SPECIFICATION

FOR

LABORATORY GAS INSTALLATION

AT

CSIR KLOPPERSBOS EXPLOSION RESEARCH FACILITY

FOR

CSIR KLOPPERSBOS

CLIENT

CSIR Facilities Management
Meiring Naudé Road
Brummeria
PRETORIA
0184

Tel: (012) 841 3570

TENDERER

.....

TENDER AMOUNT

.....

TENDER CLOSING DATE

.....

PREPARED BY	:	Lucille Makaum/C van Niekerk
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DATE	:	29 July 2019
SPEC NO	:	00
PROJECT NO.	:	191013

Dîêntsênêre Tša Meago
MECHANICAL & ELECTRICAL CONSULTING ENGINEERS

TABLE OF CONTENTS

THE TENDER **PAGE**

Part T1: Tendering procedures

T1.1 Tender notice and invitation to tender T1.1/1
T1.2 Tender data ..... T1.2/1 – T1.2/2

Part T2: Returnable documents

T2.1 List of returnable documents T2.1/1
T2.2 Returnable schedules ..... T2.2/1 to T2

T2.2.1 Schedule of Rates ..... T2.2.1/1 – T2.2.1.1/2
T2.2.2 Schedule of Imported Equipment and Material T2.2.2/1
T2.2.3 Statement of Compliance or Qualification by Tenderer T2.2.3/1
T2.2.4 Schedule of Sub-Contractors Proposed by the Tenderer T2.2.4/1
T2.2.5 Non-Scheduled Bill Items T2.2.5/1
T2.2.6 Schedule of Information of Components and Equipment ..... T2.2.6/1 – T2.2.6/4
T2.2.7 Schedule of Competence/Previous Experience by the Tenderer ..... T2.2.7/1 – T2.2.7/2

THE CONTRACT

Part C1: Contract Data

C1.1 JBCC Minor Works Agreement – Contract Data ..... Page 1 – 6
C1.3 JBCC – Minor Works Agreement (Reference only) C1.3/1

TABLE OF CONTENTS

C1.5 Special Subcontract Conditions ..... C1.5/1 – C1.5/30

C1.5.01 Definitions and Abbreviations C1.5/2
C1.5.02 General C1.5/5
C1.5.03 Drawings and Submissions C1.5/6
C1.5.04 Work Provided by Others C1.5/8
C1.5.05 Compliance with Regulations and Standards C1.5/10
C1.5.06 Safety C1.5/11
C1.5.07 Hoisting and Rigging C1.5/12
C1.5.08 Materials and Workmanship C1.5/13
C1.5.09 Programming C1.5/14
C1.5.10 Contract Management C1.5/15
C1.5.11 Organization and Staff of Gas Contractor C1.5/16
C1.5.12 Protection against Damage C1.5/17
C1.5.13 Access to Equipment and Systems C1.5/19
C1.5.14 Cleaning and Start-up C1.5/20
C1.5.15 Testing, Commissioning, Operating of Plant and Handover C1.5/21
C1.5.16 Completion of Subcontract Work C1.5/23
C1.5.17 Quality Management System, Testing, Inspection C1.5/24
C1.5.18 Guarantee C1.5/25
C1.5.19 Operating and Maintenance Manuals C1.5/26
C1.5.20 Free Maintenance C1.5/30
C1.5.21 Special Attendance C1.5/31

Part C2: Pricing data

C2.1 Pricing Instructions ..... C2.1/1 – C2.1/5
C 2.2 Bills of Quantities ..... C2.3/1 – 12
C.2.3 Summary of Bills of Quantities ..... C2.4/1 – 1

TABLE OF CONTENTS

Part C3: Scope of work

C3.1 Description of the Works ..... C3.1/1 to C3.1/2

C3.2 Standard Specification C3.2/1

C3.2.01 Instrumentation C3.2.1/2
C3.2.02 Identification C3.2.2/3
C3.2.03 Painting and Protection against Corrosion C3.2.3/5
C3.2.04 Gas & Vacuum Systems C3.2.4/11
C3.2.05 Sound and Vibration Control C3.2.5/13
C3.2.06 Life Cycle Cost Adjustment for Equipment C3.2.6/15

C3.3 Detailed Specification

C3.3.01 Piping, Fittings and Accessories ..... C3.3.01/1 – 13
C3.3.03 Gas Pipe and Electrical Distribution Support & Protection System ..... C3.3.03/1 – 3
C3.3.09 Gas Cylinder Manifold ..... C3.3.09/1 – 5
C3.3.12 Gas Plant Electrical Installation ..... C3.3.12/1 – 3

Part C4: Information

C4.1 Schedule of Drawings C4.1/1
C4.2 Waiver of Contractor's Lien C4.2/1
C4.3 Form of Indemnity ..... C4.3/1 – 2
C4.4 Construction Guarantee – Principal Agreement ..... C4.4/1 – 5
C4.5 Extract of Principal Contract Document N/A .....
C4.6 Unfixed Material Guarantee ..... C4.6/1 – 5
C4.7 Maintenance Agreement – Extended Maintenance Period ..... C4.7/1 – 24
C4.8 Schedule of Test Certificates ..... C4.8/1 – 4
C4.9 Certificate of Safety Test ..... C4.9/1 – 3
C4.10 Directions to Site C4.10/1

PART T1

TENDERING PROCEDURES

CSIR Kloppersbos (The Employer) invites tenderers to tender for the supply, delivery, installation, testing, commissioning & guarantee of the **laboratory gas installation for CSIR Kloppersbos Explosion Research Facility.**

Queries relating to the issues of these documents shall be addressed to the employer's agent (s):

Procurement Enquiries	**Name:**	
	E-mail Address:	
	Fax Number:	
Technical Enquiries	**Name:**	Corné van Niekerk
	E-mail Address:	cornevn@dtm-gauteng.co.za
	Fax Number:	012 663 1960

There will be a Compulsory clarification meeting with the representatives of the Employer:

Place	CSIR Kloppersbos
Date:	As per CSIR RFP/Q attached
Time:	As per CSIR RFP/Q attached

Only companies in possession of the tender document will be entitled to attend the briefing session.

Tender Offers shall be delivered to:

Place	As per CSIR RFP/Q attached
Date:	As per CSIR RFP/Q attached
Time:	As per CSIR RFP/Q attached

The tender shall be sealed envelope with the following identification details:

Title of tender	
Closing date:	
Closing time:	
Tenderer name	
Tenderers address:	

A GENERAL

A.1 Employer's Agent

A.1.1 The employer has appointed DIENTSENERE TSA MEAGO (DTM) as their authorised agent to deal with all matters relating to this enquiry and tender and the ensuing contract.

A.1.2 The contact details of the employer's agent is:
Name: Corné van Niekerk
E-mail: cornevn@dtm-gauteng.co.za

A.2 Checking of Documents

A.2.1 Tenderers must satisfy themselves that the documents are complete and conform to the index of this document. Should any figures or writing be indistinct or should any pages be missing from this document or should this document or the drawing(s) contain any obvious errors, the tenderer must immediately notify the Employer's Agent in writing in order to have any discrepancy rectified, as no claim whatsoever, will be entertained for faults in the tender price resulting from the abovementioned discrepancies.

A.2.2 The drawings issued with the tender are for tendering purposes only. The construction drawings shall take precedence over the drawings issued for tender.

A.3 Seek Clarification

A.3.1 Any clarification or queries are to be addressed in writing to the employer's agent noted in A.1.2 at least five (5) working days prior to the closing time as stated in the Tender Notice.

A.4 Cost of Tendering

A.4.1 The Employer will not compensate the tenderer for any costs incurred by the tenderer preparing and submitting the tender, in attending site inspections, meeting or for any reason whatsoever concerning this tender.

A.5 Dispute Resolution

A.5.1 Any dispute or whatsoever nature arising out of this tender shall be referred to the Arbitrators Foundation of South Africa (AFSA). Such dispute shall be determined as expeditiously as possible in accordance with the rules of AFSA including any appeal procedure.

A.6 Direct Specialist Contractors

A.6.1 Tenderers are to note that the employer may be appointing other Direct Specialist Contractors who will be working concurrently with the successful building contractor, and whose scope of work will be co-ordinated by the employer's agent.

B TENDER SUBMISSION

B.1 Signing of The Tender

B.1.1 The tender shall be signed by a person who is authorised to sign the document on behalf of the tenderer.

B.1.2 Written authorisation to this effect shall be submitted. Witnesses to the tenderer's signature shall fill in their personal details in the appropriate space provided on the form.

B.1.3 Each page shall be initialled as proof that the tenderer are aware of the contents of each page.

B.2 Tenderer to Submit Full Tender

B.2.1 Partial tenders will not be accepted. The fully priced Bill of Quantities must be submitted with the tender.

B.3 Tender Prices

B.3.1 This tender shall be a fixed price tender without escalation.

B.3.2 Tender prices shall include all duties, levies and taxes, but exclude Value Added Tax (VAT).

B.3.3 Tenderer shall provide the imported content and applicable exchange rate in the form provided.

B.4 Return of Tender Documents

B.4.1 A tenderer who does not submit a tender shall return the tender document to DTM within seven (7) days of the closing date of the tender.

B.5 Period of Validity of Tenders and Withdrawal of Tender After Closing Date

B.5.1 All tenders shall remain valid and open for acceptance for a period of *ninety (90) days* after the time and date set for the closing of tenders, or until the tenderer is relieved of this obligation by the employer's agent, in writing, at an earlier date.

Should a tenderer:

a) withdraw his tender during the period of its validity; or

b) give notice of his inability to execute the contract or fail to execute the contract; or

c) fail to sign the Contract Agreement or furnish the required security within the period stated in the document or any extended time agreed to by the project manager;

then the employer's agent may, in addition to any other remedies it may have, agree to the withdrawal of the tender or contract which may have been entered into, and the tenderer shall be liable for and pay to the employer:

- all expenses incurred in calling for fresh tenders, if it should be necessary;
- the difference between his tender and any less favourable tender accepted either by fresh tenders being called or by another tender being accepted from those already received;
- any escalation of the final Contract Price resulting from any delay caused in calling for fresh tenders.

B.5.2 The employer's agent will notify the appropriate tenderer in writing within a period of validity of acceptance of his tender.

B.5.3 If requested by the employer or his agent, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

B.6. Repudiation of Tender or Invalidation of Contract

B.6.1 If the employer's agent is satisfied that the tenderer or any person being an employee, partner, director or shareholder of the tenderer or a person acting on behalf of or with the knowledge of the tenderer:

a) has offered, promised or given a bribe or other gift or remuneration to any person in connection with the obtaining or execution of a contract;

b) has acted in a fraudulent or corrupt manner in obtaining or executing a contract;

c) has approached an officer or employee of the employer or project manager with the object of influencing the award of a contract in the tenderer's favour;

d) has entered into any agreement or arrangement, whether legally binding or not, with any other person, firm or company;

- to retrain from tendering for this contract;
- as to the amount of the tender to be submitted by either party;

e) has disclosed to any other person, firm or company other than the project manager, the exact or approximate amount of his proposed tender except where the disclosure, in confidence, was necessary in order to obtain insurance premium and surety quotations required for the preparation of the tender;

the employer's agent may, in addition to using any other legal remedies, repudiate the tender or declare the contract invalid should it have been concluded already.

B.7 Amendments to or Qualifications of Tender Documents

B.7.1 No unauthorized amendment shall be made to the form of tender, the schedule of quantities, or to any other part of the tender documents. If any such amendment is made or if the schedule of quantities is not properly completed, it may cause the tender to become invalid.

B.7.2 Tenders submitted in accordance with these tender documents shall not have any qualifications. Any point of difficulty of interpretation shall be cleared with the project manager as early as possible during the tender stage. Should any query be found to be of significance, all tenderers will be informed accordingly by the project manager as early as possible.

B.7.3 Should the tenderer, notwithstanding the above, wish to make any amendments to or qualification of the tender documents, such amendment or qualification shall be set out explicitly in full detail on the form: Amendments or Qualifications by the Tenderer. Any qualification or amendment not set out on such form or in the covering letter to the tender, the tender will be deemed fully compliant. Any qualification or amendment appearing in or to be inferred from a program and submitted with any tender will not have any force and effect unless set out in writing in accordance with the above requirements.

B.8 Alternative tender Offers

B.8.1 Unless otherwise stated in the tender data, submission of an alternative tender is only permitted if a main offer which complies fully with the requirements of the tender document is also submitted.

B.9 Confidentiality and Copyright of Documents

All recipients of the tender documents, whether they submit a tender or not, shall treat the details of the documents as private and confidential. The use and copy of the documents issued may only be done for the purpose of submitting a tender in response to the invitation.

B.10 Electronic Tenders

B.10.1 Faxed or e-mailed tenders will not be considered. (Refer to CSIR RFP/Q attached, which will have preference if in contradiction)

B.10. Inspection on Site

B.10.1 The Tenderer shall inspect and examine the site and its surroundings and shall satisfy himself before submitting his tender as to the form and nature of the site, the quantities and nature of the work and materials necessary for the completion of the Works and the means of access to the site, the accommodation he may require and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his tender.

B.10.2 If a compulsory site visit is required refer to the tender invitation

C TENDER EVALUATION

C.1 Opening of Tender Submissions

C.1.1 Tenders will not be opened in public.

C.2 Test for Responsiveness

C.2.1 Prior to detail evaluation the employer's agent will determine:

- If the tender complies with the conditions of tender;
- If the tender has been properly and fully completed and signed;
- If all returnable documents have been included;
- If all the returnable schedules have been completed and signed;
- If the tender complies with the technical specification.

C.2.2 Should the tender received not be responsive it may be disqualified

C.3 Arithmetical Errors, Omissions and Discrepancies

C.3.1 Arithmetical errors

The employer or the employer's agent shall adjust arithmetical errors in the extension of rates and totals in the tender, and the tenderer will be informed of the effect of any corrections on his tender sum prior to the award of the contract. In no case will tendered rates be adjusted when correcting such errors.

C.3.2 Imbalance in tender rates

In the event of there being tendered rates or prices which are declared by the project manager to be unacceptable to him, because they are either excessively low or high or not in proper balance with other rates, the tenderer may be required to produce evidence and advance arguments in support of the tendered rates or prices objected to. If after submission of such evidence and any further evidence requested, the project manager is still not satisfied with the tendered rates or prices objected to, it may request the tenderer to amend these rates and prices along the lines indicated by him.

The tenderer may or may not thereupon alter and amend the rates and prices objected to and such other related prices as are agreed with the project manager. Should the tenderer fail to amend his tender in a manner acceptable to the project manager, or not at all, it may be prejudice his tender.

C.4 Interview with and Additional Information Required from Tenderers

C.4.1 During the period of adjudication the employer or his agent may require the tenderer to attend a meeting to clarify matters relating to the tender. The tenderer shall clarify any aspect of his tender verbally and/or in writing, as may be requested.

C.4.2 The employer or his agent may also request that the tenderer provide written evidence that his labour and other resources are adequate for carrying out the contract.

C.4.3 All written information submitted by the tenderer, together with and in support of his tender, shall be considered to form the basis on which the tender has been made.

C.5 The Employer's Right to Decline Any Tender

C.5.1 The employer is not bound to accept the lowest or any tender received. Tenderers whose tenders are not accepted will be notified and the employer reserves the right not to provide tenderers with reasons for non-acceptance of unsuccessful tenders.

C.5.2 The employer reserves the right to negotiate with other contractors or any other party in the event that a contract cannot be successfully negotiated between the employer and a tenderer.

C.5.3 The Employer may suspend, terminate or abandon this tender at any time if there is no response to its invitation to tender or if the response to such invitation is significantly reduced or varied. In this event the employer will notify tenderers in writing.

C5.4 The employer reserves the right in its absolute discretion to stop or vary the tender process, or re-tender, at any time. In the event that there is any variation in the tender process or a re-tender, the original invitation or request for tender will be given the same distribution as the original request for tender.

C.5.5 The decision by the employer is final and the successful tenderer shall subject to clause C.5.2 above, be invited to conclude a contract with the employer.

PART T2

RETURNABLE DOCUMENTS

The Tenderer shall complete and submit the following returnable schedules and documents:

Item	Description	Details	Compulsory (Yes / No) Non-Submission will render to tenderer non-responsive	Compulsory (Yes / No) For Tender Evaluation Purposes	Bidders Check	Employers Check
Documents Relating to the Tender Submission						
1	Mandatary Requirements	Refer employer's specific requirements	**Yes**	**Yes**		
2	Schedule of Proposed Sub-Contractors	Submission of a schedule of Sub-contractors intended to be used on the project		**Yes**		
3	Record of Addenda to Tender Documents	Acknowledgement of receipt of addenda		**Yes**		
4	Bill of quantities	Completed bill of quantities		**Yes**		
5	Form of Tender	Completed and signed form	**Yes**	**Yes**		
6	Schedule of rates (Non bill items)	The form duly completed.		**Yes**		
7	Schedule of imported equipment and materials	The form duly completed.		**Yes**		
8	Statement of compliance and/or qualification by tender	The form duly completed.		**Yes**		
9	Schedule of information of components and equipment	The form duly completed.		**Yes**		
10	Metholodology / Approach	Refer to Annexure 1 – A1.1		**Yes**		
11	Tenderer's Experience	Refer to Annexure 1 – A1.2		**Yes**		
12	Tenderer's Resources	Refer to Annexure 1 – A1.3		**Yes**		
12.1	Qualification of Gas Designer	Qualification & Registration Certificates	**Yes**	**Yes**		
12.2	Qualification of Gas Supervisor	Qualification & Registration Certificates	**Yes**	**Yes**		
12.3	Qualification of Gas Installer	Qualification & Registration Certificates	**Yes**	**Yes**		
12.4	Qualification of Gas Commissioning	Qualification & Registration Certificates	**Yes**	**Yes**		
12.5	Qualification of Gas Maintenance	Qualification & Registration Certificates	**Yes**	**Yes**		
13	Quality Control procedure	Refer to Annexure 1 – A1.4		**Yes**		

PART T2.

RETURNABLE SCHEDULES

The following information is required to enable the Engineer to determine the costs of variations.

Materials/Equipment

The rates shall be calculated on the following basis: -

- Net costs of equipment/materials supplied, hoisted, rigged and installed on site.
- Including profit, overheads, financing, insurance and guarantee costs.
- Including engineering, management and quality control.
- Excluding Value Added Tax and Builder's Discount.

1. CHANGE IN EXTENT OF THE WORKS

Change in the scope and extent of the works included in the Bills shall be allowed to meet the Employer's requirements and shall be dealt with in accordance with the provisions of the contract applicable to the Works.

Items of a similar character shall be priced using and same method as used to arrive at the Bill rates.

Changes involving work executed out of sequence or not of a similar character or executed under dissimilar conditions to the items in the original Bills – i.e. where Bill rates cannot reasonably be used as the basis – should be priced independently and wherever possible, agreed prior to execution. Such variations should be presented in break down form at rates declared at tender stage in the variations Bills as follows:

		NORMAL RATE	AFTER HOUR OVERTIME	SUNDAY & PUBLIC HOLIDAY OVERTIME
1	Artisan – rate per hour	R.....	R.....	R .....
2	Technician – rate per hour	R.....	R.....	R .....
3	Labourer/Assistant – rate per hour	R.....	R.....	R .....
4	Engineer – rate per hour	R.....	R.....	R .....
5	Draughts person – rate per hour	R.....	R.....	R .....

6.	Transport – rate per kilomter			
	a. DV + car	R...../km	R ...../km	R ..... /km
	b. Truck up to 5 Tons	R...../km	R ...../km	R ..... /km
	c. Truck more than 5 tons	R...../km	R ...../km	R ..... /km

2. COMPOSITION OF STANDARD TEAM

	PIPING	GAS DETECTION	ELECTRICAL	COMMISSIONING
No off Artisan per team				
No off Labourers per team				

3. Overhead and profit percentage …… (%) to be added to the nett cost of materials and labour based on rates stated above.

The tenderer shall complete in this schedule the required information of proposed suppliers of equipment and materials. The selection of equipment may be used in adjudication of tenders. Equipment indicated in the schedules shall comply in all respect with the subcontract documents. If it appears that the offered equipment does not comply, then the subcontractor shall be responsible for replacing of such equipment at his own cost.

Final approval of equipment and materials will be subject to full submission of required information at equipment submission stage to check conformance with the performance specification and design concept.

Omission or ambiguity in the data submitted may invalidate this tender.

Description of Equipment or Material	Item reference in Bills of Qty (Page/Item)	Qty.	Foreign Cost and Currency	Rand/ Foreign Currency Rate used by Tenderer	Equivalent Rand Amount	Surcharge Percentage and Amount	Import Duty Percentage and Amount

DATE: …….. SIGNATURE OF TENDERER: ……..

SCHEDULE B

This Tender complies in every respect with the Conditions of Contract, Specification, Schedules and Drawings - * (YES) / (NO).

If (NO). detail qualifications hereunder. Failure to detail qualifications shall signify compliance.

QUALIFICATIONS		
PART NO	**CLAUSE NO**	**QUALIFICAITONS**

DATE: …… SIGNATURE OF TENDERER ……..……

* (Delete which is not applicable)

SCHEDULE C

SCHEDULE OF SUBCONTRACTORS PROPOSED BY THE TENDERER

The Tenderer shall state in the Schedule below the names of all Subcontractors he wishes to employ in the Works and shall define their duties and outline their experience.

NAME OF SUB-CONTRACTOR	PROPOSED DUTIES	EXPERIENCE	VALUE OF THE SUB-CONTRACT (RAND)

DATE: …… SIGNATURE OF TENDERER……..……

ITEM	DESCRIPTION	UNIT	QUANTITY	TARIFF	RANDS	CENTS

SCHEDULE OF INFORMATION
(To be filled in by Tenderer)

NB: All schedules which accompany the tender notice form an integral part of it and must be completed in every detail. Failure to do this may render a tender intelligible for consideration.

Under no circumstances will the following types of statement be accepted as answers:

See attached pamphlets
Refer to catalogue
Data to follow
To be advised, etc.

SPECIAL NOTE TO TENDERERS

Whenever an alternative, or equal make or type of equipment is offered at the tendering stage, the Director shall on the acceptance of the tender inform the Contractor in writing as the make and/or type of equipment accepted.

Note, however, that the words ‘or equal’ is to be discouraged and could lead to the disqualification of the tender.

The tenderer must complete the schedule of information and submit it with the tender. The schedule must be completed accurately and in full detail.

REGULATOR STATION – TWO STAGE

1. Make :
2. Name of supplier :
3. Model and type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

MANUAL CHANGE-OVER MANIFOLD – FLAMMABLE GAS HIGH PURITY

1. Make :
2. Name of supplier :
3. Model and type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

MANUAL CHANGE-OVER MANIFOLD – INERT GAS HIGH PURITY

1. Make :
2. Name of supplier :
3. Model and type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

VALVES – INSTRUMENT TUBE BALL VALVES

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

VALVES – NEEDLE VALVES

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

VALVES – GLOBE VALVES

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

PRESSURE GAUGES

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

CABLE TRAYS

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

FIRE PROOF PAINT

1. Make :
2. Name of supplier :
3. Type :
4. Country of origin :
5. Describe in detail any deviation from the contract document :

1. GAS PRACTITIONERS' REGISTRATION UNDER SAQCC

No	Name	SAQCC Gas Practitioner Registration No	Expiry date	Signature of Practitioner
1				
2				
3				

Categories approved under current registration: (Indicate 1 and/or 2 and 3 in table below)

Primary Classification	Gas System	Select (Y/N)	Scope of Work Select (Y/N)			Commercial Select (Y/N)	Industrial Select (Y/N)
			Design	Installation	Maintenance & Repair		
Inert Gases	Nitrogen						
	Argon						
	Carbon Dioxide						
	Helium						
	Other (State Type)						
Oxidant Gases	Oxygen						
	Nitrous Oxide						
	Other (State Type)						
Flammable Gases	Hydrogen						
	Methane						
	Natural Gas (LNG/CNG)						
	Acetylene						
	LPG						
	Other (State Type)						

Primary Classification	Gas System	Select (Y/N)	Scope of Work Select (Y/N)			Commercial Select (Y/N)	Industrial Select (Y/N)
			Design	Installation	Maintenance & Repair		
Special Gases							
Medical Gases	Medical Oxygen						
	Medical Air						
	Nitrous Oxide						
	Entonox						
	Carbogen						
	Other (State Type)						

2. LIST OF PREVIOUS PROJECTS

a. List of projects completed in the last year:

Project	Gas Contract Value (R)	Date completed

b. List of projects currently undertaking:

Project	Gas Contract Value (R)	Date started

PART C1

CONTRACT DATA

THE JOINT BUILDING CONTRACTS COMMITTEE

JBCC

MINOR WORKS AGREEMENT: CONTRACT DATA

Project	CSIR Kloppersbos - Laboratory Gas Installation
Employer	Council for Scientific and Industrial Research
Contractor	
Contract Date	
File Code	FM - REQ - 2018 - 039

The Joint Building Contracts Committee® - NPC

CONTRACT DATA
Minor Works Agreement
Edition 5.2 - May 2018

JBCC®

The Joint Building Contracts Committee® NPC (JBCC®) is representative of building owners and developers, professional consultants and general and specialist contractors who contribute their knowledge and experience to the compilation of the JBCC® documents. The JBCC® documents portray the consensus view of the constituent members and are published in the interests of standardisation and good practice with an equitable distribution of contractual risk

For more information about the JBCC®, frequently asked questions, where documents may be purchased as well as training courses visit www.jbcc.co.za

Application of JBCC® agreements

The definitions contained in the JBCC® Minor Works Agreement apply to this document. A word or phrase in bold type in the text has the same meaning assigned to it in the definitions of such agreement. Where a word or phrase is not in bold type it has the meaning consistent with the context of its use

This contract data contains unique requirements applicable to the project and variables referred to in the JBCC® Minor Works Agreement and the JBCC® General Preliminaries. The information provided in this document by the principal agent is complete and accurate at the time of calling for tenders. Where additional information becomes available, all tenderers will be informed in writing. Reference to clause numbers in the JBCC® Minor Works Agreement are shown in [square brackets] in this contract data eg [3.2.1]. Spaces requiring information must be filled in, or marked as 'not applicable' but not left blank

This contract data, when completed and submitted by the contractor, becomes the form of tender. Where the contractor is appointed, the contract documents comprise the signed JBCC® Minor Works Agreement, this completed contract data, the priced document, drawings and other listed documents

Warning!

The JBCC® Minor Works Agreement Edition 5.2 has been coordinated with the JBCC® General Preliminaries and the JBCC® certificate forms and support documents. Forms from previous editions are not compatible with the JBCC® Minor Works Agreement Edition 5.2

Persons entering into or preparing contracts using the JBCC® suite of contract agreements and support documents are warned of the dangers inherent in modifying any part of it

Experience has shown that changes drafted by others, including members of the building professions, often have unintended results that may be prejudicial to either, or both, parties

Disclaimer

While the JBCC® aims to ensure that its publications represent best practice it does not accept or assume any liability or responsibility for any events or consequences which derive from the use of JBCC® documents

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A PROJECT INFORMATION

A 1.0 Works [1.1]

Project name	CSIR Kloppersbos - Laboratory Gas Installation
Reference number	FM - REQ - 2018 - 039
Works description	Engineering, drawings for and obtaining of Local Authority Approval, supply, installation, testing, commissioning, one year maintenence and handover of the laboratory gas installation

A 2.0 Site [1.1]

Erf / stand number	CSIR Strategic Initiatives and Implementation Unit, Kloppersbos
Township / Suburb	Kloppersbos
Site address	Kloppersbos Pyramid Road (Off N1 Exit 163)
Local authority	City of Tshwane Metropilitan Municipality

A 3.0 Employer [1.1]

Name	Council for Scientific and Industrial Research		
Legal entity of above		Contact person	Mr. Chris Roos
Business registration number	N/A (State)	Telephone number	012 841 4367
VAT/GST number	4470114283	Mobile number	082 533 8026
Country	RSA	E-mail	croos@csir.co.za
Postal address	PO Box 395, Pretoria,		
		Postal code	0001
Physical address	Meiring Naudé Road, Brummeria, Pretoria		
		Postal code	0184

A 4.0 Principal agent [1.1; 5.1]

Name	N/A		
Legal entity of above		Contact person	
Practice number		Telephone number	
		Mobile number	
Country		E-mail	
Postal address			
		Postal code	
Physical address			
		Postal code	

A 5.0 Agent [1.1; 5.2]

Discipline	Laboratory Gas

Name	Diêntsênêre Tša Meago (Pty) Ltd		
Legal entity of above	Pty Ltd	Contact person	Corné van Niekerk
Practice number	1999/025643/07	Telephone number	012 663 3125
		Mobile number	082 881 7086
Country	RSA	E-mail	cornevn@dtm-gauteng.co.za
Postal address	Box 7270, Centurion		
		Postal code	0046
Physical address	1284 South Street, Centurion		
		Postal code	0157

A 6.0 Agent [1.1; 5.2]

Discipline	

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
		Mobile number	
Country		E-mail	
Postal address			
		Postal code	
Physical address			
		Postal code	

A 7.0 Agent [1.1; 5.2]

Discipline	

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
		Mobile number	
Country		E-mail	
Postal address	-		
		Postal code	
Physical address			
		Postal code	

A 8.0 Agent [1.1; 5.2]

Discipline	

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
		Mobile number	
Country		E-mail	
Postal address			
		Postal code	
Physical address			
		Postal code	

B CONTRACT INFORMATION

B 1.0 Definitions [1.1]

Bills of quantities: System/Method of measurement	Bills of Quantities

B 2.0 Law, regulations and notices [2.0]

Law applicable to the **works**, state country [2.1]	RSA

B 3.0 Offer and acceptance [3.0]

Currency applicable to this **agreement** [3.2]	South African Rands

B 4.0 Documents [4.0]

The original signed **agreement** is to be held by the **principal agent** [4.2], if not, indicate by whom	DTM (Pty) Ltd
Number of copies of **construction information** issued to the **contractor** at no cost [4.5]	2

Documents comprising the **agreement**	Page numbers
The **JBCC**® Minor Works Agreement, Edition 5.2 May 2018	1 to 19
The **JBCC**® Minor Works Agreement - Contract Data, Edition 5.2 May 2018	1 to 11
The **JBCC**® General Preliminaries for use with the **JBCC**® Minor Works Agreement, Edition 5.2 May 2018	1 to 7
Specification for Laboratory Gas Installation at CSIR Kloppersbos	As per Index
Explosion Research Facility	

Contract drawings – description	Number	Revision	Date
Building 1 Gas Storage & Reticulation Layout 191013	M-G-4GF	00	2019/04/10
Typical Manual Change Over Gas Manifold Schematic	M-G-110	00	2019/07/19

B 5.0 Employer's agents [5.0]

Authority is delegated to the following **agents** to issue **contract instructions** and perform duties for specific aspects of the **works** [5.2]
Diêntsênêre Tša Meago (Pty) Ltd - Corné van Niekerk

Principal agent's and **agents**' interest or involvement in the **works** other than a professional interest [5.3]
None

B 6.0 Insurances [8.0]

Insurances by **employer**		Amount including **tax**	Deductible amount including **tax**
Contract works insurance:		NA	
	New **works** [8.2.1] (**contract sum** or amount)	NA	
or	**Works** with alterations and additions [8.2.1] (reinstatement value of existing structures with or including new **works**)	NA	
	Direct contractors [13.0] where applicable, to be included in the contract works insurance	NA	
	Free issue [10.1.12] where applicable, to be included in the contract works insurance	NA	
	Escalation, professional fees and reinstatement costs if not included above	NA	
Total of the above contract works insurance amount		NA	
Supplementary insurance [8.2.2]		NA	
Public liability insurance [8.2.3]		R10 000 000.00	R10 000.00
Removal of lateral support insurance [8.2.4]		NA	
Other insurances [8.2.5]		NA	
Yes/no?	If yes, description 1		
Yes/no?	If yes, description 2		

B 7.0 Obligations of the employer [10.1]

Existing premises will be in use and occupied [10.1.3]		Yes/no?	Yes
If yes, description	Adjacent rooms are in use		
Restriction of working hours [10.1.3]		Yes/no?	Yes
If yes, description	08h00 to 16h30 Workdays		
Natural features and known services to be preserved by the **contractor** [10.1.4]		Yes/no?	No
If yes, description			
Restrictions to the **site** or areas that the **contractor** may not occupy [10.1.5]		Yes/no?	Yes
If yes, description	All adjacent rooms in the building and any other building on site		
Supply of **free issue** [10.1.12]		Yes/no?	No
If yes, description			

B 8.0 Direct contractors [13.0]

Extent of work [10.1.13]	Laboratory Gas
Extent of work [10.1.13]	
Extent of work [10.1.13]	
Extent of work [10.1.13]	
Extent of work [10.1.13]	

B 9.0 Possession of site [10.1.6] practical completion[15.0;17.0] and penalties [18.0]

	Intended date of possession of the **site** [10.1.6]	Period for inspection by the **principal agent** [15.3]	Date for **practical completion** [15.1.1]	**Penalty** [18.1]
Practical completion for the **works** as a whole	Date	**working days**	Date	Penalty amount per **calendar day**
		5		R 450.00

Criteria to achieve **practical completion** not covered in the definition of **practical completion**

B 10.0 Payment [19.0]

Date of month for issue of regular **payment certificates** [19.2]	20

B 11.0 Dispute resolution [22.0]

Adjudication [22.5.1] Name of nominating body	
Applicable rules for adjudication [22.5.2]	
Arbitration [22.6.4] Name of nominating body	Arbitration Foundation of South Africa
Applicable rules for arbitration [22.6.5]	

B 12.0 JBCC® General Preliminaries – selections

Provisional bills of quantities [P2.2]		Yes/no?	Yes	
Availability of construction information [P2.3]		Yes/no?	Yes	
Previous work - dimensional accuracy - details [P3.1]				
Previous work - **defects** - details [P3.2]				
Inspection of adjoining properties - details [P3.3]				
Handover of **site** in stages - specific requirements [P4.1]			No	
Enclosure of the **works** - specific requirements [P4.2]				
Geotechnical and other investigations - specific requirements [P4.3]				
Existing premises occupied - details [P4.5]				
Services - known - specific requirements [P4.6]				
Water [P8.1]	By **contractor**	Yes/no?	No	
	By **employer**	Yes/no?	Yes	
	By **employer** – metered	Yes/no?	No	
Electricity [P8.2]	By **contractor**	Yes/no?	No	
	By **employer**	Yes/no?	Yes	
	By **employer** – metered	Yes/no?	No	
Ablution and welfare facilities [P8.3]	By **contractor**	Yes/no?	Yes	
	By **employer**	Yes/no?	No	
Communication facilities - specific requirements [P8.4]			Contractor to provide	
Protection of the **works** - specific requirements [P11.1]				

Protection / isolation of existing **works** and **works** occupied in **sections -** specific requirements [P11.2]	Protection and hoarding of newly finished building interior and equipment
Disturbance **-** specific requirements [P11.5]	
Environmental disturbance **-** specific requirements [P11.6]	

B 13.0 Changes made to JBCC® documentation

Reference may be made to other documents forming part of this **agreement**
Clause 19.9 shall read: The employer shall pay the contractor the amount certified in an issued payment certificate including default interest, if due, within forty five (45) calender days of the date of the payment certificate [CD]

C TENDER CLOSING

Tender closing date		Time		
Tender submission address	Refer to CSIR RFP/Q attached, for date, time and address of submission			
Tender may be submitted by e-mail	yes/no ?		E-mail	Refer to CSIR RFP/Q attached

D TENDERER'S SELECTIONS

D 1.0 Securities [9.0]

Guarantee for construction: Select Option A or B ☐

Option A	**Guarantee for construction** (variable) by **contractor** [9.1.1]

Option B	**Payment reduction** [9.1.2]

Guarantee for payment by **employer** [9.2]	Amount	Purchase Order
Advance payment, subject to a **guarantee for advance payment** [9.4]	Amount	

D 2.0 Contractor's annual holiday periods during the construction period

Year 1 **contractor**'s annual holiday period	start date		end date	
Year 2 **contractor**'s annual holiday period	start date		end date	
Year 3 **contractor**'s annual holiday period	start date		end date	

D 3.0 Payment of preliminaries [19.0]

Select Option A or B ☐ Where the **contractor** does not select an option, Option A shall apply

Where the total amount of **preliminaries** is not identified (in a lump sum contract) it shall be taken as 7.5% (seven and a half per cent) of the **contract sum**, excluding contingency sums, and any provision for contract price adjustment (cost fluctuation)

Option A	Assessed by the **principal agent**, an amount prorated to the value of the **works** executed in the same ratio as the amount of the **preliminaries** to the **contract sum** which **contact sum** shall exclude the amount of **preliminaries.** Contingency sum(s) and any provision for contract price adjustment (cost fluctuations) shall be excluded for the calculation of the aforesaid ratio

Option B	An amount agreed by the **principal agent** and the **contractor** in terms of the **bills of quantities** or the **priced document** to identify an initial establishment charge, a time based charge and a final disestablishment charge. Payment of the time based charge shall be adjusted from time to time as may be necessary to take into account the progress of the **works**

D 4.0 Adjustment of preliminaries [20.6.3]

Select Option A or B ☐ Where the **contractor** does not select an option, Option A shall apply

The amount of **preliminaries** shall be adjusted to take account of the effect of changes in time and/or value on **preliminaries.** Such adjustment shall be based on the particulars provided by the **contractor** for this purpose in terms of Options A or B, shall preclude any further adjustment of the amount of **preliminaries** and shall apply notwithstanding the actual employment of resources by the **contractor** in the execution of the **works**

For the adjustment of **preliminaries** both the **contract sum** and the **contract value** shall exclude the amount of **preliminaries**, contingency sum(s) and any provision for contract price adjustment (cost fluctuations)

Where the total amount of **preliminaries** is not identified (in a lump sum contract) it shall be taken as 7.5% (seven and a half per cent) of the **contract sum**, excluding contingency sums, and any provision for contract price adjustment (cost fluctuation)

Option A	The **preliminaries** shall be adjusted in accordance with an allocation of **preliminaries** amounts to be provided by the **contractor** within fifteen (15) **working days** of the date of acceptance of the tender as follows: - An amount which shall not be varied; - An amount varied in proportion to the **contract value** as compared to the **contract sum**; - An amount varied in proportion to the number of **calendar days** extension to the date of **practical completion** to which the **contractor** is entitled with an adjustment of the **contract value** as compared to the number of **calendar days** in the initial **construction period** Where the above mentioned information is not provided the following allocation of **preliminaries** amounts shall apply: - Ten per cent (10%) shall not be varied - Fifteen per cent (15%) shall be varied in proportion to the **contract value** as compared to the **contract sum** - Seventy five per cent (75%) shall be varied in proportion to the number of **calendar days** extension to the date of **practical completion** to which the **contractor** is entitled with an adjustment of the **contract value** as compared to the number of **calendar days** in the initial **construction period** Where completion in **sections** is required the **contractor** shall provide an apportionment of **preliminaries** per **section.** Should the **contractor** fail to provide the apportionment of **preliminaries** per **section** the categorised amounts shall be prorated to the cost of each **section** within the **contract sum** as determined by the **principal agent**

Option B	The **preliminaries** shall be adjusted in accordance with a detailed breakdown of **preliminaries** amounts for the **works** or of a **section** to be provided by the **contractor** within fifteen (15) **working days** of possession of the **site.** Such breakdown shall inter alia include administrative and supervisory staff charges and charges for the use of **construction equipment**, all in terms of the **programme** The adjustment of **preliminaries** shall be based on the number of **calendar days** extension to the date of **practical completion** to which the **contractor** is entitled with an adjustment of the **contract value** as compared to the number of **calendar days** in the initial **construction period** taking into account the resources planned for the period of construction during which the delay occurred (not for the period added to the initial or extended date for **practical completion**) Where the **contractor** does not provide the detailed breakdown of **preliminaries** within the period stated, Option A shall apply

E FORM OF TENDER

E 1.0 Tenderer's details

Name			
Legal entity of above		Contact person	
Business registration number		Telephone number	
VAT/GST number		Mobile number	
Country		E-mail	
Postal address			
		Postal code	
Physical address			
		Postal code	

E 2.0 Acceptance of tender conditions

By submission of this tender to the **employe**r the tenderer offers and agrees to execute and complete the **works** and to remedy any **defect**s in conformity with the specification for the tender amount stated

The tender shall remain in full legal force for forty-five (45) **calendar days** from the closing date of the tender. The tenderer accepts liability for loss or damages that may be suffered by the **employer** should the tender validity period not be honoured

The lowest or any tender will not necessarily be accepted by the **employer** nor will reasons be given for such a decision

E 3.0 Tender amount compilation

			Amount
Tenderer's work excluding **tax**			
Tax	15.00	%	
Total tender amount including **tax**			
Total tender amount including **tax**, in words			

Signature	Tenderer who by signature hereto warrants authority		Place		
Name		Capacity		Date	

Signature	Witness		Place		
Name				Date	

E 4.0 Tender qualifications

Refer Returnable Schedules T2.2.3

PART C1.3

MINOR WORKS AGREEMENT

A COPY OF THE MINOR WORKS AGREEMENT CAN BE OBTAINED FROM:

The Association of South African Quantity Surveyors
P O Box 3527
HALFWAY HOUSE
1685

TEL: (011) 315 4140
FAX: (011) 315 3785

PART C1.5

SPECIAL GAS CONTRACT CONDITIONS

The following terms shall, unless the context otherwise requires, have the meanings hereunder assigned to them:

'Approved' 'accepted' or 'directed'	As approved, satisfactory, accepted or 'satisfactory' directed by the Architect.
'Accessories'	'Accessories' in pipe or tubing systems are valves,
'Balancing'	Work adjustments and checks necessary to proportion the flow within the distribution system (sub-mains, branches, terminals) in accordance with specified design quantities.
'Commissioning'	Work necessary to place the installation and work covered by this specification into normal operating condition.
'Concealed'	Embedded in masonry or other construction, installed in furred spaces within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.
'Construction Manager'	Construction Manager of the Principal Contractor or the Construction Manager directly appointed by the Employer for the management of the contract
'Latest edition'	Of a standard, regulation, code or law shall be the latest edition promulgated and available, from the publisher to the public, on the tender closing date.
'Exposed'	Not installed underground or concealed as defined above.
'Formed Bend'	Bend formed on site from pipe or tube, using appropriate tools and bending machines, manufactured for the purpose by a pipe or tube manufacturer or approved by a pipe or tube manufacturer as applicable.
'Indicated' 'shown' or 'noted'	As indicated, shown or noted on drawings and/or specifications.
'Install'	To erect, mount and connect complete with all related accessories.
'Polished/ Unpolished'	Stainless steel tube surface finish: polished or bright annealed, or unpolished or pickled
'Provide'	To supply, install and connect up complete and ready for safe operation.
'Similar' or 'equal' by name.	Of approved manufacture equal as regards to materials, weight, size and efficiency of performance to product specified
'Supply'	To purchase, procure, acquire and deliver complete with all related accessories.
'Testing'	Work and checks necessary to determine qualitative and quantitative performance of equipment, installation and workmanship.
'Wiring'	Conduit, fittings, wiring, junction and outlet boxes, switches, cut-outs and socket outlets and all related items.
'Work'	All labour, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

Abbreviations used in these documents shall mean: -

'ASIB'	Automatic Sprinkler Installation Bureau.
'AFI'	Air Filter Institute.
'AMCA'	Air Moving and Conditioning Association.
'ASA'	American Standards Association.
'ASHRAE'	American Society of Heating, Refrigeration and Air Conditioning Engineers.
'ARI'	Air Conditioning and Refrigeration Institute (USA).
'ASME'	American Society of Mechanical Engineers.
'ASTM'	American Society for Testing Materials.
'AWWA'	American Water Works Association.
‘BCGA’	British Compressed Gases Association
‘B/S, b/s’	Black steel
'BSS'	British Standard Specification.
'BSI'	British Standard Institute.
'BS CP'	British Standard Code of Practice.
'BS EN'	UK Implementation of European Standard (EN).
'CIBS'	Chartered Institution of Building Services.
‘CoP’	Codes of Practice
'DIN'	German Standards Institute.
‘EIGA’	European Industrial Gases Association
‘EN’	European Standard, Norme Européenne, Europäische Norm
‘FAD’	Free Air Delivery at atmospheric pressure
‘GSA’	Gas Sampling Arrangement (for gas testing)
‘HTM’	Hospital Technical Memorandum
'HVAC'	Heating and Ventilating Contractor's Association (UK).
'NBFU'	National Board of Fire Underwriters (USA).
'NBS'	National Bureau of Standards (USA).
'NEMA'	National Electrical Manufacturers Association (USA).
'NFPA'	National Fire Protection Association (USA).

‘TA’	Terminal Outlet Arrangement consisting of mounting brackets/plates, piping, fittings and accessories to be fitted at end user points, as specified on drawings.
'SABS'	South African Bureau of Standards.
‘SANS’	South African National Standard
'SICO'	Safety, Instrumentation, Control, Operation.
'SMACNA'	Sheet Metal and Air Conditioning Contractors National Association, Inc. USA).
‘S/S, s/s’	Stainless Steel; grade as specified in the schedule or on the drawings
‘SVA’	Solenoid Valve Arrangement consisting of mounting brackets/plates, piping, fittings and accessories as specified on drawings.
'UL'	Underwriters Laboratories.
‘VA’	Valve Arrangement consisting of mounting brackets/plates, piping, fittings and accessories as specified on drawings.
‘VB’	Valve box for housing valves, recessed, flush or surface mount

1. The contract works to be carried out consists of the engineering, manufacturing, supply, delivery, offloading, erection, testing, balancing and commissioning into service, guarantee and maintenance of the Gas installation as described in the document and as shown on the drawings.

2. The engineering, quality control and inspections, equipment selection, preparation of shop drawings, testing, balancing, commissioning and preparation of operating and maintenance manuals, are to be executed in a systematic manner, once programmed, under the Engineer's general supervision and direction.

1. ENGINEER'S DRAWINGS

1.1 The drawings prepared by the Consulting Engineer show general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the Gas contractor to estimate the cost and to determine how the system must be installed, tested, balanced, inspected, operated, serviced and maintained.

1.2 These drawings are not dimensioned Shop Drawings and cannot be used as Shop Drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

1.3 Design/Selection/Construction Details and Installation Arrangements for Equipment and/or Distribution Systems which are available from either the Manufacturer/Supplier in their officially published literature/documentation, design/application manuals, or other authoritative sources such as:

1) SABS 2) BCGA 3) EIGA 4) ISO

shall be used as the basis for Shop Drawings and specific source identified at submission stage.

Where these details are non-existent or not sufficient, reference might be made to the Sections and Detail Drawing.

2. GAS CONTRACTOR'S DRAWING, EQUIPMENT SELECTION AND SAMPLE SUBMISSIONS

2.1 SHOP DRAWING SUBMISSIONS

2.1.1 Shop Drawings shall indicate all equipment, distribution systems, testing/ inspection/ instrumentation positions, access requirements and builder's work requirements.

Builder's work requirements shall include all work to be provided by others (holes in concrete and masonry bases, etc) as well as the sizes, capacities and positions of service connections.

2.1.2 Shop Drawings shall be based on the Engineer's design concept shown on the tender drawings, approved equipment selections and samples. The Shop Drawings shall be checked and passed by the Gas contractor's Chief Draughtsman and Project Engineer/Manager. The Shop Drawings shall be stamped to confirm that co-ordination with Architects, Structural and other affected Sub- contractor's drawings, has taken place.

2.1.3 Copies of Shop Drawings of all parts of the subcontract works shall be submitted to the Engineer for approval.

2.1.4 The Gas contractor may, if he so desires, obtain “electronic /e-mail” copies of the Engineer's drawings for modifications and updating if required. These drawings shall be re-titled in accordance with the Gas contractor's system and shall thereafter be submitted as the Sub- contractor's Shop Drawings. No portion of the Sub- contractor's works shall be commenced until the shop drawing has been approved by the Engineer.

2.2 “AS BUILT” DRAWING SUBMISSIONS

2.2.1 “As Built” drawings are the Shop Drawings embodying all modifications made during construction. They shall include floor- and ceiling layout drawings indicating all terminal outlets and/or traps and/or valve boxes and/or pressure sensors and/or alarm panels positions. SICO drawings are also “As Built” drawings indicating the intended functioning, capacity data and control functioning of all systems.

2.2.2 Copies of “As Built” drawings shall be submitted to the Engineer for approval.

2.3 EQUIPMENT SELECTION SUBMISSIONS

2.3.1 The Gas contractor shall select equipment which complies with these specifications. These selections shall be submitted to the Engineer for approval.

2.3.2 No equipment shall be installed until the equipment selection submission has been approved by the Engineer if the selected equipment deviates from the design concept and/or deviates from the accepted equipment offered.

2.4 SAMPLE SUBMISSIONS

Samples are any samples required by the Architect or Engineer. Samples shall be physical examples to illustrate materials, equipment or workmanship, and to establish standards by which the works may be judged. Such samples, after approval, will be retained by the Architect or Engineer for a period sufficient to ascertain that the relevant component is actually provided as per such sample, but will then be returned to the Gas contractor for incorporation in the works.

3. SUBMISSION PROCEDURES

Submission for approval will consist of the following activities executed by the Gas contractor and other parties involved:

3.1 The Gas contractor shall review, stamp, date and sign to signify his approval and submit in the manner required by the Engineer and with reasonable promptness and in orderly sequence so as to cause no delay in the work, all Gas contractor's drawings, equipment selections and/or samples required by the Subcontract documents or subsequently by the Architect or Engineer. Gas contractor's drawings, equipment selections and samples shall be properly identified as specified or as the Architect or Engineer may require.

3.2 At the time of submission the Gas contractor shall inform the Engineer in writing of any deviation in the Gas contractor's drawings, equipment selection or samples from the requirements of the subcontract documents.

3.3 Each individual Equipment Selection Submission shall be accompanied by a copy of the applicable detailed technical specification. Each clause of this specification shall be marked "complies" or "Does not comply", complete with reason stated and countersigned by the Gas contractor's Project Engineer/Manager.

3.4 Equipment Selection Submissions shall be indexed similar to the index for Part II - Equipment of the "Operating Instructions and Maintenance Manual" as described under Section 18 of Part C1.5 in order to form part of the O&M Manual.

3.5 The drawings and Equipment Selections shall be submitted in a number of copies and along the channels agreed.

3.6 By submitting drawings, Equipment Selections and/or samples, the Gas contractor represents that he has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and co-ordinated each Contractor's drawing and sample with the requirements of the Works and of the Subcontract documents.

3.7 The Engineer, on behalf of the Contractor, will review Gas contractor's drawings, Equipment Selections and samples with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Subcontract Works and with the information given in the Subcontract documents. The Engineer's approval of a separate item shall not indicate approval of an assembly in which the item functions.

3.8 The Gas contractor shall make any corrections required by the Engineer and shall re-submit the required number of corrected copies of the Gas contractor's drawings, Equipment Selections or new samples until approved. The Gas contractor shall direct specified attention in writing on resubmitted drawings to revisions other than the corrections required by the Engineer on previous submission.

1. GENERAL

1.1 The following related work to the Gas contract will be provided by others. The Gas contractor shall be responsible for the detailing, checking and ensuring that the work as listed in the schedules and shown in principle on the drawings is provided as per his detailed builder's work and related services drawings.

1.2 Instructions for Gas contractor's exact requirements shall be transmitted to the Construction Manager timeously in the form of builder's and associated services drawings in accordance with an agreed programme. Should these instructions be issued after the completion of relevant areas, then this work will be carried out at the expense of Gas contractor.

Building Contractor and Gas contractor

No.	ITEM	CONTRACT DOCUMENTS	
		BUILDER	GAS
	PLANTROOMS, VERTICAL AND HORIZONTAL DISTRIBUTION		
	- Holes through structure and brickwork		X
	- Timber frames		NA
	- Hoisting		X
	- Rigging		X
	- Pipe supports		X
	- Spreading of weight		X
	- Maintenance space for equipment		X
	- Access to shafts		X
	- Sealing off around pipes		X
	TERMINALS / PIPING		
	- Opening in walls for flush mounted outlets		NA
	- Openings in walls for piping		X
	- Supply and delivery of sleeves to site		X
	- Marking of openings and position of sleeves		X
	- Cutting/core drilling of openings		X
	- Making good of openings		X
	- Fire sealing of openings		X
	- Opening in ceiling for piping		X
	- Finish off openings in ceilings		X
	- Cut openings in plaster board ceiling for piping		NA
	- Access to outlets and controls		X
	VALVE BOXES		
	- Building in box in wall, Conduits in wall from box to ceiling void		NA
	- Making good of walls after installation of surface mounted valve arrangements and piping		X

Electrical contractor and Gas contractor

No.	ITEM	CONTRACT DOCUMENTS	
		ELECTRICAL	GAS
	GENERAL		
	- The Electrical contractor will test, demonstrate and handover the electrical system related to the GAS Contract to the GAS contractor on completion. The Gas contractor shall be responsible for testing or checking of this equipment to ensure proper and safe operation, and in so doing shall indemnify the Electrical contractor for any damage to any portion of the Gas Works	NA	
	- Rupturing capacities	NA	
	- Supply voltages at 400/230 Volt	NA	
	- 24Volt supply	NA	
	- Plantroom lighting	NA	
	- Socket outlets in plantroom(s)	NA	
	- Dynamic power factor correction	NA	
	- Rupturing capacities	NA	
	GAS BOARDS		
	- Power supply to Gas Plantroom Boards (Normal and Emergency)	NA	
	- Power supply to Gas Floor Boards (Normal and Emergency)	NA	
	- Connection of power supply in Gas Plantrooms Boards		NA
	- Connection of Power supply in Gas Floor Boards		NA
	- Connected load of each board (Normal and Emergency)		NA
	EQUIPMENT		
	- *5 Amp power supply terminated in an isolator at Alarm panels (1 per store)	X	
	- Conduits and draw wires from alarm panel to manifolds		X
	- Single phase power from alarm panel to pressure sensors		X
	- 15A switched socket outlet within 1.5m from mobile vacuum pumps	X	
	- Wiring and connecting of fans, alarm panels and pressure sensors		X
	*NOTE: Should more than one alarm panel be required for a gas store, power between panels shall be supplied from the isolator supplied by the electrical contractor and distributed to the other panels by the gas contractor		X

1.1 The Gas Contractor shall comply with the latest amendments, as at date of tender, unless applicable with immediate effect if published after date of tender, of all Acts of Parliament, regulations, bylaws of local and or other authorities having jurisdiction of the execution of the contract works, SANS and other Codes of Practice and in particular the following:

- Occupational Health and Safety Act, No. 85 of 1993
- Pressure Equipment Regulations (PER) published in Government Gazette 32395 of 15th July 2009, as regulation R734 and the accompanying SANS 347, Categorization and conformity assessment criteria for all pressure equipment, as amended.
- National Building Regulations and Building Act SANS 10400, 1977 No. R441 published in Government Gazette No. 33892 dated 23 December 2010
- Government, Provincial and Local Authorities Ordinances, Regulations, By-Laws, Rules and other statutory requirements.
- SANS 10260-1 - Distribution of oxygen, nitrogen & argon at consumer sites
- SANS 10260-2 - Distribution of hydrogen at consumer sites
- SANS 10260-3 - Distribution of acetylene at consumer sites
- SANS 10260-4 - Distribution of carbon dioxide at consumer sites
- SANS 10263 - The warehousing of dangerous goods
- SANS 10140 - Identification colour marking
- SANS 60079 - Electrical apparatus for explosive gas atmospheres
- SANS 10087 - The handling, storage, distribution & maintenance of liquefied petroleum gas in domestic, commercial, & industrial installations
- SANS 10263-2 - The storage & handling of gas cylinders
- SANS 827: The installation of pipes and appliances for use with natural gas
- SANS 7396-1 - Gas pipeline systems Part 1: Pipeline systems for compressed Gases and vacuum
- SANS 7396-2 - Gas pipeline systems Part 2: Anaesthetic Gas Scavenging disposal system
- SABS Code of Practice SANS10142-1_2017_Ed2, as amended, for the Wiring of Premises.
- BS EN 13480-3 Metal Industries Piping
- ASME B31.12: Hydrogen Piping and Pipelines
- Codes of Practice issued by the British Compressed Gases Association
- Specifications and Codes of Practice issued by the South African Bureau of Standards and British Standards Institute. The former shall have precedence over the latter where both bodies have issued conflicting specifications or codes of practice.

The installation in its entirety shall comply with regard to electrical safety and supply interference suppression requirements, with SABS and/or local authorities by-laws, and/or Post Office regulations.

All safety devices shall be tested in the presence of the Gas contractor's responsible Project Engineer under the simulated or actual fault conditions for which the safety devices are installed to prevent damage to system equipment and/or building. Confirmation of proper functioning of these safety devices shall be in the form of signed inspection reports from Gas contractor's Project Engineer.

Fire Hazard

Satisfactory test results from the National Building Research Institute or test reports from an approved testing laboratory are required, to certify the fire hazard ratings for proposed materials for insulation, covering and vapour sealing.

Such fire hazard ratings shall be as determined by the National Building Research Institute of the South African Council for Scientific and Industrial Research, and in accordance with test procedures of BS 476.

Insulating materials, finishes, vapour barriers and adhesives shall conform to the fire hazard ratings specified as follows: -

- The fuel contribution index shall not exceed 0 when compared with asbestos taken as 0.
- The smoke contribution index shall not exceed 10 when compared with hardboard taken as 100.
- The spread of flame index shall not exceed 0 when compared with asbestos taken as 0.

Any products of combustion of said materials shall be completely non-toxic and non-corrosive.

1. HOISTING

The Gas Contractor shall allow for the hoisting of all equipment, unless indicated to the contrary in the Preliminaries of the Principal Contractor, if applicable. Refer Part C2.2 Clause 10.2 Special, Attendance.

2. RIGGING

The Gas Contractor shall be responsible for rigging of his equipment into final position.

1. GENERAL

1.1 All materials shall be new, undamaged, free of rust or other defects and shall be of the best quality. Materials shall comply with the relevant SANS, BCGA, EIGA, ISO or BS specifications where applicable. The contractor shall upon the request of the engineer, furnish him with documentary proof to his satisfactions that the materials are of the quality specified. Samples of materials for testing, if required, shall be supplied by the contractors, free charge.

1.2 The installation as a whole shall be erected in a workmanlike manner, to the satisfactions of the engineer, and shall include all materials and equipment required for the successful operation of the paint specified.

1.3 Fittings, components and/or accessories shall be selected from one manufacturer, i.e. compression fittings and accessories of different manufacturers shall not be mixed in the installation.

1. PROGRAMMING

1.1 The Gas contractor shall submit to the Engineer within two weeks of appointment, a practicable work programme, based on the building completion date. The programme shall be agreed with and finally incorporated in the Contractor's programme in accordance with the relevant clauses of N/S Subcontract agreement.

This Gas contractor's programme shall state:

a) Access dates to various plantrooms to start installing sub- system equipment.

b) Access dates to clean, safe, protected vertical shafts to start modifying main distribution systems linking plantrooms and floors.

c) Access dates to either ceiling or floor plenums of the different floors (or section of floors) to start installing the sub-distribution systems (so called 1st Fix).

d) Access dates to the various rooms with completed walls and partitioning (fully cleaned out) to start installing room terminals and connect these to the sub-distribution systems (so called 2nd Fix).

1.2 The section of the programme covering submission of Structural and Installation Drawings, equipment selection, submission of inspection reports of completed sections of the installation, preparation of Operating Instructions and Maintenance Manuals, Testing, Balancing and Commissioning shall be presented in the form of a GANT CHART.

1.3 The network graphic representation must clearly depict the sequence of the activities planned by the Gas contractor, according to the Contractor's requirements, their interdependence, and time required to perform each activity. In developing the project network, the Gas contractor shall use arrow or precedence notation (on which available computer programme are based).

1.4 The Gas contractor shall furnish with the initial programme, a tabular listing of all activities listed on the programme. For each activity there shall be listed the earliest and latest finish times and the "float". Activities on the critical path shall be so indicated.

1.5 The Gas contractor shall regularly, throughout the progress of the works, amend and update the work schedule (both the network graphic representation and the tabular list of activities) to incorporate all variations, new drawings and site instructions, and all such amendments are to be subject to the Contractor’s approval and shall not amend the completion date of the project unless extensions of time have been granted by the Contractor.

1.6 If, in the opinion of the Contractor, the Gas contractor falls behind the programme, the Gas contractor shall take such steps as may be necessary to improve his progress. The Construction Manager may require him to increase the number of shifts and/or overtime operation, days of work and/or the amount of construction plant, and to submit for approval revised programmes in the form required above in order to demonstrate the manner in which the required rate of progress will be achieved, all without additional cost to the Employer.

1.7 Regular meetings to monitor progress will be held under the chairmanship of the Contractor. The meetings must be attended by as many of the representatives of the Gas contractor as the Contractor shall require

1.8 The purpose of such meetings will be to review progress against the programme, to investigate and establish actual or impending causes of delays, to instruct on such remedial action as may from time to time be necessary and generally to ensure that the progress of the work remains on programme at all times.

1. All activities, information required, approvals, etc. shall be managed by the officially appointed Gas contractor's Project Engineer/Manager to ensure completion of the Subcontract at the agreed completion date and of specified quality.

2. It shall be the duty and responsibility of this Project Engineer/Manager to identify any item such as delays, activity time overrun, late information and/or approval at least fortnightly, and describe in his standard report to the Contractor proposed action to overcome the adverse conditions to maintain the planned construction schedule.

3. It shall be the duty and responsibility of this Project Engineer/Manager to prepare a detailed tabulated construction activities breakdown with related earliest and latest dates for information required, approval, area availability and inspection.

   Construction activities are:

   a) Drawing Submissions.

   b) Equipment Selection Submissions.

   c) Off Site Manufacturing.

   d) Installation on Site.

   e) Testing, Cleaning, Leak and Pressure testing, Purging and Commissioning Procedures Submission.

   f) Testing, Cleaning, Leak and Pressure testing, Purging and Commissioning of the Works.

4. The Project Engineer/Manager shall monthly, throughout the progress of the Subcontract, amend and update the 'tabular list of activities' to incorporate all variations, delays and remedial action to ensure that the completion date will be met. He shall particularly note and report to the Contractor on unusual conditions encountered which may (or has) delayed progress of the work related to the contractor's programme.

5. The Project Manager shall monthly report to the contractor, with copies to the Architect and Engineer, in writing only and shall sign each progress report, equipment submission, drawings and inspection checklists.

6. The Project Manager shall be capable of using network diagrams to explain the sequence and actual dates used by him in his tabular form monthly report in order to prove that 'cut-off' dates are realistic and factual and not an attempt to formulate claims for delays.

7. On the request of the Engineer and/or Contractor, the Gas contractor shall remove from the works a person who is negligent in his contractual obligations.

1. ORGANISATION AND STAFF OF GAS CONTRACTOR

In addition to the Site Supervisor/Foreman, the gas contractor shall employ, (apart from the required artisans and labourers), as many trustworthy and experienced engineers, programmers, inspectors and administrators as may be necessary for the purpose of the gas contract.

2. DUTIES AND RESPONSIBILITIES

The Engineer is responsible for the design of the system.

The gas contractor shall take full responsibility and accountability for the gas installation and their personnel, who will be responsible for the engineering, installation, commissioning, testing and maintenance and repairs shall be registered with the South African Qualification and Certification Committee (SAQCC) as an Authorised Gas Practitioner for the specific, above mentioned activity, industry and the specific gas they will be responsible for. Gases shall include all gases in the relevant categories, which forms part of this contract e.g. inert, oxidant, flammable, medical, food, beverage and special gases including toxic, corrosive, pyrophoric, high and ultra-high purity or gas mixtures.

2.1 The complete gas reticulation system shall be engineered, installed, supervised, inspected, tested, commissioned and certified, maintained and repaired upon completion, by Authorised Gas Practitioners, appropriately qualified and registered with the Qualification and Certification Committee (SAQCC) for the category of work and relevant gas, they will be responsible for, i.e. as design engineer, supervisor, installer(s), commissioning, maintenance and repairs as specified and indicated on the drawings.

2.2 Where the contractor designs and manufactures a component they shall be responsible for the design of that component.

2.3 The contractor shall be responsible to select the appropriate equipment and accessories, compliant with the specification and relevant standards and regulations and submit these for approval by the Engineer.

2.4 The abovementioned Authorised Gas Practitioners shall take full responsibility for the installation by certification and sign-off thereof, in terms of the relevant codes, Occupational Health and Safety Act – No. 85 of 1993 – Sections 43 and 44 and Regulations R734 of 15th July 2009 – “Pressure Equipment Regulations (PER)”.

2.5 Where stainless steel instrument tubing has been specified for a project, the gas contractor shall be an approved installer, trained and certified by the manufacturer of the tubing system to be used. Proof of such training and certificates shall be submitted with the equipment submissions, prior to commencement of construction.

2.6 An Authorised Person or Independent Inspections Authority, commissioned by the contractor in terms of the OHS Act shall certify and sign off the installation and shall obtain the relevant approval from all relevant Authority(ies) required for the Employer to obtain the relevant permissions and permits to use the installation and to store the relevant gases in terms of all relevant legislation, codes, regulations and safe practice.

2.7 The drawings are schematic and do not purport to show the exact positions of pipe runs. Pipework shall be laid out in consultation with and to the satisfaction of the Engineer and complete shop drawings, of the layouts shall be submitted for approval by the Engineer.

2.8 Pipe sizes, details, designs, safety requirements, etc., as indicated on the drawings, shall be verified by the contractor and shall be confirmed to be in compliance with the relevant regulations and codes of practise, to the Engineer, with the shop drawing submissions.

2.9 Should any pipe size, pipe route, support, detail, specification or design indicated on the drawings, or specifications not comply with relevant regulations, codes of practise, laws or by-laws, these deviations or items of non-compliance shall be identified, by the Authorised Gas Practitioner, discussed with the Engineer and submitted to the Engineer in writing, complete with the motivation for the findings, suggested variations, modifications or alterations and the cost variation thereof for approval by the Engineer.

2.10 In conjunction with 2.6 above, the registered Authorised Gas Practitioners, who will be responsible for the certification of the systems shall advise of and install all accessories / safeties etc. required in the system by the relevant by-laws, specifications, etc. that may not be specifically mentioned in this document.

2.11 Duties and responsibilities of the Gas contractor shall inter alia include the following:

a) Engineer (modifying the current design if deemed necessary) the gas systems to comply with all applicable and relevant codes, regulations and standard(s).

b) Submission to and obtaining approval by the local authority on construction and as-built drawings.

c) Installation including construction, instrumentation, installation, pressure and leak testing and commissioning.

d) Maintenance and repair including maintenance and repair of the gas system including inspection.

e) Programming and coordination of the works in agreement with the Construction Manager.

f) Directing his employees to ensure efficient, timely and safe execution of the work, and co-operation with the Construction Manager/ Health and safety Officer and other contractors to ensure such execution.

g) Selection and/or engineering of equipment and components into working assemblies all in conformance with the design concept contained herein.

h) Equipment selection and submissions of installation drawings for approval in accordance with the required procedures and relevant applicable standards.

i) Expedition of the work.

j) Attendance of routine site progress meetings and programme monitoring meetings which may be arranged by the /Construction Manager.

k) Preparation and submission of Cleaning, Purging, Leak and Pressure Testing, Balancing and Commissioning Procedures and Programming.

l) Final inspection and leak testing to proof compliance and operation as specified and required by national or local authorities, applicable codes and/or regulations, initially for witnessing by the Engineer and thereafter, upon acceptance of the testing, witnessing by the Local Authority, for their final approval for use of the system by the employer.

m) Appointment of an external authorised person or an approved inspection authority as applicable in terms of sub-regulation (1)(c) to:

- Perform an inspection and witness a leak test(s).
- Issue a certificate of conformity after completion of a gas installation, modification, alteration or change of user or ownership in the form of Annexure 1 in the PER

1. Special care shall be taken in transport, delivery, storage of material, accessories and equipment to and on site and during installation to ensure that the entire system is in 'as new' condition and not contaminated at start-up.

2. Packaging material shall be of sufficient strength and/or temporarily reinforced during transport to - and handling on site, until installed in its final position, to ensure that the equipment “packed” retains its structural and dimensional integrity during these phases of the contract.

3. The gas contractor shall remain responsible for equipment in 'as new condition' and is not allowed to install equipment in areas or spaces where it can be subjected to damage through weather or trades for which it has not been designed.

4. The gas contractor is only allowed to install equipment intended for internal use if the following pre-installation requirements are met:

4.1 Areas are sealed and protected from outside weather - (facade and roof closed and finished).

4.2 All wet building trades are finished inspected and accepted by the construction manager, agent so that no further remedial patch-up work by building trades is required.

4.3 The areas are clean, isolated and secure (no other trades' material and labourers cross-traffic) and protected against possible damage and pilferage.

1. The gas contractor shall familiarise himself with the proposed location of the equipment and shall be responsible for ensuring that sufficient access is available on site to allow the largest component parts to be brought into position.

2. The required unobstructed space shall be left around the equipment for access, maintenance and service of the equipment in accordance with the manufacturer's instructions.

3. Equipment shall be installed so as to be readily accessible for testing, operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this, but changes of magnitude or which involve extra costs shall not be made without approval of the construction manager and relevant agent.

4. Platforms and ladders shall be provided for access to instruments and equipment requiring maintenance.

1. Repaired equipment/components will be accepted at "handover" of system if defects become apparent during start-up, testing and commissioning only at the discretion of the “Engineer”.

2. No compressors, pumps, fans or other power-driven equipment are allowed to be started-up unless screens, filters, strainers, etc. are installed and checked to prevent damage to the rotating/reciprocation equipment.

3. All necessary system cleaning, flushing, must be completed before system is started up and control valves activated.

4. PRE-START PROCEDURE

   The pre-start procedure shall comply with relevant legislation, PER, SANS 347 and the relevant SANS codes for the specific gas and HTM 02-01 Chapter 15 and Appendix A, as a guideline for the pre-start-up procedure.

   Complete and submit Pre-start and Checklist for all sub-systems

1. Concurrent with equipment submissions the Gas contractor shall submit full testing, balancing and commissioning procedures for each item of equipment and each gas system, in compliance with the relevant legislation, regulations, by-laws and SANS codes applicable to the gas system.

   Refer to SANS 10260, 10087, 827 and 7396-1 Sections 12.2 to 12.7 and Annexures C and D.

   HTM 02-01 Chapter 15 and Appendix A shall be referred to as a guide for the procedures.

2. Prior to the pre-start inspection the gas contractor shall submit and have obtained approval of a fully detailed commissioning programme.

   The programme shall include but may not be limited to the following:

   a) Checking and setting of all safety features and proving operating by simulation of overload or abnormal conditions.

   b) Setting and recording of all protective devices allowing efficient and safe operation. All settings and operating points to be recorded on SICO drawings.

   c) Full and part load tests of the system. Operating points of ammeters, thermostats and controllers, etc. to be recorded on SICO drawings.

   d) Method of adjustments to correlate operating pressure with chosen point of application on the performance curves of equipment.

   e) Systems shall be checked for flow and pressure loss and results recorded at design conditions.

   f) Checking the performance criteria by plotting it on the original selection curves of all equipment.

3. After physical completion of the subcontract works the gas contractor shall carry out all preliminary tests necessary to satisfy himself that the plant, materials and equipment comply with the provisions of the subcontract and are in a state suitable to satisfy the requirements of the acceptance tests by the Engineer. The preliminary tests shall then be completed satisfactorily before the gas contractor, through the construction manager, requests the Engineer to witness the acceptance tests.

4. The Engineer may request the gas contractor to replace any portion of the subcontract work which does not conform to the requirements of the subcontract documents.

5. In the event of the plant or installation not conforming to the requirements of the subcontract documents, the Employer shall be at liberty to either recover from the gas contractor or to deduct from the gas contract price all reasonable expenses incurred by himself or his agents attending the repeated test.

6. After physical completion has been reported and all defects made good, "start-up" shall take place and the above check-out procedures shall be carried out.

7. Prior to the carrying out of acceptance tests the gas contractor shall operate the entire system for as long a period as may be required to provide satisfactory performance at all times in the occupied spaces served by that system for up to 24 hours a day continuously.

8. The gas contractor's Operator(s) shall be fully conversant with the plant operation and experienced in running similar installations. The gas contractor shall train the Employer's operator(s) to enable them to be responsible for and capable of operating the plant. Logging of the plant operation shall commence once plant has been commissioned and the gas contractor shall continue logging until the acceptance tests have been carried out and the plant handed over.

9. The gas contractor shall also log, as part of his commissioning, record the gas usage over a minimum period of six months for each gas in every plantroom so as to determine the replacement intervals of the cylinders and the amount of full cylinders required in the storage facility.

10. All tests results shall be recorded in a field test report for insertion in the operating instructions and maintenance manual. Values of operating pressure, shall be marked on gauges and instruments as appropriate and recorded on SICO drawing.

11. Marking operating values (pressures etc.) on gauges as appropriate.

12. The field pressure, leak testing, balancing and commissioning report shall be signed off by the Employer or his representative.

13. Compile a field test report of the above tests for inclusion in the operating and maintenance manual.

14. All systems shall be commissioned in strict accordance with the Manufacturers' instructions.

Completion of the works will occur after the following procedure has been certified by the principal agent as having been carried out in accordance with the specification: -

1. After the defects are made good and approval of the Engineer is obtained, physical completion has been reported to the construction manager by the gas contractor.

2. Cleaning, Pressure, leak testing and purging has taken place and test results have been witnessed (where required), recorded and finally approved by the contractors Engineer as well as the engineer from the professional team.

3. All piping has been colour coded and identified for the gas inside the pipe as per standard identification codes and standards.

4. Certificate of conformity has been issued by an authorised person or an approved inspection authority employed by the gas contractor.

5. A fire clearance certificate by the Local Authority Fire Department for the gas installation.

6. Three hard copies and 2 electronic soft copies of indexed manuals containing complete Operating Instructions and Maintenance Manuals have been furnished to the Principal Agent after approval by the Engineer, the gas systems, equipment and controls, and for all other equipment or systems specified under this subcontract. The Operating Instructions and Maintenance Manuals shall be as set out and described in Part C1.5 Section 18.

1. The tender adjudication will take into account the Tenderers official Quality Manual and Quality Control Systems.

2. The manual shall not only describe in detail the qualifications, responsibilities and authority of the proposed Project Engineering, Managing and Quality Assurance personnel but also the firms' technical standards and detail procedures for:

   a) Programme Submission and Contract Management.

   b) Equipment Selection Submissions.

   c) Installation/Shop Drawing Submissions.

   d) Gas system(s) Testing, Balancing and Commissioning Manual Submission.

   e) Site Installation Inspection Report Submissions.

   f) Progress Payments and Evaluation.

3. The quality of managing, as reflected in the Gas contractor's submission of:

   a) Work programming.

   b) Equipment selection.

   c) Shop drawings.

   d) Testing, Balancing and Commissioning Documentation.

   e) Operating Instructions and Maintenance Manuals.

   f) Inspection Record Cards/Checklists shall be in accordance with ISO-9000 or otherwise/approved.

4. No portion of the work shall commence before this manual has been approved by the Engineer.

1. The Gas contractor shall guarantee that the gas and associated systems will be installed and adjusted in such a manner that it will, subject to the capacity limits specified in Part C3 maintain the flows and pressures specified in Part C3.

2. Noise levels in rooms caused by the operation of the gas and associated systems, whether generated within the rooms or through duct or floors, etc. shall not exceed the values given in Part C3 at any point within the room.

3. The gas contractor shall guarantee the works described in this document against failure of any sort for a period of 12 months after certifying completion of the gas system.

4. Any repairs and replacement of parts or equipment during the 36 months guarantee shall be performed without any cost to the Employer.

1. PLANTROOOM INSTRUCTIONS

1.1 Large scale wiring and sub-system safety, instrumentation, and control operation diagrams shall be mounted near each sub-system in plantrooms. They shall be complete with regard to:

a) Final Sub-system Schematics

b) Block Logic Operating Sequence for:

- Normal/Abnormal/Emergency Conditions
- Written Description of Plant Operation
- Sub-system Equipment performance, Instrumentation and Safety Settings
- Automatic Control

The diagrams and operating instructions shall be printed on high quality, non-deteriorating paper, framed behind glass or plastic laminated and located in a properly illuminated position.

1.2 Copies of Government Acts and Local Regulations, as required, shall be mounted within glazed or plastic covered frames in the plantrooms, in positions to be approved by the Engineer.

1.3 Plantroom log sheets shall be provided in each plantroom. The log sheets shall contain operating details of each gas system with provision for performance logging and making service notes.

2. OPERATING AND MAINTENANCE MANUALS

2.1 The Sub-contractor shall furnish to the Engineer before the Works are taken over a draft copy of the Operating and Maintenance Manuals, As Built drawings and Preliminary Commissioning Data for approval or comment.

2.2 Three hard copies and two electronic copies on USB drives/memory sticks of the approved Operating and Maintenance Manuals, As Built Drawings, final Commissioning Data and all Certificates shall be submitted to the Engineer prior to Handover/Practical Completion/Operation of the installation by the Employer. Three hard copies shall be issued as follows:

a) 1 copy to the Employer's agent.

b) 2 copies to the Employer.

c) Original to be kept by the gas contractor for a minimum period of 10 years.

2.3 The manuals shall be comprehensively indexed and bound with the name of the project type written on the front cover. Files shall be sequentially numbered.

2.4 The manuals shall be arranged in four parts: -

a) Part I - Certificates

b) Part II - Systems Operations

c) Part III - Equipment details and all test results

d) Part IV - As Built Drawings and schematics

2.4.1 Part I - System Operation

This part describes the system in the building broken down in sub-systems, their operation, trouble shooting and corrective action, and monitoring and logging by means of text, graphics, table, flow charts, etc.

The contents of this section of the manual shall be arranged in accordance with the following index and shall contain information requested against each index heading:

A. Description of each Gas system in building
B. Gas System Operation
C. Detailed Gas System Description
D. Gas Systems Users department and gas engineers Instructions

A. DESCRIPTION OF THE GAS SYSTEM BUILDING
A.1 Total system concept, broken down in sub-system "Blocks" In form of pure Engineering (Non-building configuration) schematic showing: - 1. Plants with manifolds and instrumentation 2. Distribution System including all solenoid and shut off valves including normal position of valves 3. Gas outlets The same drawing is Pictorial Index for contents of Manual.
A.2 Physical location of the Gas systems and Distribution systems in the building Coloured drawings, maximum size A3 - with codes, notes and special explanatory isometrics or photographs arranged in the sequence as shown on the master schematic drawing starting from gas outlets in the room , pressure reducing stations, pipe distribution and ending at the cylinders in the various plantrooms. Estimated maximum gas consumption for each gas system
B. GAS SYSTEM OPERATION
B.1 Operating instructions Normal daily operating instructions for the total system. In the form of block logic flow diagram, showing how gas systems are started manually and/or automatically.
B.2 "Abnormal" Operating Instructions After hours, emergency, gas failure override selection of operation mode of gas systems. In the form of decision flow diagrams showing the action of the Gas Operator in detail depending on the type of failure, section of building impacted on.

C.	**DETAILED GAS SUB-SYSTEM DESCRIPTION**
C.1	Normal Sub-system Operation In the form of sub-system schematic drawing. Drawing with the following five subdivisions: - i. Gas-system schematic ii. Tested performance, instrumentation, safety settings. iv. Detailed capacity control description. v. Filled in commissioning results on SICO.
C.2	Abnormal sub-system operation (equipment and/or control failure). In the form of a decision flow diagram showing the action of the operator depending on the equipment failure, malfunctioning, etc.
C.3	Gas-system performance log and report forms For use by system operator/inspector to monitor and report on system performance. In the form of the standard sub-system logging and report form for each gas-system, on which all "normal operating conditions" are listed and against which actual gas-system performance must be monitored.
C.4.	Scheduled list of all equipment to include Description, Make, Model Number and Suppliers name and address.
D.	**GAS SYSTEMS END USERS INSTRUCTIONS**
D.1 i) ii)	End user circular in the form of decision flow diagrams and graphics showing: - Actions of the end-user when experiencing problems with gas pressure/flow. Relocation of terminals due to change in experiment requirements.
E.	**LAYOUT DRAWINGS**
E.1 i) ii)	Reduced to size A3, copies of all "As Built" Drawings and Diagrams to include the following: Plant layout drawings showing the actual positions and sizes of all plant and equipment, shafts and pipes, the location of all panels, valves and controls and discharge points. Control diagrams and schematic piping diagrams noting, where pressure reducing stations, solenoid, shut-off valves, instrumentation are located.
F.	**OVERALL SUMMARY OF MAINTENANCE / SPARE PARTS**
F.1	In schedule form setting out each item of equipment, the description and frequency of the required maintenance operations as necessary for preventative maintenance of the Gas installation as installed.
F.2	List of spare parts supplied (In accordance with Supplier's recommendations with detailed description of each part, make, model or part number and Supplier's name and address.

2.4.2 Part II - Equipment

This part shall be sub-divided on an equipment basis as sequenced in Project Technical Specification. The following checklist shall be used as a guideline in indexing and sequencing the Manufacturer's information and results of final test data.

A. Description Literature

1. Catalogue Cuts, Brochures or Shop Drawings
2. Dimensional Drawings and Record Drawings
3. Materials of Construction
4. Parts of Designation

B. Operating Characteristics and Commissioning Results

1. Performance tables, Charts or Curves and marked Operating Point or Points
2. Pressure, Temperature Limitations
3. Safety devices and Settings
4. Final approved pressure, leak and commissioning results.

C. Operating Instructions

1. Pre-start Checklist
2. Leak test Procedure
3. Inspection During Operation
4. Adjustment and Regulations
5. Testing
6. Detection Signals

D. Inspection Instruction and Procedures

1. Normal and Abnormal Operating.
2. Schedule of inspections to be conducted and the frequency thereof
3. 'Trouble Shooting' Guides

E. Maintenance and Instructions and Procedures

1. Schedule of Routine Maintenance
2. Procedure
3. 'Trouble Shooting' Guides.

F. Parts List

G. Spare Parts

1. Essential Spares to be Stored by Building Owner.
2. Suppliers details for all accessories, gauges, fittings etc.

H. Supplier Data

I. Maintenance and Service Contracts

2.4.2 Part III – As Built Drawings

In addition to reduced sets of drawings in each set of manuals one set of full scale drawings on high quality paper and with DXF files of the drawings shall be provided.

As Built drawings shall be CAD drawings and shall be layered and numbered in accordance with an agreed standard, available on request from the Engineer

1. The Gas Contractor shall furnish free of charge all maintenance on the entire subcontract works for a period of twelve months after Practical Completion or Handover of the Gas Contract or Principal Contract works, where applicable. Maintenance shall include systematic examination and adjustment of equipment at least once a month.

2. The Gas contractor shall in the course of such maintenance, or on call during the maintenance period, repair or replace defective parts, and shall use only genuine parts produced by the manufacturer of the original part.

3. The Gas contractor shall supply all replacement, materials, components, etc. during the free maintenance period.

4. Refer to Part C4.7 for details of the maintenance contract applicable to this subcontract.

5. The 'Free' maintenance contract can be extended in accordance with the Detailed Maintenance Specification.

The Gas Contractor shall allow, in their tender rates, the cost for working in a “Live Building Environment”. This means:

1. The Employer will not vacate the building for this project. Therefore, the Tenderer shall allow in his/her tender rates for normal hours but keeping in mind that the hours will be dictated by the Construction Manager’s Construction Programme, or a program agreed with the Employer.

2. This could mean that a certain laboratory or area is fully vacated/accessible only for certain hours in the week, as determined by the Employer’s operational requirements for that laboratory.

3. A reasonable amount of hours would be allowed by the in the Construction Programme to ensure that the Gas Contractor would not be forced to work after hours, weekends or public holidays.

4. The successful Gas Contractor could negotiate the Construction Programme with the Construction Manager but the final decision on what is a reasonable programme would rest with the Construction Manager or the Engineer, where no Construction Manager is involved.

5. If, due to the circumstances caused by the Employer or any of the Employer’s other contractors on site, the Gas Contractor is forced to work after hours, weekends, public holidays he/she will be compensated for it. Proof of such hours worked would have to be provided by the successful Gas Contractor to the Contracts Manager. However, proof of such hours is not a guarantee that the successful Tenderer would be compensated. The Construction Manager or Engineer will take all relevant factors into account and, once again, the final decision rests with the Construction Manager or Engineer, as applicable.

6. A biometric time and attendance system may be used in this project and the data will be used to adjudicate overtime claims. It is the responsibility of the successful Tenderer to ensure that its employees use the system as prescribed. If not no claim for overtime would be entertained.

PART C2

PRICING DATA

1. GENERAL

1.1. These Bills of Quantities contain pages numbered consecutively in each bill as indicated in the Master Index. Before the tenderer submits his tender, he should check the number of pages, and if any are missing or duplicated or the figures or writing indistinct, or the Bills of Quantities contain any obvious errors, he should apply to the enquirer at once and have same rectified, as no liability whatsoever will be admitted by the enquirer in respect of errors in tender due to foregoing.

1.2. The Bills of Quantities form part of and shall be read in conjunction with the specifications and drawings which contain the full description of the work to be done and material and equipment to be used.

1.3. Definitions and abbreviations used in the Bills of Quantities are listed in Part C1.5 Section 01.

1.4. Tenders shall be submitted for initial consideration on the declaration of the total value of the bills, Bill Summary, Non-Scheduled Bill Items, Rates and Extra over Rates. Subject to declaration of intent to enter into a contract, the bills priced in detail shall be made available within 4 working days upon request to submit the completed bill.

1.5. The enquirer may request the submission of completed bills by more than one tenderer subsequent to the tender opening where special circumstances warrant this request.

1.6. The total sum in the Form of Offer, Tender Form; other sum, subsequently negotiated between the enquirer and tenderer; shall constitute the contract sum of the successful tenderer. Tenderers are advised to check their item extensions and total additions, as no claim for arithmetical errors or omissions will be considered.

1.7. "No alteration, erasure or addition is to be made in the Bills of Quantities. Should any alteration, erasure or addition be made and included in the contract Bills of Quantities; it will not be recognized or accepted and the original wording; prior to the unauthorized alteration, erasure or addition; of the tender Bills of Quantities will supersede and be adhered to."

1.8. The tenderer will receive the Bills of Quantities in a .pdf format as well as a Microsoft Excel.xlsx format. Both versions shall be submitted, but the .pdf version (i.e. not a .pdf version of the Excel file) shall take precedence over the Excel version, for tender evaluation and contractual purposes. The Microsoft Excel version may be used by the tenderer, strictly for capturing of rates only. Rates shall be captured in the 'LOCAL PRICE' column. Rates of line items having a foreign price component shall be broken down and all components including the 'CURRENCY', 'FOREIGN PRICE' and 'EXCHANGE RATE' captured in these columns for each line item. All columns, including the 'RATE' column is protected. The 'RATE' column is a summation of the converted 'FOREIGN PRICE' and 'LOCAL PRICE'. Tenderers have to provide for their profit in the 'local price' column together with any other local price components.

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT	CURRENCY	FOREIGN PRICE	EXCH RATE	LOCAL PRICE
					0				

Figure 1: The .xlsx Bill of Quantities column layout

1.9. The priced Bills of Quantities of the successful tenderer will be checked and the enquirer reserves the right to call for reasonable adjustments to any individual price and to rectify any discrepancy whilst the total tender price, as submitted, remains unaltered. Rectifications would entail that calculations need to be done in reverse resulting in the item rate(s) being altered to resolve discrepancies as no change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted. Should the tenderer wish to withdraw his tender as a result of the rectifications, the tenderer may do so in writing. All discrepancies need to be resolved before award of the contract."

1.10. The responsibility for the accuracy of the quantities written into the bills remains with the party who prepared the bills. The tenderer shall be relieved of responsibility of measuring quantities at the tender stage, and tender sum submitted shall be in respect of the quantities set out in the bills, although he will be required to make his assessment of items such as fixings, etc. from details stated in the bills and shall include in the item prices for such small installation materials as are required for the complete installation in accordance with the specification.

1.11. The Contractor and the Employer or his Agent may agree that the total of any bill or bills, including any changes by way of additions thereto or deductions therefrom, represents a fair and accurate qualification of the items set out in the bills and the parties may agree final payment on that basis. In the event of any dispute as to the quantities, then the disputed item or items shall be adjusted where necessary.

1.12. Quantities in these Bills of Quantities shall not to be used for ordering purposes.

1.13. Changes in the scope and extent of the work included in the Bills shall be allowed to meet the Employer's requirements.

1.14. Unless separate rates for the supply and for the installation of any item are specifically called for, the supply and installation costs of any item shall be fully included in the unit price.

1.15. The description and pricing of each item shall, unless otherwise stated herein, be held to include making, conveying and delivering, unloading, unpacking, setting, fitting and fixing in position, cutting and waste, patterns, templates, plant, return of packings, profit and all other obligations arising out of the conditions of contract, excluding preliminaries.

1.16. Unless measured separately in the bills, with the related equipment, cost for the following items should be included in Bill No. 1 Preliminaries, Section D: Special Conditions of Contract Agreement (Refer to Clause C1.5 for descriptions):

1.16.1. Testing and commissioning. (Refer Part C1.5 Section 15)

1.16.2. Free maintenance. (Part C1.5 Section 20)

1.16.3. Guarantee (Refer Part C1.5 Section 18)

1.16.4. Maintenance and guarantee, extended beyond the Free maintenance period (Refer Part C4.7)

1.16.5. Hoisting and rigging i.e. rental cost of mobile cranes with related cost of hoisting and rigging should be listed separately. All other hoisting and rigging, including hoisting by builder's cranes, truck mounted cranes for off-loading of equipment, etc. shall be included in the installation cost of the line items.

1.16.6. Labels on equipment, excluding statutory signage and labels, which should be included with the equipment rate.

1.17. The labour and transport rates and the overhead and profit percentage included for Non-Scheduled Bill Items in the tender shall form part of the contract.

1.18. Tenderers shall price the Preliminaries under any or all of three groups, i.e.:

1.18.1. A fixed amount.

1.18.2. An amount varied in proportion to the final contract value as compared to the tender price;

1.18.3. An amount varied in proportion to the final contract period as compared to the originally specified contract period.

1.19. The allocation of prices to the three categories listed above shall be realistic and the Contractor may be required to justify the allocation of the prices. Attention is particularly drawn to the rights reserved in terms of Clause 1.9 above.

1.20. Any work for which a budgetary allowance has been made, shall be priced in terms of the relevant Contract agreement as per Part C1. Any balance remaining shall be deducted from the budgetary allowance in the contract sum.

1.21. The quantities in these Bills of Quantities are measured provisionally. All work executed in accordance with the workshop drawings approved by the Engineer shall be re-measured by the agent who measured the original Bill of Quantities and priced at rates contained in, or based on, the priced Bill of Quantities.

1.22. Provision is made on the Tender Form for the Value Added Tax to be added, as applicable at date of tender closure.

1.23. Monthly progress claims may be based on the percentage completion of the items under the main headings.

1.24. Where escalation is calculated in terms of CPAP, all non-scheduled item prices shall be de-escalated to the base date. Alternatively, the non-scheduled item could be treated as a proven cost item.

2. METHOD OF MEASUREMENT

2.1. Gas Piping

2.1.1. Piping and tubing shall be measured in meters, stating the external diameter in accordance with accepted trade usage. The rate for piping shall include cutting, jointing, cleaning and fixing. The lengths of pipes shall not be measured over/through fittings, valves, pumps or inline instruments. Pipe supports and brackets shall be included in the pipe rate and shall include fixing to suspending structures and/or surfaces.

2.1.2. Purging of piping and equipment with inert gases and final purpose gas shall not be included in the pipe rate but shall be included in the commissioning of the system.

2.1.3. Piping is measured with distinction being made between the various pipe materials in the item descriptions.

2.1.4. Cleaning of piping and tubes for oxygen compatibility, shall form part of the pipe and/or tube rates.

2.2. Pipe fittings and accessories

2.2.1. Pipe and tube fittings shall include all bends, elbows, tees, crosses, reducers, flanges, blank flanges and blanking plates complete with gaskets/seals, unions, end caps, sockets for mounting sensors, coiling of tubes, etc. measured individually under the various material types of piping.

2.2.2. Pipe and tube accessories shall include all accessories to the piping systems, including their specific connectors and connection pieces, seals, gaskets, O-rings, reducers, etc. required to be fixed to the pipe system, e.g. valves, pressure regulators, pipe/tube mounted instrumentation, filters, traps, flexible connections, painting, cladding, measured under Pipe and Tube Accessories. Where reducers are required to connect an accessory to the piping, these shall be included with the accessory item rate.

2.2.3. Pipe fittings and accessories shall be billed as “fitting welded” piping and the rate shall include all necessary welds as welds are not measured separately. Pipe fittings such as unions, elbows, bends, tees, junctions, etc. to pipes shall be given listed separately in the bill except for fittings smaller than or equal to 30mm diameter which will be grouped together.

2.2.4. Connecting fittings to specified accessories and fittings, shall be part of the fitting/accessory rates.

2.2.5. Rates for accessories installed at high level shall be the same as those installed at low level as the items will be installed with the piping at high level, i.e. pipe rates should include for difference in cost.

2.2.6. The bill distinguishes between bends and formed bends. 45° Bends, 90° bends and long radius bends are classified as off the shelf factory manufactured bends. Formed bends are made on site using the pipe bending equipment as specified and/or approved by the manufacturer.

2.2.7. Rates for formed bends shall be extra over rates in order to compensate for the additional labour component associated with bending and installing the pipe section. The pipe material cost will be recovered from the measured item(s) associated with the running meter of the particular pipe section.

2.2.8. Formed bends is the default construction method. Factory manufactured bends are only to be installed where approved by the engineer in writing. The Contractor shall refer to the Revit model for the locations of the manufactured bends as detailed and approved by the engineer. Should manufactured bends be installed without the written approval of the engineer the additional costs involved shall be for the Contractor’s account. Reducers shall include all types of reducing couplings, male/female threaded fittings, etc. and special seals, gaskets, etc. required for jointing the pipe, accessory, or equipment specified.

2.2.9. Threaded stainless steel (S/S) tube fittings refers to double ferule, threaded compression fittings, as specified.

2.2.10. Valves including flanges, etc. shall be given separately for all diameters of pipe. Purpose made fittings are to include for the alignment of fittings.

2.2.11. Accessories are measured in the following working pressure categories:

- Low pressure (LP): ≤ 1 600kPa
- Medium pressure (MP): > 1 600kPa, ≤ 10 000kPa
- High-pressure (HP): > 10 000kPa

2.2.12. X-ray testing of welding on piping shall be listed separately and rates shall be per welded joint apart from socket welded joints in straight piping. Welded joints shall be measured as one weld (whether socket or butt welded), elbows measured as two welds and Tees measured as three welds; to be x-rayed.

2.2.13. Accessories which forms part of a HDPE, black steel or composite tube system are generally referred to as HDPE, black steel or composite tube accessories. That does not necessarily indicate the material of which these accessories are manufactured from, but shall mean that the accessories shall be compatible with the piping and the gas type,

purity, pressure and temperature specified. The particular accessories shall be available with the necessary connectors, flanges, etc. to be installed in the piping system.

2.3. Pipe painting and labelling

2.3.1. Pipe labelling and painted bands shall be included in the rates for pipe measured per meter.

2.3.2. Where full length of pipe painting is required, this shall be listed separately and measured per meter of pipe.

2.4. Outlets

2.4.1. Terminal Outlet Arrangements (TA) shall include all accessories and fittings, e.g. mounting plates, mounting brackets, piping, fittings, connectors, valves, pressure gauges, etc. as per detail drawings and schedules on the drawings or in the specification.

2.4.2. Medical gas outlets shall be measured in numbers, e.g. flush or surface wall mounted, bedhead or pendant mounted.

2.5. Traps, valve boxes, valves and alarm panels

2.5.1. Traps, valve boxes and alarm panels shall be given in number. Valve boxes shall be measured complete with the different valve size included in the price.

2.5.2. Valve Arrangements (VA) and Solenoid Valve Arrangements (SVA) shall include all accessories and fittings, e.g. mounting plates, mounting brackets, piping, fittings, connectors, valves, pressure gauges, etc. as per detailed drawings and schedules on the drawings or in the specification.

2.5.3. Other valves shall be billed in numbers distinguishing between the different types of valves i.e. diaphragm, ball type.

2.5.4. Alarm panels shall be in number for each type i.e. Master, slave and local given with the amount of alarms required.

2.6. Supports

2.6.1. Mounting height of piping, cable trays, cable ladders and trunking, suspension height from overhead structure shall be determined from drawings and shall be included in pipe and/or rates, complete with all hangers, galvanized threaded or other rods, bolts, nuts, anchors, clamps, drilling or welding for fixing of the above.

2.6.2. Rates for pipework shall allow for “normal” supports. Where trunking, cable trays or cable ladders are required for pipe supports, the trunking, trays and ladders shall be billed separately, but the pipe brackets, clamps and supports shall be included in the pipe rates.

2.6.3. Where additional supports between roof trusses and purlins are required or where stands for equipment have to be provided, these supports or stands are billed separately.

2.6.4. Trunking, cable trays and cable ladders shall be billed separately and shall include fixing to suspending surfaces at a maximum of 1.5m centre to centre between hangers.

2.6.5. Wiring ducts (trunking), cable trays and cable ladders’ rates for bends / elbows shall include for internal, external and horizontal bends/elbows.

2.6.6. ‘Square’ bends or Tees in cable trays and cable ladders shall be manufactured from mitred corners, cable trays or ladders. Cut ends of trays and ladders shall be corrosion protected as specified in Part C3.2 Section 03

2.6.7. Where cable trays, trunking or wiring duct and cable ladders are specified for protection of piping against walls or suspended from slabs or ceilings, all special fixing brackets, frames for rigidity and strengthening thereof shall be included in the rates per meter.

2.7. Spares and replacements

2.7.1. Any spares to be billed separately in detail.

2.7.2. Filters and other elements to be replaced during the guarantee period to be billed separately.

2.8. Commissioning

2.8.1. The commissioning price included in the preliminaries shall include for all activities listed in the commissioning specification as detailed.

3. PRELIMINARIES

3.1. Refer to Part C2.2 for Preliminaries

PART C2.2

BILLS OF QUANTITIES

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 1 Preliminaries			**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
	Note 1: Minor Works Agreement				
	The agreement entered into between the employer and the contractor is the JBCC Minor Works Agreement, Edition 6.2 - May 2018 prepared by the Joint Building Contracts Committee, as amplified and amended by: 1.1The JBCC General Preliminaries Edition 6.2 - May 2018; 1.2The Spoormaker & Partners Special Conditions (September 2017 Rev 4); 1.3The Specification; 1.4The bills of quantities; 1.5Such other documents as are identified in the schedule to the agreement. (The documents referred to in Note 1 above and comprising the Minor Works Agreement, the preliminaries, the bills of quantities, and such other documents as are identified in the schedule shall collectively be referred to as the agreement)				
	Note 2:				
	The tenderer is referred to the agreement identified in Note 1 above for the full intent and meaning of each clause thereof. These clauses are hereinafter referred to by clause number and heading only. Where standard clauses or alternatives are not applicable to this agreement such modifications / corrections as are necessary are given under each relevant clause heading. Changes to any clauses shall be identified clearly. The tenderer shall allow apposite each clause for any cost involved in complying with such clauses.				
	Structure of this preliminaries bill				
	Section A:A recital of the headings of the individual clauses of the aforementioned JBCC Minor Works Agreement				
	Section B:A recital of the headings of the individual clauses of the aforementioned JBCC Preliminaries				
	Section C:A recital of the headings of the individual clauses of the aforementioned Spoormaker & Partners Special Conditions				
	Section A: Minor Works Agreement				
	Interpretation (A1-A7)				
1	Clause 1.0 : Definitions and Interpretation	CONT	1		R -
	(F..... / V:..... / T:.....)	Item			R -
2	Clause 2.0 : Law, Regulations and Notices	CONT	1		R -
	(F..... / V:..... / T:.....)				
3	Clause 3.0 : Offer, Acceptance and Assignment	CONT	1		R -
	(F..... / V:..... / T:.....)				
4	Clause 4.0 : Documents	CONT	1		R -
	(F..... / V:..... / T:.....)				
5	Clause 5.0 : Employer's agents	CONT	1		R -
	(F..... / V:..... / T:.....)				
6	Clause 6.0 : Principal agent	CONT	1		R -
	(F..... / V:..... / T:.....)				
7	Clause 7.0 : Design Responsibility	CONT	1		R -
	(F..... / V:..... / T:.....)				

BILL No. 1 Preliminaries **Refer to drawing no 191013-M-G-4GF-GS_rev0**

Item	Description	Unit	Quantity	Tariff	Amount
	Insurances and securities (A8-A9)				R -
8	Clause 8.0 - Risks, indemnities and insurances	CONT	1		R -
	(F..... / V:..... / T:.....)				
9	Clause 9.0 - Securities	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Execution (A10-A14)				R -
10	Clause 10.0 : Obligations of the Employer	CONT	1		R -
	(F..... / V:..... / T:.....)				
11	Clause 11.0 : Obligations of the Contractor	CONT	1		R -
	(F..... / V:..... / T:.....)				
12	Clause 12.0 : Setting Out	CONT	1		R -
	(F..... / V:..... / T:.....)				
13	Clause 13.0 : Direct Contractors	CONT	1		R -
	(F..... / V:..... / T:.....)				
14	Clause 14.0 : Contract Instructions	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Completion (A15-A18)				R -
15	Clause 15.0 : Practical Completion	CONT	1		R -
	(F..... / V:..... / T:.....)				
16	Clause 16.0 : Defects Liability Period and Final Completion	CONT	1		R -
	(F..... / V:..... / T:.....)				
17	Clause 17.0 : Revision of the Date for Practical Completion	CONT	1		R -
	(F..... / V:..... / T:.....)				
18	Clause 18.0 : Penalty for late or non-completion	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Payment (A19-A20)				R -
19	Clause 19.0 : Payment	CONT	1		R -
	(F..... / V:..... / T:.....)				
20	Clause 20.0 : Adjustments to the Contract Value and Final Account	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Suspension and Termination				R -
21	Clause 21.0 : Suspension or Termination	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Dispute Resolution				R -
22	Clause 22.0 : Dispute Resolution	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Subtotals for the JBCC Minor Works Agreement				R -
23	Agreement	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Definitions and Interpretation (B1)				R -
24	Clause 1.1 - Definitions	CONT	1		R -
	(F..... / V:..... / T:.....)				
25	Clause 1.2 - Interpretation	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Documents (B2)				R -
26	Clause 2.1 - Checking of documents	CONT	1		R -
	(F..... / V:..... / T:.....)				
27	Clause 2.2 - Provisional bills of quantities	CONT	1		R -
	(F..... / V:..... / T:.....)				
28	Clause 2.3 - Availability of construction information				R -
	(F..... / V:..... / T:.....)				
29	Clause 2.4 - Ordering of materials and goods				R -
	(F..... / V:..... / T:.....)				

BILL No. 1 Preliminaries **Refer to drawing no 191013-M-G-4GF-GS_rev0**

Item	Description	Unit	Quantity	Tariff	Amount
	Previous work and adjoining properties (B3)				R -
30	Clause 3.1 - Previous work - dimensional accuracy	CONT	1		R -
	(F..... / V:..... / T:.....)				
31	Clause 3.2 - Previous work - defects	CONT	1		R -
	(F..... / V:..... / T:.....)				
32	Clause 3.3 - Inspection of adjoining properties	CONT	1		R -
	(F..... / V:..... / T:.....)				
	The site (B4)				R -
33	Clause 4.1 - Handover of site in stages	CONT	1		R -
	(F..... / V:..... / T:.....)				
34	Clause 4.2 - Enclosure of the works	CONT	1		R -
	(F..... / V:..... / T:.....)				
35	Clause 4.3 - Geotechnical and other investigations	CONT	1		R -
	(F..... / V:..... / T:.....)				
36	Clause 4.4 - Encroachments	CONT	1		R -
	(F..... / V:..... / T:.....)				
37	Clause 4.5 - Existing premises occupied	CONT	1		R -
	(F..... / V:..... / T:.....)				
38	Clause 4.6 - Services - known	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Management of contract (B5)				R -
39	Clause 5.1 - Management of the works	CONT	1		R -
	(F..... / V:..... / T:.....)				
40	Clause 5.2 - Progress meetings	CONT	1		R -
	(F..... / V:..... / T:.....)				
41	Clause 5.3 - Technical meetings	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Samples, shop drawings, etc (B6)				R -
42	Clause 6.1 - Samples of materials	CONT	1		R -
	(F..... / V:..... / T:.....)				
43	Clause 6.2 - Workmanship samples	CONT	1		R -
	(F..... / V:..... / T:.....)				
44	Clause 6.3 - Shop drawings	CONT	1		R -
	(F..... / V:..... / T:.....)				
45	Clause 6.4 - Compliance with manufacturer's instructions	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Deposits and fees (B7)				R -
46	Clause 7.1 - Deposits and fees	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Temporary services (B8)				R -
47	Clause 8.1 - Water	CONT	1		R -
	(F..... / V:..... / T:.....)				
48	Clause 8.2 - Electricity	CONT	1		R -
	(F..... / V:..... / T:.....)				
49	Clause 8.3 - Ablution and welfare facilities	CONT	1		R -
	(F..... / V:..... / T:.....)				
50	Clause 8.4 - Communication facilities	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Prime cost amounts (B9)				R -
51	Clause 9.1 - Responsibility for prime cost amounts	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Attendance on subcontractors (B10)				R -
52	Clause 10.1 - General attendance	CONT	1		R -
	(F..... / V:..... / T:.....)				
53	Clause 10.2 - Special attendance	CONT	1		R -
	(F..... / V:..... / T:.....)				

BILL No. 1 Preliminaries **Refer to drawing no 191013-M-G-4GF-GS_rev0**

Item	Description	Unit	Quantity	Tariff	Amount
	General (B11)				R -
54	Clause 11.1 - Protection of the works (F..... / V:..... / T:.....)	CONT	1		R -
55	Clause 11.2 - Protection/isolation of existing works and works occupied in sections (F..... / V:..... / T:.....)	CONT	1		R -
56	Clause 11.3 - Security of the works (F..... / V:..... / T:.....)	CONT	1		R -
57	Clause 11.4 - Notice before covering work (F..... / V:..... / T:.....)	CONT	1		R -
58	Clause 11.5 - Disturbance (F..... / V:..... / T:.....)	CONT	1		R -
59	Clause 11.6 - Environmental disturbance (F..... / V:..... / T:.....)	CONT	1		R -
60	Clause 11.7 - Works cleaning and clearing (F..... / V:..... / T:.....)	CONT	1		R -
61	Clause 11.8 - Vermin (F..... / V:..... / T:.....)	CONT	1		R -
62	Clause 11.9 - Overhand work (F..... / V:..... / T:.....)	CONT	1		R -
63	Clause 11.10 - Tenant installations by direct contractors (F..... / V:..... / T:.....)	CONT	1		R -
64	Clause 11.11 - Advertising (F..... / V:..... / T:.....)	CONT	1		R -
	Subtotals for the JBCC Preliminaries				R -
	Section C: Special Conditions of Contract Agreement				R -
	Refer to Part C1.3 "Special Contract Conditions" within of the tender document				R -
	Section 01: Definitions and Abbreviations (C1.1 - C1.2)				R -
65	Clause 01: Definitions (F..... / V:..... / T:.....)	CONT	1		R -
66	Clause 02: Abbreviations (F..... / V:..... / T:.....)	CONT	1		R -
	Section 02: General (C2.1)				R -
67	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 03: Drawings and Submissions (C3.1 - C3.3)				R -
68	Clause 01: Engineer's Drawings (F..... / V:..... / T:.....)	CONT	1		R -
69	Clause 02: Contractor's Drawing, Equipment Selection and Sample Submissions (F..... / V:..... / T:.....)	CONT	1		R -
70	Clause 03: Submission Procedures (F..... / V:..... / T:.....)	CONT	1		R -
	Section 04: Work provided by others (C4.1)				R -
71	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 05: Compliance with Regulations and Standards (C5.1)				R -
72	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 06: Safety (C6.1 - C6.2)				R -
73	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
74	Clause 02: Fire Hazard (F..... / V:..... / T:.....)	CONT	1		R -

BILL No. 1 Preliminaries **Refer to drawing no 191013-M-G-4GF-GS_rev0**

Item	Description	Unit	Quantity	Tariff	Amount
	Section 07: Hoisting and Rigging (C7.1 - C7.2)				R -
75	Clause 01: Hoisting (F..... / V:..... / T:.....)	CONT	1		R -
76	Clause 02: Rigging (F..... / V:..... / T:.....)	CONT	1		R -
	Section 08: Materials and Workmanship (C8.1)				R -
77	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 09: Programming (C9.1)				R -
78	Clause 01: Programming (F..... / V:..... / T:.....)	CONT	1		R -
	Section 10: Contract Management (C10.1)				R -
79	Clause 01: Contract Management (F..... / V:..... / T:.....)	CONT	1		R -
	Section 11: Organisation and Staff of Contractor (C11.1 - C11.2)				R -
80	Clause 01: Organsation and Staff of Contractor (F..... / V:..... / T:.....)	CONT	1		R -
81	Clause 02: Duties (F..... / V:..... / T:.....)	CONT	1		R -
	Section 12: Protection against Damage (C12.1)				R -
82	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 13: Access to Equipment and Systems (C13.1)				R -
83	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 14: Cleaning and Start-up (C14.1 - C14.2)				R -
84	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
85	Clause 02: Pre-Start Procedure (F..... / V:..... / T:.....)	CONT	1		R -
	Section 15: Testing, Balancing, Commissioning, Operating of Plant and Handover (C15.1 - C15.2)				R -
86	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
87	Clause 02: Green Star (F..... / V:..... / T:.....)	CONT	1		R -
	Section 16: Guarantee (D16.1)				R -
88	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 17: Quality Management System - Testing - Inspection (C17.1)				R -
89	Clause 01: General (F..... / V:..... / T:.....)	CONT	1		R -
	Section 18: Operating and Maintenance Manuals (C18.1 - C18.5)				R -
90	Clause 01: Plantroom Instructions (F..... / V:..... / T:.....)	CONT	1		R -
91	Clause 02: Operating and Maintenance Manuals (F..... / V:..... / T:.....)	CONT	1		R -
92	Clause 03: Part I - Systems Operation (F..... / V:..... / T:.....)	CONT	1		R -
93	Clause 04: Part II - Equipment (F..... / V:..... / T:.....)	CONT	1		R -
94	Clause 05: Part III - As built Drawings (F..... / V:..... / T:.....)	CONT	1		R -

BILL No. 1 Preliminaries **Refer to drawing no 191013-M-G-4GF-GS_rev0**

Item	Description	Unit	Quantity	Tariff	Amount
	Section 19: Free Maintenance (C19.1)				R -
95	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Section 20: Special Attendance (C20.1)				R -
96	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Section 21: Pre-start Up (C21.1 - C21.5)				R -
97	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
99	Clause 03: Visual check for air tightness	CONT	1		R -
	(F..... / V:..... / T:.....)				
101	Clause 05: Electrical	CONT	1		R -
	(F..... / V:..... / T:.....)				
102	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
103	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
105	Clause 03: Roles and Reponsibilities	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Section 24: Environmental Management (C24.1 - C24.2)				R -
107	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
108	Clause 02: Contractors Reponsibilities	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Section 25: Waste Management (C25.1 - C25.2)				R -
109	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
110	Clause 02: Contractors Reponsibilities	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Section 26: Waste Management (C26.1)				R -
111	Clause 01: General	CONT	1		R -
	(F..... / V:..... / T:.....)				
	Subtotals for the Special Conditions of Contract				R -
	SUMMARY OF CATEGORIES				R -
	Category : Fixed R.....				
	Category : Value R.....				
	Category : Time R.....	Item	0		R -
TOTAL BILL - PRELIMINARIES					**R -**

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 2	**Instrument Tubing – Stainless Steel**		**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
	Extra over for S/S, 316 Grade, instrument tube fittings, welded				
	S/S instrument tube, bends				
2.1	Ø6mm S/S tube 90° Bend	No	9		R -
2.2	Ø10mm S/S tube 90° Bend	No	28		R -
2.3	Ø6mm S/S tube formed bend	No	48		R -
	S/S instrument tube, Tee's				
2.4	Ø10mm - Ø10mm - Ø10mm S/S tube Tee	No	4		R -
	S/S instrument tube, reducers (largest size)				
2.5	Ø10mm - Ø6mm S/S tube reducer	No	8		R -
	Stainless steel, 316 Grade, instrument tubing and ancillaries, unpolished, welded, including supports and fixings				R -
	S/S instrument tubing, supported in single volume space				
2.6	Ø6mm S/S pipe	m	117		R -
2.7	Ø10mm S/S pipe	m	65		R -
TOTAL BILL - INSTRUMENT TUBING - STAINLESS STEEL					**R -**

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 3	**Reticulation and Support Systems**		**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
	Perforated metal cable trays including supports and fixings				
	Pre-galvanised (GMS) cable trays, supported in single volume space c/w brackets and support fittings				
	300mm Medium duty cable tray with return				
3.1	flange	m	30		R -
3.2	300mm GSM Tray cover	m	15		R -
	Pre-galvanised (GMS) cable trays, supported in vertical space c/w brackets and support fittings				
	300mm Medium duty cable tray with return				
3.3	flange	m	16		R -
3.4	300mm GSM Tray cover	m	2		R -
	Perforated metal cable tray fittings				
	Pre-galvanised (GMS) cable tray bends				
3.5	300mm Medium duty square bend	No	12		R -
3.6	300mm Square bend cover	No	8		R -
TOTAL BILL - RETICULATION AND SUPPORT SYSTEMS					**R -**

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 4	**Pipe and Tube Accessories**		**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
	Stainless steel instrument tube accessories c/w pipe connections, supports and identification				
	316S/S Instrument tube ball valves				
4.1	Ø6mm S/S instrument tube ball valve, nylon directional handle	No	16		R -
4.2	Ø10mm S/S instrument tube ball valve, nylon directional handle	No	8		R -
	316S/S Instrument tube emergency solenoid type, shut off valves, electrically operated (Refer to schedules on drawings)				
4.3	Ø10mm S/S instrument tube 2-way solenoid valve, direct acting, 1600kPa SVA01	No	4		R -
TOTAL BILL - PIPE AND TUBE ACCESSORIES					**R -**

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 5 **Equipment**			**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
	General				
	Emergency shut-off system, electrical connections and galvanise steel conduit				
5.1	Emergency shut off push button lockout stop c/w cabling to emergency solenoid shut off valve arrangement	No	2		R -
	Gas manifolds				
	Flammable, high purity 316S/S tube gas manifolds, oxygen compatible c/w manaul change over panel, 600kPa distribution				
5.2	2 x 1 Manual change-over c/w duty / standby pressure regulator panel, braided steel hoses, connector fittings and cylinder holding brackets	No	1		R -
	High purity, oxygen compatible, 316 S/S tube gas manifolds c/w manual change over panel, 600kPa distribution				
5.30	2 x 1 Manual change-over c/w duty / standby pressure regulator panel, braided steel hoses, connector fittings and cylinder holding brackets	No	3		R -
TOTAL BILL - EQUIPMENT					**R -**

CSIR KLOPPERSBOS GAS			191013		
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION					
BILL No. 6 **Budgetary Allowance**			**Refer to drawing no 191013-M-G-4GF-GS_rev0**		
Item	**Description**	**Unit**	**Quantity**	**Tariff**	**Amount**
6.1		No			R -
TOTAL BILL - BUDGETARY ALLOWANCE - CARRIED FORWARD TO FORM OF TENDER					**R -**

PART C2.3

SUMMARY OF BILLS OF QUANTITIES

CSIR KLOPPERSBOS	191013
BILL OF QUANTITIES: LABORATORY GAS INSTALLATION	
PART C2.3	PAGE 1 OF 1

TENDER SUMMARY

ITEM	DESCRIPTION	UNIT	QTY	TARIFF	AMOUNT
1	Bill No 1 - Preliminaries				R -
2	Bill No 2 - Instrument Tubing – Stainless Steel				R -
3	Bill No 3 - Reticulation and Support Systems				R -
4	Bill No 4 - Pipe and Tube Accessories				R -
5	Bill No 5 - Equipment				R -
6	**Contingency**				
	Allow Ten (10) per cent of the contract sum, excluding contingencies, for contingencies to be used at the discretion of the principal agent and deducted in whole or in part if not required.	%	10	R -	R -
Subtotal to be transferred to Form of Tender (Excl VAT)					R -

PART C3

SCOPE OF WORK

1. THE COMPLEX

The complex is located on the CSIR Kloppersbos Explosion Research Facility, north of Pretoria. (Refer map in Directions, Part C4.10 and co-ordinates under Design Weather Parameters, Clause 3.1 below.)

The building is an existing single storey building consisting of a face-brick shell with a concrete roof. Two of the existing rooms in the building has recently been refurbished to accommodate new research equipment. The internal layout of the building consists of a corridor with rooms on both sides. The building is remotely located away from other buildings on the premises.

2. THE GAS INSTALLATION

The gas installation will consist of the following:

- New low pressure, high purity gas installation.
- New gas manifold cylinder stores, detached from the building.
- Four new gas systems serving one new set of terminal outlet arrangements (TA;'s) in each lab, including namely: Argon, Helium, Nitrogen and Methane

2.1 Existing Systems

Existing gas systems, in adjacent laboratories, remains as is and does not form part of the scope of works.

2.2 New Systems

A new gas store will be constructed to accommodate the four new gas manifolds to serve the newly refurbished labs in the facility.

Four new gas systems will be installed with new 2 x 1 cylinder, manual change over manifolds in the new centralised gas store.

No provision is made for the storage of spare or empty cylinders, as the empty cylinders will remain in position until replacement thereof upon delivery by the gas supplier.

2.3 Schedule of Gas Systems

The following new gas systems will be installed in the building:

Item	Gas	Symbol	Type	Purity (Baseline)	[1)]Pressure (kPa)	[2)]Flow Rate (l/min)
1	Argon	Ar	Inert	N4.0	1 050	0.4
2	Helium	He	Inert	N4.0	1 050	0.4
3	Nitrogen	N_2	Inert	N4.0	1 050	0.2
4	Methane	CH_4	Flammable	N5.0	1 050	0.2

1) System Nominal Working Pressure
2) Flow rate FAD at NTP

2.4 Plant

New gas systems will consist of manual change over manifolds, welded stainless steel tubing, threaded accessories, e.g. valves, regulators, etc., all suitable for high purity gas of baseline N4 and larger.

2.5 Mains and Risers

New services will be reticulated via mains piping from the new gas store on the outside of the building in covered cable trays, or pipe ducts (from Gas Store) to the entry point on the perimeter from where it will be distributed into the building.

2.6 Secondary Reticulation

Piping will enter the laboratory via a solenoid valve arrangement (SVA) incorporated with the valve arrangements (VA) at the main entrance doors of the laboratories. Valve arrangements will include the main isolating valve for each gas in a laboratory, pressure regulators where 'room' regulators are required for the gases in the laboratories and solenoid valves where the pipe entry point is close the main entrance door and valve arrangement.

3. DESIGN CONDITIONS

3.1 DESIGN WEATHER DATA

The proposed design weather data for Wonderboom Airport is as follows:

PARAMETER	NORMAL COMFORT
Latitude	25.29°S
Longitude	28.22°E
Elevation	1 1248 m
Summer Ambient Design Temperature	33.3 °C/21.6 °C
Daily Swing	9.7 °C
Winter Ambient Design Temperature	0.1 °C
Conditions within which equipment shall be able to operate as per normal:	
• Extreme Min Temperature DB	– 0.2°C
• Extreme Max Temperature DB	38.3°C
• Extreme Temperature WB	24.7°C
• Relative humidity	5 – 90%

4. LIVE BUILDING ENVIRONMENT

Construction will take place in a 'Live Building Environment' and tenderers have to make due allowance in the costing of the tender as required.

PART C3.2

STANDARD SPECIFICATION

The equipment and/or sub-system supplier/assembler shall provide under the overall responsibility and control of the Gas Contractor, all permanently installed instrumentation necessary for logging and monitoring of status and performance of equipment and components.

In addition, a hand held digital electric instrument, measuring temperature and humidity shall be provided at handover for use by the Employer.

All instruments shall be of such dimensions and mounted in position so that they are easily and accurately readable by an operator standing on the floor.

Test instruments shall be checked for accuracy by the manufacturer or by an approved laboratory with certificates being submitted prior to site tests, showing the degree of accuracy.

TEMPERATURE INDICATION

All direct reading thermometers and temperature reading devices shall have an accuracy of 0,5^{o}C and a range of -10^{o}C to 50^{o}C, unless otherwise specified, with graduation being in steps of 1^{o}C.

Stem thermometers shall be approximately 150 mm long and dial type thermometers approximately 80 mm diameter.

Wells shall be set vertical or at an angle to retain oil. Pipes smaller than 80 mm bore shall be enlarged at points where wells are installed as per following table:

-	Pipe bore (mm)	15	20	25	32	40	50	65
-	Size of enlargement (mm)	21	40	50	50	50	65	80

The sensor element shall be at the centre of the pipe.

PRESSURE INDICATION

All dial pressure gauges, excluding those for oxidant gases, shall be glycerine filled to prevent pointer vibration. Gauge component material and composition shall be selected for compatibility with the gas served. Gauges shall have an accuracy of 2%. The range shall extend to 130% of the maximum operating pressure.

All differential dial pressure gauges shall have an accuracy of 2% and shall not be less than l00 mm diameter. Zero pressure reading shall be in the centre, and the range of scale on either side shall extend to 150% of the maximum operating pressure, with provision being made for individual pressure reading.

HYGROMETERS

Hygrometers shall have an accuracy of 5% in the range of 20% to 100% relative humidity.

FLOW METERS

Air and Gas flow shall be measured by means of an in-line orifice, or Venturi tube and differential pressure gauge normally calibrated in litres per second - 5% accuracy.

All identification shall be legible and shall be painted or fixed after completion of final finishes. Identification colours shall be in accordance with SANS 10140 and/or as instructed or approved by the Engineer.

SIGHTGLASS/MOISTURE INDICATOR

A sight glass/moisture indicator shall be installed in the refrigerant circuit of each chiller and/or condensing unit.

The indicator shall be suitable to read the recommended moisture levels of the refrigerant used.

LABELS

A label shall be provided under each gauge, meter, instrument, pilot lamp, remote control switch, motor controller and panel mounted item identifying the equipment controlled and/or performance indication by such items.

The labels shall consist of a non-corroding material with a non-glossy appearance, engraved with black lettering on a white background. All labels shall slide in a screwed-on type aluminium bracket.

VALVE TAGS AND CHARTS

Numbered stainless steel tags including letters to identify the system, shall be fixed to all valves indicated on the drawings, by the handle fixing nut or if the nut arrangement is not suitable, fastened to such valves by stainless steel wires, cables or straps complete with proprietary fixing mechanism, suitable for the application.

The tags shall be 50 mm in diameter and 1 mm thick and shall have stamped-in number and letters.

The Gas Contractor shall be responsible for submitting a list of all valves and controls on the workshop and as-built drawings showing the location and function, together with diagrammatic charts featuring each piping system with valves and controls, identified by numbers and letters shown on the corresponding tags.

PIPING

In addition to painting of pipes (including insulation), colour coded polyvinyl chloride bands shall be applied to pipes identifying their content and direction of flow.

Bands shall be provided to piping at valve location, at points where piping enters or leaves a partition, wall, floor or ceiling and at least at every 5 m centres of straight runs. Where piping is concealed, bands shall be applied at valves or other devices whenever access is provided by doors or panels. Exit and entrance points to each vessel, tank or place of equipment shall be identified by bands. Insulated pipes shall be banded after insulation and painting work has been completed.

The band's width shall be minimum 150mm wide for pipes up to 250 mm diameter and 400 mm wide for larger diameter piping. The pre-printed letters on band, identifying the service shall be at least 20 mm high.

Flexible hoses for low pressure applications shall be in the colour code as specified for the full length of piping. Stainless steel braided hoses shall be identified as described above.

COLOUR CODING

Unless otherwise indicated by SANS 7396-1, for medical gas, or SANS 10140-3 for all other gases the following colour code shall be used:

	APPLICATION	REFERENCE
1	Steel bases	1
2	Motors	1
3	Fans	1
4	Pipe brackets	1
5	Concrete bases	2
6	Drain piping	2
7	Compressors	4
8	Belt guards	8
9	Switches and boxes or covers	9
10	Plenums	15
11	Compressed air - Industrial	5

REFERENCE	DESCRIPTION	COLOUR CODE
1	Mines Grey	G15P
2	Black	
3	Brilliant green or light orange	Codes BS No 221
4	Magic green or dark orange	G406
5	Light blue	G16P
6	Midnight blue	G116P
7	Azure blue	BSF05
8	Golden yellow	BS49
9	Signal red	G7P
10	White	
11	Carrier green	
12	Aluminium numelon code AN	
13	Everest grey	G7P
14	Battleship grey	G13P
15	Beige	BS366

GENERAL REQUIREMENTS

The requirements of ISO 12944:1998 shall apply as a minimum to all coating application activities. Supplementary requirements are given in this document. In the event of conflict between this document and the ISO standard, the requirements of this document will prevail.

The Gas Contractor shall be responsible for ensuring that the coating manufacturer's instructions, including, but not limited to:

1. Surface preparation and cleaning.
2. Preparation and application of coating materials.
3. Shelf life and storage requirements

are adhered to:

Only approved coating materials as detailed in the specification shall be used. These shall not be mixed with materials from different manufacturers.

The Gas Contractor shall use experienced labour with qualified supervision and inspection.

The Gas Contractor shall use colours selected by the design team to the SANS 1091 colour standard.

The Gas Contractor shall ensure that piping and proprietary equipment are adequately protected when stored on site to prevent internal corrosion.

SURFACE PREPARATION

All sharp edges, burrs, rags and weld splatter shall be removed and weld areas shall be abraded and/or ground.

The surface shall be de-greased and rinsed with solutions supplied by the coating manufacturer prior to mechanical cleaning (clause 4.4 of SANS 10064).

Surface preparation shall be as specified in accordance with ISO 8501-1 and SANS 10064 and shall be conducted before erection of pipes

COATING/PROTECTION SPECIFICATIONS

APPLICATION	SPECIFICATIONS/CODES
Protective Coatings	(Refer to Appendix A)
The external protection of insulated chilled water piping.	PCS 01
The external protection of uninsulated steel piping internal and external to buildings in both inland and marine environments.	PCS 02
Mild steel support structures internal and external to buildings in inland environments.	PCS 03
Mild steel support structures internal and external to building in marine environments.	PCS 04

APPLICATION	SPECIFICATIONS/CODES
The external surfaces of galvanised steel ducting internal and external to buildings in both inland and marine environments.	PCS 05
Electric motors, gearboxes, pumps, valves and other proprietary equipment internal or external to buildings in both inland and marine environments.	PCS 06
Hot Dip Galvanizing Due cognisance of the type of article and zinc thickness is required.	 ISO 1461 Heavy duty applications.
Powder Coatings Steel or galvanised components. Architectural aluminium components.	 SANS 1274 – Type 6 SANS 1578-1 SANS 1578-2
ANODIZING OF ALUMINIUM Architectural components General purpose aluminium articles	 SANS 999 SANS 1407

Should the applicator or manufacturer wish to propose alternative products or coating materials, he shall submit a detailed motivation to the Employers Agent. The motivation shall include, but not be limited to the following:

- Benefit to the Client
- Product licensor and technical back-up available;
- Location, experience and ISO quality rating of the production facility;
- Detailed case histories;
- Performance guarantee offered;
- Manufacturer's data sheets for each product.

COATING APPLICATION

The Gas Contractor shall submit a Quality Plan for approval prior to the commencement of any coating work.

The coating application work shall be carried out in strict accordance with the most recent Product Data Sheet from the coating manufacturer.

The product data sheet shall be deemed to be part of this specification.

Coatings shall not be applied when surface may become damaged due to rain, dust, condensation, surface temp (>30^{o}C) or excessive humidity (>85%).

All surfaces shall be coated as specified. Successive coats shall be of distinctly different colour to the previous coat to ensure correct undercoat coverage. Special attention shall be given to cracks, crevices and edges to ensure complete coverage and paint thickness.

The primer shall be applied as soon as possible after the surface preparation operation, but within 4 hours.

Concealed surfaces shall be completely coated.

All edges, corners, bolt holes and cut ends shall be stripe coated by brush application, prior to the application of the second coat.

No coating shall be applied to any surface containing traces of grit, grease, soil, loose rust, surface contaminants (i.e. dust) or loose corrosion product of any kind.

Surface rust on steelwork shall not exceed Grade B of ISO 8501-1.

FASTENERS

All nuts and bolts shall be either hot dip galvanised or stainless steel unless otherwise specified.

All galvanised nuts and bolts shall be de greased, patch primed and finish coated in accordance with the specification for the respective area of the plant.

THE PREVENTION OF GALVANIC CORROSION

Care must be taken to prevent or mitigate the corrosion caused by dissimilar metal contact on cooling coils, tubes and tube plates, pipes, flanges, frames etc. Typical metals encountered would be copper, aluminium, zinc, mild steel and stainless steel.

The junctions between dissimilar metals must be electrically insulated where possible.

Pipe flanges between dissimilar metals must be insulated using insulating gaskets for the flange faces and insulating sleeves and washers for all nuts and bolts.

Where the insulation of the junction between dissimilar metals is not practical, the cathode surface on the electrolyte or 'wet' side must be coated for a minimum distance of 100 mm from the junction. The applied coating must effectively isolate the coated surface from the electrolyte.

INSPECTIONS AND TESTING

The following inspections and tests shall be performed by the Gas Contractor and witnessed by the design team in accordance with the approved Quality Plan on corrosion protection.

Visual inspection for paint film defects shall be performed after each coat is applied. All defects including pinholes, sags and runs shall be corrected before the next full coat is applied.

Dry Film Thickness

Dry film thickness shall be measured in accordance with ISO 2808:1967. Instrument calibration shall be on the smooth calibration disc provided by the instrument manufacturer.

The required dry film thickness given in 'windows' for each coat in the relevant coating specification, i.e. required minimum and acceptable maximum. Any reading outside this range is cause for rejection and may require the removal of the entire coating and reapplication thereof.

Actual readings and not averages shall be recorded.

QUALITY ASSURANCE

Gas Contractor Qualification

The design team may, at its discretion, require a Quality Audit of the painting Gas Contractor to ensure that he has the management, facilities, skilled staff and quality control facilities and staff, to carry out quality control during application of coatings to ensure compliance with specification.

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

The Gas Contractor shall keep at least the following records:

- Material batch records
- Psychometric records
- Records of surface preparation
- Dry film thickness measurements per coat

GUARANTEES

Performance guarantees for the applied coating systems shall be offered jointly by the coating manufacturer and coating applicator. Whilst the period of guarantee will vary from situation to situation, the criteria for failure will not exceed Ri2 of ISO 4628-3:1982.

All guarantees in the terms of protection against corrosion shall be ceded to the client.

APPENDIX A
PROTECTIVE COATING SPECIFICATIONS

SPECIFICATION NO: PCS 01

Description: The external protection of insulated chilled water piping.

	Surface Preparation	Primer Coat	Intermediate Coat	Finishing System
Supplier	Degrease Wire brush St 3	Al filled surface tolerant epoxy primer 50 – 125 microns	High build micaceous iron oxide epoxy 75 – 150 microns	Insulation + vapour barrier
Ameron	Degrease Wire brush St 3	Amerlock 400 Al	Amercoat 888 MIO	-
Stoncor Carboline	Degrease Wire brush St 3	Carbomastic 186	Carboline 888 MIO	-
Sigma	Degrease Wire brush St 3	Sigmacover Aluprimer	Sigmacover CM MIO	-
Barloworld Plascon International Paints	Degrease Wire brush St 3	Intershield 670HS	Interguard 400 MIO	-
Jotun	Degrease Wire brush St 3	Jotamastic 80	Penguard Mio Express	-

SPECIFICATION NO: PCS 02				
Description: The external protection of un-insulated steel piping internal and external to buildings in both inland and marine environments.				
	Surface Preparation	Primer Coat	Intermediate Coat	Finishing Coat
Supplier	Degrease Wire brush St 3	Al filled surface tolerant epoxy primer 50 – 125 microns	High build micaceous iron oxide epoxy 75 - 150 microns	Recoatable Polyurethane Enamel 50 – 75 microns
Ameron	Degrease Wire brush St 3	Amerlock 400 Al	Amercoat 385 MIO	Amercoat 450 S
Stoncor Carboline	Degrease Wire brush St 3	Carbomastic 186	Carboline 888 MIO	Carboline 134
Sigma	Degrease Wire brush St 3	Sigmacover Aluprimer	Sigmacover CM MIO	Sigmadur Gloss
Barloworld Plascon International Paints	Degrease Wire brush St 3	Intershield 670HS	Interguard 400 MIO	Interthane 990
Jotun	Degrease Wire brush St 3	Jotamastic 80	Penguard Mio Express	Hardtop AS

SPECIFICATION NO: PCS 03
Description: Mild steel support structures internal and external to buildings in inland environments.
Hot-dip galvanise to ISO 1461

SPECIFICATION NO: PCS 04/PCS 05				
Description PCS 04: Mild steel support structures internal and external to buildings in marine environments. Galvanise (un-passivated) + duplex coating Description PCS 05: The external surfaces of galvanised steel ducting internal and external to buildings in both inland and marine environments.				
	Surface Preparation	Primer Coat	Intermediate Coat	Finishing Coat
Supplier	Galvanised Iron Precleaner	Epoxy Galvanising primer 50 – 80 microns	-	Recoatable Polyurethane Enamel 50 – 75 microns
Ameron	Galvanised Iron Precleaner	Amercoat 71	-	Amercoat 450 S
Stoncor Carboline	Galvanised Iron Precleaner	Carboline 193	-	Carboline 134
Sigma	Galvanised Iron Precleaner	Sigmacover Primer	-	Sigmadur Gloss
Barloworld Plascon International Paints	Galvanised Iron Precleaner	Interguard 269	-	Interthane 990
Jotun	Galvanised Iron Precleaner	Penguard Special	-	Hardtop AS

SPECIFICATION NO: PCS 06

Description: Electric motors, gearboxes, pumps, valves and other proprietary equipment internal and external to buildings in both inland and marine environments.
Over manufacturer's standard finish.

Note: Cross-cut adhesion tests will be carried out to assess the adhesion and integrity of the proprietary finish. If acceptable, it may be overcoated as specified. If rejected it will be returned to the manufacturer.

	Surface Preparation	Primer Coat	Intermediate Coat	Finishing Coat
Supplier	St3 Degrease	Epoxy maintenance primer 50 - 125 microns	-	Polyurethane enamel 50 -75 microns
Ameron	St3 Degrease	Amerlock 400AL	-	Amercoat 450S
Stoncor Carboline	St3 Degrease	Carbomastic 186		Carboline 134
Sigma	St3 Degrease	Sigma Multimastic	-	Sigmadur Gloss
Barloworld Plascon International Paints	St3 Degrease	Intershield 670 HS	-	Interthane 990
Jotun	St3 Degrease	Primastic		Hardtop AS

1. GENERAL

The specification applies to all gases, vacuum and compressed air, etc. distributed via central piping systems and equipment for laboratory and industrial applications.

The installation in its entirety shall be designed, engineered, installed and rendered serviceable in accordance with the latest, amended publication of the following, at time of tender closing date:

a) Occupational Health and Safety Act, No. 85 of 1993
b) Pressure Equipment Regulation; R734 of 15 July 2009; GG 32395
c) All by-laws and ordinances of the relevant supply authorities.
d) National Building Regulations and Building Standards Act (Act No. 103 of 1977)
e) National Building Regulations R1081 of 10 June 1988
f) Hazardous Substances Act No. 15 of 1973 (Amendment Act, No. 53 of 1992)
g) National Environmental Management Act (act 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations as defined in GN No R386 and R387 of 21 April 2006
h) SANS 347
i) SANS 827
j) SANS 10087
k) SANS 10260
l) SANS 10263
m) SANS 7396-1
n) ASME 31
o) BCGA Code of Practice 4: Industrial Gas Cylinder Manifolds and Gas Distribution Pipework (excluding Acetylene)
p) BCGA Code of Practice 5: The Design and Construction of Manifolds Using Acetylene Gas from 1.5 to 25 Bar
q) BCGA Code of Practice 18: The Safe Storage, Handling and use of Special Gases
r) Any particular requirements of this specification and drawing attached hereto.
s) The performance of the equipment offered shall be suitable for operation under the existing site conditions and system details.
t) All SANS, ISO, DIN, BSS, ASME, ASTM and other specifications and or standards specified in various sections of this document

All equipment for the installation shall be supplied by firms properly established in the Republic of South Africa which are regularly engaged in the supply and maintenance of such equipment and who can issue complete catalogue information covering their full line of equipment.

Supply and installation shall include all equipment as detailed on the drawings and the system shall include all components shown or specified or necessary to perform the specified functions.

Commissioning shall include the validation of the system as detailed on the drawings and the Detailed Specification Part C3.3 and shall prove that the gas and vacuum installation does in fact provide the sequence of operation, control and safety as detailed on the approved shop drawings.

2. COMPETENCE OF INSTALLATION TECHNICIANS

Refer to clause Organisation and Staff of Gas Contractor, Part C1.5, Section 11.

All pipe fitters employed for the construction of the gas and vacuum installations shall be registered with the SAQCC, have knowledge of and experience in, such installations and shall

submit sufficient proof thereof for approval by the Engineer, before commencing work on a gas and/or vacuum system.

Registration shall be current and valid at the time of construction of these installations.

3. INTERRUPTION TO SERVICES

The Gas Contractor may only interrupt any services after having obtained permission from the designated staff member of the Employer, in writing, for the relevant section of the system to be interrupted. Any such interruptions shall be kept to an absolute minimum.

The Gas Contractor shall be responsible for the rectification of any excessive noise and/or vibration caused by the operation of the vacuum pumps & compressor system installed under this subcontract.

The Gas Contractor shall be responsible for the detail design of concrete inertia blocks, if required or specified, but such blocks will be provided by others.

The Gas Contractor shall be responsible for the detailed selection and design of bases and isolator in conformance with the requirements specified in latest ASHRAE - Systems Manual - Sound and Vibration Control - Guide for Selection of Vibration Isolators.

ISOLATION OF MECHANICAL EQUIPMENT

All equipment shall be orientated or screened in such a way that maximum sound radiation patterns are directed so as to cause least disturbance.

All rotating machinery shall be balanced. The critical speed shall be at least 20% above the operating speed.

Vibration isolation mountings shall be provided for all vibration inducing equipment and associated pipe work and ducting. Mountings shall be installed in accordance with the manufacturer's instructions. However, the Gas Contractor shall be responsible to ensure that amplitude of motion and vibration transmission will not exceed the specified limits.

Floor mounted equipment shall be erected on a concrete plinth, which shall protrude at least 25 mm above finished screeded floor level.

Isolators shall be selected to give both horizontal and vertical flexibility (compression and shear). The amplitude of motion due to operation of the supported equipment shall not exceed 3 mm.

Spring isolators shall be designed and installed in such a way that the ends of the springs are constricted to remain parallel during deflection. For stability, the outside diameter of springs shall be at least equal to their compressed height at rated load. Springs shall have a minimum additional travel to solid, equal to 20% of the rated deflection. Each spring mounting shall be set on 7 mm thick neoprene acoustical pads.

ISOLATION OF PIPING

All connections to equipment shall be sufficiently flexible to prevent excessive strain to allow the equipment freedom to move and to prevent plant vibration being conducted. Initially, special flexible connection may be omitted in a piping system and use shall be made of natural flexibility of resilient hangers or mountings for vibration isolation. However, flexible connections shall be inserted and other necessary adjustments be made, at the Gas Contractor's expense, should the need arise.

All piping within 15 m from connected vibration-inducing equipment shall be hung on resilient hangers. The first four hanger supports shall be capable of supporting piping at a fixed elevation during installation and, in addition, shall have a secondary adjustment to transfer the load to the spring element within the mounting, after the system has been filled.

The Gas Contractor may be required to disconnect the piping after the installation is completed to demonstrate that no strain is exerted at the connections to the equipment.

Noise suppressors shall be installed downstream of all steam pressure reducing valves.

Where piping passes through walls, floors or ceilings or plantrooms, acoustical seals shall be employed to confine airborne noises to the inside of such rooms.

SOUND ATTENUATION

Sound attenuating units or treatment shall be provided as indicated and/or required to control the noise from vacuum and compressor systems to within the limits specified.

It should be noted that the provisions for sound attenuation shown on the Engineer's drawings (or the absence of same) are based on average published data for equipment noise and inherent attenuation. The Gas Contractor shall, nevertheless produce his own calculations, and select isolators/isolating methods following a recognised certified method and Guidelines - ASHRAE Systems Volume Chapter 32 for noise levels in the areas specified for the sound power of the actual selected equipment and provide additional silencing equipment and/or treatment if necessary.

To minimise the need for sound attenuation, fans shall be selected to operate near their maximum efficiency point when producing the required air quantity and static pressure.

Sound attenuators and acoustic treatment shall be fire, fungus and erosion proof.

"Package" attenuators shall normally be flanged for bolted connections, and flexible connectors shall be used as shown or required.

Attenuators shall have an air resistance not exceeding 75 Pa measured at sea level at maximum air quantity.

NOISE MEASUREMENT

The Gas Contractor shall submit sound pressure levels measured on the completion of the installation, detailing the sound pressure levels in dB (re: $2 \times 10^{-5} N/m^2$), for the seven International Standard Octave Bands measured by means of a sound meter in at least six (6) areas within the building, as selected by the Architect.

Measurements for sound pressure level data shall be taken by the Gas Contractor, or at his expense by an approved organisation, under full or nearly full cooling and air flow conditions.

ENERGY CONSUMPTION AND MAINTENANCE COSTS

The annual cost of energy consumed and total annual maintenance and service costs are an essential input in the adjudication process to select the appropriate equipment/tender. The selection will be based on the lowest total life cycle cost for a 15-year period. The present day tender price which might be used in comparing the various tenders is based on the application of a present-day cost formula which allocates the appropriate influence to:

1. Initial Capital Cost.

2. Estimated Annual Electricity Costs.

3. The Annual Maintenance Costs.

4. The Average Interest Rate.

5. The Estimated Energy Costs Escalation Rate.

6. The Estimated Labour and Material Escalation Rate (Consumers Index).

Because initial cost is not the only determining factor, tenderers are advised to carefully consider energy efficiency and quality of equipment offered, if requested in the Schedules of Components and Equipment.

PART C3.3

DETAILED SPECIFICATION

1 FUNCTIONAL PERFORMANCE

1.1 PERFORMANCE

1.1.1 All components of the gas distribution installation, including piping, tubing, fittings and accessories specified in this tender shall be fully compatible with the gases and gas supply system(s) which forms part of this project, as well as any existing system this installation will be connected to, where relevant.

1.1.2 As specified in Part C1.5, the complete gas reticulation system shall be engineered, installed, supervised, inspected, tested, commissioned and certified, maintained and repaired, upon completion, by Authorised Gas Practitioners, appropriately qualified and registered with the South African Qualification and Certification Committee (SAQCC) for the category of work and relevant gas, they will be responsible for, i.e. as design engineer, supervisor, installer(s), commissioning, maintenance and repairs as specified and indicated on the drawings.

1.1.3 Where stainless steel instrument tubing has been specified for a project, the gas contractor shall be an approved installer, trained and certified by the manufacturer of the tubing system to be used. Proof of such training, experience and certificates shall be submitted with the equipment submissions, for approval prior to commencement of construction.

1.1.4 All equipment, pipe, tubing, fittings, accessories, etc. shall be manufactured by well known, long established companies, with well-established distributers in South Africa. Manufacturers shall hold a valid (by the time of delivery) ISO9001, or equivalent, Quality Control Certificate for the design, manufacturing and maintenance of the latter.

1.1.5 The project drawings are schematic and do not purport to show the exact positions of pipe runs. Pipework shall be laid out in consultation with and to the satisfaction of the Engineer and complete shop drawings, of the layouts shall be submitted for approval by the Engineer.

1.1.6 Pipe sizes, details, designs, safety requirements, etc., as indicated on the drawings, shall be verified by the contractor and shall be confirmed to be in compliance with the relevant regulations and codes of practise, to the Engineer, with the shop drawing submissions, as specified in Part C1.5.

1.1.7 Should any pipe size, pipe route, support, detail, specification or design indicated on the drawings, or specifications not comply with relevant regulations, codes of practise, laws or by-laws, these deviations or items of non-compliance shall be identified, by the Authorised Gas Practitioner, discussed with the Engineer and submitted to the Engineer in writing, complete with the motivation for the findings, proposed variations, modifications or alterations and the cost variation thereof, for approval by the Engineer, before implementation thereof.

1.1.8 In conjunction with 1.1.5 above, the registered Authorised Gas Practitioners, who will be responsible for the certification of the systems shall advise of and submit for approval for installation of all accessories / safeties etc. required in the system by the relevant regulations, codes of practice, by-laws, specifications, etc. that may not be specifically specified or indicated in the tender documentation, but are required in terms of the relevant and applicable codes.

1.1.9 The piping system shall provide the gas flows, pressures and pressure losses specified on the schematic piping diagram or schedules on the drawings.

1.1.10 All components shall be selected to operate safely at 1.5 times the specified working pressure.

1.2 OPERATING RANGE

1.2.1 The final selection of equipment connected to the piping system, fittings, valves, regulators, etc. shall ensure that the variation in gas flow through connected equipment does not vary more than ± 10% between maximum and minimum flows under maximum design load conditions.

1.3 SAFETY AND ALARMS – ABNORMAL CONDITIONS

1.3.1 Pressure relief valves shall be installed in all closed piping systems (or systems which can be closed) and in all sections of piping with different operating pressures, before and after pressure regulators, in easily accessible positions. The discharge of each relief valve shall be visible and shall reset automatically.

1.3.2 Credentials of the testing authority of safety valves and equipment submitted for approval to the Engineer, shall be submitted with equipment submissions.

1.3.3 Original test certificates of all safety valves and equipment shall be issued to the Engineer at practical completion / handover and copies included in the O&M Manuals.

1.3.4 All necessary gauges, shall be installed on the pipelines to check pressures for monitoring the functioning of various components. Operating and maximum safe working pressures shall be marked on the gauges as specified in Part C1.5. Gauges shall be clearly legible from a standing position on the floor, with normal lighting.

1.4 SYSTEM OPERATION - OPERATOR INTERFACE

1.4.1 Valves shall close CLOCKWISE, when facing the handle from the top. An arrow and the words "CLOSE" shall clearly be cast or forged or stamped on the hand wheel to indicate the closing direction.

1.4.2 Shut off valves shall be operable by personnel standing on the floor.

1.4.3 All instruments installed for regular monitoring by Operator/Inspector shall be easily legible standing on floor with normal room illumination.

1.4.4 All automatic control/solenoid valves, change over valves, and balancing valves shall have easily legible position indicators when standing on room floor.

1.4.5 All pressure gauges shall be installed on the pipelines to check pressures for monitoring the functioning of various components as specified.

1.4.6 Flow meters and/or connections for portable flow meters shall be provided as shown.

2 RELIABILITY AND AVAILABILITY

2.1 DOWNTIME

2.1.1 Piping shall be complete with all necessary isolating valves to enable repairs/expansions to sections of the system without the necessity of shutting down and venting the entire system.

2.1.2 Components or equipment requiring regular inspections, cleaning and removal shall be isolated by shut-off valves to enable this to be done without affecting the entire system.

2.1.3 Components shall be so connected and installed that removal and re-installation will not take longer than two hours by a Gas Practitioner registered for maintenance and repair of the relevant gas.

2.2 DOCUMENTATION

2.2.1 The piping system control, monitoring and safety equipment requiring service, maintenance, trouble shooting, and possible periodic replacement shall be documented in accordance with the equipment part of the Operating and Maintenance Manual.

3 TECHNICAL RESTRAINTS

3.1 All sections, components, material, construction details/methods, installation procedures, etc. for which SANS, ISO, EN, BSS or ASME codes of practice or standard specification exist on date of tender, shall conform to the latest edition of these codes of practice/standard specifications, as well as the Occupational Health and Safety Act as amended.

3.2 Eddy current testing shall be carried out on all tubes to ensure freedom from physical defects as specified in ASTM Standard E243. Contractors may be required, at the discretion of the Engineer, to obtain copies of documentation proving compliance with this requirement from the piping supplier.

3.3 All pipework shall be supported to ensure that no strain is imposed on any component in the system. Support spacing shall be as scheduled below.

3.4 Fittings and accessories, e.g. bends, Tees, reducers, valves, etc., with the recommended low loss co-efficient and compliance with the listed standard specification, shall be selected.

3.5 Suitable off sets shall be provided where windows, mains etc. interfere with the straight running of piping.

3.6 Bends shall be of the long radius type. Elbows will be acceptable in minimal cases where required by the site constraints as indicated on the contractor's shop drawings and as approved by the Engineer.

3.7 Components shall be standard catalogued products and documentation shall include selection tables or pressure loss data for the expected range of operating conditions.

3.8 Pipe fittings made up by butt brazing or welding of pipes or tubes to form reducers, tees, bends, etc. are not acceptable, at all.

3.9 Piping shall be installed so as to allow for expansion and contraction and shall be installed that the first point of support is a minimum of 6 pipe diameters in each of three directions from an anchor point, instrument or any equipment.

3.10 System vibration isolation shall be in accordance with Sound and Vibration Control, Section 5 of Part C3.2.05

3.11 On completion of the pipe reticulation system, all piping shall be purged with dry air or nitrogen until clean, before any accessories, valves etc. are fitted. For high purity gas lines, instrument air or high purity nitrogen shall be used for purging.

3.12 Sheet metal sleeves shall be provided where piping passes through walls, slabs etc. The diameter of the sleeves shall be large enough to allow removal of the pipe with its flange(s) where applicable. Space between pipe and sleeve shall be filled with fiberglass and covered with stainless steel sheet metal plates fixed to the wall.

3.13 All pipework, excluding stainless steel tubing and fittings shall be externally protected against corrosion by an impervious surface layer, as specified in Part C3.2

3.14 Piping material and applicable standard specifications (amended as per Part C1.5 Section 5) for the different piping application shall be as stated in the Schedule, Clause 3.3.01 below

3.15 BORE CLEANLINESS

3.15.1 General

3.15.1.1 All tubes shall be processed to ensure that the bore are bright and clean. The use of carbon tetrachloride as a cleaning agent is not allowed.

3.15.1.2 The measure of acceptable cleanliness shall be that specified in SANS 1453 and EIGA IGC Doc 33/06. This requires that when the interior of a test sample of the tube is washed with trichloroethylene, or other solvent such as re-distilled chloroform or re-distilled trichloroethylene, the residue remaining upon evaporation of the solvent shall not exceed 0.0376 g/m^2

3.15.2 Cleaning Specification

3.15.2.1 The following processes shall be undertaken on Oxygen compatible and Medical Grade Copper Tubing, before and after annealing, at the manufacturer's premises:

- Blow pipes clean with medically grade compressed air.
- Steam vapour aggravation cleaning inside of pipes.
- Hot detergent wash of the pipes internally.
- Finally a soft abrasive cleaning organic liquid.

3.15.2.2 The Gas Contractor is finally responsible to ensure that clean tubing is installed and remains clean until handover.

3.15.2.3 The above steps are required for all tubing sizes in order to ensure compliance with paragraph 3.15 above.

3.16 IDENTIFICATION AND PACKING

3.16.1 All straight length tubes shall be packed and delivered in timber cases of suitable size and capacity, normally half tonne (500kg) net.

3.16.2 All tubes shall be packed in M.G. standard cardboard boxes and with the word "Medical", or the letters "MG"

3.16.3 All straight tube lengths shall be identified by means of a continuous red line and 'SABS 1453 M.G.' printed along the length of the tube. Pipe ends shall be protected with red plastic caps to prevent ingress of foreign matter during transport and storage on site.

3.16.4 All tubes shall be stored off the ground in a clean, safe area, with the ends capped at all times.

3.17 PIPE MATERIALS

3.17.1 Copper Pipe (Cu), Medical Grade (MG) and Oxygen Compatible (OC)

3.17.1.1 All piping or tubing, specified for low pressure gases and oxygen compatibility, or as medical grade, shall be copper and in compliance with the latest editions of SANS 7396, SANS 1453 and ISO 15001 and shall be cleaned for oxygen compatibility.

3.17.1.2 Medical grade copper tube nominal outside diameter and wall thickness shall comply with the sizes as per SANS 1453, 'non-preferred' sizes. Pipe sizes indicated on the drawings are the closest round numbers to the abovementioned non-preferred outside diameters. "Half hard" piping is required up to 35mm outside diameter in straight lengths of 3m to 5.5m long and hard drawn piping for all larger sizes in 5.5m straight lengths.

3.17.2 Stainless steel, Instrument Tubing (S/S IT)

3.17.2.1 Stainless steel instrument tubing, shall be standard, metric, seamless, stainless steel grade 304, 304L, 316 or 316L tubing, as scheduled for the specific gases below and shall be suitable to be welded or connected with proprietary manufactured, two ferrule, threaded connectors.

3.17.2.2 Tubing shall be manufactured in accordance with ASTM A269 & ASTM A213 marked to indicate the size, material specification and heat code of each tube, which shall also be traceable to manufacturer's records. Tubes shall be supplied in nominal 6m lengths.

3.17.2.3 Where oxygen, or oxygen rich gases are specified for distribution via stainless steel tubing on a site or under this project, all tubing to be installed on the site or under the project shall be cleaned for oxygen compatibility. Tubing cleanliness identification shall be marked along the length of the tubes.

3.17.2.4 Working pressure of tubing shall be as per manufacturer's published data and shall be based on equations from ASME B31.3 and ASME 31.1 for EN ISO 1127 tubing (D4, T4 tolerance for 3 to 12 mm; D4, T3 tolerance 14 to 50 mm), based on a stress value of 137.8MPa and tensile strength of 516.4MPa. Correction factors for operating temperature and welding shall be applied as per manufacturer's and ASME codes.

3.17.2.5 Tube hardness shall not exceed 90 HRB or 200 HV. Tubing shall be free of scale and scratches and shall be suitable for bending and flaring.

3.17.2.6 Finish and jointing of tubing, e.g. polished (bright annealed) or unpolished (pickled), welded or threaded shall be as per schedules for specific gases below. OD tolerances shall not exceed ±0.076 mm for 3 mm OD tubing.

3.17.2.7 Welding of stainless steel tubing shall be performed with an orbital welding system, supplied or approved by the manufacturer of the stainless steel instrument tubing installed on site. Tube ends to be orbital welded shall be factory prepared. Where tubes are cut on site, tube ends shall be prepared with the same process and to the same standard as the factory prepared tube ends.

3.17.2.8 Welded joints shall be x-ray inspected by an approved inspection authority (AIA). A minimum of 20% of all welds shall be x-rayed. Should any welds fail, all welds shall be tested on the gas contractor's expense. Failed welds shall be cut out and re-done until approved.

3.17.2.9 Tubing shall be supported with manufacturer's, purpose made, tube support system, consisting of polypropylene, ultra-violet resistant clamps, with 304 stainless steel cover plates and bolts and nuts. Clamps shall be suitable to stack up to three single clamps with stainless steel cover and locking plates. Refer to typical details on drawings.

3.17.2.10 Where tubing is supported on walls, in cable trays or on hangers from roof or slab soffit, channel support brackets with clamps, purpose made by the tube manufacturer for the channel and tubing installed on site, complete with thermoplastic polypropylene-based elastomer insert for vibration isolation and galvanic corrosion shall be used. Support systems for each application shall be approved by the Engineer.

3.17.2.11 Formed bends shall be used as far as possible and practical. Where manufactured bends have to be used, long radius type shall be installed. Elbows will be acceptable in minimal cases where required by the site constraints and approved by the Engineer on a shop drawing.

3.17.2.12 'Formed' bends shall be formed on site by bending instrument tubing with a tube bending machine, specifically manufactured for the tubing used and approved by the tube manufacturer. Bends shall be formed in as long lengths of straight tube as possible to reduce the number of welds as far as possible.

3.17.2.13 Tube socket weld threaded connections, where required, shall be used for connection of accessories, shall be of the gaugeable, 'live loaded', two ferrule, mechanical grip design. Tube end of connectors shall be welded to the tubes.

3.17.2.14 Threaded connections shall be made with appropriately designed tools, e.g. Tee or ratchet wrenches, swage and pre-swaging tools, supplied or approved by the manufacturers.

3.17.2.15 Thread of threaded connections shall comply with ASME B1.20.1, SAE AS71051, ISO 228, JIS B0202, ISO 7, BS EN 10226-1, JIS B0203, ISO 228, JIS B0202, ASME B1.1, for the relevant type of thread, i.e. tapered, parallel, gauge or unified.

3.17.2.16 Lubricants and thread sealants shall be used, strictly in accordance with the manufacturer's specifications.

3.17.2.17 No torque shall be transmitted to tubing during installation. Connections shall be easy to disconnect and re-tighten.

3.17.2.18 Tightness shall be possible to be verified with an inspection gauge, supplied by the manufacturer for the purpose.

3.17.3 Black Steel, Schedule 40

3.17.3.1 Schedule 40 piping shall be manufactured BS, ISO or ASME standards of which certificates or acceptable proof shall be submitted with equipment submissions.

3.17.3.2 Arc welding shall be in accordance with SANS 15609-1:2007

3.18 HANGERS AND SUPPORTS

3.18.1 Reference shall be made to the drawings for the typical details of hangers and supports required on the project. The Authorised Gas Practitioner (Design), employed by the gas contractor shall be responsible for the final design of the hangers and supports. Final design of the support system shall not impose an additional cost to the project.

3.18.2 Hangers for steel pipes shall conform to BSS 3974 where applicable.

3.18.3 Pipes shall be supported by means of compatible clamps, clips, holder bats or hangers in the manner laid down in BS CP 310.

3.18.4 Stainless steel instrument tube shall be secured with proprietary clamps manufactured for the relevant pipe diameters, by the same manufacturer as the tubing.

3.18.5 Anchors and guides shall be provided for all horizontal and vertical piping for proper control of thermal movement and to prevent undue strain on branches and equipment and to provide proper performance of expansion joints and loops.

3.18.6 Additional steel framing for proper support, handling, anchoring and guiding of piping shall be used whenever required.

3.18.7 Hangers and supports shall be selected to support the full weight of piping and covering.

3.18.8 Where pipe mounting will be vulnerable and prone to mechanical damage, e.g. below low level ceilings, underneath lab benches and against walls at low level, piping shall be supported and / or covered by cable trays, or other protection as specified or indicated on the drawings.

3.18.9 The maximum spacing of pipe support, for the following pipe materials, shall be as per manufacturer's recommendations and engineered by the Authorised Gas Practitioner and registered designer, but shall not be greater than distances as per schedule, Clause 6.2, below.

3.19 WORKING LIFE

3.19.1 Piping system, including accessories, hangers, supports and vibration isolators shall be selected and installed to give minimum working life of 20 years under normal building service conditions.

3.20 LEAK TESTS

3.20.1 The entire piping system shall be subjected to a leak pressure test with a suitable gas, e.g. clean dry air or nitrogen. For this test it is permissible to add a trace agent to enable leakages to be more easily detected. Trace agents shall not contaminate the piping, in terms of the gases or purity of the gases to be distributed through the piping.

3.20.2 Prior to carrying out this test the Subcontractor shall verify by examination of the various parts of the components of the system that the test pressure to which they were subjected to at the manufacturer's works, are adequate for the required duties.

3.21 PIPE ACCESSORIES AND FITTINGS

3.21.1 All accessories and fittings shall be fully catalogued products and the documentation shall include performance curves or selection tables, for the expected range of operational conditions.

3.21.2 The piping accessories and connections shall be selected to ensure no gas leakage from piping system during its operational life.

3.21.3 Manufacturers of fittings and accessories shall operate in accordance with and approved quality management program and shall have a valid ISO 9001, or approved equal, certificate, which shall be submitted for approval with equipment submissions prior to order and installation.

3.21.4 Test certificates of the fittings, based on DIN 3387, from an Authorised Inspection Authority, shall be submitted to the Engineer for approval with equipment submissions, prior to ordering and installation

3.21.5 Accessories' test certificates based on the relevant parts of DIN2470, DIN 3230, DIN 30690, or equivalent standards, shall be submitted to the Engineer for approval with equipment submissions.

3.21.6 All pressure gauges shall be connected to the piping system or major components through isolating shut-off valves.

3.21.7 Joints can be made by welding, brazing or screwed connection, as specified in the schedules below. Welding and brazing shall only be carried by competent, certified welders.

3.21.8 Solenoid shut-off valves shall be installed directly after the gas supply station for all gases.

3.21.9 Manual emergency shut-off valves shall be at reachable height and shall be installed where the gas line(s) enters the building.

3.21.10 Valves on branch lines shall be installed in order to prevent interruption of production in an entire plant or building where only a section is required to be shut down.

3.21.11 Where further extensions are planned, a valve should be installed after the branch-off and blanked off with a flange.

3.21.12 Piping shall be painted or labelled in accordance with SANS specifications, or as specified where the SANS specification does not address the type of gas.

3.22 ACCESSORIES – GENERAL.

3.22.1 Isolating valves shall be of the needle or ball type to minimize the restriction to the gas flow as per the schedules on the drawings.

3.22.2 Where oxygen or oxygen rich gas distribution forms part of the scope of the contract, all valves for the entire project shall be manufactured for gas systems, shall be cleaned for medical grade and/or oxygen compatible purposes. Medical grade copper piping shall comply with European Pharmacopoeia standard.

3.22.3 Accessories shall be manufactured for gases, suitable to be installed in the pipe system specified and shall be compatible with the pipe material, working pressure, temperature and type of gas and purity thereof. Accessories manufactured for other fluids shall not be acceptable and may not be used.

3.22.4 Ball valves

3.22.4.1 Gas ball valves shall be purpose made and shall be compatible for the gases served and shall be manufactured and certified for use in gas systems. Ball valves manufactured for any other fluid shall not be acceptable.

3.22.4.2 Ball valves shall be of the three piece, stainless steel (S/S) ball valves with bar type, plastic covered handle.

3.22.4.3 Three piece stainless steel, gas ball valves shall be suitable to be installed in the pipe system specified and shall be compatible with the pipe material, working pressure, temperature and type of gas and purity thereof.

3.22.4.4 Valve to pipe connectors shall be welded to copper, black steel or stainless steel piping as applicable.

3.22.5 Laboratory gas taps

3.22.5.1 Laboratory gas taps shall be of the turret, bench mounted, suspended, wall or fume cupboard mounted type, as indicated on the drawings.

3.22.5.2 Gas taps shall be selected for the type of gas, flammable/non-flammable gas, configuration, outlet and mounting type specified in the schedules and on the drawings.

3.22.5.3 Lab tap construction shall be brass with steel handle, surface treated with highly resistant to most chemicals, UV fading and heat.

3.22.5.4 Headworks for flammable gas taps shall have a lift/turn or press/turn action to prevent accidental or unintentional opening. Valves shall be 90° open/close ball valves with nitrile rubber seals and mineral oil based lubricant

3.22.5.5 Media identification on the lab taps shall be in accordance with SANS and EN13792.

3.22.5.6 Taps shall be suitable for a working pressure of 700kPa with test pressure of 1 000kPa

3.22.5.7 Lab taps for flammable gases shall be fitted with flashback arrestors and non-return valves

3.22.5.8 Lab tap quick connectors shall be compatible with the lab taps and shall be manufactured by the same manufacturer.

3.22.5.9 Lab taps, quick connectors and hoses shall be approved or certified by testing and certification authorities, e.g. DBI, BSI, DVGW, KIWA, etc.

3.23 ACCESSORIES – COPPER PIPE SYSTEMS

3.23.1 Accessories specified to be installed in the copper pipe systems shall be as specified under Accessories – General, above.

3.24 ACCESSORIES – STAINLESS STEEL INSTRUMENT TUBE SYSTEMS

3.24.1 All stainless steel instrument tube gas accessories shall be from reputable manufacturer(s) with a valid ISO 9001 Quality Management system for the design, manufacture and service and quality control

3.24.2 Test certificates of the equipment, based on DIN 3387, from an Authorised Inspection Authority, shall be submitted to the Engineer for approval with equipment submissions, prior to ordering and installation.

3.24.3 Suppliers shall conform to IEC 60079-29-2 and accessories shall be certified by an approved certification body such as ExploLabs.

3.24.4 Stainless steel instrument tube valves shall be supplied by the tube manufacturer and shall be precision accessories compatible with the tubing installed.

3.24.5 Solenoid Valves

3.24.5.1 Solenoid valves shall be two or three way type, direct acting solenoid valves. High pressure valves shall be ball valves with rotary actuators, as scheduled on the drawings.

3.24.5.2 Actuators shall be wired for normally closed operation and fitted with spring return, or similar device for fail safe operation.

3.24.5.3 Valves shall be selected the gas type, purity, pressure, flow rate, operation and environment as specified, or indicated on the drawings and applicable to the environment of operation.

3.24.5.4 Third port of three way valves shall be piped to a safe location to release gas from the downstream pipe to atmosphere upon closure of the gas supply to the building.

3.24.5.5 Solenoid valves in hazardous classified zones shall be tested, certified and labelled based on SANS 60079-29-1 or proven similar and equivalent and accepted by the Engineer and Local Authority. Valves shall be certified by a local inspection authority (IA) as being explosion protected. All such certificates shall be provided by the Gas Contractor to the Engineer, for approval, prior to ordering and installation.

3.24.5.6 Ex rating for Hazardous Area classifications shall be as follows:

- Suitable for a Zone 1 hazardous location i.e. the minimum equipment protection level (EPL) shall be Gb. Suitable Ex equipment are Ex ia, Ex ma, Ex d+e, Ex ib, Ex mb, Ex d, Ex e Ex py and Ex q.
- Suitable for the application i.e.:
    - The solenoid valves shall be selected based on the gas properties of all the gases distributed in the area in which the valves are likely to come in contact with, not only the gas(es) served the valves.
    - The applicable explosive gas atmosphere group (IIA, IIB or IIC), as per Figure 1, Properties of gases, shall be applied. Where different gases occur in the same laboratory/corridor/shaft/gas store then the gas group with the lowest spark ignition energy shall be used for all the GDs in that area.
    - The applicable temperature class, as per Figure 1, Properties of gases, shall be applied. Where different gases occur in the same laboratory/corridor/shaft/gas store then the gas temperature class with the lowest auto-ignition temperature shall be used for all the valves in the area.

- The applicable specification for compliance in the hazardous areas are as follows:

  - Hazardous zone classification: Zone 1
  - Minimum equipment protection level (EPL): Gb
  - Suitable Ex equipment: Ex ia, Ex ma, Ex d+e, Ex ib, Ex mb, Ex d, Ex e Ex py and Ex q.
  - Class IIC gases (Hydrogen)
  - Temperature class: T3 to T6

No.	Material	Composition	Relative density (air=1)	Flash point (°C)	LEL % (v/v)	UEL % (v/v)	Boiling Point (°C)	Vapour pressure at operating T (kPa)	Auto-ignition temperature (°C)		Material group[1]	Temperature Class[2] or Smoulder temperature in case of dust	
									Gas	Dust cloud		Gas	Dust (T_{5mm} in °C)
Liquid/Gas/Vapour													
1	Acetylene	C_2H_2	<1	Gas	2.3	82	-	-	305	-	IIC	T2	-
2	Ammonia	NH_3	<1		15.0	25	-	-	630	-	IIA	T1	-
3	Carbon Monoxide	CO	>1	Gas	10.9	74.0	-	-	652	-	IIB	T1	-
4	Hydrogen	-	<1	Gas	4.0	77.0	-	-	560	-	IIC	T1	-
5	LPG	-	>1	Gas	5	15	-	-	287-537	-	IIA	T3	-
6	Methane	-	<1	Gas	4.4	17.0	-	-	537	-	IIA	T1	-
7	Diesel	-	>1	>55	-	-	-	-	257	-	IIA	T3	-

NOTES

1. Flammable materials are generally divided into groups to distinguish their ignition properties, as follows:
   - Group I: mines susceptible to firedamp;
   - Group II: explosive gas atmospheres occurring in areas other than mines susceptible to firedamp (surface applications).
   - Group III: explosive dust atmospheres (surface applications).

   Group II the explosive gas atmospheres are divided based on spark ignition energies into IIA, IIB and IIC, IIC gases having the lowest ignition energies.

   Group III are subdivided according to their ignition properties as follows:

Material group	Description
IIIA	Combustible flyings
IIIB	Non-conductive dusts
IIIC	Conductive dusts

2. Group II gases are divided into the following 6 temperature classes based on their auto-ignition temperatures

Temperature class	Auto ignition temp. range of gas (°C)
T1	>450
T2	>300 to 450
T3	>200 to 300
T4	>135 to 200
T5	>100 to 135
T6	>85 to 100

Figure 1 Properties of gases

3.25 VIBRATION ISOLATORS: FLEXIBLE CONNECTORS

3.25.1 Pipe lines connected onto equipment that is subject to vibration shall be fitted with flexible connectors to fit over piping having the same size as the line in which they are installed.

4 MEASUREMENT TO CONFIRM EQUIPMENT COMPLIANCE WITH SPECIFICATION

4.1 Full documentation and calculations shall be submitted for approval showing all detailed pressure loss and velocity calculations for the entire piping system and components both under full load an idle condition.

4.2 The testing and balancing of the system shall be executed an Authorised Gas Practitioner duly registered for the applicable gas and with more than ten years experienced on the applicable gas installations.

4.3 The method – instrumentation, procedure and recording shall be documented in a Testing and Commissioning Procedure Book.

4.4 The system shall be purged upon completion and leak testing, with a suitable gas, i.e. high purity Nitrogen and finally with the relevant final gas. Test samples taken at various gas terminal outlets to proof the cleanliness of the system and purity of the gas at supply points.

4.5 A satisfactory pressure test will not absolve the Gas contractor from responsibility for leaks, which develop when the piping is operating under its normal working conditions, and also under any abnormal conditions, which may reasonably be expected to occur.

4.6 On completion of testing of the piping system a signed report shall be submitted by the Gas contractor's Design and Commissioning Engineer listing all the results to prove that the system complies with all regulations and laws.

4.7 Gas contractor shall submit proven and necessary calibration certificates that measurement has a 5% accuracy.

5 SCHEDULE

5.1 Piping material and applicable standards for the various piping applications shall be as scheduled below:

ITEM	TYPE OF GAS	PURITY / GRADE	PIPING STANDARD	PIPE MATERIAL & GRADE	JOINT METHOD & STANDARD	JOINT TEST STANDARD
1	[1)]Ultra-High Purity Gas (UHPG)	>N5.0	Working Pressure: <2500kPa : SANS 10260 >2500kPa : ASME B31	[1)]316 stainless steel	Butt or socket welded pipe joints with threaded compression accessories	
2	[1)]High Purity Gas (HPG)	≥N3.5 <N5.0	ASME B31 ASTM A269 & ASTM A213	[1)]316 stainless steel	Butt or socket welded pipe joints with threaded compression accessories	
3	[1)]Low purity gas	<N3.5	Working Pressure: <2500kPa : SANS 10260 >2500kPa : ASME B31	[1)]316 stainless steel	Butt or socket welded pipe joints with threaded compression accessories	
4	Argon, Nitrogen, Oxygen	<N3.5	SANS 10260-1 SANS 1453	Copper, Oxygen compatible	Copper/Copper alloy soldered	
5	Acetylene		SANS 10260-3	Carbon (Black) Steel New piping 316 S/S	SANS 10260	
6	LPG		SANS 460	Carbon (Black) Steel Copper MG or better	SANS 10087 SANS 1067-2 – Copper/Copper alloy soldered.	

5.2 Copper Piping (Cu) – Medical Grade and Class 1

Nominal Pipe Size	Maximum span	
(mm)	Vertical Runs (m)	Horizontal runs (m)
8	1.2	0.6
10	1.5	0.9
15	1.8	1.1
22 to 28	2.4	1.8
35 to 54	2.8	2.5

5.3 Stainless Steel Instrument Tube (S/S IT)

Nominal Pipe Size	Maximum span	
(mm)	Vertical Runs (m)	Horizontal runs (m)
8	1.2	0.6
10	1.5	0.9
15	1.8	1.5
22 to 28	2.4	2.0
35 to 54	2.8	2.5

5.4 Black Steel (B/S) and Galvanised Mild Steel (GMS) Piping

Nominal	Maximum span							
Pipe Size	Medium		Heavy		Schedule 40		Schedule 80	
(mm)	Vertical (m)	Horizontal (m)	Vertical (m)	Horizontal (m)	Vertical (m)	Horizontal (m)	Vertical (m)	Horizontal (m)
8	1.2	0.6	1.2	0.6	1.2	0.6	1.2	0.6
10	1.5	0.9	1.5	0.9	1.5	0.9	1.5	0.9
15	1.8	1.1	1.8	1.5	1.8	1.5	1.8	1.5
22 to 28	2.4	2.0	2.4	2.0	2.4	2.0	2.4	2.0
35 to 54	2.8	2.5	2.8	2.5	2.8	2.5	2.8	2.5

1 GENERAL

1.1 Wiring channels shall be of "O-Line" or "Electroduct" type or approved equivalent. It shall be manufactured of hot dip galvanised rolled steel.

1.2 Wiring cable trays and ladders shall comply with SANS 763 with respect of finishes. PVC trays shall be rigid unplasticised.

1.3 The Contractor shall supply and install all wiring channels, cable trays and/or ladders as specified or as required including the necessary supports, clamps, hangers, fixing materials, bends angles, junctions, reducers, T-pieces etc. He shall further liaise with the Main Contractor for the provision of holes and access. All wiring channels, cable trays or ladders shall be properly earthed.

1.1 SUPPORTS

1.1.1 Trays and ladders shall be supported at the following maximum intervals:

a)	1,6 mm thick metal trays with 12 mm return	-	1m spacing
b)	Metal trays with folded over return and 50 mm upstand	-	1,22m spacing
c)	2,4mm thick metal trays, and 75mm return	-	1,5m spacing
d)	Metal cable ladders	-	1,5m spacing
e)	3,0 mm thick PVC trays with 40 mm return	-	1,0m spacing
f)	4,0 mm thick PVC trays with 60 mm return	-	1,5m spacing

1.1.2 In addition trays and ladders shall be supported at each bend, offset and T-Junction. The above spacing of supports is applicable to both vertical and horizontal installation of trays and ladders.

2 WIRING CHANNELS

2.1 JOINTS

2.1.1 All joints shall be aligned and secured by means of standard connection pieces that are pop-riveted to both adjoining sections. Adjoining sections shall butt tightly. Covers shall fit tightly across the joint. All joints/terminations shall be made electrically continuous.

2.2 EXPANSION JOINTS

2.2.1 Where channels cross expansion joints suitable expansion joints shall be provided in the channels by means of fish plates pop-riveted to the channel on one side of the expansion joint and floating freely in the channel on the other side of the expansion joint. Such expansion joints shall be made electrically continuous by installing a coiled conductor of suitable size across the joint.

2.3 SUPPORT FOR CONDUCTORS

2.3.1 All conductors in inverted cable channels shall be retained by means of standard clips or spacer bars at approximately 1m centres.

2.4 FINISHES

2.4.1 Burrs and sharp edges shall be removed and the inside edges of all joints shall be lined with rubber protective lining or other suitable rubberised or plastic compound to prevent laceration of the

conductor insulation.

2.4.2 All holes through, which conductors pass shall be fitted with grommets.

2.5 VERMIN PROOFING

2.5.1 All wireways shall be made vermin proof. Holes shall be covered by means of screwed metal plugs or by means of metal strips that are pop-riveted to the channel.

2.6 COVER PLATES

2.6.1 Where possible the suppliers' standard metal or PVC cover plates shall be used. All cover plates shall be neatly and securely fitted.

2.6.2 Steel cover plate finishes shall be the same as for the channels.

2.7 WIRING CHANNEL CAPACITIES

2.7 The overall cross sectional areas of all conductors, including insulation, shall not exceed 45% of the total internal cross sectional area of the trunking whilst in the case of ducting, this figure shall be 40%.

2.8 FIXING OF CHANNELS

2.8.1 The Contractor shall supply and install all hangers, supports or fixings as required for the channels. Channels shall be supported at maximum intervals of 1,5m or as otherwise specified. Channel runs shall be carefully planned to avoid clashes with other services and to ensure that all covers can be removed after completion of the entire installation. Standard clamps, hangers etc. shall be used as required. Where it is not possible to support the channels at the specified intervals, they shall be supported in a sound manner to the satisfaction of the Engineer.

2.9 INSTALLATION IN CONCRETE

2.9.1 Channels shall be filled with suitable fillers to prevent the ingress of cement and shall be securely fixed in position to the shuttering.

2.10 ACCESSORIES

2.10.1 All accessories i.e. hangers, cover brackets, etc. shall be standard items and in general have the same finish as the channels.

2.10.2 Purpose made accessories shall not be acceptable.

3 CABLE TRAYS AND LADDERS

3.1 JOINTS

3.1.1 Joints shall be made smooth without rough edges etc., that may damage the cable. Joints shall as far as possible be arranged to occur at supports. Where joints do not coincide with supports, joints shall be made by means of wrap-around pieces of the same thickness of the tray and at least 200mm long. The two cable tray ends shall butt tightly in the centre of the splice, the splice shall be bolted to each cable tray by means of at least 4 round head bolts, nuts and washers on each side of the joint. Splices with the same finish as the tray shall be provided at joints which do coincide with supports.

3.2 EXPANSION JOINTS

3.2.1 Where cable trays or ladders cross expansion joints, the trays or ladders must form a gap of at least 25 mm between the two sections. Cables installed across expansion joints, must have enough slack to accommodate the expansion of the building.

3.3 EARTHING

3.3.1 Bare copper conductors or straps of sufficient length to accommodate expansion and contraction shall be installed across all expansion joints, also to joints where continuity cannot be guaranteed. These additional conductors shall always be installed in outdoor conditions or coastal regions.

3.4 FIXING

3.4.1 Trays and cable ladders shall be bolted to supports by at least two bolts per support.

3.4.2 It is the responsibility of the Contractor to ensure that adequate fixing is provided and the manufacturer's instructions shall be strictly adhered to. Intervals between brackets above 1,5m shall not be acceptable. Cable trays and ladders that work loose shall be rectified at his own expense.

3.4.3 The fixing shall take into account conditions on site during installation.

1 FUNCTIONAL PERFORMANCE

1.1 This specification shall be read in conjunction with the drawings and the schedule below.

1.2 Manifold and component material shall be suitable for the application and compatible to the type and purity of gas supplied by the manifold, as specified in the schedules and on the drawings.

1.3 Manifold arrangements shall be as specified in the schedules and indicated on the drawings.

1.4 Except where otherwise indicated, gas cylinder manifolds shall be the product of a manufacturer regularly engaged in the production thereof, with a well-established distribution (of new equipment and components) and maintenance network in South Africa.

1.5 Manifolds shall be factory assembled, cleaned, tested and certified and packed in sub-sections, suitable for transport to site, in rigid containers, suitably protecting the content against dust, dirt, corrosion and mechanical damage.

1.6 Storage on site, prior to installation shall be secure and properly protected against the ambient weather, dirt and mechanical damage.

1.7 OPERATING RANGE

1.7.1 Operating range shall be suitable for the type of application, type and purity of gas, flow rates and pressure requirements specified.

1.7.2 Ambient conditions shall be as specified in Part C3.

1.7.3 Published catalogue data with a certified laboratory test report showing gas flow rates of components, e.g. regulators, safety valves, etc. shall be available and submitted with the equipment submissions for approval by the Engineer.

1.8 SAFETY

1.8.1 Manifold manufacturing shall be subject to an approved quality control system as specified in SANS 347. Quality control system shall be submitted with the equipment submissions for approval.

1.8.2 Safety relief valves shall be fitted on each pressure section of the manifold. Test certificates of all safety valves shall be issued at practical completion. Certificates of the testing authority shall be submitted with equipment submissions.

1.8.3 Manifolds shall be accommodated in separate cylinder storage rooms, as per the relevant SANS or other relevant codes, which shall not be the same rooms where moving machinery is accommodated.

1.8.4 All manifolds serving flammable gases shall be earthed.

2 RELIABILITY AND AVAILABILITY

2.1 DOWNTIME

2.1.1 Components of the manifold shall be selected and installed to limit the down time of the pipe system to one hour when either service/repair or removal and re-installation of these components is required [Refer PART C4.7].

2.2 DOCUMENTATION

2.2.1 Control and safety equipment requiring service, maintenance, trouble shooting and possible periodic replacement, shall be documented in accordance with the equipment part of the Operating and Maintenance Manual. [Refer Part C1.5 Section 16].

3 TECHNICAL RESTRAINTS

3.1 Manifolds shall be constructed for the number of banks, cylinders per bank and the changeover requirements as indicated in the schedules and drawings.

3.2 Change over panels shall be automatic, semi-automatic or manual as scheduled. Change over panels shall be manufactured from forged bronze, black steel or stainless steel suitable for the application, gas type, gas purity, pressure and temperature and as specified.

3.3 Change-over panel assembly shall include the following items, to suit the gas and scheduled requirements:

- Change over assembly as scheduled
- Regulators, single or dual, as specified on the drawings
- Regulator by-pass lines, complete with relevant shut-off valves, as per schedule
- Safety relief valves
- Non-return or check valves
- Shut off valves to suit the cylinder pressure
- Gas inlet filter where specified
- Change over and cylinder status alarm electric pressure switches – normally closed
- Flash-back arrestors (Flammable gas manifolds)
- Mounting panel and brackets finished in epoxy powder coated steel for copper systems or stainless steel for stainless steel systems.

3.4 Regulators shall be multi-stage cylinder regulators, selected for the gas type, purity, in and outlet pressure, flow rate and temperature specified. Regulators shall control the outlet pressure within 10% of the set pressure.

3.5 Regulator outlet pressure range shall vary from zero to the maximum pressure specified.

3.6 Safety relief valves shall be lockable and relief pressures shall be set at 50% above the section working pressure.

3.7 Relief ports of the safety valves shall be piped to the outside of the building. Pipe discharge ends shall be a safe distance from any windows or air intakes into the building or any equipment and shall be fitted with vermin/insect protection. Discharge shall be downwards to prevent ingress of dust and dirt, at a safe distance to prevent injury to people and shall pose no fire risk.

3.8 Pipe sizes for discharge shall be at least one size larger than the main pipeline.

3.9 Manifold headers shall be constructed from brass, black steel or stainless steel materials as indicated in the schedules and certified for 1.5 times the working pressure of the cylinders connected at 20^{o}C (for gases in gaseous state in storage cylinder) or 65^{o}C for CO_2, C_2H_2 and N_2O. (for gases in liquid state in storage cylinder).

3.10 Connection of cylinders to manifold headers shall be with pigtails, flexible connectors or braided stainless steel hoses with restraining cables, suitable and compatible for the type of gas, purity, pressure and temperature as specified.

3.11 Copper pigtails shall be coiled from annealed copper tubing, suitable for the gas cylinder pressure and sized for the specified flow rate. Tubing shall be selected and pressure test certified for 1.5 times the cylinder pressure.

3.12 Pigtails shall be shall be of sufficient length to connect to cylinders with no strain due to extended connections. Pigtails shall be complete with standard cylinder and high pressure header connection fittings and minimum 200mm long fixed steel handle to hold tubes while fixing pig tails to cylinders.

3.13 Connection of pigtails to manifold headers shall be by high pressure gas connections, complete with check valves.

3.14 CYLINDER STORAGE BRACKETS

3.14.1 All cylinders shall be fixed with chains, one end welded or secured with an eye bolt, to a steel frame, fixed to a wall or free standing self-supporting, rigid steel frame and the other secured with a hook welded to the support frame.

3.14.2 Entire frame and chains shall be hot dipped galvanised. Chain support shall be at a height, 2/3 of the cylinder height, above floor level, to thoroughly secure cylinders.

3.14.3 All brackets shall be painted in the identification colours of the relevant gas and shall be labelled with the chemical symbol of the gas and the gas name, in English.

3.14.4 Cylinder holding frames for spare and empty cylinder banks shall be identified as per the manifold banks and with permanently secured labels indicating SPARE and EMPTY

3.14.5 Labels shall be manufactured and secured as specified in 'Identification' Part C3.2 Section 02. All lettering on the labels shall be minimum 100mm high.

3.14.6 Statutory identification labels shall manufactured from steel, engraved and comply with the relevant SANS standard.

3.15 CLEANING

3.15.1 Upon installation, the manifold shall be cleaned, as prescribed by the manufacturer and high pressure purged with the relevant gas to be served by the manifold.

3.16 OPERATING INSTRUCTIONS

3.16.1 Clearly printed, legible from floor level, operating instructions, complete with schematic diagrams, as specified in Part C3.2 Section 02 shall be mounted against a wall above the or adjacent to the manifold.

3.17 TESTING

3.17.1 All tests as specified in the OHS Act, Pressure regulations SANS 347 and other relevant or specified code codes, e.g. SANS 10260, SANS 7396, regulation or authority's requirements, shall be performed and the appropriate certificates issued to Engineer, prior to the Employer taking occupation of the facility.

3.17.2 Manufactures, importers and suppliers of pressure equipment shall comply with regulations as per SANS 347, Section 5.3, and shall submit proof thereof.

4 SCHEDULE

Complete the outstanding data relevant to the offered product

General	Refer	Units	Tender	Offered	Tender	Offered
Gas			Helium		Argon	
Abbreviation			He		Ar	
Identification						
Drawing reference						
Mounting type (Wall/Free standing)		(W/FS)	W		W	
Purity (Baseline/Medical Grade/O_2)	1	(N/MG/O_2)	4.0		4.0	
Cylinder banks per manifold (Primary, secondary, reserve)	2	(1,2,3)	2		2	
Cylinders per bank		(No)	1		1	
Gas supply rate (Free Air Delivery – FAD)		(l/min)	0.4		0.4	
Cylinder pressure (in)		(kPa)	20 000		20 000	
Line pressure (out)		(kPa)	1050		1050	
Gas inlet metal filter		(Y/N)	Y		Y	
Change-over panel (Auto, Semi-Auto, Manual)						
- Primary/secondary banks		(A/S/M)	A		A	
- Reserve supply bank		(A/S/M)	A		A	
- Panel pipe & fitting material (Cu/Brass, stainless, black steel)	3	(Brass,s/s, b/s)	s/s		s/s	
- Header material			s/s		s/s	
Bank pressure regulator stages (Single/ Two stage)		(1 or 2)	2		2	
- Pressure – in		(kPa)	20 000		20 000	
- Pressure – out		(kPa)	1050		1050	
Line Pressure regulator						
- No off (Single/Dual)		(S/D)	D		D	
- Regulator stages		(1 or 2)	2		2	
- Pressure – in		(kPa)	1050		1050	
- Pressure – out (Adjustment max to 0)		(kPa)	400		400	
- By-pass regulators		(Y/N)	N		N	
- Outgoing pipe diameter	4	(mm dia)				
Dimensions						
- overall width		(mm)				
- length per side		(mm)				
- change over panel width (centre to centre – first cylinders)		(mm)				
Bulk tank connection		(Y/N)	N		N	
- pipe connection diameter		(mm)				
Cylinder connections (Cu pig tails, braided s/s or approved)		(Cu/s/s)	s/s		s/s	

NOTES

1. Purity: Baseline (e.g. N4.5 – 99.995% pure); MG – Medical Grade; O_2 – all components are cleaned for Oxygen compatibility
2. Cylinder banks per manifold (Primary, secondary, reserve); 1 – primary only; 2 – primary and secondary; 3 – primary, secondary and reserve banks
3. Manifold change over and pressure regulating panel material shall be brass 70/30, 316 stainless steel (SS) or black steel (BS) suitable for the cylinder pressure and gas
4. Outgoing pipe diameter – as per drawings

General	Refer	Units	Tender	Offered	Tender	Offered
Gas			Nitrogen		Methane	
Abbreviation			N_2		CH_4	
Identification						
Drawing reference						
Mounting type (Wall/Free standing)		(W/FS)	W		W	
Purity (Baseline/Medical Grade/O_2)	1	(N/MG/O_2)	4.0		5.0	
Cylinder banks per manifold (Primary, secondary, reserve)	2	(1,2,3)	2		2	
Cylinders per bank		(No)	1		3	
Gas supply rate (Free Air Delivery – FAD)		(l/min)	0.4		0.4	
Cylinder pressure (in)		(kPa)	20 000		20 000	
Line pressure (out)		(kPa)	1050		1050	
Gas inlet metal filter		(Y/N)	Y		Y	
Change-over panel (Auto, Semi-Auto, Manual)						
- Primary/secondary banks		(A/S/M)	A		A	
- Reserve supply bank		(A/S/M)	A		A	
- Panel pipe & fitting material (Cu/Brass, stainless, black steel)	3	(Brass,s/s, b/s)	Cu		s/s	
- Header material			s/s		s/s	
Bank pressure regulator stages (Single/ Two stage)		(1 or 2)	2		2	
- Pressure – in		(kPa)	20 000		20 000	
- Pressure – out		(kPa)	1050		1050	
Line Pressure regulator						
- No off (Single/Dual)		(S/D)	D		D	
- Regulator stages		(1 or 2)	2		2	
- Pressure – in		(kPa)	1050		1050	
- Pressure – out (Adjustment max to)		(kPa)	400		400	
- By-pass regulators		(Y/N)	N		N	
- Outgoing pipe diameter	4	(mm dia)				
Dimensions						
- overall width		(mm)				
- length per side		(mm)				
- change over panel width (centre to centre – first cylinders)		(mm)				
Bulk tank connection		(Y/N)	N		N	
- pipe connection diameter		(mm)				
Cylinder connections (Cu pig tails, braided s/s or approved)		(Cu/s/s)	s/s		s/s	

1. General

All electrical work carried out and all materials used, shall be in accordance with the following standards, latest edition:

- SANS 1507 - Electric cables
- SANS 0142 - Standard Regulation Wiring of Premises

The electrical work includes the supply, delivery, erection and commissioning of all electrical equipment associated with this sub-contract. Unless otherwise specified, electrical power supply to the warning light panel and to the plant rooms will be supplied by others. The correct positioning and size of end boxes etc. remains, however, the responsibility of the as contractor.

A wiring diagram of all electrical circuits involved in the gas, vacuum and compressed air plant must be framed behind glass and mounted on the walls of the respective plant rooms in suitable positions

2. Warning light Panels- Manifold Systems

Warning light panels shall be constructed, wired and mounted where shown on the plans. The face of the panels shall be of chromium plated brass or stainless steel with engraved nomenclature.

New Master Alarm Panel and Slave Panels shall be supplied, installed in the positions shown on the drawings and tested. The panels shall be designed to monitor and to sound a visual/audible alarm of a failure to any of the following plants/systems:

- Manifold - Left bank
- Manifold - Right bank
- Main supply pressure
- Standby generator. (Supplied by others)

Alarm panels shall have the following features and capabilities:

- Main power spike and surge protection.
- Voltage regulation to protect against mains voltage fluctuations.
- Solid state 12 Volt DC switching (no relays) eliminating dangerous sparks at pressure switches and gauges
- Distances up to 400 metres from switches to master.
- Distances up to 600 metres from slave to master
- Low maintenance due to electronic chips and LED's
- Up to 5 slaves on standard master panel.
- Standard master panel to give 12 signals, 5 gasses right and left bank manifold, compressed air and vacuum.
- UPS or Battery back-up

The system shall be provided with a 220 Volt AC supply which shall be transformed to 12 Volt DC in the Master control panel. This shall also be a facility for Battery Back-up in the event of a power failure.

For construction and general lay-out of warning light panel reference shall be made to drawing ME040503. Visual and audible alarms and status of equipment shall be indicated as follows:

- When all the gases are in normal condition, Green L.E.D's are activated.
- On signal from either a pressure switch or contact gauge, Green L.E.D deactivates.
- Red L.E.D directly below commences flashing and the Audible Alarm activates.
- On pressing the "accept button" the Audible Alarm cancels. Audible alarm shall only be reactivated when another alarm is activated.
- Red L.E.D remains flashing until condition reverts to "normal".
- With the systems operating transistors there are no hazardous sparks at the switching points.
- The system has twelve alarm contacts as a standard but can have additional alarm contacts in multiples of 12.

3. Responsibility for quality of Installation

3.1 Upon completion of the installation, the sub-contractor shall sign a Certificate of Compliance in respect of this work.

This certificate of compliance shall affirm that the following has been complied with:

a) All materials installed, cable routes and equipment settings are as set out on the Engineer's drawings and in this specification.

b) All materials and workmanship comply fully with all of the requirements of the documents listed.

3.2 The Contractor shall be responsible for the costs of repairs or any other costs resulting from the non-conformance with these requirements.

4. Low Voltage Cable Reticulation

4.1 In Cable trays

LV cables of the PVC.PVC.SWA.PVC type with copper conductors to SABS 1507 must be installed along the routes as indicated on the drawings and according to the schedule of cables.

4.2 Testing of Cables after Installation

All LV cables shall be tested in accordance with the Standard Specification for LV cable installation.

4.3 Earth Conductors with LV Cables

Earth conductors are to be run with all cables constituting part of the low tension distribution system. Such earth continuity conductors are to be bare copper wire of a cross sectional area equal to and at least half that of one live conductor of the cable. The earth continuity conductor shall be bonded to the cable armouring as well as to the local earth bar.

5. Distribution Boards/Motor Control Centres (MCC)

5.1 The distribution boards/MCC shall be surface mounted and must be supplied fully equipped with trays, covers, panels and wired as specified, and installed in positions as indicated on the drawings. Cover panels must be secured with captive thumb screws or quick - release catches provided with slots for large screw driver or coin. Dome units will not be allowed.

5.2 Available Space and Access

The contractor shall check on the plans and on the site that sufficient space and access is available for the mounting of boards as specified. No extra will be allowed arising from failure by the sub-contractor to check these details.

5.3 Mountings Heights

Minimum height above floor level to bottom of board shall be 1.2 m and maximum height to top of board shall be 2.0 m.

5.4 Completion

Prior to first delivery, all boards shall be thoroughly cleaned inside and outside, all rubbish and dust blown out and removed from the board and equipment. Finished surfaces shall be made good where necessary, using identical paint. The contractor is to procure sufficient “touch-up” paint to cover 5% of the total area of any colour used. The colour of boards shall be appliance white, unless otherwise specified.

PART C4

INFORMATION

PART C4.1

SCHEDULE OF DRAWINGS

NOTE: The drawings listed below and issued with this Gas Contract document illustrate the broad scope of the contract works. The Tenderer is referred to the Principal Contract Preliminaries, where applicable, in this regard.

Existing System Modifications		
191013-M-G-4GF-GS	00	Building 1 Gas Storage & Reticulation Layout
191013-M-G-110	00	Typical Manual Change Over Gas Manifold Schematic

PART C4.2

WAIVER OF CONTRACTOR'S LIEN

Waiver of the Contractor's Lien for use with the …

Principal Building Agreement Edition used ?

Minor Works Agreement Edition used ?

Contractor

Employer

Works

Site

AGREEMENT

The **contractor** waives in favour of the **employer** any lien or right of retention that is or may be held in respect of the **works** to be executed on the **site**

This waiver shall only come into effect on provision by the **employer** of a **security for payment** in fulfilment of obligations in terms of the identified **agreement**

This done and signed at

Date

Name of Signatory

Capacity

For and on behalf of the **contractor** who by signature hereto warrants such authorisation

Signature of Witness

Contractor

Street Address

Code

Postal Address

Code

E-mail

Mobile

Fax

Telephone

PART C4.3

FORM OF DESIGN RESPONSIBILITY/INDEMNITY

TENDER FOR THE GAS INSTALLATION CONTRACT

SCHEDULE 11: FORM OF INDEMNITY

Project Name: .....

Tender for (description of work) .....

I/We, the undersigned, hereby:

1. Warrant and undertake unto and in favour of the Employer, the Architect, the Engineer and the Principal Contractor, where applicable, that:

   (a) I/We, insofar as the gas contract works relating to my/our foregoing tender have been or will be designed by me/us, have exercised and shall exercise due and proper skill and care in such design; and

   (b) I/We, insofar as any part of the materials or goods for the gas contract works relating to my/our foregoing tender have been or will be selected by me/us, have exercised and shall exercise due and proper skill and care in such selection of materials or goods; and

   (c) I/We, shall comply with and satisfy any performance specification or requirement insofar as such performance specification or requirement is included or referred to in my/our foregoing tender; and

2. Undertake and shall be obliged to pay and make good to the Employer all damages which the Employer may suffer as a result of my/our non-compliance with the warranties as set out in paragraph 1 above; and

3. Indemnify the Architects, the Engineer and the Contractor and hold them blameless and free of claims and proceedings of whatsoever nature, instituted against them or any one or more of them by any person whatsoever (including the Employer) in respect of or arising from the design of the Sub-contract works relating to my/our foregoing tender, insofar as such design has or shall be made by me/us, or from the use of any materials or goods for the Sub-contract work relating to my/our foregoing tender, insofar as such materials or goods have been or shall be selected by me/us, or from my/our failure to comply with and satisfy any performance specification or requirement as is included or referred to in my/our foregoing tender.

For purposes of this Warranty and Indemnity the terms Employer, Architect, Engineer and Contractor shall mean the persons indicated as such under the heading GENERAL INFORMATION in the foregoing tender document and in the event of:

(1) No Engineer being appointed by the Employer, all references to the Engineer in the Warranty and Indemnity shall for all purposes be deemed to be deleted; and

(2) No Contractor being indicated as aforesaid, the term Contractor shall mean the person or firm to be appointed by the Employer as Contractor

Except to the extent as set out in this Warranty and Indemnity, nothing herein contained shall create any privity of contract between the Employer and myself/ourselves. This Warranty and Indemnity shall become of force and effect in the event of my/our foregoing tender being accepted by the Contractor with or without any modification and shall in such an event for all purposes be deemed to have been accepted by the Employer, the Architect, the Engineer and the Contractor.

Date .....

Signature .....

Name of Signatory .....

Name of firm represented by signatory .....

PART C4.4

CONSTRUCTION GUARANTEE – PRINCIPAL AGREEMENT

PART C4.6

UNFIXED MATERIALS GUARANTEE

UNFIXED MATERIALS GUARANTEE
(To be provided by a Selected Subcontractor)

1 **UNFIXED MATERIALS GUARANTEE** ("Guarantee") by -

1.1 [ ] (Note 1) ("Guarantor")

in favour of -

1.2 [ ] ("Employer")

2 **DEFINITIONS**

In this guarantee, unless the context requires otherwise -

2.1 "Employer" shall mean ……..

2.2 "Guarantor" shall mean the person or institution identified in 1.1 above;

2.3 "Contractor" shall mean [ ] (Note 2);

2.4 "Principal Agreement" shall mean the written agreement of building contract

2.4.1 which has been or shall be entered into between the Employer and the Contractor;

2.4.2 which comprises the agreement and the contract documents as defined therein;

2.4.3 in terms of which the Contractor has undertaken or shall undertake to execute and complete the following works -

[ ] (Note 3) ("Works");

2.5 "Subcontractor" shall mean the following body corporate or person who has been or shall be employed by the Contractor as a nominated or selected subcontractor under the Principal Agreement to perform the following subcontract works -

[ ] (Note 4) ("Subcontract Works");

2.6 "subcontract" shall mean the nominated or selected subcontract -

2.6.1 which has been entered into or shall be entered into between the Contractor and the Subcontractor; and

2.6.2 in terms of which the Subcontractor has been or shall be employed to complete the Subcontract Works;

2.7 "Works" shall mean the Works referred to in 2.4.3;

2.8 "Site" shall mean the Site upon which the Works shall be and/or, are being constructed;

2.9 "Guaranteed Amount" shall mean the amount of R [ ] (Note 5) which shall constitute the limit of the Guarantor's liability hereunder.

3 **BASIS**

It is the basis of this Guarantee that -

3.1 The Employer shall from time to time, subject to delivery to the Employer of this Guarantee, pay to the Contractor or the Subcontractor, in terms of the Principal Agreement, the value of materials and/or goods ("Unfixed Materials") which:

3.1.1 are intended for use in or to be built into the Works or the Subcontract works;

3.1.2 have been delivered to the Site or are still off Site; and

3.1.3 at the time of such payment to the Contractor or the Subcontractor have not been built into and/or affixed to the Works or the Subcontract Works; and,

3.2 Should the Employer pay the Contractor or the Subcontractor the value of any Unfixed Materials, the ownership of which does not pass to or vest in the Employer, the Guarantor shall, in the terms set forth in this Guarantee, refund to the Employer the value of such Unfixed Materials so paid to the Contractor or the Subcontractor; and

3.3 The Guarantor hereby acknowledges and agrees that -

3.3.1 It is conversant with the Principal Agreement and the subcontract and that each word or phrase as defined in clause 1.0 of the Principal Agreement shall, when utilised in this Guarantee, have the same meaning ascribed thereto in the Principal Agreement; and,

3.3.2 Reference herein to the Principal Agreement and/or the Subcontract and the reference thereto in terms of 3.3.1, shall not be construed to constitute this Guarantee as being a suretyship or an accessory obligation of any nature whatsoever.

4 **LIMIT TO GUARANTOR'S LIABILITY**

Notwithstanding anything to the contrary contained herein the Guarantor's liability to the Employer under this Guarantee shall be and is limited to the Guaranteed Amount.

5 **THE GUARANTEE**

5.1 Subject to the Guarantor's maximum liability referred to in 4, the Guarantor hereby binds itself unto and in favour of the Employer, as principal debtor and as such, hereby undertakes as a principal and independent obligation in favour of the Employer forthwith upon receipt by the Guarantor at its domicile address referred to in 6.2 of the documents identified in 5.1.1 and 5.1.2 hereof to pay to the Employer the sum of money referred to in 5.1.1.2, namely -

5.1.1 a written demand addressed to the Guarantor and issued by or on behalf of the Employer in which the Employer -

5.1.1.1 has recorded that such demand has been issued in terms of this Guarantee; and,

5.1.1.2 has demanded payment of a stated sum of money which -

5.1.1.2.1 does not exceed the Guaranteed Amount; and,

5.1.1.2.2 is equal to or is less than the value of the unfixed materials described in the statement of the Principal Agent which is referred to in 5.2; and,

5.1.2 a written statement prepared and signed by the Principal Agent which records -

5.1.2.1 the value and description of Unfixed Materials;

5.1.2.2 that the value of the Unfixed Materials referred to in 5.1.2.1 has been paid by the Employer to the Contractor or to the Subcontractor; and,

5.1.2.3 either that the unfixed materials referred to in 5.1.2.1 have despite demand therefor addressed to the Contractor, not been delivered to the Site or that such Unfixed Materials have, despite such demand, not been affixed to or built into the Works or the Subcontract Works or that the ownership of such Unfixed Materials has not passed to or vested in the Employer or that a person other than the Employer has claimed ownership of the Unfixed Materials referred to in 5.1.2.1.

5.2 The Guarantor shall not be entitled to withhold payment to the Employer in terms of 5.1 even if the Guarantor contends that the Guarantor is not obliged to make such payment on the basis of any fact or allegation which would constitute a legal or equitable defence to or a discharge of any claim by the Employer under this Guarantee; provided however that the aforegoing provisions of this 5.2 shall not be construed as preventing the Guarantor from reclaiming any amount paid under protest pursuant to a claim by the Employer in terms of this 5.2 if the Guarantor contends that it was not obliged to pay such amount.

6. **GENERAL**

6.1 The Employer shall have the absolute right to arrange his affairs with the Contractor and/or the Subcontractor under the Principal Agreement the Subcontract or otherwise in any manner which the Employer deems fit and the Guarantor shall not have the right to claim his release from this Guarantee on account of any conduct alleged to be prejudicial to the Guarantor. Without derogating from the generality of the aforeging -

6.1.1 any compromise by the Employer and the Contractor relative to the Principal Agreement and/or the Subcontract and/or the parties' respective obligations thereunder; and/or

6.1.2 any amendment or variation of or addition to the provisions of the Principal Agreement, the Subcontract and/or the parties' respective obligations thereunder;

6.1.3 any revision of the construction period, indulgence, release and/or waiver of the Employer's and/or the Contractor's and/or the Subcontractor's obligations under the Principal Agreement and/or the Subcontract,

6.1.4 shall not affect the validity of this Guarantee and shall not afford the Guarantor the right to claim its release from its undertakings and/or obligations under this Guarantee.

6.2 The Guarantor hereby chooses domicilium citandi et executandi for all purposes in connection with this Guarantee and any legal proceedings instituted on the basis of this Guarantee at the following address -

[ ] (Note 6);

6.3 This Guarantee is neither negotiable nor transferable and shall be returned to the Guarantor upon it having lapsed in terms of 6.4;

6.4 This Guarantee shall lapse and be of no further binding force of effect upon the earlier of -

6.4.1 the date of issue of Certificate of Final Completion by the Principal agent in terms of the Principal Agreement; or

6.4.2 the date upon which the Guaranteed Amount shall have been paid to the Employer in full in terms of this Guarantee.

6.5 The rights of the Employer under this Guarantee shall in no way be affected or diminished if the Employer at any time obtains additional suretyships, guarantees, securities or indemnities in connection with the obligations of the Guarantor hereunder or in connection with the obligations of the Contractor under the Principal Agreement.

6.6 Solely for the sake of clarity and without prejudice to or limitation of the aforegoing provisions of this Guarantee, it is recorded that the Guarantor renounces the benefits of all otherwise applicable legal immunities, defences and exceptions to the extent that they would be applicable in the absence of this renunciation, including the defences and exceptions of "cession of actions", "excussion", "division", "de duobus vel pluribus reis debendi", "non causa debiti", "errore calculi", "no value received" and "revision of accounts", with the meaning and effect of all of which the Guarantor declares itself to be fully acquainted.

6.7 As part of the Guarantor's liability in terms hereof, the Guarantor shall pay the amount of any costs, charges and expenses of whatever nature incurred by the Employer in securing or endeavouring to secure fulfilment of the Guarantor's obligations hereunder, including, without limitation, collection commission and legal costs on the scale as between an attorney and his own client.

6.8 This document constitutes the sole record of the agreement between the Employer and the Guarantor in regard to the subject matter hereof.

6.9 Neither the Guarantor nor the Employer shall be bound by any express or implied term, representation, warranty, promise or the like not recorded herein, but the provisions hereof are without prejudice to such other rights as the Employer may have at law.

6.10 No addition to, variation, or unilateral or consensual cancellation of this Guarantee shall be of any force or effect unless in writing and signed by or on behalf of the Employer and the Guarantor.

6.11 No indulgence which may be granted to the Guarantor by the Employer shall constitute a waiver of any of the rights of the Employer which shall not thereby be precluded from exercising any right against the Guarantor which may have arisen in the past or which may arise in the future.

6.12 If any provision of this Guarantee should be found by a competent court to be wholly or partly invalid or unenforceable then this Guarantee shall be severable in respect of the provision in question (to the extent that it is invalid, unenforceable or unlawful) and the remaining provisions of this Guarantee shall remain in full force and effect.

7. NO PRIVITY OF CONTRACT

The provisions of this Guarantee shall not create any privity of contract between the Employer and the Subcontractor under and in respect of the Principal Agreement or the subcontract.

8. **EXECUTION**

SIGNED at [ ] on this [ ] day of [ ] by (hereafter "Signatory") (Note 7) on behalf of the Guarantor, which Signatory -

8.1 has been duly authorised to bind the Guarantor to this Guarantee by virtue of the attached resolution (Note 8);

8.2 in his personal capacity (that it not representative capacity) hereby warrants in favour of the Employer that he has been invested with the necessary authority to bind the Guarantor to the provisions of this Guarantee.

AS WITNESSES:

1. _____

2. _____ _____
(Note 9) The Signatory on behalf of the Guarantor

NOTES

Note 1: Insert the Guarantor's name and registration number.

Note 2: Insert the Contractor's name and registration number.

Note 3: Insert description of the Contract Works.

Note 4: Insert description of the Subcontract Works.

Note 5: Insert the maximum Guaranteed Amount.

Note 6: Insert Guarantor's physical address (not Post Box Number).

Note 7: Insert the name of the Signatory on behalf of the Guarantor.

Note 8: Attach a certified copy of resolution by the directors of the Guarantor authorising the Signatory to sign this Guarantee on its behalf.

Note 9: The Signatory and the witnesses must initial each page hereof and sign clause 8 in full.

PART C4.7

MAINTENANCE AGREEMENT – EXTENDED MAINTENANCE PERIOD

[*Job Name*]

GAS SYSTEM/ PLANT MAINTENANCE AGREEMENT

between

[***Employer*** **]**

and

[ ]

PERIOD	OPTION
STANDARD 12 MONTHS MAINTENANCE	YES
EXTENDED PERIOD – 1 to 3 YEARS	NO
EXTENDED PERIOD – 1 to 5 YEARS	NO

TABLE OF CONTENTS

1 **INTERPRETATION** 4

2 BASIS 6

3 SCOPE 6

4 MAINTENANCE OBJECTIVES 6

5 MAINTENANCE WORK 7

6 QUALITY ASSURANCE 9

7 MAINTENANCE MANAGEMENT SYSTEM 9

8 MAINTENANCE PROGRAMME 10

9 MAINTENANCE STAFF AND MEETINGS 11

10 LIMITATION OF RESPONSIBILITY OF CONTRACTOR 11

11 GENERAL RESPONSIBILITIES OF CONTRACTOR 11

12 EMPLOYER'S OBLIGATIONS 13

13 MAINTENANCE ACTIVITY SCHEDULES 14

14 MAXIMUM EQUIPMENT DOWNTIMES 14

15 INSPECTIONS 14

16 MAINTENANCE CONSIDERATION REPLACEMENT PARTS FACILITIES BONUS 15

17 COMMENCEMENT AND DURATION 17

18 TERMINATION 17

19 SUSPENSION OF MAINTENANCE 17

20 PENALTIES 18

21 BREACH 18

22 SECURITY 18

23 INSURANCE 18

24 ARBITRATION 19

25 NOTICES 20

26 GOVERNING LAW 20

27 GENERAL 21

28 EXECUTION 21

GAS SYSTEM/ PLANT MAINTENANCE AGREEMENT

between

[ ]
("Employer")

and

[ ]
("Contractor")

1 **INTERPRETATION**

In this Agreement, clause headings are for convenience and shall not be used in its interpretation and, unless the context clearly indicates a contrary intention -

1.1 an expression which denotes -

1.1.1 any gender includes the other genders;

1.1.2 a natural person includes an artificial or juristic person and vice versa;

1.1.3 the singular includes the plural and vice versa;

1.2 the following expressions shall bear the meanings assigned to them below and cognate expressions bear corresponding meanings -

1.2.1 "Agreement" means this Agreement and the appendices thereto;

1.2.2 "Annual Maintenance Consideration" means any Annual Maintenance Consideration in respect of which the Contractor shall have submitted a Tender under and in terms of the Subcontract to supply and instal the Equipment referred to under the definition of Certificate of Works Completion;

1.2.3 "Call-Back Rate" means the number of times the Contractor shall, in each twelve month period of this Agreement, be required by the Employer to provide Corrective Maintenance in respect of the Equipment, or any part thereof;

1.2.4 "Call-Back Response Time" means the call-back response time(s) referred to in 4.8;

1.2.5 "Certificate of Works Completion" means the Certificate of Works Completion as shall be issued by the Principal Agent in terms of the Principal Building Agreement according to which the Building in [ ] shall be or has been constructed for the Employer, by a principal building Contractor to which the Contractor has contracted, by means of a subcontract to supply and install the Equipment in the aforegoing Building;

1.2.6 "Commencement Date" means the first anniversary of the Final Completion Date;

1.2.7 "Contractor" means [ ];

1.2.8 "Corrective Maintenance means repairs maintenance to Equipment failing or malfunctioning while in service in order to correct such failing or malfunctioning and to restore the Equipment to normal functioning and satisfactory operating condition;

1.2.9 "Employer" means [ ]

1.2.10 "Equipment" means the entire Gas system/ plant and equipment to be installed in or situated in the Employer's building [ ]

1.2.11 "Equipment Manufacturers Maintenance Instructions" means the maintenance instructions which -

1.2.11.1 Are contained within the Operating and Maintenance Manuals;

1.2.11.2 have been prepared and issued by any manufacturer or supplier of the Equipment;

1.2.11.3 shall have been delivered to the Employer by the contractor or subcontractor which shall have supplied and/or installed the Equipment;

1.2.12 "Final Completion Date" means the date specified in the Certificate of Works Completion;

1.2.13 "High Priority Equipment" means equipment which affects the performance of Gas system in critical areas or substantial portions of the Gas system eg. Manifolds, Vacuum plant, Compressed air plant,etc;

1.2.14 "Low Priority Equipment" means equipment which affect performance of the Gas system in a small portion of a working zone eg. Regulators, Terminal outlets, Flashback arresstorsetc;

1.2.15 "Maintenance Activity Schedules" means the maintenance activity schedules as referred to in 13;

1.2.16 "Maintenance Management Systems means the management system referred to in 7;

1.2.17 "Maintenance Programme" means the Maintenance programme referred to in 8;

1.2.18 "Maintenance Quality Assurance means the quality assurance and standards referred to in 6;

1.2.19 "Maintenance Service" means the supply by the Contractor of Predictive Maintenance, Preventative Maintenance and Corrective Maintenance in respect of the Equipment in terms of this Agreement;

1.2.20 "Maximum Equipment Downtime" means the Maximum Equipment Downtime referred to in 14;

1.2.21 "Medium Priority Equipment" means equipment which affect performance of Gas sub-systems in a local working zone or non critical areas eg. Gas???? etc;

1.2.22 "Operating and Maintenance Manuals" means the operating and maintenance manuals which -

1.2.22.1 have been prepared and issued by any manufacturer and/or supplier of the Equipment; and

1.2.22.2 shall have been delivered to the Employer by the contractor or the subcontractor which shall have supplied and/or installed the Equipment;

1.2.23 "Parties" means the Employer and the Contractor;

1.2.24 "Party" means either the Employer or the Contractor;

1.2.25 "Predictive Maintenance" means the collection of data, performing of tests and inspections, determining and monitoring trends to enable timely identification of, and to predict, degradation of the Equipment, or any part thereof, or loss of performance in order that Preventative Maintenance can be performed prior to Equipment failure;

1.2.26 "Preventative Maintenance" means maintenance carried out within the anticipated endurance time of the Equipment or any part thereof (including the replacement of worn components when components have reached the end of their operational life or if components are no longer capable of meeting their operational design criteria) in order to ensure the safe, efficient and reliable operation of the Equipment according to their design criteria;

1.2.27 "Response Time" means the response times referred to in 4.8;

1.2.28 "Site" means the Employer's Building referred to in [ ];

1.3 any reference to any statute, regulation or other legislation shall be a reference to that statute, regulation or other legislation as at the signature date, and as amended or substituted from time to time;

1.4 if any provision in a definition is a substantive provision conferring a right or imposing an obligation on any party then, notwithstanding that it is only in a definition, effect shall be given to that provision as if it were a substantive provision in the body of this agreement;

1.5 where any term is defined within a particular clause, other than this 1, that term shall bear the meaning ascribed to it in that clause wherever it is used in this agreement;

1.6 where any number of days is to be calculated from a particular day, such number shall be calculated as excluding such particular day and commencing on the next day. If the last day of such number so calculated falls on a day which is not a business day, the last day shall be deemed to be the next succeeding day which is a business day;

1.7 any reference to days (other than a reference to business days), months or years shall be a reference to calendar days, months or years, as the case may be;

1.8 any term which refers to a South African legal concept or process (for example, without limiting the aforegoing, winding-up or curatorship) shall be deemed to include a reference to the equivalent or analogous concept or process in any other jurisdiction in which this agreement may apply or to the laws of which a party may be or become subject.

2 BASIS

It is the basis of this Agreement that the Contractor shall, during the period of this Agreement, and any extensions thereof, supply the Employer with a Maintenance Service for and in respect of the Equipment in terms of the provisions contained in this Agreement, the Operating and Maintenance Manuals and the Equipment Manufacturers Maintenance Instructions.

3 SCOPE

3.1 The Maintenance Service which shall be supplied by the Contractor to the Employer shall -

3.1.1 consist of Corrective Maintenance, Preventative Maintenance and Predictive Maintenance;

3.1.2 achieve the maintenance objectives set forth in 4 below; and

3.1.3 be performed and supplied in accordance with the provisions of this Agreement.

4 MAINTENANCE OBJECTIVES

Without limiting the Contractor's obligations in terms of this Agreement, the Contractor shall, by means of the supply of the Maintenance Service in terms of 2 and 3 ensure -

4.1 the safety and comfort of persons using the Equipment;

4.2 the accuracy and reliability of the performance of the Equipment;

4.3 that the Maintenance Service is carried out at all times irrespective of whether or not such maintenance is necessitated by faulty design, faulty materials or faulty workmanship employed in connection with the manufacture and/or installation of the Equipment, or by reason of fair wear and tear;

4.4 that the Maintenance Service is carried out in accordance with the Maintenance Programme, the Maintenance Quality Assurance and the Maintenance Management System;

4.5 that the Equipment and associated spares are kept clean and presentable at all times;

4.6 that the frequency of Equipment break-downs shall not result in the target number of (8) eight call-backs per annum being exceeded on the basis that -

4.6.1 the actual call-back rate shall be recorded by the Contractor on a monthly basis and assessed and calculated on a twelve monthly basis;

4.6.2 each twelve month period referred to in 4.6.1 shall, in each case, be the twelve month period preceding each anniversary of the Commencement Date;

4.7 that the Maintenance Programme shall be structured and implemented so as to ensure that a Maximum Equipment Downtime shall not be exceeded;

4.8 that at any time of the day or night, seven days a week, inclusive of statutory holidays, throughout the period of this Agreement, the Contractor (his Technician) shall be available to respond to call-backs with regard to breakdowns of Equipment on the basis that -

4.8.1 the response times shall be reckoned from the time the call is received by the Contractor to the time the Contractor's technician arrives on Site;

4.8.2 the response time during normal working hours shall be two hours;

4.8.3 the response time outside of normal working hours shall be three hours;

5 MAINTENANCE WORK

5.1 Maintenance Work comprises –

5.1.1 Predictive Maintenance;
5.1.2 Preventative Maintenance;
5.1.3 Corrective Maintenance.

5.2 The Contractor shall perform Predictive Maintenance in accordance with the Equipment Manufacturer's Maintenance Instructions and the Operating and Maintenance Manuals and in accordance with good maintenance practice to ensure that the objectives in 4 are attained in respect of the Equipment.

5.3 The Contractor shall, following on Predictive Maintenance and as may be evidenced thereby, report any trends detected of Equipment degradation, loss of performance or frequency of failure to the Employer.

5.4 The Contractor shall perform the Preventative Maintenance in accordance with the Equipment Manufacturer's Maintenance Instructions and the Operating and Maintenance Manuals, and as may become evident by Predictive Maintenance to ensure achievement of the objectives in 4.

5.5 Without limiting the generality of 5.4, the Preventative Maintenance shall comply with the Maintenance Activities Schedules.

5.6 The Contractor shall arrange with the Employer and obtain approval for the date, time and duration when Equipment shall be out of service for purposes of performing the Preventative Maintenance and/or the Predictive Maintenance provided that the Maximum Equipment Downtimes shall not be exceeded by such Maintenance Service.

5.7 The Contractor shall perform the Corrective Maintenance on broken down Equipment within the Maximum Equipment Downtimes.

5.8 Following Corrective Maintenance, the Contractor shall deliver a written report to the Employer recording -

5.8.1 date and time of the failure;
5.8.2 reason for the failure;
5.8.3 date and time when Corrective Maintenance completed;
5.8.4 details of Corrective Maintenance supplied; and
5.8.5 the results of any post Corrective Maintenance testing performed to ensure satisfactory operation of the Equipment.

5.9 Without limiting the generality of 5.1 through to 5.9, it shall be the obligation of the Contractor in connection with the Maintenance Service -

5.9.1 to ensure that Maintenance Service shall be performed by Competent persons who are qualified Gas system/ Equipment Mechanic/s experienced and skilled in maintaining equipment similar to which are subject matter of this Agreement and who are employed and supervised by the Contractor. The Employer reserves the right to request and be granted copies of certificates of qualification/competence for the aforegoing technicians;

5.9.2 to maintain locally or nationally an inventory of all regularly wearing parts or parts relative to the Equipment whose failure can be reasonably predicted/anticipated;

5.9.3 to provide and keep or have access to a national or international inventory of all wearing parts in respect of the Equipment's maintenance and operation. The Employer reserves the right to inspect the spares inventory at any time during the term of this Agreement;

5.9.4 to ensure that major Equipment components not included in the local or national inventory of spares are sourced and ordered prior to these components failing or not being able to deliver the Maintenance Service in terms of this Agreement;

5.9.5 to supply, repair and replace all parts of every description made necessary by Preventative or Corrective Maintenance without expense to the Employer when such replacement or repair is deemed necessary by the Contractor in accordance with this Agreement. Only parts that are correctly designed, manufactured and suitable in all respects, shall be used;

5.9.6 to replace all parts timeously, thereby limiting the incidence of break-downs, unplanned maintenance or repair and consequently maintain maximum equipment operation;

5.9.7 to ensure that the break-time does not exceed the Maximum Equipment Downtime;

5.9.8 to carry out all Equipment changes or revisions, which may become necessary to ensure an operation that conforms to the original design and performance specification or a subsequent, documented and approved revised specification, without expense to the Employer;

5.9.9 to notify the Employer of all improvements or revisions related to the Equipment. These notifications shall take the form of technical notices or sales releases under a covering letter from the Contractor;

5.9.10 to ensure that all wiring diagrams and other drawings of a technical nature related to the Equipment kept up to date and are available for the sole use of the Contractor, Employer or its technical personnel. The wiring diagrams enclosed in plastic protection sleeves shall be located and retained in suitably sized and constructed steel cabinets/enclosures situated within the machine room. Any amendments to these wiring diagrams shall be marked up as a revision and the diagrams reprinted by the Contractor within a ten day period after such change occurring;

5.9.11 to provide within a one month period after being appointed for the Maintenance Service under this Agreement, a maintenance site register located in the machine room and maintain accurate records of all service procedures, site visits, stoppages, breakdowns, planned repairs and safety related Equipment operation tests and checks;

5.9.12 to provide within a one month period after being appointed for the Maintenance Service under this Agreement, a customer communication logbook situated at a mutually agreed location for effective two-way communication, between the Employer and the Contractor's personnel. This logbook shall accurately record each and every site visit;

5.9.13 to provide on request by the Employer or its duly appointed agents, computer generated reports detailing a history of the equipment call-backs, repairs and breakdown repairs;

5.9.14 to inform the Employer verbally and in writing and act immediately on any potentially hazardous or undesirable situation which may cause harm to persons or which may damage or reduce the life expectancy of the Equipment, even if the hazardous or undesirable situation does not form part of the Contractor's responsibilities;

5.9.15 to inform the Employer in writing at least forty-eight hours prior to carrying out of any modification to the existing Equipment deemed necessary by the Contractor, even if this modification may benefit the equipment or if the cost of this modification is for the Contractor's account.

6 QUALITY ASSURANCE

6.1 The Contractor shall, as an integral part of the Maintenance Service, and the supply thereof to the Employer, adopt a quality system and the standards which shall comply with SABS 150 9001:1994 or SABS 150 9002:1994 as appropriate.

6.2 The Contractor shall, forthwith after the Commencement Date, provide the Employer with satisfactory written proof of the Contractor's certification in respect of the quality system in 6.1.

6.3 If the Contractor is not in possession of a valid certificate, as referred to in 6.2, he shall submit to the Employer, forthwith after the Commencement Date -

6.3.1 a written advice of the steps the Contractor shall then currently be taking towards achieving such certification and the date by which such certification shall be accomplished; and

6.3.2 copies of the Contractor's programme of activities leading to such certification and a statement of progress to date; which information the Employer shall be entitled to verify; and

6.3.3 the Contractor's then current quality assurance system which shall be adjusted in such reasonable respects by the Contractor as the Employer may require in writing

7 MAINTENANCE MANAGEMENT SYSTEM

The Contractor shall, with effect from the Commencement Date, implement the following Maintenance Management System, shall ensure that the following information in respect of the system remains current during the period of this Agreement and shall submit such information to the Employer on the latter's request, or failing which, on such regular basis as shall be agreed with the Employer -

7.1 SPARE PARTS INVENTORY

Schedule of spare parts required to ensure that Maximum Equipment Downtimes are not exceeded, and updated inventory of spare parts and parts on order;

7.2 JOB CARDS

The Contractor shall draw up the necessary Job Cards from the Maintenance Programme, or in response to emergency call outs, or equipment failure, and hand the completed cards to the Employer for verification and acceptance that the work has been duly executed. The format of the Job Cards shall be approved by the Employer;

7.3 COST CONTROL

Obtaining and recording of quotations for materials or equipment, selecting the most competitive Supplier, obtaining approval from the Employer before placing orders, and monthly submission of proven cost of materials and equipment to the Employer;

7.4 PERFORMANCE LOGGING

Check performance of top and medium priority sub-systems and controls against the control drawings, commissioning date and set points on a monthly basis and re-commission or re-calibrate if necessary;

7.5 COMPLAINTS

Record complaints' date, time and details, and details of the faults detected and corrective action taken;

7.6 REPORTING

Preparation of Reports, on the half yearly inspections and on repairs which have taken place during the period preceding the inspection, to be submitted not later than two weeks after the inspection to the Employer.

Monthly water treatment reports, bi-annual oil sample analysis reports, and annual vibration test reports on high priority equipment;

7.7 EQUIPMENT INVENTORY

Provide and maintain an up-to-date equipment inventory;

7.8 EQUIPMENT HISTORY SYSTEM

Implement a system whereby each item on equipment's history of maintenance and repairs are recorded and retrievable at all times.

8 MAINTENANCE PROGRAMME

8.1 The Contractor shall forthwith after the Commencement Date for the ensuing twelve month period, and thereafter of each anniversary of the Commencement Date, for each ensuing twelve month period of this Agreement, prepare and deliver to the Employer a Maintenance Programme in weekly subdivisions indicating when specific Predictive Maintenance and Preventative Maintenance shall be performed in respect of the Equipment.

8.2 The Maintenance Programme in 8.1 shall be prepared in accordance with the provisions of this Agreement, the Equipment Manufacturer's Maintenance Instructions and the Operating and Maintenance Manuals.

8.3 The frequency of maintenance activities shall be in accordance with the Equipment Manufacturer's Maintenance Instructions and trends obtained from Predictive Maintenance test results and other Predictive Maintenance information.

8.4 The Contractor shall monitor maintenance progress against the Maintenance Programme and shall submit monthly progress reports to the Employer.

8.5 In the event of any delays against the Maintenance Programme, the Contractor shall expedite the Maintenance Service to make up any delays, in accordance with this Agreement.

8.6 The Contractor shall deploy sufficient staff to ensure completion of the Maintenance Service within the Maintenance Programme and within normal working hours.

9 MAINTENANCE STAFF AND MEETINGS

9.1 The Contractor shall employ and manage his maintenance staff to ensure timely, efficient execution of the Maintenance Services with minimum interruption to the Employer, and in accordance with the provisions of this Agreement.

9.2 The Contractor shall attend maintenance co-ordination meetings and any other meetings called by the Employer.

10 LIMITATION OF RESPONSIBILITY OF CONTRACTOR

10.1 The Contractor shall not be obliged in terms of this Agreement to provide a Maintenance Service in respect of repairs, replacement or services necessitated by the improper operation of Equipment or negligence of Employer's staff or misuse of the Equipment, or from any other cause beyond the reasonable control of the Contractor, except for defective design, workmanship or materials employed in respect of the Equipment or normal wear and tear thereof.

10.2 The Contractor shall not in terms hereof be obliged to furnish any additional Equipment or alterations thereto as recommended by the Insurance Companies or Authorities.

10.3 In the event that unauthorised additions, alterations, repairs or adjustments are made to the Equipment by others resulting in mechanical damage, the Contractor shall not be liable under this Agreement to provide a Maintenance Service in respect thereof.

11 GENERAL RESPONSIBILITIES OF CONTRACTOR

11.1 GENERAL RESPONSIBILITIES OF CONTRACTOR

11.1.1 The Contractor must be fully conversant and experienced with the type of Equipment installed and must be capable of rectifying malfunctioning of Equipment installed.

11.1.2 The Contractor guarantees performance at all times of the Equipment, subject to proper operation of the Equipment by the Employer as defined by the Operating and Maintenance Manual, except for the specified routine and annual maintenance and breakdown times.

11.1.3 The Contractor shall perform as a minimum the service and maintenance work as specified in this Agreement and as contained in the maintenance schedules in the Operating and Maintenance Manuals and the Equipment Manufacturers Maintenance Instructions of the Equipment.

11.1.4 The Contractor shall ensure that, in consultation with the Employer, all his activities are carried out with a view to optimising the energy consumption of the Equipment in the buildings.

11.1.5 The Contractor shall abide by the Employer's housekeeping rules.

11.1.6 In addition to the equipment contained in the Equipment Inventory, the Contractor shall maintain as the need arises all general items not provided with specific maintenance instructions. These items shall include but not be limited to the following -

11.1.6.1 Housekeeping

Replace all globes and fluorescent tubes in plant room areas (globes and fluorescent tubes shall be drawn from the Employer's store). Cleaning and general painting in plantroom areas;

11.1.6.2 General Gas Electrical

Perform any Gas Electrical work not specifically associated with DB's and MCC's in the Equipment Inventory (Vacuum & Compressed air pumps);

11.1.6.3 Piping

Maintain all gas reticulation piping and fittings including supports. Inspect for any corrosion, cracks or any other form of damage and leaks.

11.1.6.4 Manifolds and Supports

Inspect for and repair corrosion or mechanical damage to manifolds and their supports;

11.1.6.5 Regulators, Valves and Flashback Arresstors

Inspect and repair method of fixing, balancing device and paint touch up;

11.1.6.6 Insulation

Inspect and repair all damage to gas piping

11.1.6.7 Corrosion Protection

Inspect and repair corrosion;

12 EMPLOYER'S OBLIGATIONS

In addition to its other undertaking and obligations under this Agreement, the Employer shall -

12.1 perform simple trouble diagnosis on occurrence of fault, logging in logbook and reporting to Contractor by both telephone and facsimile;

12.2 provide safe prompt and reasonable access to the Contractor for Maintenance Service activities, as well as use of all necessary facilities;

12.3 return of all substitute equipment installed on a temporary basis to keep the Equipment running;

12.4 sign off the Contractor's Job Cards to certify that work has been done by the Contractor, but not accepting responsibility for the quality and adequacy of the work performed;

12.5 brief the Contractor on general housekeeping rules;

12.6 approve quotations submitted by the Contractor for spares and materials;

12.7 record equipment downtimes;

12.8 appoint a responsible person for operating the Equipment;

12.9 advise the Contractor immediately the Equipment malfunctions or becomes inoperative;

12.10 not to authorise or allow any person/s other than the Contractor or its duly authorised employees or agents to carry out any maintenance work on the Equipment during the currency of the Agreement, unless the prior written consent from the Contractor has been obtained. Should any work be carried out by any other company or person, prior to or during the term of the Agreement, the Contractor shall not be liable for any act, occurrence or omission on the part of such company or person/s or equipment supplied;

12.11 immediately notify the Contractor of any injury or harm to any person or property resulting from the usage of the Equipment and to make available all relevant information pertaining to equipment incidents;

12.12 ensure that the Contractor's workmen shall at all reasonable times have free and undisturbed access to the Equipment for the effective execution of normal maintenance procedures in accordance with this Agreement;

12.13 instruct the Contractor on any technical queries;

12.14 instruct the Contractor on any actions as may be required from trends highlighted by the Predictive Maintenance Testing;

12.15 instruct the Contractor on required course of action following catastrophic failures, or failures of high priority Equipment;

12.16 analyse Post Maintenance Test results and instruct the Contractor on corrective actions required;

12.17 chair and record Maintenance Co-ordination and Technical meetings;

12.18 monitor progress against the Maintenance Programme.

13 MAINTENANCE ACTIVITY SCHEDULES

13.1 The Contractor shall forthwith after the Commencement Date, prepare and deliver to the Employer Maintenance Activity Schedules relative to the Equipment in accordance with the Operating and Maintenance Manuals and/or the Equipment Manufacturer's Maintenance Instructions.

13.2 The Maintenance Activity Schedules shall be in such format as shall be approved by the Employer and shall be prepared by the Contractor and delivered to the Employer with such frequency and such intervals as shall reasonably be required by the Employer.

13.3 A specimen Maintenance Activity Schedule is attached hereto as Appendix 1 on the basis that in the event of the Contractor's Maintenance Activity Schedules, to be prepared in accordance with 13.1 and 13.2, conforming to the format of Appendix 1, it shall be deemed that the Employer has, as required under 13.2, approved the format thereof.

14 MAXIMUM EQUIPMENT DOWNTIMES

14.1 The Contractor shall plan and execute this Agreement in such a way, and ensure that spares, materials and staff are sufficiently available, to limit the downtime of the Equipment to the following Maximum Equipment Downtimes.

14.2 Planning of Predictive and Preventative Maintenance must ensure that there will be no interruption to comfort conditions or services provided by the Equipment.

14.3 The following Maximum Equipment Downtimes shall apply to this Agreement –

14.3.1 High Priority Equipment

Preventative Maintenance	Major Service	2 Hours
Preventative Maintenance	Minor Service	1 Hour
Corrective Maintenance for Breakdowns	1 Day	

14.3.2 Medium Priority Equipment

Preventative Maintenance	Major Service	4 Hours
Preventative Maintenance	Minor Service	2 Hours
Corrective Maintenance for Breakdowns		2 Days

14.3.3 Low Priority Equipment

Preventative Maintenance	Major Service	8 Hours
Preventative Maintenance	Minor Service	4 Hours
Corrective Maintenance for Breakdowns		4 Days

15 INSPECTIONS

15.1 The Employer or its duly appointed agents shall retain the right to witness and/or verify the performance of any maintenance work by the Contractor in terms hereof at any time.

15.2 CONTRACTOR'S ANNUAL INSPECTIONS/SURVEYS

15.2.1 To enable the Contractor effectively to monitor the Equipment's Maintenance Service, detailed annual inspections of the Equipment shall be undertaken by the Contractor's senior personnel (supervisor level);

15.2.2 The details of the annual inspections, date of inspection and the condition of the Equipment shall be recorded on a checklist signed and certified by the Contractor's Representative.

15.2.3 Should any defects or remedial work be required in terms of the Annual Inspection, the Contractor shall expeditiously undertake the Corrective Maintenance work. Should any of the items noted in the Annual Inspection not be rectified within a two week period, the Contractor shall forward the Employer with a copy of a detailed works programme.

15.2.4 The Employer or its duly appointed agents shall have the right to request copies of the Annual Inspection checklists.

15.3 INDEPENDENT INSPECTIONS

15.3.1 The Employer shall have the right to authorise independent inspections of individual or entire Equipment installations using suitably qualified personnel at any time and the results of such inspections shall be promptly communicated in writing to the Contractor. Should any defects or remedial work be required in respect of Equipment in terms of this Agreement, the Contractor shall expeditiously undertake within a mutually agreed time period the Corrective Maintenance. When the Contractor's work has been completed satisfactorily, the Employer or its duly appointed agent(s) shall be notified in writing. In the opinion of the Employer, a further follow-up inspection by the Employer or its agent(s) may be conducted.

15.3.2 Should the follow-up inspection show that the work as agreed and undertaken by the Contractor has not been satisfactorily carried out, the procedure as detailed in 15.3.1 shall be repeated until the established standard of maintenance has been attained.

15.3.3 The Independent Inspections under 15.3.1 and 15.3.2 shall in no way limit the Contractor's responsibility with respect to any obligation or liabilities in terms of this Agreement.

16 MAINTENANCE CONSIDERATION REPLACEMENT PARTS FACILITIES BONUS

16.1 For purposes of this clause 16, unless the context requires otherwise -

16.1.1 "Monthly Maintenance Charge" has the meaning ascribed thereto in 16.2;

16.1.2 "Employer's Parts Stock" means those replacement parts, relative to the Equipment, which the Contractor shall, in terms of the Tender, have stipulated, shall be acquired and maintained by the Employer on site at its cost or failing which as shall be indicated by the Contractor in each Maintenance Programme delivered in terms of 8; provided however that if the Employer, in its sole discretion, regards the Employer's Parts Stock so indicated to be unreasonable in the circumstances, the Employer's Parts Stock shall be determined by any independent consulting engineer appointed by the Employer for such purposes which consulting engineer's determination shall be final and binding on both the Employer and the Contractor;

16.1.3 "Tender" means the tender and the tender documents which the Contractor shall, as a subcontractor, have submitted for purposes of executing the works involving the supply and installation of the Equipment in its relevant building;

16.1.4 "Tender Mark-up" means the percentage mark-up which the Contractor shall have indicated in the Tender, he shall require in respect of the supply of replacement parts other than the Employer's Parts Stock.

16.2 Subject to 16.3, the remuneration payable by the Employer to the Contractor in respect of the supply of the Maintenance Service under this Agreement, shall be the Annual Maintenance Consideration which shall, in addition to VAT thereon, be paid by the Employer to the Contractor during each twelve monthly period of this Agreement, in twelve equal instalments ("Monthly Maintenance Charge") on the last business day of every month, the first of which instalments shall be so paid on the last business day of the month within which the Commencement Date falls, and the subsequent of which instalments shall be so paid on the last business day of each succeeding month; provided that the monthly instalment for the period from the Commencement Date to the end of the month in which the Commencement Date falls, shall be pro rated on the basis of a thirty day month.

16.3 The Annual Maintenance Consideration shall be adjusted annually on the anniversary of the Commencement Date according to the following escalation formula -

$$AAMC = AMC \times \frac{CPI}{CPI}$$

where

AAMC is the adjusted Annual Maintenance Consideration payable as from each anniversary of the Commencement Date;

AMC is the Annual Maintenance Consideration payable as at the Commencement Date for the first annual period of this Agreement;

CPI' is the Consumer Price Index on each anniversary of the Commencement Date on the basis that the reference herein to the Consumer Price Index is a reference to the Consumer Price Index for all expenditure groups, Metropolitan and other areas (Base 1995 = 100) as published from time to time by Statistics South Africa in Statistical Release P0141.1 provided that if after the commencement date, such index shall cease to be published the Parties shall use such other index as may be available and acceptable to both of them, or failing such acceptance on index determined in writing as fair and reasonable by the independent chartered accountants employed at the time by the Employer to audit its books of account; and

CPI is the Consumer Price Index on the Commencement Date.

16.4 In providing the Maintenance Service the Contractor shall -

16.4.1 at his cost, and at no expense to the Employer, provide all labour, consumables, tools required for maintenance work, travelling costs, water sample testing, call-outs, standby provisions and electrical maintenance;

16.4.2 be entitled and obliged to utilise replacement parts from the Employer's Parts Stock provided that the Contractor shall not be entitled to a mark-up or any other compensation in regard to the use of such replacement parts; and

16.4.3 be entitled and obliged to utilise replacement parts other than from the Employer's Parts Stock in which event the Contractor shall be entitled to be reimbursed for such replacement parts so utilised, over and above the Monthly Maintenance Charge, on the basis of the cost to the Contractor of the acquisition of such replacement parts plus the Tender Mark-up thereon.

16.5 For purposes of providing the Maintenance Service, the Employer shall provide the Contractor with the Storage Area, the Marking Area and the Parking indicated by the Contractor in the Tender, failing which as shall be agreed between the Parties and failing such agreement as shall be determined by any independent consulting engineer as shall be appointed by the Employer for such purposes, which determination shall be final and binding on the Parties.

16.6 If in any continuous period of twelve months during this agreement, the Call-Back Rate is NIL, the Employer shall be obliged to pay the Contractor a bonus which is equal to the Monthly Maintenance Charge provided however that such bonus shall not be due and/or payable more frequently than once in any twelve monthly period, the first of which shall commence on the Commencement Date, and the subsequent of which shall commence on each anniversary of the Commencement Date.

17 COMMENCEMENT AND DURATION

17.1 Subject to 18, 19 and 21, this Agreement shall -

17.1.1 commence on the Commencement Date; and

17.1.2 thereafter continue until terminated by either Party in terms of 17.2 or otherwise as provided in this Agreement.

17.2 Either Party may unilaterally terminate this Agreement on the basis that -

17.2.1 such termination shall take effect ninety days after the date upon which a written notice of termination is delivered by any Party to the other;

17.2.2 neither Party shall be entitled to deliver a notice of termination in terms of 17.2.1 prior to the fifth anniversary of the Commencement Date.

18 TERMINATION

Notwithstanding anything to the contrary contained in this Agreement, the Employer shall be entitled to terminate this Agreement summarily by means of written notice of such termination delivered to the Contractor provided that -

18.1 such termination shall take effect on the date of delivery of such termination notice to the Contractor;

18.2 such termination is based upon the fact that -

18.2.1 the Equipment being permanently disconnected from operation;

18.2.2 the Employer ceases for any reason to be the registered owner of the building in which the Equipment is installed;

18.2.3 the Employer decides to replace or modernise the Equipment and the Contractor is not the successful tenderer for the installation of new Equipment or the modernisation thereof; or

18.2.4 the Employer ceases to be responsible for the management function of the building in which the Equipment is installed.

19 SUSPENSION OF MAINTENANCE

19.1 If the tenant occupancy level in the building in which the Equipment has been installed, drops to a level which is commercially insufficient, the Employer shall be entitled to -

19.1.1 de-commission the Equipment either temporarily or permanently on thirty days written notice thereof to the Contractor;

19.1.2 re-commission the Equipment thereafter once more on thirty days' notice to the Contractor.

19.2 The Maintenance Consideration and the Parties' respective obligations under this Agreement shall be suspended and not be enforceable during the period of de-commissioning of the Equipment referred to in 19.1, namely from the expiry of the thirty day period from the delivery of the notice in 19.1.1 to expiry of the thirty day period of the delivery of the notice in 19.1.2.

19.3 On being requested to de-commission the Equipment, the Contractor shall undertake, under a separately charged order from the Employer to take such actions as shall be necessary to disconnect the Equipment and preserve the Equipment while non-operational.

19.4 In the event of any Equipment being withdrawn from service, the Contractor shall for the period of its withdrawal assume no responsibility of any nature for the safety of any persons or goods that are in any way affected by the said withdrawal of such Equipment.

19.5 On request by the Employer to re-commission the Equipment, the Contractor shall undertake, under a separately charged order from the Employer, to clean, inspect and report to the Employer any defects which may have occurred during the

period the Equipment was not in use, including but not limited to the following: corrosion, malicious damage, water and any other damage to the Equipment.

20 PENALTIES

Without prejudice to the Employer's rights and remedies in terms of 21 below, the Employer shall be entitled to recover (by means of set-off or otherwise) the following penalties from the Contractor as a genuine pre-estimate of the Employer's anticipated damages in the following instances –

20.1 CALL-BACK RATE PENALTY

20.1.1 If the Call-Back Rate exceeds 4 (four) in any twelve month period referred to in 4.6.2, the Employer shall be entitled to recover a penalty from the Contractor equal to 50% of one month's Maintenance Consideration;

20.1.2 If the Call-Back Rate exceeds 6 (six) in any twelve month period referred to in 4.6.2, the Employer shall be entitled to recover a penalty from the Contractor equal to one month's Maintenance Consideration;

20.1.3 If the Call-Back Rate exceeds 8 (eight) in any twelve month period referred to in 4.6.2, the Employer shall be entitled to recover a penalty from the Contractor equal to two month's Maintenance Consideration.

20.2 DOWN-TIME PENALTY

On each occasion on which a Maximum Down-Time is exceeded, the Employer shall be entitled to recover a penalty from the Contractor equal to 10% (ten per centum) of one month's Maintenance Consideration.

20.3 CALL-BACK RESPONSE TIME PENALTY

20.3.1 On each occasion on which a Call-Back Response Time is exceeded, the Employer shall be entitled to recover a penalty from the Contractor equal to 10% (ten per centum) of one month's Maintenance Consideration.

20.3.2 In the event of any Call-Back Response Time being exceeded by 24 hours or more, the Employer shall be entitled, without prejudice to any other rights or remedies it may have in terms of this Agreement, including the rights and/or remedies referred to in 20.3.1 and/or 21 hereof to engage a person other than the Contractor ("Third Party") to rectify any fault in the Equipment or Equipment breakdown on the basis that, in such event, the Employer shall be entitled to claim and recover from the Contractor the reasonable charges to the Employer by the Third Party relative to the corrective maintenance which shall have been applied to the Equipment by such Third Party.

21 BREACH

Should either Party ("Defaulting Party") breach any material provision of this Agreement and fail to remedy such breach within fourteen days of receiving written notice from the other Party ("Aggrieved Party"), then the Aggrieved Party shall be entitled, without prejudice to its other rights in law, including without limitation the right to claim and recover damages in lieu of any penalties stipulated for in this Agreement, to cancel this Agreement by written notice delivered to the Defaulting Party or to claim immediate specific performance of all the Defaulting Party's obligations under this Agreement.

22 SECURITY

The Contractor shall deliver to the Employer, within fourteen days of the Employer's written demand therefor, security to the extent of 25% of the Annual Maintenance Consideration for the due and faithful fulfilment by the Contractor of its obligations under this Agreement on the basis that -

22.1 such security shall be in the form of a Bank Guarantee issued by a Bank or other financial institution approved by the Employer;

22.2 such Bank Guarantee shall, materially conform to the specimen Bank Guarantee attached hereto as Appendix 2;

22.3 the cost of such Bank Guarantee shall be for the account of the Contractor.

23 INSURANCE

23.1 The Contractor shall at its cost and expense be obliged for the duration of this Agreement to effect and maintain the following policies of insurance with insurers which are acceptable to and have received the prior approval of the Employer -

23.1.1 a Contractor's all risk insurance policy and an insurance policy with SASRIA in the joint names of the Employer and the Contractor and its subcontractors which provides indemnity cover for not less than R2 000 000 (two Million Rand) against physical loss of or damage to works which the Contractor shall effect in addition to and/or in respect of the Equipment and materials on site, in connection therewith;

23.1.2 a public liability insurance in the joint names of the Employer, the Contractor and his subcontractors, which provides indemnity cover for not less than R2 000 000 (two Million Rand) and which shall indemnify the Employer, its employees and officials, the Contractor and the Contractor's subcontractors, employees and officials from all claims for the recovery of loss, damage and/or personal injury by any person arising out of the fault of the Contractor or any of its subcontractors employees or officials in connection with the Equipment and/or the provision of the Maintenance Service in terms hereof.

23.2 The Contractor shall forthwith after the Commencement Date deliver to the Employer satisfactory written proof of the existence and validity of the Insurance Policies in 23.1 and the Contractor shall, whenever the premiums became due under such policies of insurance, deliver to the Employer proof of the payment of each of such premiums.

24 ARBITRATION

24.1 Save as in hereinbefore provided, should any dispute at any time arise between any of the Parties in regard to any matter arising out of this Agreement or its interpretation or rectification or termination or cancellation, any Party shall be entitled, by written notice to the other Party, to require that the dispute be referred to arbitration in accordance with this 28.

24.2 The arbitration referred to in 24.1 shall be held -

24.2.1 at Johannesburg;

24.2.2 under the provisions of the Arbitration Act No 42 of 1965, as amended from time to time.

24.3 The arbitrator shall be, if the question of issue is -

24.3.1 primarily an accounting matter, an independent practising accountant agreed upon between the Parties or failing such agreement, an accountant appointed by the President of the South African Institute of Chartered Accountants;

24.3.2 primarily a legal matter, a practising senior counsel of not less than five years standing or practising senior attorney of not less than twenty years standing as agreed upon between the Parties or failing such agreement appointed by the chairman of the Johannesburg Bar Council;

24.3.3 any other matter, an independent person, agreed upon between the Parties or failing such agreement a person appointed by the president for the time being of the South African Institute of Civil Engineers.

24.4 If agreement cannot be reached within seven business days after the arbitration has been demanded as to whether the question in issue falls under 24.3.1,24.3.2 or 24.3.3, then a practising senior counsel of not less than five years standing as such agreed upon between the Parties, and failing agreement appointed by the Chairman of the Johannesburg Bar Council as soon as possible thereafter, shall be appointed as arbitrator so that an arbitration can be held and concluded, if possible, within the prescribed period of twenty-one business days.

24.5 The Parties irrevocably agree that the decision in those arbitration proceedings -

24.5.1 shall be binding on them;

24.5.2 shall be carried into effect forthwith;

24.5.3 shall, at the request of any one of the Parties, be made an order of any court of competent jurisdiction.

24.6 The arbitrator shall be obliged to give written reasons for his decision.

24.7 Notwithstanding anything to the contrary contained herein, any Party shall in the case of urgency be entitled to seek interim relief from the High Court of South Africa having jurisdiction in respect of Johannesburg, pending a final determination by the arbitrator.

24.8 Notwithstanding the referral of any dispute to arbitration in terms of this clause, all other matters governed by this Agreement shall continue to be so governed.

24.9 This clause shall survive the termination or cancellation of this Agreement for any reason whatsoever.

25 NOTICES

25.1 Each Party chooses as its address for all purposes under this Agreement, ("Chosen Address"), whether for serving any court process or documents, giving any notice, or making any other communications of whatsoever nature and for any other purpose arising from this agreement ("notice") as follows -

25.1.1 Employer - [ ]

Telefacsimile - [ ]

25.1.2 Contractor - [ ]

Telefacsimile - [ ]

25.2 Any notice required or permitted to be given under this Agreement shall be valid and effective only if in writing and shall be addressed to be for the attention of the designated officer of the Party to which it is addressed.

25.3 Any Party may by notice to the other Parties change its chosen address to another physical address in the Republic of South Africa and such change shall take effect on the seventh day after the date of receipt by the Party who last receives the notice.

25.4 Any notice to a Party contained in a correctly addressed envelope and -

25.4.1 sent by prepaid registered post to it at its chosen address; or

25.4.2 delivered by hand to a responsible person during ordinary business hours at its chosen address, shall be deemed to have been received, in the case of 25.4.1, on the tenth business day after posting (unless the contrary is proved) and, in the case of 25.4.2, on the date of delivery.

25.5 Notwithstanding anything to the contrary herein, a written notice actually received by a Party, including a notice sent by telefax ("the first notice"), shall be an adequate notice to it notwithstanding that it was not sent or delivered to its chosen address, provided that, within the next three succeeding business days a copy of the first notice is delivered to the chosen address, accompanied by a notice giving the following particulars -

25.5.1 where the first notice was sent by telefax, the date and time of despatch and the telefax number to which it was sent; and

25.5.2 where the first notice was delivered in a manner other than by telefax, the manner of delivery, the date on which it was delivered, the person by whom it was received and where it was received.

26 GOVERNING LAW

Subject to 24 the law governing this Agreement, including without limitation its interpretation and all disputes arising out of this Agreement, is the law of South Africa, and the Parties submit to the exclusive jurisdiction of the South African courts in respect of any matter arising from or in connection with this Agreement, including its termination. The Parties further consent to the jurisdiction of the High Court of South Africa having jurisdiction in respect of Johannesburg.

27 GENERAL

27.1 This Agreement constitutes the sole record of the agreement between the Parties with regard to the subject matter hereof. No Party shall be bound by any express or implied term, representation, warranty, promise or the like not recorded herein.

27.2 No addition to, variation of, or agreed cancellation of this Agreement shall be of any force or effect unless in writing and signed by or on behalf of the Parties.

27.3 No relaxation or indulgence which any Party may grant to any other shall constitute a waiver of the rights of that Party and shall not preclude that party from exercising any rights which may have arisen in the past or which might arise in future.

27.4 Any provision of this Agreement which contemplates performance or observance subsequent to any termination or expiration of this Agreement shall survive any termination or expiration of this Agreement and continue in full force and effect.

27.5 An approval or consent given by a Party under this Agreement shall not relieve the other Party from responsibility for complying with the requirements of this Agreement nor shall it be construed as a waiver of any rights under this Agreement except as and to the extent otherwise expressly provided in such approval or consent, or elsewhere in this Agreement.

28 EXECUTION

This Agreement has been signed as follows in two originals on behalf of each of the Parties -

28.1 Signed at [ ] on [ ] 20……..

For the Employer who warrants that he is duly authorised hereto

28.2 Signed at [ ] on [ ] 20……..

For the Contractor who warrants that he is duly authorised hereto

PART C4.7 MAINTENANCE AGREEMENT

MAINTENANCE SCHEDULE FOR: - GAS DISTRIBUTION SYSTEMS

ITEM	DESCRIPTION	MONTHLY	QUARTERLY	BI-ANNUALLY
1	Check piping and pipe components for gas leaks and rectify if necessary.			X
2	Check control valve operation.		X	
3	Check emergency shut off and rectify system if necessary	X		
4	Check regulators and rectify if necessary.		X	

PART C4.7 MAINTENANCE AGREEMENT

MAINTENANCE SCHEDULE FOR: - ACTUATORS & SOLENOID VALVES

ITEM	DESCRIPTION	MONTHLY	QUARTERLY	ANNUALLY
1	Actuator settings and operation to be checked and adjusted if necessary	X		
2	Rotary ball valve actuator operation to be checked	X		
3	Actuator operation and motors to be checked and operation observed, lubricate and reset if necessary.		X	
4	Actuators to be fastened to shaft.		X	
5	Check all electrical connections and controls, ensure all connections are tight			X

PART C4.7 MAINTENANCE AGREEMENT

MAINTENANCE SCHEDULE FOR: - GENERAL

ITEM	DESCRIPTION	MONTHLY	QUARTERLY	ANNUALLY
1	Attend to any complaints made by the Client's Representative.	X		
2	While attending to any defects and servicing the plant the Contractor shall not unduly disturb the occupants in the areas concerned.		X	
3	Replace all inspection panels and covers and re-fix all screws, bolts and nuts and replace if necessary.	X		
4	Clean all plant and equipment and record and report dirty plant condition to correct authority.	X		
5	Lock switch panels and plant rooms and return keys to proper authority.	X		
6	Sign log book and enter details where required.	X		
7	Acknowledgement of service and report to be completed and signed by Client's Representative. Report on remedial work undertaken and on any faults found and replacements and repairs required.	X		

NOTES:

- A copy of each such acknowledgement of service and report to be submitted to the Client by the Contractor within 7 days of each service.
- Air conditioning plants shall never be operated with any safety or overload protection device bridged out.
- When power is initially switched on, after being off or disconnected for more than one hour, the compressors should not be operated for a further period of two hours.

PART C4.8

SCHEDULE OF TEST CERTIFICATES

Form D.1.1 — Summary of tests

NOTE: This Summary is based on tests as per SANS 7396, but should however serve as a list of tests required for the laboratory gas installation, as applicable. Tests shall however not be limited to these tests, but shall include all other tests and demonstrations required by applicable standards, local authority by-laws, statutory regulations and / or national legislation and regulations.

In terms of SANS 7396-1 Clause 12.3 and 12.4 [items a) through j)], i.e. up to and including 12.6.16 (see 12.7.1)

Facility: …… Area identification ……..

This is to certify that the following tests and procedures have been carried out satisfactorily on the gases and vacuum pipeline systems at the abovementioned facility.

Date …… (Sheet …… of ……sheets)

Form	Description of tests and procedures	Test req'd Yes/No	Procedure	Clause	Date Completed
D.2	Marking and supports	Y	C.2.1	12.5.1	
D.3	Design specification	Y	C.2.2	12.5.2	
D.4.1	Mechanical integrity of vacuum pipeline systems	N	C.3.1.1	12.6.1.1	Not Applicable
D.4.2	Leakage into vacuum pipeline systems	N	C.3.1.2	12.6.1.2	Not Applicable
D.5.1	Mechanical integrity of compressed gas pipeline systems	Y	C.3.1.3	12.6.1.3	
D.5.2	Leakage from compressed gas pipeline systems (upstream sections)	Y	C.3.1.4 or C.3.1.6	12.6.1.4 or 12.6.1.6	
D.5.3	Leakage from compressed gas pipeline systems (downstream sections)	Y	C.3.1.4 or C.3.1.6	12.6.1.4 or 12.6.1.6	
D.6.1	Combined leakage and mechanical integrity of compressed gas pipeline systems (before concealment)	Y	C.3.1.5	12.6.1.5	
D.6.2	Combined leakage and mechanical integrity of compressed gas pipeline systems (after concealment)	N	C.3.1.6	12.6.1.6	Not Applicable
D.7	Area shut-off valve leakage, closure, zoning and identification	Y	C.3.2	12.6.2	
D.8	Cross-connection	Y	C.3.3	12.6.3	
D.9	Terminal units: obstruction and flow, mechanical function, identification, gas specificity	Y	C.3.4 C.3.5	12.6.4 12.6.5	
D.10	NIST or DISS connectors: obstruction and flow, mechanical function, identification, gas specificity	N	C.3.4/C.3.5	12.6.4 12.6.5	Not Applicable
D.11	System performance	N	C.3.6/C.3.7	12.6.6	Not Applicable
D.12	Pressure-relief valves	Y	C.3.8	12.6.7	
D.13	Sources of supply	Y	C.3.9	12.6.8	
D.14.1	Emergency and cylinder status alarms	N	C.3.10	12.6.9	
D.14.2	Operating alarms	N	C.3.10	12.6.9	Not Applicable

Form	Description of tests and procedures	Test req'd Yes/No	Procedure	Clause	Date Completed
D.15	Particulate contamination	Y	C.3.11	12.6.10	
D.16	Quality of air produced by supply systems with air compressor(s)	N	C.3.12	12.6.11	Not Applicable
D.17	Quality of gas at terminal outlet points	N	C.3.12	12.6.12	Not Applicable
D.18	Quality of air produced by supply systems with proportioning unit(s)	N	C.3.13	12.6.13	Not Applicable
D.19	Quality of oxygen-enriched air produced by supply systems with oxygen concentrator(s)	N	C.3.14	12.6.14	Not Applicable
D.20	Filling with specific gas	N	C.3.15	12.6.15	Not Applicable
D.21.1	Gas identity with oxygen analyser	N	C.3.16	12.6.16	Not Applicable
D.21.2	Gas identity with different pressures	Y	C.3.16	12.6.16	
D.21.3	Gas identity with gas-specific analyser	Y	C.3.16	12.6.16	
	Construction labels removed	Y			

On completion of the installation, the attached Certificate of Safety Test shall be completed. The tests shall be witnessed by the Engineer, Facility Manager or responsible person from the Employer as designated by the Employer

Refer to Section 4.9 for the Test Certificate. The relevant test forms can be generated from SANS 7396-1.

Registered Authorised Installer (1):

Position :……. Signature: …….

Date :…….. Name : …….

SAQCC Registration No: ……

Registered Authorised Installer (2):

Position :……. Signature: …….

Date :…….. Name : …….

SAQCC Registration No: ……..…

Contractor's Project Representative

Position :……. Signature: …….

Date :…….. Name : …….

Employer Authorised Person:

Position :……. Signature: …….

Date :…….. Name : …….

Consultant Representative:

Position :……. Signature: …….

Date :…….. Name : …….

PART C4.9

CERTIFICATE OF SAFETY TEST

CERTIFICATE OF SAFETY TEST OF A *HOSPITAL / *LABORATORY *GAS AND *VACUUM SYSTEM
*Strike through which is not applicable

INSTITUTION : .....

DETAILS OF SERVICE : .....
(NEW OR EXTENSION) : .....
*ITEM NUMBER : .....
DATE OF TEST : .....
TIME OF TEST : .....

IT IS CERTIFIED THAT THE APPLICABLE TEST UNDER ADDENDUM A2 AND HAVE BEEN SATISFACTORILY CARRIED OUT IN TERMS OF THE REQUIREMENTS AS LAID DOWN IN THE SUBCONTRACT DOCUMENTS

TESTING OFFICERS

GAS CONTRACTOR. (Company Name) : .....

NAME OF REPRESENTATIVE (Block Capitals) : .....

SIGNATURE : .....

GAS CONTRACTOR's REGISTERED AUTHORISED GAS PRACTITIONERS:

DESIGN ENGINEER : .....

NAME (Block Capitals) : .....

REGISTRATION NUMBER : .....

SUPERVISOR : .....

NAME (Block Capitals) : .....

REGISTRATION AUTHORITY & NUMBER : .....

INSTALLER 1 : .....

NAME (Block Capitals) : .....

REGISTRATION AUTHORITY & NUMBER : .....

INSTALLER 2 : .....

NAME (Block Capitals) : .....

REGISTRATION AUTHORITY & NUMBER : .....

INSTALLER 3 : .....

NAME (Block Capitals) : .....

REGISTRATION AUTHORITY & NUMBER : .....

COMMISSIONING AGENT 1 :

NAME (Block Capitals) : ……

REGISTRATION AUTHORITY & NUMBER : ……

AUTHORISED INSPECTION AUTHORITY : .....

NAME (Block Capitals) : ……

REGISTRATION AUTHORITY & NUMBER : ……

SIGNATURE : .....

FACILITY SERVICES : .....

NAME (Block Capitals) : ……

SIGNATURE : .....

EMPLOYER REPRESENTATIVE. (To acknowledge receipt of original of test certificate):

NAME (Block Capitals) : ……

POSITION (Block Capitals) : ……

SIGNATURE : ……..

*List of Items inspected and tested:

GAS	Ar	CA	C_2H_2	CH_4	CO	CO_2	H_2	He	LPG	N_2	N_2O	NH_3
Low Purity, Low Pressure	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
High Purity, Low Pressure		NA	NA		NA	NA	NA		NA		NA	NA
High Purity, High Pressure	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAS	**O_2**	**SA**	**ZA**	**Mix 1**	**Mix 2**	**Mix 3**	**Mix 4**	**Mix 5**	**Mix 6**	**Vac**		
Low Purity, Low Pressure	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
High Purity, Low Pressure	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
High Purity, High Pressure	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

MIX 1 (Composition) :……. MIX 2 (Composition) :…….

MIX 3 (Composition) :……. MIX 4 (Composition) :…….

MIX 5 (Composition) :……. MIX 6 (Composition) :…….

MIX 7 (Composition) :……. MIX 8 (Composition) :…….

Other (Composition) :……. Other (Composition) :…….

CSIR - Kloppersbos

CSIR Strategic Initiatives and Implementation Unit
Testing and training facility for mining-related fires and explosions
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