.1.2 Demolishing of the existing plinths, and steel structures and removal of the old compressors and equipment from the works area to a pre-defined storage area at the station.
- 3.2.1.3 Construction of new plinths or trenches for the support of the new four (4) x Blowdown Air Compressors and local control panels.

3.2.1.4 Design, manufacture, factory acceptance test, supply, delivery to site, offloading, installation, testing and commissioning of the complete, fully functional, and fully integrated solution that consists of the following equipment:

- a) Four (4) x Blowdown Air Compressors with 3-phase motors. The motor starting method is star-delta.
- b) Four (4) x Local control panels with OEM approved Electronic PLC Controllers and motor control equipment, one for each new compressor to be installed in a position as identified on site.
- c) Four (4) x closed loop cooling water circuits, one for each compressor. The closed loop cooling circuit will include a heat exchanger, pump, air receiver for pressure damping, isolation valves, and monitoring instrumentation and shall be designed for use with clean water and coolant. The local control panels will also house the motor control equipment for the closed loop cooling water pumps.
- d) Four (4) x pneumatic panels with associated equipment. Each compressor is equipped with a pneumatic panel that has its stand and plinth.
- e) Four (4) x gauge panels, one per compressor that houses the pressure gauges/transmitters. Pressures are tubed from the relevant measuring port on the compressor to a central gauge board where the pressure transmitters are located. The pressure signals are then wired to the Control Panel. Each compressor is equipped with a gauge panel that has its stand and plinth.
- f) Compressor local instrumentation to include the various compression stage pressures, temperatures, and cooling water flow switch.
- g) Associated pipework, valves, fittings, and accessories. The *Contractor* is responsible for the design, supply, delivery, fabrication, non-destructive testing, galvanizing and installation of all pipework and supports for the blowdown air, cooling water, pneumatic and condensate pipelines for the compressors.
- h) The new compressor unloader valves need to be pneumatically operated via new pneumatic control panels. Air is available from the Station air at 700 kPa as an instrument/control air supply. The air supply is to be monitored by a pressure switch to ensure that the compressors are not started if no pneumatic air is available. The pressure switch signal is used as an interlock in the control system. Provision for four new pneumatic control panels to be made.
- i) Isolation valves are arranged such that each compressor can be individually isolated without impacting the rest of the blowdown system.

3.2.1.5 The *Contractor* provides a guarantee inspection for each air compressor.

3.2.1.6 The *Contractor* provides training for Operating, Maintenance and Engineering resources.

3.2.1.7 The *Contractor* provides recommended spares for all compressors.

3.2.1.8 The *Contractor* installs an overhead crawl beam to perform maintenance on the compressors.

3.2.2 Provide design integration with the following existing and new systems

3.2.2.1 Cooling Water System

The *Contractor* designs, supplies, installs, tests and commissions the following:

- a) The integration of the existing common services cooling water system for the supply of cooling water for dissipating heat from the newly installed closed loop coolant system for the new compressors.
- b) The integration of the new closed loop coolant system is designed and installed to cater for the cooling requirements of the four (4) x compressors.

3.2.2.2 SCADA

The *Contractor* designs, supplies, installs, tests and commissions the following:

- a) The new blowdown control system will interface with the *Employer's* SCADA system via an Ethernet interface (preferred) or a Serial interface (RS-232/485). If a Serial interface is supplied, a suitable Serial to Ethernet converter is to be included.
- b) The following signals are required for display on the SCADA system:
 - Blowdown air system/final delivery pressure
 - Blowdown compressor final stage air temperature
 - Blowdown compressor current
 - Blowdown compressor lube oil pressure
 - Blowdown compressor cooling water flow
 - Blowdown compressor ON and OFF status feedback
 - Blowdown compressor Fault
 - Blowdown compressor Health/Ready-to-Start
 - Blowdown compressor pneumatic air supply pressure status (if applicable)
 - MCC status feedbacks
 - Local/Remote status feedback
 - Auto/Manual status feedback
 - All hardwired I/O and derived signals are to be displayed on the event/alarm screen.
- c) Ethernet or F/O cable to be installed between Blowdown compressors and the Equipment Room or the nearest Network Switch.
- d) If media convertors are required, they are to be supplied by the *Contractor*.
- e) Standard communication protocols are to be used to communicate with the *Employer's* SCADA system in the following order of preference: (1) IEC 60870-5-104, (2) IEC 61850, (3) Modbus TCP, (4) Modbus RTU. The *Contractor* provides a datasheet to indicate which communications protocols and communication interfaces are supported.
- f) The OEM PLC should be capable of time-stamping at the source and time synchronization via NTP. The *Contractor* provides a datasheet to indicate which communications protocols and communication interfaces are supported.
- g) The *Contractor* is responsible for the supply, installation, terminating and testing of wiring (Fibre and Copper) between the compressor controllers and the SCADA network. This includes racking (wire mesh) and/or route building.

3.2.2.3 Instrument cabling

- a) The *Contractor* supplies all instrument/C&I cabling between the system pressure monitoring equipment and the control panel. This is in addition to any instruments and cabling supplied with the new compressor.

- b) The cables supplied should meet the minimum requirements as defined in the Eskom Standard 240-56227443 Generation Requirements for Control and Power Cables for Power Stations

3.2.2.4 380V AC Switchgear and Power Cables

- a) The existing four Blowdown Air Compressors are supplied from the 380V Service Boards 1A and 1B (Non-Essential Supply Board), two compressors per service board, and are rated at 220kW with a full load current of 466A and starting current of 2796A, started directly online.
- b) The protection coordination for the compressors that are currently in the plant, is type 2 co-ordination, a Mitsubishi Electric Magnetic type AC3, 315kW contactor with a separate thermal coil for overload protection and an overload phase failure protection relay (TH-600PP, Mitsubishi Electric) with a setting range between 400A-600A, and utilization category gL/gG, 630A power fuses for short circuit protection, the supply cable is a 185mm², 3 core, PVC insulated, PVC bedded SWA, PVC sheathed, 600/1000V cable (BVX03SCV)
- c) The existing motor starter circuits in the existing Switchgear Service Board 1A and 1B will be decommissioned to form feeder circuits to the new compressors respectively as referenced in section 3.6.8.

3.2.2.5 Station Air Supply (instrument air solution)

This role requires installation, testing and commissioning of the following:

- a) The integration between the station air supply system and the pneumatic control air supply system for blowdown air compressors pneumatically operated valves.
- b) The *Contractor* supplies, installs, terminates, and tests piping between the station air supply and the compressor pneumatic control panel and the compressors. A new pneumatic control panel is to be installed for each compressor.
- c) The air supply is monitored by a pressure switch to ensure that the compressors are not started if no pneumatic air is available. The pressure switch signal is used as an interlock in the control system.

3.2.2.6 Air & Cooling Water Piping

- a) Pipework and fittings are rated according to the maximum allowable working pressure in the system.
- b) Welding requirements are per Eskom Standard 240-106628253 - Standard for Welding Requirements on Eskom Plant.
- c) The *Contractor* provides a Welding Procedure Specification (WPS) supported by a valid Weld Procedure Qualification Record (WPQR)/Procedure Qualification Record (PQR) and Weld Qualification Record (WQR) for welding that will be performed during fabrication of the air and cooling water piping integration.
- d) Weld procedure qualification for all welds is per the appropriate welding standard incorporated into the relevant design and construction code.
- e) The WPS and WPQR/PQR are approved by a registered IWE or IWT with the minimum requirements as defined in the Eskom Standard 240-106628253. This is subject to approval by the *Project Manager*.
- f) The WPQR/PQR is submitted with its relevant NDT and DT reports.

- g) The WPS with associated weld maps relevant to the air and cooling water piping are provided.
- h) All welding must be performed by an ISO 3834 Part 2, accredited company.
- i) All piping less than and equal to 150mm diameter must be Stainless Steel.
- j) All piping interfaces between Carbon Steel and Stainless steel must be galvanically isolated.

3.2.2.7 The *Contractor* provides Non-Destructive Testing (NDT) of all welds

- a) NDT on welds is performed according to the requirements of the relevant design and construction codes and Eskom Standards 240-83539994 and 240-83540088.
- b) Provide qualifications of NDT personnel.
- c) Provide NDT procedures.

3.2.2.8 The *Contractor* provides hydrostatic pressure testing of Air and Cooling Water pipework.

- a) Following the NDT process, all pipework is hydrostatically pressure tested to a pressure of 1.5 x maximum allowable working pressure and this pressure is maintained for not less than 30 minutes. No leakage is acceptable.
- b) Test certificates are provided for all pipework tests conducted.

3.2.2.9 The *Contractor* provides corrosion protection for all fabricated Air and Cooling Water piping per the following requirements.

- a) All carbon steel piping is hot dip galvanised per SANS 121.
- b) The galvanized piping is then coated externally per approved corrosion protection specifications. The corrosion protection details the procedure for cleaning the external galvanized surface before applying the galvanized undercoat and the remaining coats.

3.2.3 The *Contractor* provides method statements, safety files, decommissioning/installation procedures, check sheets, corrosion protection specifications, welding & NDT procedures, quality control plans, drawings and documentation before installation, allowing for enough time to be reviewed by the *Employer*.

3.2.4 The *Contractor* provides loop/circuit diagrams, termination diagrams/schedule, assembly drawings, parts lists, signal lists, interface points, control logic, configuration settings, and overall system topology, allowing for enough time to be reviewed by the *Employer* as per section 3.3.2.

3.2.5 The *Contractor* provides 3x copies of As-Built Drawings and Operations and Maintenance Manuals.

3.2.6 Undertake a full conformity assessment of pressure components as per SANS 347:2019 and OHS Act Pressure Equipment Regulation, 2009.

3.2.7 The *Contractor* provides all necessary nameplates, dimensional, material and test certificates for components per the classification performed to SANS 347, and per 240-154283718: Pressure Equipment Regulations Compliance Manual.

3.2.8 The *Contractor* provides a complete list of recommended/critical spares with datasheets, expected lead time and cost.

3.2.9 The Contractor provides a catalogue of spares for the Works. The *Employer* will supply the template for the cataloguing of spares for the *Contractor* to populate.

3.2.10 The Contractor provides a detailed fault-finding and alarm response guide that includes:

- a) All the different types of faults.
- b) The indications relating to the faults.
- c) Possible causes and effects (fault tree).
- d) Operator and technician response.
- e) *Employer* to supply alarm response template.

3.2.11 The Contractor provides labelling of equipment as per section 3.6.9.2

3.2.12 The *Contractor* provides all necessary equipment, tools, and materials to complete the *Works* and training.

3.2.13 The *Contractor* provides OEM approved and supported control system engineering tools (hardware & software) with licences that can perform the following functions:

- a) I/O card configuration and system configuration
- b) Logic programming
- c) Fault/failure diagnostics
- d) Pre-configured laptop which contains all necessary engineering and maintenance tools and provided to the Employer at factory acceptance tests (FAT) of the first compressor.

3.2.14 The *Contractor* provides supervision and resources to complete the works.

3.2.15 The *Contractor* provides operating, maintenance and engineering training and necessary documentation.

3.2.16 Civil works design, supply, and installation

- a) The compressors are located in the existing blowdown area, which is one level below the machine hall floor, level 1177.50 MASL.
- b) The installation of the compressors suits the existing civil infra-structure layout - position, dimensions and available space, noise, vibrations, and ergonomics.
- c) The *Contractor* does the civil alterations/modifications to accommodate the *Contractor's* design to ensure a functional compressor installation which promotes ease of maintenance and operation. Modifications to existing cable/pipe trenches or construction of new trenches and plinths on the floor are to be done where required.
- d) The design accommodates dynamic loading and vibration.
- e) Fix and anchor compressors onto foundation/plinths.

- f) The *Contractor's* design accommodates the existing routing and layout dimensions for cable and pipe trenches and ducting.
- g) The *Contractor* provides civil engineering drawings showing layout, general arrangement, cross sections and reinforcing details.
- h) Design and construction are per SANS design codes and SANS 1200 Series specifications for civil construction.
- i) The *Contractor* provides a Method Statement for any demolition and construction work, where applicable.
- j) The *Contractor* provides a Quality Control Plan for the civil work.
- k) A main overhead crane is available on the machine hall floor which can be used for lowering the compressors through the removable floorboards to the compressor area. However, no overhead crane facility is available in the compressor location to rig them into position.
- l) The *Contractor* is required to design, install and load test an overhead crawl beam system (or similar) to accommodate maintenance of the blowdown compressor and motors.

3.2.17 Limitations

- a) The requirements in section 3.2.1 provide specific elements of design, construction, and materials, but are not intended to preclude ingenuity of design or improvement.
- b) Deviations are not acceptable, however, if the *Contractor* proposes any deviations from this WI and Technical Schedule A & B, they will be considered provided they are necessary, either to improve the quality performance and efficiency or to secure the overall economy, without affecting the performance.
- c) The equipment offered is complete with all parts that are necessary or useful for their efficient operation. Such parts are within *Contractor's* scope whether specifically mentioned or not.
- d) Guidelines for completing schedules are further explained in Appendix B.
- e) Where known limitations exist, these are drawn to the *Employer's* attention with the necessary details explaining the limitation as noted in Appendix B.
- f) **NOTE:** The Schedule A&B (The *Contractor* populates Column/Schedule B) must be returned with the tender documents.

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

- a) The *Contractor* is made aware that all documents or designs submitted for review to the *Employer* for acceptance require a process of review as stipulated in the Engineering Change Management Procedure (240-5331402). This process consists of:
 - Submission of Detail Design by *Contractor*
 - *Employer's* Project team reviews
 - Updates Detail Design review by *Contractor*
 - Detail Design Scope Freeze review
 - Procurement of material
 - Manufacturing of Compressors and associated components
 - Factory acceptance tests

- Delivery of Compressors and associated components to Drakensberg Power Station
- Implementation
- Commissioning
- Handover and Final acceptance by the *Employer*

3.3.1 Process for Submission of Documents

The process for the submission of documents is described below and applicable to each End-of-phase Design review.

- a) The *Contractor* submits the documents/drawings to the *Project Manager* with the appropriate reference Design Review Submission (DRS).
- b) The *Employer's* project team reviews the documents/drawings and will submit all comments or inputs to the *Project Manager* and the *Project Manager* submits to the *Contractor* for consideration.
- c) If the *Employer* finds major or fundamental deficiencies in the submitted documents/drawings, the design is rejected and the *Contractor* revises the documents/drawings for resubmission to the *Project Manager*.
- d) The *Employer* reviews the documents/drawings and if no major deficiencies are found, the *Contractor* organises a Design Review session with the *Employer* and *Contractor*.
- e) If any fundamental errors are found in the designs or further actions are required, the *Contractor* records all concerns raised and revises the designs.
- f) The *Contractor* organises a Design Review session once all designs are revised according to the concerns raised by the *Employer*.
- g) If no fundamental errors were found in the designs during the Design Review session, the *Contractor* compiles the Design Review Sheet and submits it to the *Project Manager*.
- h) The *Employer's* project team reviews the *Contractor's* DRS. If the DRS are not acceptable, the *Contractor* revises the DRS and resubmits it to the *Project Manager*.
- i) The *Project Manager* will accept the *Contractor's* design once the DRS are accepted by the *Employer's* project team.
- j) All large files (>10MB) shall be provided via <https://zendto.eskom.co.za/>
- k) All compressed files shall be provided via WinZip, WinRAR or .zip files.

3.3.2 Time Required for Acceptance of Designs

- a) Not later than six weeks after receipt, the *Project Manager* returns one copy of the submitted technical document.
- b) The *Contractor's* DRS is completed by the *Employer* detailing all concerns and marked "Accepted"; "Accepted as Noted" or "Not Accepted (rejected)", as may be appropriate.
- c) The notation "Accepted" indicates that the *Employer* has approved the technical document/drawing but has not authorized/permitted to continue with the next phase of design.
- d) Where documents or drawings have been "Not Accepted (rejected)" or "Accepted as Noted", the *Contractor* makes the necessary revisions to the documents/drawings and submits further copies for acceptance in the same procedure as for the original submission.

- e) Every revision is shown by number, date and subject in the revision block on the document/drawing.

3.4 Other requirements of the *Contractor's* design

- a) The *Contractor* submits all technical documentation such as bill of materials, wiring diagrams, schematics, drawings, datasheets, certificates etc. for acceptance by the *Employer* before manufacturing.
- b) The *Contractor* submits two hard copies plus an electronic copy of all documentation listed in the section. The *Contractor* is to comply with all legislated safety requirements as well as Eskom's health and safety standards.

The *Contractor* provides all plant, equipment, materials and services needed to execute all work necessary to fulfil all requirements specified in this scope.

The *Contractor* makes provision for the following:

- i. All plant materials are new.
- ii. The *Contractor* decommissions and installs all the compressors and associated equipment.
- iii. All electrical installations of 220V and above are performed by a qualified electrician.
- iv. All new electrical cabling must be certified by the *Contractor's* electrician issuing a certificate to prove that it has been tested.
- v. The *Contractor* provides a commissioning engineer during the cold and hot commission of the completed compressor installation. The commissioning engineer ensures all relevant tests are performed to ensure a successful handover to the *Employer*.
- vi. All existing plant interfaces are to be considered and verified during the design.
- vii. Newly installed equipment is to be labelled and codified according to the *Employer's* requirements.
- viii. All arrangement drawings, schematics, wiring diagrams, operating and maintenance manuals, plant, equipment, cabling, panels and signals utilise the Kraftwerk Kennzeichen System (KKS) coding system to the third level of coding. The system is applied from the design stage and cross-referenced to all arrangement drawings, schematics, wiring diagrams, manuals and where practical spare parts lists/manuals.
- ix. All codes are unique and verification by the *Employer* is done before handover. The lists of KKS keys are derivatives of the Guidelines and KKS Key Part, KKS-Identification System for Power Stations, and Eskom KKS Key part OPS0014. The order of precedence is also in that order.

3.4.1 Design Freeze

3.4.1.1 After the Contract Award, the *Contractor* performs the detailed design per *Employer's* requirements. The designs are agreed with the *Employer* to achieve Design Freeze acceptance.

3.4.1.2 The *Contractor* submits as a minimum the following data in neat files for acceptance by the Project Manager before the Design Freeze status can be declared.

3.4.1.2.1 Compressor Control and Instrumentation System

- a) The *Contractor* provides a preliminary design of the *works* for review and acceptance by the *Employer* before the commencement of manufacturing of panels.

- b) The *Contractor* only proceeds with manufacturing upon acceptance of the design by the *Employer* and when notified by the *Employer* that the design is acceptable. As a minimum, the design includes:
- i. Control Panel Layout/Assembly Diagram
 - ii. Control Panel Parts List
 - iii. Circuit Diagrams (Complete signal loops)
 - iv. Termination Diagrams
 - v. Equipment specifications and data sheets (Control system and compressor instrumentation)
 - vi. Control logic
 - vii. Signal List (both hard-wired and over communication protocol)
 - viii. Control Philosophy
 - ix. System Network topology, (switches, media converters, network adapters, firewalls, etc.)
 - x. P&ID's
 - xi. List of all required software applications and related drivers for supported protocols. (OPC drivers, Modbus drivers, etc.)
 - xii. List of all alarms and trip settings values and associated time delays.
 - xiii. Cable specifications and cabling layout diagrams.
 - xiv. Manual
 - xv. Fault-finding guide (Alarm response) that includes:
 - o All different types of faults
 - o The indications relating to the faults
 - o Probable causes & corrective action

3.4.1.2.2 Civil Engineering works

The *Contractor* provides a preliminary design of the *works* for review and acceptance by the *Employer*.

3.4.1.2.3 Mechanical Engineering works

The *Contractor* provides a preliminary design of the *works* for review and acceptance by the *Employer*, consisting of, as a minimum, the following design deliverables:

- a) Piping Specifications and P&ID mark-ups for deconstruction and construction phases (for Cooling Water, Blowdown Air and Station Air piping)
- b) Equipment List
- c) Technical Specifications and data sheets for valves, filters, oils and hoses.
- d) Commissioning Procedures
- e) Equipment Location Plan
- f) Piping GA & Supports
- g) Fault-finding guide

3.4.1.2.4 Electrical System

- a) The *Contractor* provides optimal LV power cable route layout to newly installed compressors.

- b) Cable terminations and cabling layout diagrams.
- c) Labelling of the cables.
- d) The *Contractor* provides recommended motor protection settings for review and acceptance by the *Employer*.

3.4.1.2.5 Compressor System Integration

- The *Contractor* provides a preliminary design of the *works* for review and acceptance by the *Employer*.

3.4.2 Engineering Change Procedure

- a) The *Contractor* takes note of the *Employer's* Project Engineering Change Procedure (240-3114026). An engineering change includes any proposed change originating from engineering, *Contractors*, project management or construction management.
- b) The Engineering Change Procedure applies to the *Employer's* personnel or the *Contractor's* performing engineering or engineering related work where the quality of the engineering work performed is the direct responsibility of Eskom.

3.5 Use of *Contractor's* design

- a) The *Employer* may use and copy the *Contractor's* complete design (including control logic) for any purpose connected with the construction, operation, alteration, or demolition of the *works*.
- b) The copyright of the *Contractor's* drawings, including the design & details shown therein, is owned by Eskom Holdings LTD.
- c) Third parties shall not use this drawing in whole or in part without the written permission from Eskom Holding LTD.

3.5.1 Software and Licencing

- a) The *Contractor* provides the latest version of all proprietary or open-source software and licenses where applicable, including PC operating software and licenses. The *Employer* cannot accept hardware with the *Contractor's* corporate licensed operating system software.
- b) All further 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 out lasts any operating system's life expectancy. The *Contractor* therefore puts contingency plans in place when operating systems become obsolete to ensure that their applications are either migrated to a new platform or that the necessary software drivers are compatible with new hardware as well.
- c) The *Employer* is responsible for new operating system licences. All required software, including operating systems and device drivers with their respective licenses and installation files, to do maintenance and configuration changes and system recovery, are supplied by the *Contractor*.
- d) All designs, drawings, specifications, instructions, manuals, and other documents created, produced by or on behalf of the *Contractor* to provide the *works* (collectively, the "*Contractor's* Copyright Documents") and the copyright therein and all intellectual property rights relating thereto, will become the property of the *Employer* upon completion of the *works*.
- e) The *Contractor* hereby grants to the *Employer*, with effect from the Contract Date or in the case of documents or other matter not yet in existence, with the effect from the creation thereof (and

notwithstanding the Completion or abandonment of the *works* or termination of this Agreement) an irrevocable, royalty-free, non-exclusive and perpetual licence to use those of the *Contractor's* documents and other matter supplied to the *Employer* under this contract, for any purpose whatsoever connected with the *works*, including for maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the *works* or any parts thereof.

- f) The *Employer* uses the *Contractor's* Copyright Documents and all intellectual property rights relating thereto for the sole purpose of all its needs at Drakensberg Power Station, which includes any *Employer* processes and procedures about use, maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the *works*.
- g) The *Employer* may copy and submit, without restriction, all documentation to others employed or contracted by the *Employer* who has duly signed a confidentiality agreement with the *Employer*.
- h) The *Contractor* may not use any Copyright Documents (and the copyright therein and all intellectual property rights relating thereto), which are owned by the *Employer* and/or Others and provided to the *Contractor*, for any other purpose than to provide the *works*. The *Contractor* may not copy and therefore not retain copies of any such Copyright Documents. At Completion of the whole of the *works*, or earlier termination, the *Contractor* returns to the *Employer* all such documentation provided to him by the *Employer* and/or Others.

3.5.2 Special hardware requirements

- a) All computer-based systems have a solid-state drive installed that is utilised by no more than 50% of the full capacity.
- b) All hardware needed to connect with the system needs to be pre-configured and supplied by the *Contractor*.
- c) This also applies to spares.

3.5.3 Engineering and Special Tools

- a) The *Contractor* provides any special tools, test handles or keys that are required for maintenance or affecting adjustments. A detailed list of tools is supplied by the *Contractor* to the Project Manager before delivery. Should any special interfaces for connection to PCs be required it is regarded as special tools.
- b) The *Contractor* provides a Notebook with licensed operating system software and disks. The *Contractor* provides a fully functional engineering tool to commission and modify IEDs supplied as part of the Works. The engineering tool includes the necessary software and hardware required to access the IEDs.
- c) If proprietary software is used, licensed copies of such software are provided as part of the special tool's requirement for the project.

3.6 Design of Equipment

3.6.1 Extent of the *works*

- a) The extent of the *works* for the Blowdown Compressor Replacement solution is the design, supply, delivery, installation, testing and commissioning of new air compressors with a cooling system and control system.
- b) The *works* further entails installing, testing, and commissioning the new compressors to enable the handover of a complete, reliable, and fully functional blowdown air compressor solution to the *Employer*.

The scope includes:

- a) Civil alterations for a complete compressor installation.
- b) Supply, installation, termination and labelling of interface and power supply cabling.
- c) Integration with the following systems:
 - i. Customer SCADA Network
 - ii. Cooling Water System. This includes the interface between the new compressors and the new closed loop cooling water systems, as well as the raw common service cooling water system.
 - iii. Station Air (Instrument air supply solution)
 - iv. 380 VAC Switchgear

3.6.2 General Design Requirements

- a. Piping and fittings shall be designed according to the maximum allowable working pressure in the system of 8000 kPa.
- b. Piping and associated components on the cooling water system for the compressor are rated for a design pressure of 1200 kPa (g).
- c. Seamless piping is used for the blowdown of compressed air and water piping.
- d. Weld-neck flanges are used on the air side.
- e. Gaskets for the compressed air piping are of the Spiral Wound type which needs to be compatible with the medium and pressure rating of the system.
- f. All gaskets are to be asbestos-free.
- g. Slip-on flanges are used on the waterside.
- h. Compressors are to be mounted on plinths with anti-vibration pads on their footing.
- i. All relevant steel piping connected to the compressor is through a flexible hose for protection against vibration.
- j. All piping should be firmly supported.
- k. The *Contractor* is responsible for ensuring that all dimensions are coordinated with the existing blowdown area where the compressors will be installed.
- l. All piping is hot dip galvanized per SANS 121. The galvanized piping is then coated externally per an approved corrosion protection specification and the final color is Cornflower Blue.
- m. The corrosion protection specification outlines the process for coating the galvanized piping on the external surfaces per the following:
 - i. Cleaning the external surfaces with galvanised iron cleaner.

- ii. Rinse thoroughly with water to achieve a water break-free surface.
- iii. Applying galvanised primer coat.
- iv. Applying undercoat.

3.6.3 Cooling Water Systems Detail

Raw Cooling water interface

- a. The existing common services cooling water supply to each compressor are approximately 16 000 litres per hour at a differential pressure of 290 kPa.
- b. The existing compressors and their 4 respective interstage coolers are cooled by raw dam water and this raw dam water shall be used for dissipating heat from the new closed loop coolant system for the new compressors to be installed.
- c. The normal operating pressure of the existing cooling water system is between 800 – 1000 kPa.
- d. Nominal cooling water inlet temperature: 25°C
- e. Cooling water interface inlet & outlet: 3" ASA 150 SO RF

New Closed Loop Cooling Water System

- f. The closed loop system is designed to reject the full heat load from the compressor, inclusive of appropriate design factors to accommodate cooler fouling and maintain the compressor coolant outlet temperature below 35 degrees Celsius.
- g. The closed loop system is designed to use an environmentally friendly coolant at approximately 50% concentration which will improve the heat transfer and inhibit corrosion of the compressor coolers and piping components.
- h. The closed loop coolant system is designed and installed to cater for the cooling requirements of the compressor and at a minimum shall be supplied with a Heat exchanger, circulation pump, isolation valves, air receiver, coolant dosing facility, drain valve, vent valve, temperature indication, Pressure relief/safety valve, flow indication and pressure indication.
- i. Provision is made for topping up the closed-loop system from the raw dam water supply through a 10-micron cartridge filter to prevent contamination of the closed-loop coolant system.
- j. Provision is made for dosing and topping up the closed loop system with glycol-based coolant or corrosion inhibitor.
- k. Provision is made for bypassing the heat exchanger and supplying raw water directly to the compressor coolers in the event of heat exchanger failure.
- l. Provision is made for flushing/scouring the raw water side of the cooling circuit at appropriate low points. This is for cleaning debris from the raw water piping.
- m. Provision is made for venting the raw water side of the cooling circuit at appropriate high points in the piping.
- n. Provision is made for venting the closed loop cooling circuit at appropriate high points in the piping, and for draining the circuit at appropriate low points in the piping,

- o. Provision is made for visual monitoring of the coolant/water level in the closed loop cooling system expansion tank.
- p. Provision is made for coolant sampling and top up on the closed loop cooling circuit.

3.6.4 Civil Works - Location

- a. The installation of the compressors must suit the existing floor loading capacity, available space, noise, vibrations, and ergonomics.
- b. The design is to accommodate dynamic loading and vibration.
- c. The *Contractor's* design to accommodate the existing routing, and layout dimensions for cable and pipe trenches and ducting.
- d. The *Contractor* is required to do the civil modifications to accommodate his approved design for a functional, operational compressor installation and ease of maintenance and operation. This entails demolition of the existing plinths, design, and construction of new plinths. Modifications to existing cable/pipe trenches or construction of new trenches in the floor where required.
- e. The *Contractor* is required to provide civil engineering drawings showing layout, general arrangement, cross sections and reinforcing details.
- f. Design and construction to be per SANS design codes and SANS 1200 Series specifications for civil construction.
- g. Provide a Method Statement for any demolition and construction of new plinths or trenches.
- h. Provide a Quality Control Plan for the civil work.
- i. The *Contractor* supplies all required materials, equipment, and labour to construct the necessary civil works.
- j. The *Contractor* is required to install an overhead crawl beam system (or similar) to accommodate maintenance of the blowdown compressor and motors.

3.6.5 Integration

- a. The *Contractor* ensures the compressor's interface with the existing switchgear as detailed in Schedule A.
- b. The *Contractor* ensures that the compressors interface seamlessly with the station SCADA system.
- c. Other physical interfaces on the compressors include:
 - i. Cooling water inlet line and outlet lines.
 - ii. Blowdown air delivery line.
 - iii. Compressor condensate release must integrate with the existing condensate drain.
 - iv. The *Contractor* uses the existing LV power cable trenches or makes use of roof-mounted racks for each compressor motor.
 - v. Control and instrumentation equipment such as transmitters, switches and gauges that measure temperature, flow and pressure.
 - vi. Station air supply for pneumatic valve operation (if required and as a secondary option. Primary supply to be taken from between isolation and non-return valve).

3.6.6 Operational Requirements

The compressors are designed to operate both intermittently and continuously.

a. Manual Operation

In manual operation, the operator is allowed to Start and Stop the compressor from the Local Control Panel (operation interlocked with Final Delivery and/or System pressure).

b. Automatic Operation

In automatic mode, the compressors operate on demand (1) from the final delivery/system pressure and/or (2) from remote Start/Stop signals from the unit or a coordination controller.

- i. When the final delivery or system pressure controls the operation of the compressor, if the pressure falls below the final delivery pressure value to a predetermined setpoint, the compressor is started. After the final delivery pressure value has been reached, the compressor unloads and stops automatically.
 - ii. When the remote Start/Stop signals determine the compressor's running regime, the compressor will operate based on the state of these signals.
 - iii. When the final delivery pressure is reached or the remote stop signal is received, the compressor runs unloaded for a predetermined time. If the final delivery pressure falls back down to the pre-set setpoint or a remote start signal is received during the unloaded period, the compressor will load again. If the pressure is sustained during the unload period or a remote start signal is not received, the compressor stops automatically.
 - iv. Condensate release valves automatically open periodically to discharge into the station drain.
- c. The compressor plant must operate without continuous manual supervision.
 - d. The compressors are provided with safety devices to protect them in the event of faults developing. Instruments for the detection of high air temperature, high air pressure, low lubricating oil pressure and low cooling water flow rate are installed. Redundant protection must be provided for over-temperature protection.
 - e. There are safety relief valves on both the air and water sides of the compressors.
 - f. An online vibration monitoring system is installed for the new compressors. Local instruments are centralized on a common local instrument panel.
 - g. Air compressors are electrically driven.
 - h. The compressed air outlet discharges into a common header.
 - i. All compressed air piping is designed to ASME B31.3 (Process piping).
 - j. The Blowdown compressor system can be remotely monitored by the Control Room HMI via the supported standard communication protocol.

3.6.7 Compressor Performance

3.6.7.1 The new compressors' performance must be similar to or better than the existing compressor

specifications which are as follows:

3.6.7.2 The existing air compressor rating is as follows:

- a) Capacity: 12 Nm³/min
- b) Discharge Pressure: 8000 kPa
- c) Speed: 590 rpm
- d) Type: Semi-radial 4-line, 4 cylinders, 4 stages, lubricated type
- e) Driving Method: Motor Direct Coupling
- f) Stroke: 177.8 mm
- g) Suction pressure: 0.0898 MPa, 1177.5 meters above sea level
- h) Load and unload valves, pneumatically operated
- i) Cylinder Lube Type: Non-Lubricated (PTFE)
- j) Crankcase Lube Type: Pressure Lubricated

3.6.7.3 The existing compressor motor rating is as follows:

- a) Type: 3-Phase Induction Motor
- b) Max Output: 220 kW
- c) Drive Type: Direct Drive – Shaftless Motor
- d) Speed: 590 rpm
- e) Pole No.: 10p
- f) Voltage: 380 V
- g) Frequency: 50 Hz
- h) Insulation: F Class
- i) Starting Torque: 40% over of all load

3.6.7.4 The following gauges are locally positioned on the compressor:

- a) Intercooler air pressure and temperature,
- b) Air delivery pressure and temperature,
- c) Lubricating oil pressure and temperature (if applicable).

3.6.7.5 Pressure transmitters and gauges are provided for all stages of air pressure and lubrication pressure monitoring on the control system.

3.6.7.6 Temperature transmitters are provided for all stages on all compressors.

3.6.8 Compressor Motor Control System

3.6.8.1 Local Control Panel (Cabinet)

- a. The *Contractor* supplies a fully functional motor control system in four (4) floor-mounted panels. The panels are designed to perform a dual function, combined with a control system (PLC) and motor starter circuits. The PLC and motor starter circuit sections are segregated within the panels.

- b. The door panels of the motor starter circuits will not be allowed to open if the MCCBs are in the closed position. These switch disconnectors are pad-lockable and interlocked with the door to prevent the door from being opened while the MCCBs are in the closed position.
- c. Live termination points or components will be covered with perspex or similar insulation covering material to prevent accidental contact with live parts.
- d. The panels are designed to allow for heat that is generated within the panel to be dissipated through the steel structure. The installation of the components will not compromise the temperature-rise requirements and the panels' degree of protection.
- e. The new floor mounted panels will be installed adjacent to the relevant blowdown compressor. The panels should be spacious enough to accommodate the control systems, including the PLC, associated I/O, power supplies, motor starter circuits and any other equipment required.
- f. The *Contractor* is responsible for the removal of the relevant existing equipment and panels and preparing the area for the installation of the new equipment.
- g. The *Contractor* provides suitable panels and sufficient terminals for the reconnection of existing and new control field cables, and power cables.
- h. The *Contractor* is responsible for the termination of existing and new field cables and power cables to the new panels.
- i. The *Contractor* is responsible for the internal panel wiring between the new terminations and the new equipment.
- j. The panels are manufactured of mild steel and are preferably of the combinable form factor.
- k. The panels are of IP55 rating or better.
- l. Top entry – preferably components are mounted in the front half of the panel and cabling/wiring at the rear half (back-to-back plates). This is to prevent component damage should water ingress occur.
- m. The cabinets are dipcoat primed and powder coated in RAL 1015 light ivory colour.
- n. The new local control panels have 24VDC insulation monitoring and alarming capability.
- o. All internal and external wiring will align with Eskom standards.
- p. All control panel designs will align with Eskom standards.
- q. 100mm steel plinth (base plate).
- r. The local control panel will have the following local control capability:
 - i. Selecting each compressor to Local or Remote or Off (Out of service).
 - ii. Selecting each compressor for Automatic or Manual operation.
 - iii. Start and stop the compressor (operation interlocked with Final Delivery / System pressure).
 - iv. Start and Stop the closed loop CW Circulating Pump.
 - v. Emergency Stop facility (Push-button).
 - vi. Reset and clear alarm and fault conditions.
 - vii. Unload operation (maintenance).

- s. The local control panel will have the following minimum monitoring capability and status indications for the compressor:
- i. Compressor current gauge
 - ii. Applicable unit blowdown air receiver pressure gauge
 - iii. Final stage air temperature gauge/indication
 - iv. Final stage air pressure gauge/indication
 - v. Compressor running hours meter
 - vi. Compressor start counter
 - vii. Compressor Healthy/Ready-to-Start
 - viii. Compressor running indication
 - ix. Compressor off indication
 - x. Compressor fault indication
 - xi. Cooling water flow low indication
 - xii. Lube oil pressure low indication
 - xiii. Air temp high indication
 - xiv. Pneumatic air not ready indication (if applicable)
 - xv. Lube Oil Level low indication (if applicable)
 - xvi. Compressor 380VAC Unhealthy (Isolated/Racked out/Not-in-Auto)
 - xvii. Local Control Panel to be suitably earthed
 - xviii. Local Control Panel to be equipped with lighting inside

3.6.8.2 PLC

- a. The functions of the PLCs are:
 - o Automatic & Manual starting and stopping of air compressors.
 - o To protect the compressors from unsafe operation per OEM requirements.
- b. The system consists of four independent PLCs.
- c. One PLC is dedicated to one compressor.
- d. Each PLC has a single CPU without redundancy.
- e. The PLC with its associated I/O for each compressor is designed in such a manner that individual compressor I/O may be isolated for maintenance without affecting the operation of the others.
- f. The door-mounted Local Control Panel functionality is maintained at a minimum.
- g. The control system must be capable of signal time-stamping at the source.
- h. The PLC must be accessible via engineering software that can perform functions such as:
 - o I/O card configuration and system configuration
 - o Logic programming
 - o Fault/failure diagnostics

3.6.8.3 Motor Starter Circuit's

- a. The motor starter circuit protection consists of MCCBs and thermal overloads with type 2 coordination. The motor starting method is star-delta. New motor starter circuits per compressor are to be selected and installed to suit the selected motor size while maintaining type 2 coordination.
- b. A fully compliant motor control starter circuit forming part of the local control panel with protection design, capable of detecting overcurrent, under/open circuit voltage detection and earth fault plant conditions with an embedded overload motor protection scheme to be installed per compressor.
- c. The design, specification, supply, routing (and re-routing of existing and/or new power cables where needed) and installation of cables and cable trays, motor control starter circuits to interconnect between the different components of the electrical systems and the plant as per Eskom standard and specifications, referenced in section 92.
- d. Each compressor motor is fed by a 2 x 3 core 185mm² copper cable. The cables will be re-used, the cables are re-routed at the motor's end and terminate into new junction boxes (interconnecting point), if the cables do not have sufficient slack to terminate directly into the new motor control starter circuit forming part of the local control panels, new junction boxes will be installed next to the compressors against the wall in a suitable location as an interconnecting point if the cable slacks are not long enough.
- e. The junction box complies with drawing 0.66/55342. New additional correctly rated power cables are to be laid from the cable junction box to the motor control starter circuit cubicles and motor terminal box per compressor. The cables are to be lugged, glanded and terminated. Allow for additional cable racking for the additional cables. Motors to be suitably earthed. No joints in the cables are allowed.
- f. All interface signals from the Plant Control System to the motor control starter circuits will be reinstated or improved where necessary. Control cables or interface wiring are in place between the motor control starter circuits and control panels for system monitoring and regulating plant processes. During commissioning, loop checks are performed to ensure that all signals have been reinstated.
- g. Ensure interface wiring between the motor control starter circuit and control panel for monitoring, control, and feedback to the SCADA System. All control and power cables are to be labelled.
- h. Adequate protection devices and thermal overload relays are selected for the new motor control starter circuit installation.
- i. The *Employer* reviews the recommended protection thermal overload settings, MCCB ratings and contactor size design.
- j. Should there be more components required which are not part of the current design e.g., transducers, voltage monitoring relays or interposing relays, these components are to be added in a suitable location in the motor control starter circuit local control panel.
- k. The *Contractor* caters for the compressor cooling requirements by specifying motor and pump size. The *Contractor* ensures a fully functional motor control starter and protection design, capable of detecting overcurrent, under/open circuit voltage detection and earth fault plant conditions with an

embedded overload motor protection for the new cooling water pumps. The motor starter circuit for the pumps is to form part of the main compressor motor control starter circuit local control panel.

- l. The existing compressor switchgear motor starter circuits, which are part of Service Board 1A and 1B, will be decommissioned and will be modified to serve as feeder circuits and isolation points with adequately sized MCCB's switch disconnectors, short circuit current protection device (SCPD) for the newly installed motor control starter circuit at the Blowdown compressor floor level. The *Contractor* ensures adequate protection grading between the upstream and downstream protection devices.
- m. The shaft of the SCPD protrudes to the outside of the panel door to allow for closed-door operation. These switch disconnectors are pad-lockable and interlocked with the door to prevent the door from being opened while the MCCBs are in the closed position. New doors are required to allow for new switch disconnector handles if the exiting doors are found not to be adequate to be modified. Sufficient and adequate jumper' sizes are allowed from the main busbars of the Service Boards to the new MCCBs.

3.6.8.4 Power Supplies

- a. The *Employer* provides dual incoming 220VDC supplies to the panel which are fed from the 220VDC Unit Board.
- b. The *Employer* provides a non-essential 230VAC supply for lighting, heating and power socket which are supplied from each Service Board's, incoming power cables to the local control panel motor starter circuits. The power sockets are protected with earth leakage functionality.
- c. The *Contractor* provides dual redundant 220VDC/24VDC power supply converters, which are combined via a diode on the positive only.
- d. The converters are tolerant of +/-20% variation of the incoming 220VDC supplies.
- e. All incoming supplies are alarmed for failure.
- f. Internal wetting supplies are monitored and alarmed for loss of supply.

3.6.8.5 I/O Signals

Estimated current I/O count per PLC for tendering purposes:

I/O TYPE	COUNT	SIGNAL TYPE
Digital Inputs	32	24VDC
Digital Outputs	15	Relay contacts
Analogue Inputs	16	4 – 20mA
Analogue Outputs	4	4 – 20mA
Temperatures	24	PT100/1000

Table 6: Current I/O count per PLC

3.6.8.6 Cabling and Racking

- a. Power supply cabling is sized according to the design of the system.

- b. Power supply cabling is of the flame-retardant type comprising of the blue cable trace colour (Low halogen emission PVC bedding and sheath).
- c. All cabling is fitted with Eskom-approved cable and core numbers.
- d. If cable racking is required, then it shall be of the following type:
 - i. Medium-Duty Perforated Cable Tray
 - ii. Material – 1.6mm
 - iii. Finish – HDG (Hot Dipped Galvanized)
 - iv. The cable rack will be mounted using a pre-galvanized P1000 C-channel.
 - v. The C-channel will be secured to the concrete substrate with anchor bolts.
 - vi. The cable tray will be mounted to the C-channel using spring nuts, mushroom head bolts, and washers for P1000.
 - vii. The lengths of cable racks will be joined by using HDCT Splice Plates.
- e. Cable racks are supplied and installed according to Eskom standards (GGS0386 – Requirements for Control and Power Cables for Power Stations) ensuring that the cables are supported and earthed over their entire length.

3.6.9 Termination of Cables

- a. All cable screens are terminated on standard terminals at one end of the cable depending on the design.
- b. Terminals for signal cabling are of the spring-loaded link terminal type. Hook blade lugs are used.
- c. There is no bare wire or loose strands exposed between a lug and the insulation of the wire to which the lug is crimped.
- d. Lugs are compatible with the wiring.
- e. Lugs must fit the cross-area of the conductor to which they are crimped. The correct crimping tool is used.
- f. Bootlace ferrules are acceptable for signal cabling. The correct crimping tool is used.
- g. Where two conductors are connected to a terminal, lugs and ferrules are to be fitted in such a manner as to allow the wires to be terminated in parallel.
- h. No more than 2 lugs per terminal.

3.6.9.1 Stripping of Insulation

The use of an approved wire stripping device is required and stripping of insulation does not cause damage to conductors or the remaining insulation.

3.6.9.2 Core tags/labelling

- a. Core tags used in the panel are of the Graphoplast type, i.e., 23mm tag sleeve and PVC tag (yellow).
- b. Horizontal Terminal Strip: The tag must read from bottom to top.
- c. Vertical Terminal Strip: Tag must read from left to right.
- d. Cable tags used are of the Graphoplast type, i.e., 70x10mm tag sleeve and PVC tag (yellow).

- e. Each device installed in the panel must be labelled according to KKS standards using Graphoplast Self-adhesive PVC tags (white).
- f. Each field device must be labelled according to KKS standards using Graphoplast Self-adhesive PVC tags.
- g. Each field device must be labelled by name/description and measuring range using Graphoplast type, i.e., 70x10mm tag sleeve and PVC tag (yellow).
- h. All field device termination points must be labelled with a 15mm Graphoplast tag sleeve and PVC tag (yellow) as a minimum.

3.6.10 Fire Blocking of Cable Penetrations

The repair to existing fire blocking of any cable penetrations that are disturbed for cable routing is carried out according to the following requirements:

- a. The *Contractor* supplies delivers and offloads the fire-stopping material that is necessary to conduct the repairs.
- b. The *Contractor* supplies third-party test certificates for the proposed fire-stop material.
- c. Provide all necessary equipment, tools & materials required to complete the fire-stopping.
- d. Provide supervision and resources to complete the fire-stopping.
- e. Persons competent in fire blocking of penetrations are used and proof of competency is required.
- f. All fire stops shall have a fire rating per SANS 1077 or the equivalent of the fire rating up to the structure or partition, or two (2) hours, whichever is the greater against the spread of fire and smoke.
- g. Fire stop material shall meet Factory Mutual (FM) Approval and Underwriters Laboratory (UL) requirements.
- h. Fire-stopping systems are required to have been fire-tested to the requirements of SANS1077, IEEE 634, and ASTM E814.
- i. Fire stop material shall be non-toxic, asbestos and lead-free.
- j. Fire stop material shall be resistant to chemicals, oils and lubricants.
- k. Fire stops shall be weather-resistant and suitable for both indoor and outdoor use.
- l. Fire stops shall not affect cable ratings.
- m. Any cables entering/leaving a wall, floor or penetration shall be coated on both sides of the wall/floor to a length of 2 meters.
- n. Fire stops must be capable of being easily re-opened to allow the installation of future services.

3.6.11 Compressor Instrumentation

3.6.11.1 Air Temperature Probes and Gauges:

- a) PT100 Temperature Sensors will be installed on each stage of the new compressors.
- b) The PT100 Temperature Sensors will either be wired directly to an RTD I/O Card capable of reading temperature or if a standard 4-20mA analogue input card is supplied, then the PT100 will be wired via a temperature converter, for example, a Head Mounted Temperature Transmitter (Hockey Puck).
- c) The temperature converter will output a 4-20mA signal that will be relayed to the control system for

processing.

- d) Individual compressor stage temperatures will also be displayed on local gauges.

3.6.11.2 Air Pressure Gauges:

- a) Pressure gauges will be installed locally on the compressor for local indication and to assist the maintenance functions during fault finding and test runs.
- b) The gauges will display the pressure after each compression stage and should be installed on the compressors (gauge board).
- c) The operating range of the gauges will be determined by the new compressors' operating specifications and should be in kPa.

3.6.11.3 Air and Oil Pressure Transmitters:

- a) Pressure transmitters will be installed after each compression stage. The final compression stage pressure transmitter indicates the delivered pressure to the blowdown air receiver. The operating ranges of the transmitters will be determined by the new compressors' operating specifications.
- b) A pressure transmitter will be installed on the compressor lubrication oil supply line to monitor the oil pressure. The low lube oil pressure will be used as a tripping signal when the oil supply diminishes while the compressor is running. The operating range of the transmitter will be determined by the new compressor operating specification.
- c) A pressure transmitter is installed on each blowdown air receiver. This transmitter is used to monitor the receiver process conditions and to start and stop the respective compressor(s) to maintain the air receiver pressure as per the unit SCO requirements.

3.6.11.4 Oil Pressure Gauges:

- a) Pressure gauges will be installed locally on the compressors for local indication (gauge board). The gauge will display the lubricating oil pressure.
- b) The operating range of the gauges will be determined by the new compressors' operating specifications.

3.6.11.5 CW Flowmeter:

- a) A flowmeter will be installed at the cooling water outlet side of each compressor. The flowmeter will be used as an interlock for compressor pre-starting conditions as well as a tripping signal when the cooling water flow diminishes while the compressor is running.
- b) In addition to the flowmeter local cooling water flow gauges should also be installed on the outlet of the cooling water line of each compressor.

3.6.11.6 Air and CW Valves:

- a) These valves are used to operate the following:
- Condensate unloader/drain valves on each stage (220/24VDC)
 - Cylinder unloader valves for each compression stage (Pneumatic)
 - CW inlet valve (220VDC)
- b) For the new compressors, all new valves should be supplied.

3.6.11.7 Pneumatic air pressure transmitter:

A pneumatic air pressure transmitter for monitoring, indication, alarm, and tripping shall be

provided, to indicate pneumatic air availability.

3.6.12 Closed-loop Cooling System Instrumentation

3.6.12.1 Coolant Temperature Probes and Gauges:

- a) PT100 Temperature Sensors will be installed to monitor both the coolant inlet and outlet temperatures of each new compressor.
- b) The PT100 Temperature Sensors will either be wired directly to an RTD I/O Card capable of reading temperature or if a standard 4-20mA analogue input card is supplied, then the PT100 will be wired via a temperature converter, for example, a Head Mounted Temperature Transmitter (Hockey Puck).
- c) The temperature converter will output a 4-20mA signal that will be relayed to the control system for processing.
- d) The coolant inlet and outlet temperatures will also be displayed on local gauges.

3.6.12.2 Coolant Pressure Transmitters:

- a) Pressure transmitters will be installed to monitor both the coolant inlet and outlet pressures of each new compressor.
- b) The operating ranges of the transmitters will be determined by the new compressors' operating specifications.
- c) The coolant inlet and outlet pressures will also be displayed on local gauges.

3.6.13 Open loop Cooling System Instrumentation

3.6.13.1 Heat Exchanger Temperature Probes and Gauges:

- a) PT100 Temperature Sensors will be installed to display both the inlet and outlet heat exchanger temperatures on local gauges only.

3.6.13.2 Heat Exchanger Pressure Gauges:

- a) Pressure gauges will be installed to display both the heat exchanger inlet and outlet pressures of the common services system.
- b) The heat exchanger inlet and outlet pressures will only be displayed locally for condition monitoring and fault-finding purposes.

3.6.13.3 CW Flow:

- a) A flowmeter/gauge will be installed on the outlet side of the heat exchanger.
- b) The flowmeter/gauge is only for local indication and will assist in determining at what point intervention is required for cleaning.

3.6.14 Functional Requirements for Blowdown Air Compressor

- a) The existing system consists of 4 x 220kW, 80 bar reciprocating air compressors directly driven by 3-phase motors.
- b) Their function is to supply compressed air to the four blowdown air receivers for each unit.
- c) The pressure transmitter mounted on the receivers monitors the air pressure inside the receivers and sends start or stop commands to the control system to automatically start or stop the air compressors.
- d) The control system automatically monitors and controls the blowdown compressors and performs alarm and trip functions of the compressors.

3.6.14.1 Reference documents

The reference documents for the functional and physical design of the Blowdown Air Compressor PLCs are listed in this Technical Specification.

3.6.15 Functional Requirements for Plant SCADA System

- a. As a rule, all I/O is made available to the over the native standard communication protocol.
- b. The *Contractor* makes available any derived signals.
- c. The acceptable communication protocols used to communicate with the SCADA are, in order of preference:
 - o IEC 60870-5-104.
 - o IEC 61850
 - o OPC UA
 - o OPC DA
 - o Modbus TCP/IP (Ethernet)
 - o Modbus RTU (Serial)
- d. The control system must be capable of time synchronization via NTP.
- e. The control system must be capable of time-stamping at the source.

3.7 Equipment required to be included in the works

- a) The *Contractor* provides all materials, tools, equipment and/or machinery to complete the *works*.
- b) The *Contractor* provides any special tools to the *Employer* required for the maintenance of the *works*.

3.8 As-built drawings, operating manuals and maintenance schedules

3.8.1 Documentation and drawing general requirements

- a) All documentation and drawings to comply with the latest revisions of the following;
 - Eskom's Classification and Designation of Technical Documentation Standard, 240-54179170;
 - Eskom's Engineering Drawing Standard – Common Requirements, 240-86973501
 - Eskom document and records management, 32-6
 - Eskom's Documentation Management Standard, 32-644
- b) All drawings issued to Eskom are in an electronic format, MicroStation (DGN), pdf format and a hardcopy of the original size drawing.
- c) The *Contractor* updates all relevant mark-ups or changes to drawings for all defects during the defects period after the Completion of the *works*.
- d) All documentation submitted is indicated 'approved' by the *Contractor* and sent to the *Employer* for review and acceptance.
- e) All drawings submitted to Eskom shall be compatible with the latest Bentley MicroStation version used at the time.

- f) Drawings issued for review or final shall not be “right protected” or encrypted. Drawings should be fully editable when submitted for review and final issue.
- g) For the final “As built” drawings the *Contractor* shall insert all relevant signatories in the title block for final submission.
- h) One complete hard copy drawing set will be provided to Eskom (As-built).
- i) The *Employer* reviews all documentation.
- j) The *Contractor* uses one relational database drawing system.
- k) In conjunction with the electronic DGN copies the *Contractor* also provides a merged set of *.pdf electronic copies upon first issue and each time drawing updates are required. All drawings are signed, and the revisions are noted as per *Employer’s* specifications.
- l) All detailed design drawings have the pre-approved title blocks and borders as provided by the *Employer*. The *Employer* provides samples of the pre-approved title blocks to be used by the *Contractor*. The *Contractor* completes the title block information as per the drawing standard listed.
- m) Graphical symbols are used per the NRS002 standard.
- n) All drawings are submitted to the Project Manager for his acceptance.
- o) When drawings are submitted to the *Employer* for review, a registered Engineer will approve the drawings and designs. This information by the engineer is included on the drawings (CAD file) by the *Contractor* when the final drawings are submitted.
- p) The *Contractor* produces as-built drawings within 4 weeks of each site acceptance test and submits them to the *Project Manager* for his acceptance.
- q) The *Contractor* produces the following types of drawings:
 - i. Cover sheet
 - ii. Index sheet
 - iii. List of symbols
 - iv. List of components with values, tolerances, ratings, type numbers, purchasing specification numbers, manufacturer, and circuit reference numbers
 - v. General layout drawing of the proposed panels and floor plan
 - vi. General assembly drawing for air compressors
 - vii. Piping arrangement drawing
 - viii. Layout drawings indicating the position of all components.
 - ix. Single line diagram
 - x. Block diagram of the system
 - xi. Circuit/Loop Diagram
 - xii. Panel internal wiring drawings, including cross-referencing and wire numbers
 - xiii. Cable block diagrams with termination points
 - xiv. Compressor Plinth Layout and Dimensional Drawings
 - xv. Pneumatic Panel Layout and Dimensional Drawings

- xvi. Pneumatic Panel Plinth Layout and Dimensional Drawings
 - xvii. Gauge Panel Layout and Dimensional Drawings
 - xviii. Gauge Panel Plinth Layout and Dimensional Drawings
 - xix. Termination Schedule/Diagram
- r) The *Contractor* provides an updated parts list
- s) The *Contractor* updates drawings until after the final commissioning of the last unit when the *Employer* has signed off and approved the final "As Built" state of the drawings.
- t) After the commissioning of each unit, the *Contractor* supplies two sets of drawing hardcopies in two separate files and in A3 format as well as DGN and PDF formats (as indicated above).

3.8.2 Pre-implementation Documentation

The *Contractor* provides the following for acceptance by the *Employer* two months before implementation:

- a. Method Statements
- b. Quality Control Plans and Check Sheets
- c. Installation, Testing and Commissioning Procedures
- d. Design Standards, code of practice, design guidelines
- e. A Welding Procedure Specification for any welding that needs to be performed on pipework
- f. A Corrosion Protection Specification for any coating that needs to be performed.
- g. A bar chart program (in Excel, MS Project and/or Primavera format) detailing all scope of work activities.
- h. Hard copies of the following: Material, Dimensional, Data sheets and Test certificates.
- i. Design documentation detailing verification, calculations, and philosophies.
- j. Signed off Implementation drawings.
- k. List of recommended spares with datasheets
- l. Safety file

3.8.3 Post-implementation Documentation

The *Contractor* supplies the *Employer* two months after the takeover of the *works with* Instruction/Technical/Operating and Maintenance Manuals that are specific to the Drakensberg Pumped Storage Scheme and which include:

- a. Signed-off test certificates
- b. Completed and signed-off Quality Control Plan and Check sheets
- c. Standard brochures, catalogues, descriptions
- d. "As built" drawings
- e. Fault finding and maintenance instructions are supported with a fault tree.
- f. Maintenance plan

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- g. The final issues of all manuals and drawings are submitted (4) weeks after completion for acceptance by the *Employer*. Photo-stat copies are unacceptable.
- h. All design information forming part of the Technical Specification is included in the manuals.
- i. Detailed parts lists are accompanied by exploded view type drawings detailing the part, technical descriptions of the plant and material and parts, spare part ordering instructions and type test certificates
- j. The manuals are complete with:
- i. Power station name and order number.
 - ii. Content list.
 - iii. List of reference drawings.
 - iv. Details of all components.
- k. The *Contractor* ensures that the manuals/files are complete making use of the following information represented as a minimum:
- i. Details and descriptions of all hardware and software
 - ii. Design calculation sheets
 - iii. Settings and configurations sheets
 - iv. Detailed product descriptions and features
 - v. System control philosophy
 - vi. System parameters and models
 - vii. Datasheets of all instruments/components used (including order information)
 - viii. Operating, maintenance and testing requirements
 - ix. Full system maintenance program
 - x. Installation procedures for each component
 - xi. Alarm descriptions and response procedures
 - xii. Tests certificates
 - xiii. Certificates of compliance with international standards
 - xiv. Routine test results reports
 - xv. Commissioning test results reports

4 Procurement

4.1 People

4.1.1 Minimum requirements of people employed on the Site

- a) The *Contractor* ensures that all on-site personnel that are of non-RSA nationality or permanent residence have the relevant permit to work.
- b) The *Contractor* ensures that there are at all times sufficient suitably qualified, experienced and skilled staff to carry out and supervise all activities.

4.1.2 BBBEE and preferencing scheme

- a) The *Contractor* complies with and fulfils the *Contractor's* obligations in respect of the Broad-Based Black Economic Empowerment (as per clause Z3).

4.2 Subcontracting

4.2.1 Preferred sub-Contractors

The *Employer* does not have a preferred list of sub-*Contractors*.

4.2.2 Subcontract documentation, and assessment of subcontract tenders

- a) The *Contractor* makes use of the NEC suite of contracts for contracting with Sub-*Contractors*. All sub-*Contractors* are subject to the *Project Manager's* acceptance.

4.2.3 Limitations on Subcontracting

None

4.2.4 Attendance on sub-Contractors

The *Contractor* includes all his sub-*Contractors* on the site organogram, depicting all the resources on site and their lines of authority and communication.

4.3 Plant and Materials

4.3.1 Quality

- a. The *Contractor* procures, fabricates, and delivers all the materials necessary to complete the *works*.
- b. All structural and construction materials are new and of the best quality, of the class most suitable for the purpose specified and governed by the following internationally recognised standards: ASME, DIN, BS, IEC and SANS.
- c. Other standards are submitted to the *Project Manager* for approval.

- d. All materials are capable of withstanding the variations of temperature and pressure, arising under working conditions without distortion or deterioration or the setting up of undue strains in any part, such as to affect the efficiency and reliability of the air compressor assembly and its control system.
- e. The *Contractor* to comply with the requirements of Supplier Quality Management Specification 240-105658000: Category 1.
- f. The *Contractor* notifies the *Employer* of any proposed changes to the quality management system that will affect the contract quality requirements, before implementing such changes.
- g. The *Contractor* provides a complete solution in the event of specialized work based on the *Contractor's* design and their standard manufacturing product in the *works* being defective or any components found to be defective due to manufacturing defects thus forcing any improvement to be implemented to rectify such inherent defects.
- h. In case of specialized work based on the *Contractor's* design and their standard manufacturing product in the *works* being defective or any components used found to be defective due to manufacturing Defects and thus forcing, any improvement to be implemented to rectify such inherent Defects, the cost of such an undertaking would be the responsibility of the *Contractor*.
- i. Quality control plans (QCPs) to be presented by the *Contractor* for the *Employer's* acceptance.

4.3.2 Plant & Materials provided “free issue” by the *Employer*

No new Plant and Materials will be issued by the *Employer*.

4.3.3 Procurement of Plant and Materials

- a. The *Contractor* is responsible for procuring all plants and materials that are required for them to complete the *works*.
- b. The *Contractor* shall ensure that the compressors and their associated equipment are adequately packaged and crated for transportation and delivered to Drakensberg Pumped Storage Scheme, undamaged.
- c. Suitable lifting equipment is used for off-loading and loading of the compressors and associated equipment at the *works*.
- d. The plant and material are protected against any damages during storage, loading and transportation.

4.3.4 Spares and consumables

- a. The *Contractor* supplies a list of operational spares required for the life of each maintainable component of the *works*.
- b. Operational spares for 2 years of operation of each compressor are supplied as part of the *works* and delivered to the *Employer's* Stores at Drakensberg Power Station before commissioning of the compressors. It can be assumed that each compressor will operate for 2000H per year and spares should be provided accordingly.
- c. All basic routine maintenance spares are indicated and are required to be available locally.

- d. The *Contractor* ensures that all critical spares are available during commissioning to prevent any delays due to equipment failure.
- e. Operational spares are the filters, valves, gaskets, seals and any other worn parts which are replaced on a routine according to the OEM's maintenance schedule, including oil to be changed after the wear-in period, as well as for routine oil changes for the first 2 years.
- f. A complete recommended spare list includes the following details:
 - Detailed description, including dimensions and material specification
 - Part number
 - Special storage requirements
 - Replacement part or routine maintenance part
 - Quantity
 - Cost
 - Lead time
 - Supplier full contact details and address
 - Applicable test/calibration/material certificates
- g. A recommended Spare list is populated in Schedule A&B; Appendix B, this refers to mandatory and recommended spares recommended by the *Contractor*.

4.4 Tests and inspections before delivery

4.4.1 Acceptance Testing

4.4.1.1 Type Test Certificate

- a) Copies of all type test certificates, indicating the result of all type tests performed, are submitted for acceptance by the *Employer*. These tests are required to verify that the design of the equipment to be supplied meets the *Employer's* requirements.
- b) The minimum type tests are:
 - Capacity
 - Power
 - Noise test
 - Vibration test

4.4.1.2 Basic Integration tests

- a) The *Contractor* prepares and submits the Test procedures with check sheets as well as the Quality Control Plan. Quality and testing acceptance criteria are included in these procedures.
- b) All tests are carried out as per accepted testing procedures and programmes.
- c) The *Contractor* documents all tests as part of the quality assurance and control procedures. These documents are provided to the *Employer* before the commencement of Detailed Design.
- d) The *Contractor* provides test certificates for all the tests performed.
- e) The *Contractor* provides all necessary equipment and labour to carry out the integration tests.

4.4.2 Pre-FAT

- a) The *Contractor* tests all plant components required to provide the *works*, at the *Contractor works*, in preparation for the Factory Acceptance Test (FAT). During these tests, the *Contractor* verifies all software and hardware designs against the design specifications and requirements. The *Contractor* also performs full testing of the software and hardware integration.
- b) The *Contractor* prepares and submits the Test procedures with check sheets as well as the Quality Control Plan. Quality and testing acceptance criteria are included in these procedures.
- c) All tests are carried out as per accepted testing procedures and programmes.
- d) The *Contractor* provides independent third-party inspection for tests performed on selected systems, for example, the standard communication protocol tests for the plant SCADA System interface.
- e) The *Contractor* documents all tests as part of the quality assurance and control procedures. These documents are provided to the *Employer* before the commencement of FAT.
- f) The *Contractor* provides test certificates for all the tests performed.
- g) The *Contractor* provides all necessary equipment and labour to carry out the manufacturing tests.
- h) The *Contractor* provides all necessary equipment and labour to carry out testing of the interface to the plant Scada System. The *Employer* only provides the test application.

4.4.3 Factory acceptance Tests (FAT)

- a) Factory acceptance tests are performed to prove the functionality of the equipment as an integrated system with, where required, simulated Input/ output (I/O) signals and that the system meets design specifications. These tests are performed by the *Contractor* at the *Contractor's Works*, and witnessed by the *Employer*, before delivery of the plant components.
- b) The *Contractor* prepares and submits the FAT procedures with check sheets as well as the Quality Control Plan. Quality and testing acceptance criteria are included in these procedures.
- c) It is the *Employer's* intention during FAT to verify the *Contractor's* test documentation and quality plans completed during compressor and material testing. All drawings and documentation are updated after FAT and before transportation of the compressors and materials to the site so that during site testing, the *Employer* has in his possession, manufactured documentation.
- d) The *Contractor* tests all plant components required to provide the *works*, at the *Contractors Works*. During these tests, the *Contractor* verifies all software and hardware designs against the design specifications and requirements. The *Contractor* also performs full testing of the software and hardware integration.
- e) It is the *Contractor's* responsibility to carry out all testing required on the compressors and materials forming part of the *works* before FAT.
- f) All tests are carried out as per accepted testing procedures and programmes.
- g) The *Contractor* provides all necessary equipment and labour to carry out the tests.
- h) The *Contractor* documents all tests on each plant component or system as part of the quality assurance and control procedures. These documents are approved by the *Contractor* and signed off as accepted by the *Employer*. Any exceptions or deviations are noted.

- i) Copies of all tests, indicating the results of all tests performed, are submitted for acceptance by the *Employer*.
- j) The *Contractor* provides test certificates for all the tests performed.
- k) The *Contractor* provides calibration certificates and certificates of conformance for all compressor instrumentation devices. The accuracy of calibration is required to be better than $\pm 0.5\%$.

4.4.4 Performance Tests

- a) The *Contractor* prepares all documentation for commissioning and submits this to the *Employer* for approval 4 weeks before scheduled implementation.
- b) The *Contractor* provides an implementation program taking the following *Employers* constraints into account:
 - i. At least two fully functional blowdown compressors (old or new) must be always available and operational.
 - ii. Site Acceptance Testing (SAT) is required, and it entails verifying the operational modes of the blowdown system.
 - iii. Copies of all tests, including performance testing per compressor are required, indicating the results of all tests performed, are submitted to the *Employer*.
 - iv. A reliability test of 14 days is required for each compressor after commissioning.
- c) The *Contractor* completes a successful 14-day reliability test on the first compressor installed before proceeding to dismantle and install the second compressor.
- d) Only once the first two compressors have successfully passed their 14-day reliability tests will the *Employer* allow the *Contractor* to proceed to dismantle and install the last two compressors simultaneously.
- e) The *Contractor* conducts an oil analysis after each compressor's 14-day reliability test and after 500hrs of running hours. A detailed report of the findings is provided of this analysis
- f) The *Contractor* performs a guarantee inspection in accordance with his prescribed preventative maintenance requirements and includes but not limited to an internal inspection, oil or filter changes before the defect date. This will be a once off inspection per compressor as per agreed schedule.

4.5 Marking Plants and Materials outside the Working Areas

- a) All Plants and Materials paid for by the *Employer* must be clearly labelled as being the *Employer's* property.
- b) The *Contractor* marks all identified items of Plant and Material with the Contract and Order numbers.
- c) Plant and Material are delivered to either the Site or the *Contractor's* works.
- d) The following requirements apply to the off-site marking of Plant, Materials and Equipment:
 - i. The *Contractor* gives two (2) weeks' notice to the *Project Manager*, and it is shown in the Accepted Programme.
 - ii. The notification to the *Project Manager* is accompanied by a comprehensive inventory of all Plant, Materials and Equipment ready for marking by the *Contractor*.

- iii. Plant, Materials and Equipment located at the *Contractor's* Sub-*Contractor/s* or sub-suppliers are not considered ready for marking.
- iv. Only Plant, Materials and Equipment physically located at the *Contractor's* facility are considered ready for marking.

4.6 Contractor's Equipment (including temporary works).

- a) The *Contractor* ensures that any sophisticated or highly specialised equipment that is required to complete the works is put forward on notice to the *Employer* and is procured by the *Contractor*.
- b) Suitable lifting equipment is used for off-loading and loading.
- c) The *Contractor* provides all temporary where required in completing the *works*.

4.7 Cataloguing requirements by the Contractor

Not applicable

5 Construction

5.1 Temporary works, Site services & construction constraints

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

- a) Before work starts on Site, a Site inaugural meeting is held between the *Contractor* and the *Project Manager*, where details of the *works* are discussed and clarified
- b) The *Contractor's* Site Supervisor is on Site for the entire duration of the *works*.
- c) General access to the power station is controlled and Site induction has to be completed before work will be allowed to start.
- d) The *Contractor* must adhere to all security regulations in force during the period of the contract.
- e) Before entry to the Site will be allowed, everyone will undergo an alcohol breathalyser 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.
- f) **Note:** The *Contractor* adheres to Eskom's five Life-saving Rules at all times.

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

- a) The *Contractor* satisfies himself and complies with the Site conditions presented during induction.
- b) The *Contractor* is required to comply with all Site restrictions on the Site's roads, walkways and barricades.

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

The *Contractor* ensures people employed on site are recorded as well as the hours of respective work and restrictions. The *Contractor* ensures the *Project Manager* has access to these records.

Normal working hours are as follows:

Monday to Thursday: 07:00 – 16:15

Fridays: 07:00 – 12:00

Outage hours

Monday to Saturday: 07:00 – 18:30

5.1.4 Health and safety facilities on Site

The health and safety facilities on Site are discussed in detail during the Site induction.

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

- a) The *Contractor* is informed that the Power Station is situated in a highly sensitive environmental area.
- b) The *Contractor* acquaints himself with all statutory and local environment regulations and adheres to these without exception.
- c) The *Contractor* complies with the Hazardous Chemical Regulations when using any hazardous.

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 from Others

None

5.1.8 Publicity and progress photographs

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

5.1.9 Contractor's Equipment

- a) The *Contractor* provides the following to complete the *works*:
 - Any equipment necessary to complete the *works*
 - Lifting facilities
- b) The *Contractor* supplies, installs, maintains and removes all temporary construction facilities and utilities necessary to provide the *works*.
- c) The *Contractor* provides and maintains all tests and measuring equipment, required for all tests, to the required accuracy and accompanied by valid calibration certificates from an approved authority. The accuracy of test equipment is required to be better than ± 0.1 %.
- d) The type and class of equipment used are subject to the Acceptance by the *Employer*. The Project Manager may at any stage during the works require such equipment to be checked by an approved laboratory or the South African Bureau of Standards.
- e) The *Contractor's* equipment is recorded and kept in the demarcated areas in consultation with the *Employer*.

5.1.10 Equipment provided by the Employer

No equipment will be provided by the *Employer*.

5.1.11 Site services and facilities

The following services are available on-site and are not necessarily available at the point of *works*.

5.1.11.1 Overhead Crane

- a) Two x 250 Tons Main overhead and two x 10 Tons auxiliary hook cranes are available on the machine hall floor which can be used for lowering the compressors through the removable floorboards to the compressor floor. However, no overhead crane facility is available in the compressor location to rig them into position.
- b) The *Contractor* ensures that the cranes can handle the loads to be lifted and any limitations for height and operation.
- c) The cranes are to be operated by the *Employer* only.

5.1.11.2 Electricity Supply

- a) All points of supply are provided in terms of availability and location.

- b) The *Employer* indicates which supply points may be used.
- c) 220V electrical supply is generally available in the power station complex. 380V supply is also available – the *Contractor* shall ensure they have the correct matching plugs.

5.1.11.3 Water Supply

- a) All points of supply are provided in terms of availability and location
- b) The *Employer* indicates which supply points may be used.

5.1.11.4 Compressed Air Supply

- a) All points of supply are provided in terms of availability and location.
- b) The *Employer* indicates which supply points may be used.
- c) The *Contractor* verifies air compression hose requirements.

5.1.11.5 Area for Site establishment and Storage

- a) A storage and Site Establishment area will be indicated to the *Contractor*.
- b) Security of the *Contractor's* storage is the responsibility of the *Contractor*.
- c) The area allocated to the *Contractor* is reinstated to their former condition on takeover of the *works*.

5.1.11.6 Sanitary facilities

- a) The *Contractor* makes use of the *Employer's* facilities in the power station.
- b) Ablution facilities are available in the power station.

5.1.11.7 Office Space

- a) The *Employer* is not able to offer office space to *Contractors* for the period of work on Site.
- b) Laydown areas for containers are available for temporary office space.
- c) A power supply of 230V AC, 10Amps is available to the *Contractor*

5.1.11.8 Telecommunications

- a) Telephone connections are not available. The *Contractor* makes provision for his requirements.

5.1.12 Facilities provided by the Contractor

- a) The *Contractor* provides, erects and maintains for own use, adequate size office accommodation and stores together with such, lighting and heating as may be required in the area designated by the *Project Manager*.
- b) The *Contractor* is to dismantle and clear off-site all such temporary structures and associated Foundations and infrastructure.
- c) The *Contractor* provides all other facilities as deemed necessary for the completion of the *works*.
- d) The *Contractor* should make provision for accommodation, vehicles, kitchen - and office space (mobile container) and Equipment etc.
- e) The *Contractor* removes all this Equipment and waste which was generated during the installation and commissioning within 24 hours after Completion.

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

None will be provided by the *Employer*.

5.1.14 Survey control and setting out of the works

A full survey of the blowdown compressor plant area and dimension verification is to be performed by the *Contractor* before the start of the *works*.

5.1.15 Excavations and associated water control

N/A

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

- a) According to the *works*, modifications can be made to these services to ensure that they interface properly with the compressors and that they are left in a similar safe condition as before the *works*. Any damage during completion of the *works* to these services shall fall under the responsibility of the *Contractor*.
- b) The *Contractor* minimises interference of any nature concerning existing services, cable and pipe trench covers. If the *Contractor* damages one of the above, the penalty would be for the *Contractor*.
- c) Blowdown compressor cooling water supply, return pipes, air delivery and compressor unloading pipes situated in trenches around the compressors as according to drawing number 0.48/1751.
- d) According to the *works*, certain modifications can be made to these services to ensure that they interface properly with the compressors and the *works* and that they are left in a similar safe condition as before the *works*. Any damage during completion of the *works* to these services shall fall under the responsibility of the *Contractor*.

5.1.17 Control of noise, dust, water and waste

The *Contractor* makes arrangements for the disposal of waste

5.1.18 Sequences of construction or installation

- a) All activities are performed according to the Programme accepted by the *Employer*.
- b) The installation of the four air compressors is phased to cater for continuous blowdown air availability to the four generating units.
- c) The compressors need to be installed and commissioned one or a maximum of two at a time to minimize disruptions to air availability for the station
- d) After the commissioning of the compressor, the new installation will be subjected to a 14-day reliability testing period, to prove the installation and rectify any faults occurring during these 14 days, before commencing with the decommissioning and installation of the next compressor set.
- e) The *Contractor* provides for all preservation maintenance on the plant delivered to the site, up until final commissioning and handover.

5.1.19 Giving notice of work to be covered up

Not applicable

5.1.20 Hook-ups to existing works

- a) The *Contractor* notifies the *Employer* before interfacing with existing *works*.

- b) The *Contractor* ensures a seamless interface to existing *works* to minimise any possible delays.

5.2 Completion, testing, commissioning and correction of Defects

5.2.1 Work to be done by the Completion Date

- a) Completion is
- i. 30 days after the last compressor has completed the 14-day reliability test after commissioning.
 - ii. As built drawings are accepted by the *Employer*
 - iii. All documentation is received which includes As-built drawings, Test Certificates, etc.
- b) On the Completion Date, the *Contractor* shall have done everything required to Provide the *works*
- c) The *Project Manager* cannot certify Completion until all the *works* is free of Defects which prevent the *Employer* from using the *works* and Others from doing their work.

5.2.2 Use of the works before Completion has been certified

- a) The *Employer* may use any part of the *works* before completion has been certified but in doing so the *Employer* takes over the part of the *works* except if the use is for a reason stated in the Works Information.

5.2.3 Materials facilities and samples for tests and inspections

- a) Samples of components may be requested by the *Employer* for pre-acceptance where deemed necessary.
- b) The *Contractor* may request cooling water samples to ensure that their compressor coolers can operate efficiently from this supply of cooling water and thus thereby ensure no changes are required on this part of the plant.

5.2.4 Commissioning

- a) The activities forming part of live testing, live commissioning, or power-up of any component are not embarked on until the *Project Manager* accepts the Commissioning documentation from the *Contractor*.
- b) Commissioning will not start until the following documents, required for the commissioning of the equipment, are accepted by the *Project Manager*:
- i. All relevant drawings
 - ii. All relevant site acceptance test reports completed and signed
 - iii. All installation-related defects are cleared.
 - iv. All QCP's signed at the relevant steps.
 - v. All safety clearance certificates are signed.
 - vi. All implementation procedures

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

- a) The *Contractor* is on-site when the first live operation of the plant commences.
- b) All operating will be done by the *Employer* under the supervision of the *Contractor* as per the agreed commissioning program.
- c) A pre-job meeting to discuss and analyse the procedures and processes to be used on the project is held before the commencement of the work.
- d) The purpose of the pre-job meeting would be to ascertain specifics concerning this specification.
- e) Attendance shall include the *Employer*, *Contractor*, manufacturer (where required).

5.2.6 Take over procedures

- a) Take-over is when all testing, inspections and commissioning are completed.
- b) The *Contractor* provides signed-off check sheets, and up to date and Execution QCP as evidence that the system is completed and commissioned successfully.
- c) The *Contractor*, *Project Manager* and *Supervisor* will perform a plant walk-down and complete acceptance documents before take over by the *Project Manager*.
- d) The *Employer* will take over and operate a compressor as soon as all takeover paperwork is completed for each unit.

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

- a) For the correction of defects after completion, the *Contractor* is to request an opportunity for correction a minimum of 4 weeks in advance and provide full details on the work to be executed.

5.2.8 Performance tests after Completion

- a) The *Contractor* tests the works per the accepted testing procedures.
- b) The *Contractor* provides all commissioning test results and certificates.
- c) The *Contractor* makes provision for Site Acceptance Testing for Protection, Control, and Power cables electrical checks.
- d) The commissioning tests as stipulated below and in schedule A&B must be submitted to the *Employer* for acceptance, if additional tests are required, they will be communicated by the *Contractor* to the *Project Manager*
 - i. Capacity test
 - ii. Reliability test period (14 days)
 - iii. Power test
 - iv. Noise test
 - v. Vibration test
- e) The *Contractor* makes two sets of commissioning spares available during commissioning to mitigate any failures of components that can cause delays during this activity.
- f) The 14-day reliability tests are performed after the *works* to guarantee that the Blowdown air compressors perform to specification.
- g) Test runs on all compressors are performed to verify conformance to specifications.

5.2.9 Training and technology transfer

5.2.9.1 General

- a) Training provided by the *Contractor* is directly applicable to the actual Plant and Material supplied for the *works*.
- b) Training is provided by the *Contractor* at Drakensberg Pumped Storage Scheme or as agreed with the *Employer*.
- c) Generalised training based on similar Plants and Materials is not acceptable.
- d) Engineering training is provided before the Factory Acceptance Testing of the new assembly.
- e) All pre-FAT training is conducted at the *Contractor's* local test facility and all operating and maintenance training is conducted at Drakensberg Pumped Storage Scheme.
- f) The local facilities for training provided by the *Employer* are a suitably sized air-conditioned room, to accommodate the required trainees as well as trainee and trainer desks, an overhead projector and a flipchart or whiteboard.
- g) 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.
- h) The number of participants that are to be trained is as indicated in the Table 5: Employee Training Groups.
- i) 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 for the *Contractor* account.
- j) The *Contractor* provides 1 additional (repeat) training course as and when instructed by the *Project Manager*.
- k) The training of the *Employer's* personnel in the engineering, operation and maintenance of the compressor, control system and switchgear is done by the *Contractor* and the training is structured in phases as listed below.
 - i. Training phase 1 – Engineering training.
 - ii. Training phase 2 - Operator training.
 - iii. Training phase 3 - Maintenance training.
 - iv. Training phase 4 – Training for Maintenance/ Operator personnel working shifts.

5.2.9.2 Training Requirements

- a) Engineering Training
 - i. Design overview of the switchgear and control gear assembly and compressor operation.
 - ii. Overview of communication troubleshooting for all interfaces.
 - iii. The training includes the following aspects:
 - Familiarisation with documentation (maintenance plan, procedures, etc.).
 - Operator interface familiarisation e.g., operational functions, alarms etc.
 - iv. IED software configuration and engineering tools used to access, configure, and test the IEDs.
 - v. Hardware familiarisation.

- vi. Hardware maintenance.
 - vii. Maintenance of compressors, switchgear components, protection scheme, control & instrumentation interface.
 - viii. Compressor, switchgear, etc and protection scheme fault finding and engineering.
 - ix. Full commissioning understanding.
 - x. Any training deemed necessary by the Contractor or OEM.
 - xi. Logic or software and engineering tools used to access and configure the PLC's.
- b) Operator training
- i. Familiarise with documentation including drawings, configuration, and logic.
 - ii. Operating the equipment, e.g., isolations and switching, etc.
 - iii. Operator interfacing and intervention, e.g., operating functions, indications, alarm, etc.
 - iv. Safety switching and isolating mechanisms of the equipment, e.g., Incomers, feeder breakers and motor circuits.
 - v. Any training deemed necessary by the *Contractor* or OEM.
- c) Maintenance training
- i. Familiarise with documentation, e.g., drawings, maintenance plans, procedures, etc.
 - ii. Operator interface familiarisation, e.g., operational functions, alarms, etc.
 - iii. Hardware familiarisation
 - iv. Hardware maintenance
 - v. Maintenance of Compressors and Control Instrumentation
 - vi. Any training deemed necessary by the Contractor or OEM.
 - vii. Logic or software and engineering tools used to access and configure the PLC's.

5.2.9.3 Training Documentation

- a) All necessary technical data, design data literature and drawings are to be incorporated into a training manual.
- b) Course material to be in English.
- c) All third-party devices and components must be covered as well.
- d) Training documentation should be submitted to the *Employer* by the *Contractor* for Acceptance before installation.

5.2.10 Guarantee inspection after Completion

- a) The *Contractor* performs a guarantee inspection within 12 months after completion, but 3 months before the defects date.
- b) The guarantee inspection is in accordance with the *Contractor's* prescribed preventative maintenance requirements and includes but not limited to an internal inspection, oil or filter changes.
- c) This guarantee inspection will be a once off inspection for each compressor as agreed in the accepted schedule.

6 Plant and Materials standards and workmanship

This should adhere to SANS and Eskom standards as well as details provided in the sections below.

6.1 Investigation, survey and Site clearance

- a) The *Contractor* conducts a thorough site investigation of existing facilities and the area around which he is to do his work before he commences with any part of the work as detailed in this contract.
- b) If the *Contractor* requires access to specific areas, this is arranged with the *Project Manager* by notifying in advance.

6.2 Building works

Reference number	Title / Description	Tick if Publicly available
SANS 10400 Series	The application of the National Building Regulations	√
R1010	Construction Regulations	√
SANS 10100-1	The structural use of concrete Part 1: Design	√

Table 7: SANS and Eskom standards – Building Works

6.3 Civil engineering and structural works

Reference number	Title / Description	Tick if Publicly available
SANS 10400 Series	The application of the National Building Regulations	√
SANS 1200 Series	Standardized Specifications for Civil Engineering	√
GGR 0992	Plant safety regulation	√
NEMA 88	National Environmental Management Act of 1988	√
SANS 10100-2	The structural use of concrete Part 2: Materials and execution of work	√
SANS 10144	Detailing of steel reinforcement of concrete	√
SANS 10160	The general procedures and loading to be adopted in the design of buildings	√
SANS 10162-1	The structural use of steel Part 1: Limit state design of hot rolled steelwork	√
SANS 10162-2	The structural use of steel Part 2: Limit state design of cold-formed steelwork	√
SANS 10162-4	The structural use of steel Part 4: the design of cold-formed stainless steel structural members	√
240-56364537	Design of steel structures	√
SANS 1200	SANS Standard Specifications for Civil Engineering Construction	√
SANS 1200A	General	√
SANS 1200G	Concrete	√
SANS 1200AH	Structural Steelwork	√
SANS 10162	The Structural Use of Steel	√

Table 8: SANS and Eskom standards – Civil

6.4 Electrical & mechanical engineering works

Reference number	Title / Description	Tick if Publicly available
240-105929225	Compressed Air System Standard	
240-75655504	Corrosion Protection Standard for new Indoor and Outdoor Eskom Equipment, Components, Materials and Structures Manufactured from Steel Standard	
240-56227443	Requirements for Control and Power Cables for Power Stations Standard	
240-56063805	LV Power and Control Cable with Rated Voltage Standard 600/1000V	
240-56355815	Field Instrument Installation Standard for Junction Boxes and Cable Termination	
240-56356411	Fire Barrier Seals for Electrical Cable Installations at Power Plants Standard	
240-56227516	Specification for LV Switchgear, Control gear Assemblies and Associated Equipment for Voltages up to and including 1 000 V AC and 1 500 V DC	
240-106628253	The standard for Welding Requirements on Eskom Plant	
240-57617975	New LV Motor Procurement Standard	
240-56356396	Earthing and Lightning Protection Standard	
SANS 10375	The inspection, testing and examination of overhead cranes	√
ASME B31.3-2002	Process Piping	√
SANS 62	Steel Pipes	√
SANS 121	Hot Dip Galvanized Coatings on Fabricated Iron and Steel Articles	√

Table 9: SANS and Eskom standards – Engineering and Mechanical works

6.5 Process Control and IT works

Reference number	Title / Description	Tick if Publicly available
240-72344697	C&I Functional Logic Diagram Template Guideline	
240-61532252	Control Systems Design Engineering Delivery View	
240-72344727	C&I Control System Architecture Guideline	
240-56355728	Human Machine Interface Design Requirements Standard	
240-56355731	Environmental Conditions for Process Conditions for Process Control Equipment Used at Power Stations Standards	
240-56355754	Field Equipment Installation Standard	
240-119638133	Control Systems Design for Redundancy and Diversity Standard	
240-124465468	Essential HMI and Instrumentation Systems for Power Plants Standard	
240-56227443	Requirements for Control and Power Cables for Power Stations Standard	
240-56227589	List of Approved Electronic Devices to be used on Eskom Power Stations Standard.	
240-56355843	Pressure Measurement Systems Installation Standard	
240-56355888	Temperature Measurement Systems Installation Standard	
240-109607332	Eskom Plant Labelling Abbreviation Standard	
240-109607736	Eskom KKS Key Part Standard	
240-62629353	Specification of Panel Labelling Standard	
240-93576498	KKS Coding Standard	
240-71432150	Plant Labelling and Equipment Description Standard	
240-56355466	Alarm Management System Guideline	
IEC 61131-3	Programmable Controllers: Programming Languages	√
32-6	Eskom document and records management procedure	

Table 10: SANS and Eskom standards – Process Control and IT works

6.6 Other

Reference number	Title / Description	Tick if Publicly available
ISO 9001	Quality Management System	√
36-681	Generation Plant Safety Regulations	
32-726	SHE Requirement for the Eskom Commercial process	
32-6	Eskom document and records management	
32-644	Eskom's Documentation Management Standard	
240-54179170	Eskom's Classification and Designation of Technical Documentation Standard	
240-86973501	Eskom's Engineering Drawing Standard – Common Requirements	
167A/9918	Drawing Office Process	

Table 11: Other References

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
0.48/1974	4	General airflow and arrangement
0.48/817	16	Sets 1 & 2 – 1177,500 Level Plant Layout
0.48/1947	12	Machine Hall Loading Bay Extension 1177,500 Floor Concrete Details

Table 12: List of drawings

C3.2 CONTRACTOR'S WORKS INFORMATION

This section of the Works Information will always be contract specific depending on the nature of the *works*.

It is most likely to be required for design and construct contracts where the tendering contractor will have proposed specifications and schedules for items of Plant and Materials and workmanship, which once accepted by the *Employer* prior to award of contract now become obligations of the *Contractor* per core clause 20.1.

Typical sub headings could be

- a) *Contractor's* design
- b) Plant and Materials specifications and schedules
- c) Other

This section could also be compiled as a separate file.
