

PG-01.1 (EC) SCOPE OF WORKS – (GCC (2010) 2nd EDITION: 2010)

Project title:	<i>Fort Glamorgan & Mdantsane Prison: 36 Months Term Contract For Boiler Maintenance, Repairs And Service.</i>		
Tender no:	<i>PET 11/2021</i>	Reference no:	

C3. Scope of Works

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NOTE: This is an example only. Compiler / Designer to provide the applicable contents.

B: AMENDMENTS TO THE STANDARD SPECIFICATIONS

Insert amendments to standard specifications

C3.3 PARTICULAR SPECIFICATIONS

See attached specification

Tender no: *PET11/2021*

C3.1 STANDARD SPECIFICATIONS:

The standard specifications on which this contract is based are the **South African Bureau of Standards Standardized Specifications for Civil Engineering Construction SABS 1200**. *(Note to compiler. "SABS" has been changed to "SANS"; the SABS 1200 specifications are due to be replaced in the foreseeable future by SANS 2100)*

Although not bound in nor issued with this Document, the following Sections of the Standardized Specifications of SABS 1200 shall form part of this Contract:

A - 1986 - GENERAL / D – (etc, to be provide by compiler)

Tender no: PET11/2021

C3.2 PROJECT SPECIFICATIONS:

Status

The Project Specification, consisting of two parts, forms an integral part of the contract and supplements the Standard Specifications.

Part A contains a general description of the works, the site and the requirements to be met.

Part B contains variations, amendments and additions to the Standardized Specifications.

In the event of any discrepancy between a part or parts of the Standardised of Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Engineer before the execution of the work under the relevant item.

A GENERAL

PS-1 PROJECT DESCRIPTION:

Fort Glamorgan & Mdantsane Prison: 36 Months Term Contract For Boiler Maintenance, Repairs And Service.

Tender no: *PET11/2021*

B: AMENDMENTS TO THE STANDARD SPECIFICATIONS:

See attached specification

Tender no: *PET11/2021*

C3.3 PARTICULAR SPECIFICATIONS:

See attached specification



PG-02.1 (EC) PRICING INSTRUCTIONS – (GCC (2010) 2nd EDITION: 2010)

Project title:	Fort Glamorgan & Mdantsane Prison: 36 Months Term Contract For Boiler Maintenance, Repairs And Service.		
Tender no:	<i>PET11/2021</i>	Reference no:	

C2.1 Pricing Instructions

1. GENERAL

The Bill of Quantities forms part of the Contract Documents and must be read and priced in conjunction with all the other documents comprising the Contract Documents, which include the Conditions of Tender, Conditions of Contract, the Specifications (including the Standard, Project and Particular Specifications) and the Drawings.

2. DESCRIPTION OF ITEMS IN THE SCHEDULE

The Bill of Quantities has been drawn up generally in accordance with Civil Engineering Quantities 1990 issued by the SA Institution of Civil Engineers.

The short descriptions of the items in the Bill of Quantities are for identification purposes only and the measurement and payment clause of the Standardized Specifications and the Particular Specifications, read together with the relevant clauses of the Project Specification and directives on the drawings, set out what ancillary or associated work and activities are included in the rates for the operations specified.

3. QUANTITIES REFLECTED IN THE SCHEDULE

The quantities given in the Bill of Quantities are estimates only, and subject to remeasuring during the execution of the work. The Contractor shall obtain the Engineer’s detailed instructions for all work before ordering any materials or executing work or making arrangements for it.

The Works as finally completed in accordance with the Contract shall be measured and paid for as specified in the Bill of Quantities and in accordance with the General and Special Conditions of Contract, the Standard, Project and Particular Specifications and the Drawings. Unless otherwise stated, items are measured net in accordance with the Drawings, and no allowance has been made for waste.

The validity of the contract will in no way be affected by differences between the quantities in the Bill of Quantities and the quantities finally certified for payment.

4. PROVISIONAL SUMS

Where Provisional sums or Prime Cost sums are provided for items in the Bill of Quantities, payment for the work done under such items will be made in accordance with Clause 6.6 of the General Conditions of Contract 2010. The Employer reserves the right, during the execution of the works, to adjust the stated amounts upwards or downwards according to the work actually done under the item, or the item may be omitted altogether, without affecting the validity of the Contract.

The Tenderer shall not under any circumstances whatsoever delete or amend any of the sums inserted in the “Amount” column of the Bill of Quantities and in the Summary of the Bill of Quantities unless ordered or authorized in writing by the Employer before closure of tenders. Unauthorized changes made by the Tenderer to provisional items in the Bill of Quantities, or to the provisional percentages and sums in the Summary of the Bill of Quantities will lead to the disqualification of the Tenderer.

5. PRICING OF THE BILL OF QUANTITIES

The prices and rates to be inserted by the Tenderer in the Bill of Quantities shall be the full inclusive prices to be paid by the Employer for the work described under the several items, and shall include full compensation for all costs and expenses that may be required in and for the completion and maintenance during the defects liability period of all the work described and as shown on the drawings as well as all overheads, profits, incidentals and the cost of all general risks, liabilities and obligations set forth or implied in the documents on which the Tender is based.

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Each item shall be priced and extended to the “Total” column by the Tenderer, with the exception of the items for which only rates are required, or items which already have Prime Cost or Provisional Sums affixed thereto. If the Tenderer omits to price any items in the Bill of Quantities, then these items will be considered to have a nil rate or price.

All items for which terminology such as “inclusive” or “not applicable” have been added by the Tenderer will be regarded as having a nil rate which shall be valid irrespective of any change in quantities during the execution of the Contract.

The Tenderer shall fill in rates for all items where the words “rate only” appear in the “Total” column. “Rate Only” items have been included where:

- (a) an alternative item or material is contemplated;
- (b) variations of specified components in the make-up of a pay item may be expected; and
- (c) no work under the item is foreseen at tender stage but the possibility that such work may be required is not excluded.

For “Rate Only” items no quantities are given in the “Quantity” column but the quoted rate shall apply in the event of work under this item being required. The Tenderer shall however note that in terms of the Tender Data the Tenderer may be asked to reconsider any such rates which the Employer may regard as unbalanced.

All rates and amounts quoted in the Bill of Quantities shall be in rands and cents and shall include all levies and taxes (other than VAT). VAT will be added in the summary of the Bill of Quantities.

The Tenderer shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself before submitting his tender (as far as is practicable) as to:

- (a) the form and nature of the Site and its surroundings, including subsurface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of work and materials necessary for the execution and completion of the Works,
- (d) the means of access to the Site and the accommodation he may require

and, in general, shall be deemed to have obtained all information (as far as is practicable) as to risks, contingencies and all other circumstances which may influence or affect his Tender.

6. CORRECTION OF ENTRIES

Incorrect entries shall not be erased or obliterated with correction fluid but must be crossed out neatly. The correct figures must be entered above or adjacent to the deleted entry, and the alteration must be initialled by the Tenderer.

7. ARITHMETICAL ERRORS

Arithmetical errors found in the Bill of Quantities as a result of faulty multiplication or addition, will be corrected by the Engineer at the tender evaluation stage, as set out in the Tender Data.

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8. UNITS OF MEASUREMENT

The units of measurement described in the Bill of Quantities are metric units for which the standard international abbreviations are used. Non-standard abbreviations which may appear in the Bill of Quantities are as follows:

No.	=	Number
%	=	Percent
Sum	=	Lump sum
PCsum	=	Prime cost sum
Prov sum	=	Provisional sum
m ³ .km	=	Cubic metre - kilometre
Km-pas	=	kilometre - pass
m ² .pass	=	square metre – pass



PG-03.1 (EC) SITE INFORMATION – (GCC (2010) 2nd EDITION: 2010)

Project title:	<i>Fort Glamorgan & Mdantsane Prison: 36 Months Term Contract For Boiler Maintenance, Repairs And Service.</i>		
Tender no:	<i>PET 11/2021</i>	Reference no:	

C4 Site Information

The Boiler operation and maintenance is located in various existing government buildings. The sites will be fully occupied for the duration of the contract and work may have to be conducted after hours should it be necessary. Other term contracts that are currently in place; Kitchen Equipment, Fire, Refrigeration and Generator term contracts. List of various buildings in the area and equipment that will be serviced under this contract is attached.

Fort Glamorgan & Mdantsane Prison: 36 Months Term Contract For Boiler Maintenance, Repairs & Service.

2.3 SCOPE OF WORK

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2.3.1 Standard Specifications

2.3.2 Project Specifications (PS)

2.3.3 Technical Specifications

FA Steam Generating Installations
FB Steam Distribution Installations
FC Hot water Generating Installations

2.3.5 Particular Specifications

PFA Steam Generating Installations
PFB Steam Distribution Installations
PFC Hot water Generating Installations

2.3.6 Additional Specifications

SH HIV / AIDS Requirements
SI Occupational Health and Safety

C2.3.1 STANDARD SPECIFICATIONS

Tender no: PET11/2021

C3.1 STANDARD SPECIFICATIONS:

The standard specifications on which this contract is based is the **South African Bureau of Standards Application of the National Building Regulations SABS 10400: 1990 (SABS 0400)**

Although not bound in nor issued with this Document, the following list of standards shall be adhered to for the duration of the contract. Standards not mentioned below, but referenced to in the Technical, Particular and Additional specifications shall also be adhered to for the duration of the contract. Any amendments, revisions or new versions (latest specifications) shall supersede the listed documents and be applicable in all respects.

1. SANS 10400 - Application of the National Building Regulations
2. SANS 164 - Plugs, socket-outlets and couplers for industrial purposes*
3. SANS 241 - South African Standard Specification for drinking water
4. SANS 515 - Decorative paint with a non-aqueous solvent base for interior use*
5. SANS 558 - Cast iron surface boxes and manhole and inspection covers and frames*
6. SANS 630 - Decorative high gloss enamel paints*
7. SANS 631 - Decorative oil gloss paint for interior and exterior use*
8. SANS 633 - Emulsion paints for interior decorative purposes*
9. SANS 634 - Emulsion paints for exterior use*
10. SANS 675 - Zinc-coated fencing wires (plain and barbed)*
11. SANS 678 - Primers for wood for interior and exterior use*
12. SANS 681 - Undercoats for paints*
13. SANS 682 - Aluminium paint*
14. SANS 683 - Roof paints (relevant sections)*
15. SANS 723 - Wash primer (metal etch primer)*
16. SANS 801 - Epoxy-tar paints*
17. SANS 887 - Varnish for interior use*
18. SANS 926 - Two-pack zinc-rich epoxy primer*
19. SANS 935 - Hot-dip (galvanised) zinc coatings (other than on continuously zinc-coated sheet

Any reference to words "Bid" or Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".

Standard Specifications

- and wire)*
20. SANS 950 - Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical Installations
 21. SANS 10252-2 - Code of Practice "Water Supply and Drainage for Buildings, Part 2: Drainage Installations for Buildings", Annexure B: Septic Tank Systems*
 22. SANS 1085 - Wall outlet boxes for the enclosure of electrical accessories*
 23. SANS 1200 - Standardised Specifications for Civil Engineering Construction*
 24. SANS 1227 - Textured wall coatings, emulsion base, for interior and exterior use*
 25. SANS 1239 - Plugs, socket-outlets and couplers for industrial purposes*
 26. SANS 1250 - Capacitors for use with fluorescent and other discharge lamp ballasts*
 27. SANS 1319 - Zinc phosphate primers for steel*
 28. SANS 1373 - Chain-link fencing and its wire accessories*
 29. SANS 1411 - Materials of insulated electric cables and flexible cords*
 30. SANS 1507 - Electric cables with extruded solid dielectric insulation for fixed installations
 31. SANS 1777 - Photoelectric control units for lighting (PECUs)
 32. SANS 4831 - Microbiology: General guidance for the enumeration of coliforms: Most probable number technique*
 33. SANS 4833 - Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30°C*
 34. SANS 5011 - Water – pH-Value*\
 35. SANS 5217 - Water – free and saline ammonia content*
 36. SANS 6048 - Water – chemical oxygen demand*
 37. SANS 6052 - Residual chlorine content of water*
 38. SANS 6057 - Electrical conductivity of water*
 39. SANS 10064 - The preparation of steel surfaces for coating*
 40. SANS 10114 - Interior lighting*
 41. SANS 10142 - Wiring of premises*
 42. SANS 10160 - The general procedures and loadings to be adopted in the design of buildings*
 43. SANS 10162 - The structural use of steel*
 44. SANS 10198 - The selection, handling and installation of electric power cables of rating not exceeding 33 kV

Standard Specifications

45. SANS 10298 - Indirect small to medium-sized gas chlorination systems for the disinfection of water*
46. SANS 10299 - Development, maintenance and management of groundwater resources*
47. SANS 10306 - The management of potable water in distribution systems*
48. SANS 10329 - The design and construction of sectional steel tanks for storage of liquids at or above ground level*
49. SANS 61084 - Cable trunking and ducting systems for electrical installations
50. SABS 948 - 3-phase induction motors*
51. SABS 1222 - Enclosure for electrical equipment (classified according to the degree of protection that the enclosure provides)*
52. SANS ISO 5667-2 -Water quality sampling, part2: Guidance on sampling techniques*
53. OW 371 - Specification of Materials and Methods to be used. Fourth revision, October 1993 or latest version.**
54. Standard Specification for the Electrical Equipment and Installation for Mechanical Services, Issue VIII December 1984**
55. Standard Electrical Specifications, January 1984, GPS 24-0367**
56. Department of Public Works Standard Specifications for Electrical Installations and Equipment pertaining to Mechanical Installations**
57. Department of Public Works Standard Specifications for steam boilers and Equipment pertaining to Mechanical Installations**
58. Department of Public Works – Standard Electrical Specifications (April 1999)**
59. BS 1486: Part 2 - Heavy duty lubrication nipples
59. BS 4999 - General requirements for rotating electrical machines
60. BS 5316: Part 1 - Acceptance tests for centrifugal, mixed flow and axial pumps
61. ISO 281/1 - Rolling bearings – Dynamic load ratings and rating life (Mobile fuel extractor)
62. Department of Water Affairs and Forestry, Department of Health and the Water Research Commission - Department of Quality of Domestic Water Supplies

* Not issued with this document, but available at the Contractor's expense from the SA Bureau of Standards, Private Bag X191, PRETORIA, 0001.

** Not issued with this document but available from the Director General, Department of Public Works, Private Bag X65, PRETORIA 0001, or any office of the Regional Representative of this Department.

*** Copies of the Standard Department of Public Works Specifications are obtainable from the Director-General: Department of Public Works, Private Bag X 3913, Port Elizabeth, 6056, or on the website: <http://www.publicworks.gov.za>

Any reference to words "Bid" or Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".

C2.3.2 PROJECT SPECIFICATIONS

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PS 6	CERTIFICATES OF PAYMENT
PS 7	CONSTRUCTION IN RESTRICTED AREAS
PS 8	DRAWINGS
PS 9	LEGISLATION
PS 10	INSURANCE AMOUNTS
PS 11	TIMES FOR COMPLETION
PS 12	PRACTICAL COMPLETION
PS 13	PENALTIES
PS 14	NON-WORKING DAYS AND HOURS

The Project Specification contains a general description of the works, the site and the requirements to be met. In the event of any discrepancy between a part or parts of the Standardised of Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Departmental Representative / Engineer before the execution of the work under the relevant item.

PS 1 GENERAL DESCRIPTION

Each installation requires work that may include any one or more of the activities as set out in clause PS2 below: decommissioning, repair, reconditioning, testing, re-commissioning and maintenance during the 36-month Contract. The work may also include compilation of operating and maintenance manuals as well as training of User Client operators and all maintenance personnel.

NOTE: Repair and maintenance work will be carried out within facilities that are occupied by User Client's personnel and associates.

PS 2 DETAILS OF CONTRACT

All work forming part of this Contract is divided into installations. The repair and maintenance work to be performed as part of an installation under this Contract mainly consists of the following:

The St Albans prison mechanical term project comprises the repair and maintenance of the following mechanical services

- | | | |
|----|------------------------------------|------------------|
| a. | Steam Generating Installations | (see FA and PFA) |
| b. | Steam Distribution Installations | (see FB and PFB) |
| c. | Hot water Generating Installations | (see FC and PFC) |

Maintenance of each of these installations will be the responsibility of the Contractor and will be evaluated on a monthly basis by the Departmental Representative / Engineer. The remuneration for maintenance work and responsibilities will be certified accordingly.

The description of the Works given above is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract.

Approximate quantities of each type of work are given in the Bill of Quantities.

NOTE: A clear distinction will be made between the repair work to be done and the maintenance responsibilities applicable to each installation.

PS 3 CONSTRUCTION PROGRAMME

Instructions by the Departmental Representative / Engineer to expedite progress shall not be the subject of additional compensation to the Contractor unless the instruction explicitly states that the Contractor is entitled to additional compensation and cites the amount of such compensation or the basis on which it is to be determined.

The approval by the Departmental Representative / Engineer of a programme shall have no contractual significance other than that the Departmental Representative / Engineer will be satisfied if the work is carried out according to the programme. The said approval shall not limit the right of the Departmental Representative / Engineer to instruct the Contractor to vary the programme if necessary. The Contractor is also referred to Clause PS 8 and Clause PS 12 when preparing this programme.

NOTE: For reasons of limited access, it may not be possible to carry out the repair work on some of the installations in parallel with repair work on other installations. The repair work of some of the installations shall follow sequentially as indicated in the specifications.

The Contractor shall organise his work in such a manner as to cause the minimum inconvenience to the User Client's personnel and operations.

PS 4 SITE FACILITIES AVAILABLE

PS 4.1 CAMPSITE AND STORE ROOM

(a) Repair work

An area for the campsite will be provided after consultation with the User Client area manager. Only one night watchman will be allowed in the campsite at night.

(b) Maintenance responsibilities

The Contractor must provide his own storeroom facilities for the duration of the maintenance phase.

PS 4.2 WATER, ELECTRICITY AND SEWERAGE

(a) Water supply

The Contractor must make his own arrangements for water supply. Water will be available at specific points not necessarily adjacent to working areas. Water will be available free of charge but wastage will not be tolerated. The Contractor must supply his own standard fittings to couple up at the points where water is available.

(b) Electrical power supply

Electrical power supply is available on the Site and will be free of charge. The Contractor must make his own arrangements for a connection to the electrical power supply. The Contractor will be responsible, at his own cost, for the distribution of electricity for construction and domestic use.

(c) Sewerage connection

Refer to Sub clause PSA 4.2 in connection with toilet requirements. Chemical toilets shall be used.

Note: The Employer shall not be held responsible for any losses or inconvenience due to a disruption in the supply of water and/or electricity.

PS 4.3 PARKING FACILITIES

Parking facilities are available on the Site.

PS 5 FEATURES REQUIRING SPECIAL ATTENTION

PS 5.1 INSTALLATIONS AT FACILITIES

The installations at all facilities shall be carefully checked for damage and all damages shall be listed and discussed with the Departmental Representative / Engineer before commencement of repair and maintenance work. The Contractor shall present copies of all correspondence in this regard for discussion at the following site meeting.

PS 5.2 SECURITY

(a) Restrictions on movement and limited access

The Contractor's personnel, vehicles and equipment will be restricted to areas of construction only. The Contractor shall comply with any requirements that the Departmental Representative / Engineer may have in this regard and shall take note that for security reasons the access to some areas, may be limited.

(b) Prohibition on taking of photographs

The Contractor's attention is drawn to the Defence Act, 1957 (Act No 44 of 1957) and the Correctional Services Act, 1998 (Act No 111 of 1998) which clearly state that the taking of photographs is prohibited and that even the possession of a camera on Site is an offence.

(c) Security check on personnel

The Employer may require the Contractor to have his personnel or a certain number of them security-classified, if so required by any competent authority. In the event of the Employer or any competent authority requiring the removal of a person or persons from the site for security reasons, the Contractor shall do so forthwith and the Contractor shall thereafter ensure that such person or persons are denied access to the site and/or to any

documents or information relating to the work. In such circumstances the Contractor shall indemnify the Employer and the Departmental Representative / Engineer and shall hold the Employer and the Departmental Representative / Engineer harmless against any and all claims of whatever nature arising.

(d) Access cards to security areas

Should the work fall within a security area, the Contractor must obtain from the Departmental Representative / Engineer access cards for his security-cleared personnel and employees who work within such an area. The Contractor must comply with any regulations or instructions issued from time to time, concerning the safety of persons and property, by the Department of Correctional Services or SA Police services.

PS 5.3 SITE TO BE KEPT CLEAN

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner, and shall keep the Site free from debris and obstructions.

All redundant materials, rubbish and waste arising from the work must be removed from the Site at the Contractor's cost and the site and buildings left clean and tidy.

PS 5.4 FACILITIES TO OTHER CONTRACTORS

In addition to the requirements of Clause 18 of the General Conditions of Contract the Contractor must make allowances for other Contractors on the Site. This may involve adapting his programme to accommodate the work of other contractors and ensuring access to their sites along prescribed routes over the Site of this Contract.

PS 5.5 SUBCONTRACTORS

In addition to the requirements of Clause 6 of the General Conditions of Contract as amended in Part 1 of the Contract Data, the Contractor shall be responsible for work carried out by subcontractors on his behalf. The Departmental Representative / Engineer will not liaise directly with such subcontractors. Problems related to payments, programming, workmanship, etc, shall be the responsibility of the Contractor and the subcontractor, and the Departmental Representative / Engineer will not become involved.

PS 5.6 SANS SPECIFICATIONS AND CODES OF PRACTICE

All reference in this document to South African Bureau of Standards specifications and codes of practice, or any other standard specifications or codes of practice, including National Building Regulations, shall be deemed to be references to the latest issues of such specifications and codes.

PS 5.7 MATERIALS

The monthly payment for materials brought onto the Site will only be applicable for repair work and not for maintenance work. Unless otherwise instructed in writing by the Departmental Representative / Engineer, all proprietary materials are to be used, mixed, applied, fixed, etc. strictly in accordance with the manufacturer's recommendations.

PS 5.8 BORROW PITS

There will be no designated borrow pits. The Contractor shall utilise the material on Site or import material from commercial sources.

PS 5.9 PROTECTION OF FURNITURE AND EQUIPMENT

Most of the work to be done inside buildings and occupied houses will be carried out in places where there is furniture and other equipment.

The Contractor shall be responsible for moving the furniture and equipment in order to provide working space for his personnel. The programme shall be drawn up in such a way as to keep the movement of furniture and equipment to the very minimum and the Contractor shall be solely responsible for any damage to furniture or equipment.

PS 5.10 TESTING AND QUALITY CONTROL

The Contractor shall engage the services of an approved independent laboratory or other institution as applicable for quality testing, to ensure that his work complies with the Specifications.

No separate payment will be made for such testing, the cost of which will be deemed to be included in the Contractor's rates bid for the items of work that require testing in accordance with the Specifications.

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality-control system and provide experienced Departmental Representative / Engineers, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control, including testing carried out by the Contractor, will be deemed to be included in the rates bid for the related items of work.

The Contractor's attention is drawn to the provisions of the various Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Departmental Representative / Engineer for examination, the Contractor shall furnish the Departmental Representative / Engineer with the results of the relevant tests to indicate compliance with the Specifications.

PS 6 CERTIFICATES OF PAYMENT

The statement to be submitted by the Contractor in terms of Clause 49 of the General Conditions of Contract shall be prepared in accordance with the standard payment certificate prescribed by the Departmental Representative / Engineer and shall comprise at least two sets of A4-size paper copies.

All costs for the preparation and submission of the statements shall be borne by the Contractor.

PS 7 CONSTRUCTION IN RESTRICTED AREAS

Working space in certain areas may be restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. However, the Contractor must note that measurement and payment will be according to the specified cross-sections and dimensions irrespective of the method used, and that the rates and prices submitted will be deemed to include full compensation for difficulties encountered while working in restricted areas. No extra payment nor any claim for payment due to these difficulties will be considered.

PS 8 DRAWINGS

The Contractor will, in terms of Clause 13 of the General Condition of Contract, be provided free of charge with three paper prints of each drawing issued to them.

All information in the possession of the Contractor that is required by the Departmental Representative / Engineer's representative to complete the as-built drawings must be submitted to the Departmental Representative / Engineer's representative before a Certificate of Completion will be issued.

Only figured dimensions shall be used and drawings shall not be scaled unless required by the Departmental Representative / Engineer. The Departmental Representative / Engineer will provide the dimensions that may have been omitted from the Drawings.

PS 9 LEGISLATION

(a) Changes in legislation

Reference in the General Conditions of Contract and in any other standard document forming part of this Contract to legislation which has been amended or superseded by other legislation since the most recent publication of such standard document, shall be deemed to be a reference to the amended or replacement legislation.

Such amended or replaced legislation shall be applicable during the Contract Period provided the amendment or replacement occurred more than 28 days before the closing date for bids in terms of Clause 46.4 of the General Conditions of Contract as amended in Part 1 of the Contract Data.

(b) The Occupational Health and Safety Act

The Contractor shall be required to comply with the Occupational Health and Safety Act, 1993: Construction Regulations, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003. Non-compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

The proposed type of work, materials to be used and hazards likely to be encountered on this Contract are detailed in the Scope of Work, Pricing Data and Drawings. The Employers' health and safety specifications (subclause 4(1)) of the regulations will be issued separately.

The Contractor shall in terms of subclause 5(1) provide a comprehensive health and safety plan detailing his proposed compliance with the regulations, for approval by the Employer.

The Contractor shall at all times be responsible for full compliance with the approved plan as well as the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned Construction Regulations 2003.

PS 10 INSURANCE AMOUNTS

The amounts for which the Contractor must insure the Works in terms of Clause 35 of Part 1 of the Contract Data are stated in the Agreement.

PS 11 TIMES FOR COMPLETION

Times for completion of repair work to installations as well as the maintenance down-time for different types of breakdowns are given under Clause 42.1 of Part 1 of the Contract Data. The time for completion will start on the date of access to an installation.

PS 12 PRACTICAL COMPLETION

- (a) The Contractor shall be entitled in terms of Clause 51.1 of the General Conditions of Contract to receive a Certificate of Practical Completion when the Works to be executed under the Contract have been completed to the stage where:

all materials which are required to be replaced have been replaced and installed to the satisfaction of the Departmental Representative / Engineer; and

all repair works have been completed.

- (b) The Departmental Representative / Engineer shall issue to the Contractor and the Employer a Certificate of Completion in terms of Clause 51.4 of the General Conditions of Contract except where a thirty day commissioning period, as stated in paragraph (c) below, is applicable.
- (c) Where indicated at the end of this paragraph, the issuing of a Certificate of Practical Completion for a certain installation will be followed by a thirty day commissioning period. The tasks of the Contractor during the thirty day commissioning period are described in Additional specification SC: General Decommissioning, Testing and Commissioning Procedures. After the completion of the thirty day commissioning period to the satisfaction of the Departmental Representative / Engineer, a certificate of completion will be issued to the Contractor as described in Clause 51.4 of the General Conditions of Contract.

PS 13 PENALTIES

Penalties in terms of Clause 43.1 of the General Conditions of Contract for late completion of repair work to different installations are given under Clause 43.1 of Part 1 of the Contract Data. Payment reductions for exceeding the maintenance down-time for different types of breakdowns are given under the applicable pay items in the Bill of Quantities for Additional specifications SA: General Maintenance. Penalties will run concurrently where applicable.

- (a) **Penalty for failing to meet undertakings and/or conditions pertaining to Targeted Procurement for the award of points – Note: Not applicable to the term contract.**

If the bid adjudication points awarded to the Contractor are found to be based on incorrect or false information or the conditions pertaining to the award of points are not met and the Contractor fails to substantiate that such failure is due to a reason acceptable to the Employer (as being) beyond the Contractor's control, the Contractor shall be liable for and pay to the Employer, and amount determined in accordance with clause 2 and subject to clause 1 both of the Works Information, Part 2 of the Conditions of Bid.

(b) Payment reduction for non-performance

If the Contractor shall fail to rectify an emergency maintenance breakdown, an ordinary maintenance breakdown and damage breakdown within the time as stipulated in Additional Specifications SA: General Maintenance, the Contractor shall be liable to the Employer for the sum/sums stated in the Bill of Quantities for Additional Specification SA as a payment reduction for every hour/day downtime counting from the hour/day the breakdown was reported to the Contractor until the day it was repaired. These payment reductions will be cumulative and will run concurrently.

Where indicated above that the money will be recovered from the Contractor by means of payment reductions, the fixed negative amounts in the rate column of the Bill of Quantities will be used to reduce payments due to the Contractor.

The imposition of such payment reductions shall not relieve the Contractor from his obligation to complete the Works or from any of his obligations and liabilities under the Contract.

(c) Application of penalties to be accumulative

The imposition of all penalties in terms of this clause shall be accumulative and shall not relieve the Contractor from his obligation to complete the Works or from any of his obligations and liabilities under the Contract.

PS 14 NON-WORKING DAYS AND HOURS

Whenever any special non-working days stated in Clause 1.6 and Clause 38 of Part 1 of the Contract Data fall within the days allowed or stipulated in the Contract in terms of Clause 1.6 of Part 1 of the Contract Data, such special non-working days shall also be excluded from the calculation of the number of working days concerned.

The Contractor shall not work on any statutory public holidays or on any public holidays declared by the Government to be statutory non-working days, except for work related to repair fatal and emergency breakdowns which influences the functionality of any of the installations.

Working hours might be limited and the Contractor shall work in close cooperation with the User Client and Departmental Representative / Engineer in this regard. Working hours for the different installations are indicated at the end of this clause where applicable.

The Departmental Representative / Engineer shall be entitled at any time during the Contract, to vary the normal working hours specified in the Bid documents, including increasing or decreasing the total number of hours per day during which the Contractor may execute the Works or specific portions thereof.

If any variation by the Departmental Representative / Engineer of the normal working hours specified in the Bid Documents should result in an increase or a decrease in the total number of hours per week during which the Contractor is permitted to execute the Works or any particular portions of Works, then the time allowed in the Contract for the completion of the respective part of the Works to which the varied normal working hours apply shall be adjusted proportionately in relation to:

- a) the remaining time allowed for completion of the specific part or parts of the Works; and
- b) the extent of the variation in the total normal working hours per week.

PS 15 TRANSPORT

15.1 Scope

Provide for certain works to be executed on the basis of Dayworks where specified or instructed. This item may only be utilised on the specific instruction of the Engineer. All overhead costs shall be included.

In the case of work provided for in terms of Provisional Sums the Contractor shall submit a detailed quotation prior to commencing work. The amount of the quotation shall not be exceeded without approval prior to completion of the work concerned. In the case of Transport for planned maintenance, a prior quotation is not required.

15.2 Measurement

Labour : Time (hrs) including the full cost of employment such as wages, transport (excluding authorised transport), insurances, subsistence, allowances, overheads, etc. Materials markup as a portion of proven materials cost eg 15% = 0,15.

Materials: An allowance for the cost of materials utilised in connection with work performed in terms of dayworks. The materials mark-up rate shall include full compensation to the Contractor for quotation profit & attendance costs. The mark-up rate shall be given as a portion of the proven cost of the materials utilised, ie 15% must be entered as 0,15.

Transport: Authorised distance travelled measured in km, is separately quantified.

Vehicular transport measured in km between the reference location and the various sites at which services are performed will be determined on the basis of the following distance table. Transport between the contractor’s head office and the reference location is not reimbursable, the costs thereof being an overhead for the contractor’s own account. Where more than one service is performed on the same day in the same area transport costs will be calculated on actual distance travelled as defined in this measurement clause. The measured quantity in km is provisional, to be adjusted as utilised. The distances travelled shall be recorded in a log book with odometer readings, date, and origin & destination places. Logbook copies shall be submitted with the monthly job card claims.

Reference Location: General Post Office, Govan Mbeki Avenue, Central, Port Elizabeth.

The following table illustrates an example of the method of measurement which shall be adopted in order to minimise travel costs. It is the Contractor’s responsibility to ensure that all consumables, tools and spares are loaded in the transport for the sites to be visited to avoid the need to make an additional return to the depot during the day before the day’s scheduled site visits are completed. Any claims for such return journey shall be rejected unless fully motivated and approved prior to the event.

Reference location to site A	8km
Site A to site B	1km
Site B to site C	2km
Site C to reference location	6km
Total Distance	17km

15.3 Payment

Payment will be subject to the submission of a detailed claim for materials utilised and transport, together with the monthly submission of job cards for maintenance & servicing or other tasks instructed to be performed in terms of dayworks. Payment claims shall include full details of the

work performed with supporting materials invoices, close-out reports, labour time sheets & transport details with distance travelled log.

16 UNPLANNED MAINTENANCE

16.1 Scope

The Department operates a reporting system for any plant faults or breakdowns (complaints) which may occur.

The call centre is operated on behalf of the Department by Advance Call. The Contractor shall register with the call centre by submitting an application form & paying the required registration fee. The Contractor shall furthermore pay to the call centre a monthly subscription fees, call fees and reporting fees.

Client or tenant department staff report such plant faults or breakdowns to the DPW call centre which will log the complaint and transmit it by fax, e-mail & sms to the Contractor.

The contractor shall respond to the complaint as necessary in accordance with the assigned priority level & the breakdown (complaint) shall be repaired as necessary to restore the plant to full operation in the minimum time. On completion of the complaint remedy the contractor shall complete a Job Card and submit to the Engineer with a copy to the facility concerned. The Contractor shall attach to the Job Card the following documents associated with the complaint.

- Copies of vendor tax invoices for materials used, each endorsed with the Complaint Number
- The Contractor's stamp and the Contractor's original signature.
- Travel log sheet for travel exclusively incurred in attending to the Complaint. If the Complaint was repaired during a scheduled service visit to the plant concerned, then the travel log for the complaint shall be appropriately endorsed.
- Time sheets of staff who attended to the Complaint all stamped and endorsed with the Contractor's original signature.
- Further information which may be necessary or instructed.

The Engineer will be responsible for closing the call. The Contractor shall be responsible for obtaining the fax number of each facility and establishing to whom the said fax must be transmitted.

Should the contractor not be able to complete the required breakdown repair work within the maximum down-time period allowed, it shall be his responsibility to obtain extension of down-time from the Engineer. The written report shall clearly state the reasons for the extension, as well as the actual extension required.

Extension of down-time will only be granted by the Engineer if;

- (a) The maximum down-time is unreasonable in relation to the scope of the repair work required.
- (b) The delivery time of a new component/subassembly/machine or spares required for the repair of the defective component/subassembly does not enable the contractor to successfully complete the repair work within the maximum breakdown down-time allowed.

Priority Level Maximum Down-Time Allowed (MDTA) Penalties for non-performance per day

Fatal breakdown where specified 4 hours (immediate response)	R 1,500.00
Emergency breakdown 24 hours	R 750.00
Ordinary breakdown 7 days	R 1000.00
Quoted work Agreed program - failure	R 1000.00

“Maximum down time” shall mean the period of time allowed to repair a breakdown, and “actual down-time” shall mean the measured period from the instant when the breakdown was logged with the contractor until the installation has been repaired to its functional specification.

17 Measurement & Payment

a) Breakdown Repair work :

Materials, labour & transport elsewhere measured under Dayworks.

b) Call Centre Services :

The rates shall include all relevant costs associated with the call centre services but excluding the actual repair work. Items shall include the profit & attendance of the contractor on the call centre plus the call centre fees. The rate for Breakdown Calls shall furthermore include the cost of the specified administration actions. The following table of call centre fees represents the current status. Future annual adjustments are deemed to be covered by the Contract Price Adjustment Provisions (CPAP) allowed in terms of the contract.

b1). Registration Fee	R 0 (initial once off fee)
b2). Monthly subscription	R 0 (per month per department)
b3). Breakdown calls	R 0 (per breakdown includes all telephone calls and faxes)
b4). Breakdown reporting	R 0 (per report)

The stated rates exclude VAT.

17.1 Payment

Payment will be subject to the submission of detailed claims for materials utilised and transport, together with the submission of unplanned maintenance Job Cards. Payment claims shall include full details of the work performed with supporting materials invoices, Job Cards, labour time sheets & transport details with distance travelled

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

TECHNICAL SPECIFICATION FA - STEAM GENERATING INSTALLATION

CONTENTS

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FA 01 SCOPE

- (a) This specification covers the general repair and maintenance of steam generating installations which include the following two types of coal-fired boilers:
- (i) Horizontal packaged wetback shell and fire-tube type boilers with chain grate stokers
- (b) This specification also covers the repair and maintenance to the following ancillary boiler and boiler house equipment:
- (i) Coal handling equipment
 - (ii) Ash handling equipment
 - (iii) Grit collectors and chimneys
 - (iv) Chain grate and underfeed stokers
 - (v) Induced draught fan and damper controls
 - (vi) Forced draught fan and damper controls
 - (vii) Boiler level controls and alarms
 - (viii) Feed-water pumps
 - (ix) Hot well tanks
 - (x) Water treatment plant and equipment
 - (xi) Coal chutes and hoppers
 - (xii) Boiler main steam valves, safety valves, non-return valves, blow-down and drain valves
 - (xiii) Soot blower (if applicable)
 - (xiv) Refractories
 - (xv) Instrumentation and controls
 - (xvi) Electrical control panel
 - (xvii) Spares and tooling
 - (xviii) Insulation and cladding
 - (xix) Ladders and landings.

- (c) This specification also addresses the following:
- (i) Hydraulic testing and internal and external inspections
 - (ii) Training and boiler efficiencies
 - (iii) Operating of boilers
 - (iv) Coal quality and control.
- (d) This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

The Contractor shall at all times adhere to this specification unless otherwise specified in the Particular Specification.

FA 02 STANDARD SPECIFICATIONS

FA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof:

FA 02.01.01 SANS and other specifications and codes

- SANS 0400 - The applications of the building regulations
- SANS 0142 - Code of practice for the wiring of premises
- SANS 0140 - Identification colour marking
- SANS 044 - Parts I to IV: Welding
- SANS 460 - Copper tubes for domestic plumbing
- SANS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications.

SANS Specifications listed on page 3 of the DPW specification OWG 371

- CKS 332 - Specifications for industrial V-belts

Atmospheric Pollution Prevention Act, No 45 of 1965

BS 2790
BS 1740
BS 21
BS 1640

FA 02.01.02 Department of Public Works specifications

- OWG 371 - Specification of materials and methods to be used
- STD.PWD.VII - Standard Specification for steam boiler installations (Issue VII 1997)
- Standard Specification for electrical installations and equipment pertaining to mechanical installations

FA 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FA 02.01.04 Manufacturers' specifications, codes of and practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' specifications, instructions and codes of practice.

FA 02.01.05 Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

FA 02.01.06 CSIR Publications

Technical Guide K15, CSIR 1970: A guide to water treatment in low-pressure and medium-pressure boilers

FA 03 **VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS**

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

FA 03.01 **GENERAL REPAIR AND INSTALLATIONS REQUIREMENTS**

- (a) All materials and equipment supplied and installed shall be of new high quality, design and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.
- (b) All work shall be executed in a first-class workman-like manner by qualified tradesmen.
- (c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SANS specifications and codes, except where otherwise specified or approved by the Engineer/Departmental Representative in writing.
- (d) All materials and workmanship which, in the opinion of the Engineer/Departmental Representative, is inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer/Departmental Representative.
- (e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer/Departmental Representative for approval before placing orders or commencing installation.
- (f) All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.
- (g) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.
- (h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.
- (i) Repair work shall be programmed in accordance with General Decommissioning, Testing

and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and the public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

FA 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Operating and Maintenance Manuals.

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

- (a) System description
 - Complete system description and the working of the plant.
- (b) Commissioning data
 - Complete commissioning, test and inspection data of plant.
- (c) Operating data
 - (i) Plant running check list and frequency of servicing required;
 - (ii) Safety precautions to be implemented;
 - (iii) Manual and automatic operation;
 - (iv) Operator's duties (logging requirements);
 - (v) Lubricating oils and service instructions;
 - (vi) Pre-start checklist for each system;
 - (vii) Starting and stopping procedures.
- (d) Mechanical equipment
 - (i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturer or their agents;
 - (ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
 - (iii) Manufacturers' brochures and pamphlets;
 - (iv) Schedule of spares with part numbers recommended to be held as stock.
- (e) Maintenance instructions
 - (i) Schedule of maintenance particulars, frequency of services and replacements;
 - (ii) Trouble-shooting guide;
 - (iii) Part number of all replacement items and spares;
 - (iv) Capacity curves of pumps, fans and compressors;
 - (v) Serial numbers of all items of equipment.
- (f) Electrical equipment
 - (i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (ii) Maintenance instructions;
 - (iii) Manufacturers' brochures and pamphlets;

- (iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

- (g) Instrumentation and control
 - (i) Description of each control system;
 - (ii) Schedule of control equipment indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (iii) Maintenance instructions;
 - (iv) Manufacturer's brochures and pamphlets.

- (h) Drawings
 - (i) Paper prints of all as-built mechanical and electrical drawings;
 - (ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

FA 05 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in General and Maintenance. This shall consist of a log and record book which shall be utilised to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, coal delivery, chemical and salt deliveries, ash removal, readings, etc.

The logbook shall be kept in a safe place inside the boiler house and shall only be utilised by the boiler house supervisor, the Contractor and the Engineer/Departmental Representative. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Engineer/Departmental Representative.

The logbook shall be structured to include at least the following:

- (a) Daily inspection and maintenance actions;
- (b) Monthly inspection and maintenance actions;
- (c) Three-monthly inspection and maintenance actions;
- (d) Six-monthly inspection and maintenance actions;
- (e) Annual inspection and maintenance actions;
- (f) Breakdown reports;
- (g) Daily boiler plant operating conditions, observations, recordings and measurements (including CO2 measurement, steam consumption if available, steam pressure, water meter readings, etc);
- (h) Statutory inspection and test comments and reports;
- (i) Coal delivery report, stating the date, quality, quantity and delivery vehicle registration number;
- (j) Chemical and salt delivery reports, stating the date, quantity, description and vehicle registration number;
- (k) Ash removal report, stating the date and vehicle registration number.

The Contractor shall also institute an attendance register which shall be kept in a safe place inside the boiler house. This register shall be completed by all persons visiting the boiler house, including:

- (a) Boiler house operators, cleaning staff and supervisor
- (b) Contractor and maintenance personnel
- (c) Inspectors
- (d) Department personnel
- (e) Engineer.

The register shall state the date, time-in, time-out, name, company and reason for visit.

A copy of the register shall be submitted by the Contractor together with his monthly report.

FA 06 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and shall give at least 72 hours written notice to the Engineer, before commencing the test.

In the event of the plant or installation not passing the test, the Department shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer/Departmental Representative attending the repeated test.

Whenever any installation or equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until they operate to the satisfaction and approval of the Engineer/Departmental Representative.

The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.

FA 07 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer at regular intervals as required.

FA 08 COMMISSIONING AND RE-COMMISSIONING OF PLANT AND INSTALLATION

FA 08.01 GENERAL

On completion of the repair work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer/Departmental Representative. Where new plant is installed, the Contractor shall run and operate the system for a period of time as specified by the Engineer/Departmental Representative and train the staff of the User Client to operate and maintain the system.

Logging of the operation of the installations shall commence immediately upon startup.

The Contractor shall submit a full commissioning report.

FA 08.02 RE-COMMISSIONING OF BOILERS AND ANCILLARY EQUIPMENT

On completion of the statutory inspections and tests or major boiler repairs the Contractor shall re-commission the boiler and its ancillary equipment. This operation shall be done strictly in accordance with the manufacturer's specification and shall be witnessed by the Engineer. This shall include but not be limited to the following:

- (a) All required pre-commissioning mechanical checks:
 - (i) Check boiler shell waterside to ensure that it is clean of all residue and foreign matter.
 - (ii) Check that all fittings, hand holes, manholes, blow-down valves, pipe connections, etc, are properly secured and installed in accordance with the manufacturer's

specification.

- (iii) Clean out feed pump strainers.
 - (iv) Check that all joint seals are replaced with new and properly installed.
 - (v) Check boiler shell gas side to ensure that it is clean of any dust, slag, ash, loose refractory waste material, etc.
 - (vi) Check and inspect all refractory work for compliance with manufacturer's specification.
 - (vii) Check that all tube holes has been brushed and free of any foreign matter.
 - (viii) Check that all moving components are free to move and that they are securely installed.
 - (ix) Check all expansion joints and seals. Reinstall all covers and doors and check that they are properly secured.
 - (x) Check that the stoker is properly installed and that all components are installed in accordance with manufacturer's specification. These checks shall include alignment, tensioning, movement of grate without obstruction, seals, movement of dampers, guillotine door, grate links, set points, secureness of all equipment and components.
 - (xi) Check for the correct installation and operation of the soot blowers.
 - (xii) Check and record that all lubrication to equipment and components have been done in accordance with manufacturer's specification.
 - (xiii) Check that the FD and ID fans have been correctly installed and reassembled in accordance with manufacturer's specification.
 - (xiv) Check and clean grit collector and ensure that grit discharge port seals are in place and seal properly
 - (xv) Check that chimneys are clean and securely supported and fixed.
 - (xvi) Check and ensure that all valves and safety valves are correctly installed and in the correct operating position, safety valves to be set in accordance with the required blow-off pressure for this installation.
 - (xvii) Check and clean out hot well tank and flush out water supply to boilers.
- (b) All required pre-commissioning electrical checks
- (i) Check all wiring connections for tightness and repair any hot connections.
 - (ii) Check that all electrical equipment have been properly reconnected in accordance with the manufacturer's specification.
 - (iii) Perform and record all required electrical insulation tests on equipment.
 - (iv) Check and test all controls with main circuits isolated.
 - (v) Check all motor-driven equipment for correct rotational directions.
 - (vi) Check and test the operation of all indication and warning lights.
 - (vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specification.
 - (viii) Run all motor-driven equipment for a period to ensure free movement and correct operation, feed pumps only to be operated for a short interval to check rotation.
- (c) Commissioning of the boiler

On completion of the pre-commissioning checks the Contractor shall proceed with the commissioning of the boiler. This shall be done strictly in accordance with the manufacturer's specification and shall include but not be limited to the following:

- (i) Fill boiler with feed water from the hot well tank to the prescribed level in the manner as described by the manufacturer.
- (ii) During this process all level and warning system checks shall be performed on the water level control system.
- (iii) The feed pump's operation must be tested and indication lights checked.
- (iv) Check, test and set up water softener and chemical dosing equipment to the required water quality for the boiler.
- (v) Set and adjust all stoker controls in accordance with the manufacturer's specification.
- (vi) Set and adjust ID and FD damper controls in accordance with the manufacturer's specification.

- (vii) Set and adjust combustion controls in accordance with the manufacturers specification.
- (viii) Set and test steam pressure detector to the correct boiler operating pressure.
- (ix) Check the operation of the guillotine door and adjust to the required starting coal bed depth.
- (x) Check the coal hopper and coal level controls. Check and ensure that the coal conveying system operates and that the coal is at the correct level inside the hopper.
- (xi) Check and test the draught gauges for the correct operation.
- (xii) Proceed with lighting the fire.
- (xiii) Bring boiler up to steam, following the correct procedures as described by the manufacturer and ensuring correct combustion, coal bed depth, ignition line, etc, and that all controls are functioning properly and are set in the correct position.
- (xiv) When operating pressure has been reached the steam valve to the system has to be cracked open until full supply pressure to system is achieved, on which the valve can be fully opened.
- (xv) During the load conditions the boiler has to be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation.

The Contractor shall visit, inspect, test and readjust the boiler over the 30-day period following the re-commissioning to ensure the correct functioning of the boiler and its associated equipment.

FA 09 GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair work, complies with the required performance and will function as part of the complete system.

All new equipment, including, the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing upon day of issue of certificate of completion for repair work of the installation.

FA 10 MAINTENANCE TOOLS AND SPARES

Each boiler house shall be equipped with the necessary maintenance tools and spares required by the specific type of boilers and installation for the daily operation and maintenance of the plant. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the boiler and equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the boiler house supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the boiler house supervisor and record and report to the Engineer/Departmental Representative. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

(a) Tools

- Manhole spanner
- Hand hole spanner
- Double-ended spanners
- Tube cleaning rods
- Correct size tube cleaning brushes
- Correct size tube de-scaling tools
- Tube cleaning machine where required
- CO2 analyser
- Grate crank handle

Ash shovel
Grease gun
Driving drift
Shear pins
All other necessary tools for the type of installation

(b) Spares

Manhole and hand hole joints
Replacement gauge glasses and accessories
Replacement sight glasses
Replacement belt drives
Grate links and rods
Any other spares that may be required for the specific installation and/or due to the remoteness of the installation.

FA 11 COAL DELIVERY RECORDING AND CONTROL

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the User Client and coal provider, institute a quality and delivery control plan for each boiler house. This control plan shall consist of a set of records to be completed with each coal delivery, stating the following:

- (a) Delivery note number
- (b) Date of coal delivery
- (c) Quantity of coal delivered
- (d) Type of coal delivered
- (e) Coal sample identification number
- (f) Contractor's signature on acceptance of information and coal sample
- (g) Coal deliverer's signature
- (h) Boiler house supervisor's signature
- (i) Comments by any party.

The type of coal to be accepted shall comply with the specification to be agreed between the User Client and the Engineer/Departmental Representative.

The Contractor shall be responsible for taking a sample of each batch of delivered coal and sending it to an approved laboratory for confirmation that the coal samples conform to the agreed type of coal for the specific installation. The result of the tested sample shall contain the following:

- (a) Various coal sampled mesh sizes
- (b) Calorific value
- (c) Moisture content
- (d) Ash content
- (e) Ash fusion temperature
- (f) Volatile content.

The results of these tests shall be submitted to the Engineer/Departmental Representative.

The recorded information shall also be utilised to determine the boiler efficiency, together with other relevant information to be gathered.

The Contractor shall, in collaboration with the Engineer/Departmental Representative, institute the necessary measures to ensure the safe keeping and security of the coal storage.

All the relevant recorded information shall be submitted monthly together with Contractor's maintenance schedules to the Engineer/Departmental Representative.

FA 12 ASH REMOVAL RECORDING AND CONTROL

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the User Client,

ash removal company and the Engineer/Departmental Representative institute an ash removal control plan for each boiler house. This control plan shall consist of a set of records to be completed with each removal taking place and shall include the following:

- (a) Date of contact of removal company for removal of ash;
- (b) Date of actual ash removal;
- (c) Approximate quantity of ash removed;
- (d) Ash destination address, to be completed by removal company;
- (e) Random samples of ash taken and recorded by Contractor;
- (f) Contractor's signature on acceptance of information;
- (g) Removal company signature;
- (h) Boiler house supervisor's acceptance signature;
- (i) Comments by any party.

The Contractor shall at random take samples of the ash and send it to an approved laboratory for analysis in order to determine the amount of un-burnt carbon. The un-burnt carbon in the ash should normally not be more than 20 % per volume.

The Contractor shall, in collaboration with the User Client and the Engineer/Departmental Representative, also institute a control plan to ensure safe handling and storing of the ash.

All the relevant recorded information shall be submitted, together with Contractor's maintenance schedules, monthly to the Engineer/Departmental Representative.

FA 13 WATER TREATMENT CHEMICAL DELIVERIES AND CONTROL

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the User Client and chemical supplier, institute a quality and delivery control plan for each boiler house. The control plan shall consist of a set of records to be kept up to date with each delivery of chemicals, stating the following:

- (a) Delivery note number
- (b) Date of delivery
- (c) Type and quantity of salts and chemicals delivered
- (d) Make-up water volume, recorded regularly
- (e) Feed-water volume, recorded regularly
- (f) Random sampled feed-water recorded by chemical supplier
- (g) Contractor's signature on acceptance of information
- (h) Chemical supplier deliverer's signature
- (i) Boiler house supervisor's signature
- (j) Comments by any party.

The type of salts and chemicals to be accepted as in compliance with the specification shall be agreed between the User Client and the Engineer/Departmental Representative, and shall be applicable to the type of boilers employed, as well as the make-up water supplied to the feed tank.

The Contractor shall ensure, together with the chemical supplier, that at regular intervals the boiler feed-water be sampled and analysed, feed-water treatment equipment be adjusted to ensure the correct dosing percentages and treatment for the specific installation.

The Contractor shall, in collaboration with the User Client and Engineer/Departmental Representative, also institute a control plan to ensure safe handling and storing of the chemicals.

All the relevant recorded information shall be submitted, together with Contractor's maintenance schedules, monthly to the Engineer/Departmental Representative.

Where specified in the Particular Specification and/or Schedule of Quantities the Contractor shall be responsible for the supply and delivery to site of the chemicals and salts for the 36-month maintenance contract period. The Contractor shall appoint an approved chemical supplier for the delivery of these chemicals and salts. The Engineer/Departmental Representative reserves the right to send samples of these chemicals and feed water for analysis by an independent laboratory for compliance checks.

FA 14 BOILER EFFICIENCY CONTROL

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the boiler house supervisor, institute a boiler efficiency control plan for each boiler house. The control plan shall consist of a set of records to be completed regularly by monitoring the following:

- (a) Date and time entries recorded
- (b) Make-up water meter reading
- (c) Feed-water to boiler meter reading
- (d) Steam pressure gauge reading
- (e) CO₂ percentage reading of exhaust gases
- (f) Final exhaust gas temperature reading
- (g) Furnace pressure gauge reading
- (h) Steam flow meter reading if installed
- (i) Quantity of coal consumed.

The Contractor shall, in collaboration with the boiler house supervisor, ensure that these records are taken at predetermined intervals to ensure the efficient operation of the plant. Together with the boiler manufacturer's information and the above-mentioned recorded information, the Contractor shall issue a calculation indicating the approximate plant efficiency.

All the relevant recorded information shall be submitted, together with the Contractor's maintenance schedules, monthly to the Engineer. It shall be the responsibility of the Contractor to ensure that the boiler can operate at the design efficiency in all respects.

FA 15 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FA 15.01 GENERAL

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in tabular form in the Particular Specification with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the period specified in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate of completion of the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the steam generating installations are categorised under the following headings:

- (a) Statutory inspections and tests
 - (i) Internal and external inspection
 - (ii) Hydraulic pressure test
- (b) Coal-fired boiler
 - (i) Boiler shell water side

- (ii) Boiler shell gas side
 - (iii) Integral piping
 - (iv) Boiler valves and mountings
 - (v) Refractories and brickwork
 - (vi) Soot blowers
 - (vii) Lagging and cladding
- (c) Feed-water equipment and controls
- (i) Feed-water tanks
 - (ii) Feed-water pumps
 - (iii) Water level equipment and controls
- (d) Combustion and draught equipment
- (i) Stoker and stoker controls
 - (ii) Fans and damper controls
 - (iii) Combustion controls
 - (iv) Chimneys
 - (v) Ducting
- (e) Coal handling and conveying equipment
- (i) Coal bunker and gratings
 - (ii) Coal conveying equipment
- (f) Ash and grit removal equipment
- (i) Grit collectors
 - (ii) Ash conveying equipment
 - (iii) Ash and grit trolleys
 - (iv) Ash storage and handling
- (g) Electrical installation, wiring and control panels
- (i) Instrumentation and controls
 - (ii) General electrical power and lighting installation
 - (iii) Electrical control panels
- (h) Water treatment equipment
- (i) Water softener
 - (ii) Chemical dosing equipment
- (i) Boiler house ancillary equipment
- (i) Blow-down sump
 - (ii) Ladders and galleries
 - (iii) Painting of equipment, plant and building

FA 15.02 **STATUTORY INSPECTIONS AND TESTS**

The Contractor shall at the commencement of the repair and maintenance contract arrange for the compulsory statutory inspections and tests on each of the boilers in his contract in accordance with the Occupational Health and Safety Act, 1993. This shall include an internal and external inspection and hydraulic test of the boilers. These inspections and tests shall be performed and certified by an approved inspection authority. The Contractor shall be responsible for all the preparation work and

ancillary work as specified. Only one boiler at a time shall be taken out of commission for these purposes in accordance with General Decommissioning, Testing and Commissioning Procedures.

During this period the Contractor shall inspect, service, repair, replace and overhaul all ancillary boiler equipment associated with these boilers. These actions shall be planned in such a manner as to minimise the down-time of the boiler, as well as without influencing the operation of the rest of the plant. All defective equipment shall be replaced and repair work required to the boilers shall be done.

All inspections and findings shall immediately be reported to the Engineer/Departmental Representative.

FA 15.02.01 Hydraulic pressure testing and internal and external inspections

A hydraulic pressure test and internal and external inspection shall be performed on each boiler in accordance with the requirements of The Occupational Health and Safety Act, No 85 of 1993 as amended and shall be witnessed and certified by an approved inspection authority.

The inspections and hydraulic test shall be performed every 24 months as prescribed in the Occupational Health and Safety Act of 1993.

In accordance with the regulations the Contractor shall be responsible for providing the necessary tools, workmen, lights, equipment and apparatus which may be required by the Inspector for the purposes of the inspection and tests, and shall include the following equipment and actions:

- (a) All equipment, tools, rigging and other facilities necessary for conducting the test and inspections shall be provided.
- (b) The boiler test pump and gauges calibration certificates shall be made available prior to commencing the hydraulic testing.
- (c) The hydraulic test medium shall be clean cold water. The required test pressure shall be as stipulated in the Occupational Health and Safety Act, No 85 of 1993, as amended.
- (d) The maximum rating of any hand-held light source shall be 50 volt.
- (e) The hydraulic test date shall be confirmed/negotiated with the approved inspection authority.
- (f) All notices as required by the regulations shall be provided and put into place.
- (g) The up to date boiler log book and Government boiler register shall be made available to the Inspector.

FA 15.02.02 Boiler preparation for statutory inspection and testing

The following preparation work shall be carried out, prior to the external and internal inspection and hydraulic test, by the Contractor:

- a) All electrical supplies and controls to the boiler shall be isolated prior to starting of testing and inspection procedures.
- b) The boiler shall be emptied and cleaned. All scale deposits are to be removed from internal shell, tubes and water spaces. Methods to be used shall be approved by the Engineer/Departmental Representative and shall carry the approval of the boiler manufacturer.
- c) Dismantle and remove boiler lagging and cladding where necessary and where directed by the Engineer/Departmental Representative.
- d) Remove stoker from boiler
- e) Remove required refractory brickwork from boiler before inspection.
- f) All boiler fittings shall be stripped down, de-scaled, machined, re-seated, overhauled and tested to manufacturer's specification by approved engineering works. These are to be certified as complying with the manufacturer's specification.

- Each boiler fitting shall be hydraulically tested and witnessed as such by the Engineer/Departmental Representative.
- g) Any boiler fittings found to be beyond repair shall be replaced with new on approval of the Engineer/Departmental Representative.
 - h) Remove all manholes, hand hole covers, mud holes and wash-out plugs.
 - i) Remove boiler fusible plug and replace with new.
 - j) Clean out and wire brush stacks, smoke boxes, flues and plates.
 - k) Smoke boxes, stack uptake and domes to be painted in accordance with manufacturer's specification.
 - l) Tubes to be cleaned, inspected and replaced if necessary.
 - m) Open and clean out all blow-down and other trenches and replace damaged and leaking pipework.
 - n) Chemical cleaning of the tubes shall not be allowed without the consent of the Engineer/Departmental Representative.
 - o) Internal parts of the boiler shall only be painted on completion of the successful boiler inspection by the Inspector.

FA 15.02.03 Internal and external inspection

On completion of all the required preparation work the Contractor shall notify the Engineer/Departmental Representative and shall arrange for the external and internal inspection of the boiler to take place by the approved inspection authority. The inspection shall be certified with relevant comments by the inspection authority.

FA 15.02.04 The hydraulic pressure test

On completion of the necessary preparation work and internal and external inspection and relevant repair work, the Contractor shall prepare for the hydraulic test to be executed, which shall include the following:

- (a) Replace all manholes, hand hole covers, mud holes and wash-out plugs. All joints are to be renewed.
- (b) Replace boiler refractory brickwork and refractories prior to hydraulic pressure.
- (c) Properly clean and expose all boiler seams, stayheads and mountings.
- (d) All safety valves, steam valves and other connections to the boiler shall be blanked off prior to starting of testing procedures.
- (e) Ensure that all water gauge cocks are in the off-position and that all gauge glass protectors are in place.
- (f) The boiler shall be filled with clean water up to the highest opening of the boiler shell.
- (g) The system shall be put under the specified hydraulic pressure, with the boiler test pump, at least 15 minutes prior to the witnessing of the hydraulic test pressure.
- (h) The pressure shall be maintained for a minimum period as specified by the Inspector.
- (i) On completion of the hydraulic test, all boiler controls shall be tested.
- (j) Any leaks resulting from the hydraulic test shall be repaired and witnessed by the Engineer/Departmental Representative. Any repair work shall lead to a new hydraulic test to be witnessed by the Inspector.
- (k) The witnessed hydraulic test shall be signed off by the approved inspection authority.
- (l) After repair of defects and reinstallation of all equipment, components, lagging, fittings, etc, and approval and certification of all inspections and tests the Contractor shall put the boiler back into operation.

The re-commissioning shall be done strictly in accordance with the boiler manufacturer's specification and shall be witnessed by the Engineer/Departmental Representative.

Any repair work which may be required on the boiler plant installation shall be executed with approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturers' specifications and codes of practice and as specified in all additional and particular specifications included in this document. During the statutory inspections and tests the following items are to be repaired and serviced as required by the Inspection Authority, boiler manufacturer and this specification.

FA 15.03.01 Coal-fired boilers

(a) Boiler shell water side

Check and inspect boiler shell for any signs of corrosion, leaks, damages and ensure that the inside is clear of all foreign matter. All scale deposits are to be removed by means of approved method of the boiler manufacturer. If any signs of damage and/or corrosion are observed, the Contractor shall notify the Engineer. Together with the Inspection Authority a decision shall be taken on the approved type of repairs to be implemented, if repair work is possible. All repair work to the boiler shell shall be done in accordance with the boiler manufacturer's specification, by qualified personnel, and shall be approved and witnessed as complying by the Inspection Authority. Check and inspect all internal pipe connections for correct fitting and soundness, ensure that all openings are clear of any foreign matter. Replace all hand hole, manhole and mud hole covers using new joint seals and rings. All existing paint work to boiler shell shall be properly prepared and repainted in accordance with the manufacturer's specification.

(b) Boiler shell gas side

Remove all smoke box covers and doors. Clear and clean out all dust, slag, ash and any foreign matter. Brush and clean out furnace tubes ensuring that no foreign matter is left behind. Boiler furnace tubes are to be inspected by the Inspection Authority. If any tubes are found in need of replacement these shall be done in accordance with the boiler manufacturer's specification, by qualified personnel, and shall be approved and witnessed by the Inspection Authority. All existing paintwork to boiler shell shall be properly prepared and repainted in accordance with the manufacturer's specification. Replace all smoke box covers and doors and ensure that they are all properly secured.

(c) Integral pipe work

All integral pipe work to the boiler to be inspected, cleaned and checked. The Contractor shall ensure that any defective piping, fittings, etc, be replaced and/or repaired in accordance with the manufacturer's specification.

(d) Boiler valves and mountings

All boiler valves including safety, blow-down, steam stop, air release, feed-water check, sequencing, drain valves, etc, are to be stripped, de-scaled, inspected, and overhauled. Where valves are found to be beyond repair these shall be replaced with new ones on approval of the Engineer/Departmental Representative.

Overhauling of valves shall include repacking of gland packing's, machining and reseating of valve seats and valves. All boiler valves and fittings shall be inspected by the Inspection Authority prior to reassembling. All valves shall be hydraulically pressure tested, prior to refitting, and witnessed by the Inspection Authority.

The Contractor shall ensure that certificates of compliance to the manufacturer's specification are obtained and issued to the Engineer/Departmental Representative, on all overhauled and refurbished valves, prior to refitting to boilers.

All overhauling and refurbishing work to boiler valves shall be done in accordance with the manufacturer's specification.

All boiler valve mountings on removed boiler valves are to be inspected and replaced with approved new mountings in accordance with the manufacturer's specification, which shall include washers, bolts, nuts, studs, etc.

Safety valves are to be adjusted and tested to the correct blow-off pressure.

(e) Refractories and brickwork

All removed refractories and brickwork during the internal and external inspection are to be replaced with new in accordance with the manufacturer's specification. All other refractories and brickwork not removed shall be inspected and repaired where necessary.

All recasting and replacement brickwork and refractories shall be done with approved materials, tooling, moulds, etc, in accordance with the manufacturer's specification.

On completion of the above work the Inspection Authority shall inspect and certify the work.

(f) Soot blowers

All soot blowers are to be removed, inspected, cleaned, overhauled and refurbished in accordance with the manufacturer's specification. On completion prior to refitting the soot blowers shall be tested in the presence of the Inspection Authority.

(g) Lagging and cladding

Boiler lagging and cladding are to be inspected, repaired and/or replaced where necessary.

On completion of statutory inspections and testing the removed lagging and cladding are to be replaced in an approved manner, replacing damaged sections of cladding and lagging, fixing screws to be properly secured and missing screws replaced. On completion cladding has to be repainted if necessary.

Where lagging and cladding are damaged beyond repair it shall be replaced with approved type as supplied by the manufacturer of the boiler.

FA 15.03.02 Feed-water equipment and controls

(a) Feed-water tanks

The feed-water tank has to be emptied, inspected, cleaned, repaired and refilled and put back into operation. Where only a single feed-water tank exists, this operation shall be carefully planned, as a complete plant shut-down will have to be arranged. This shall be done in close collaboration with the User Client and Engineer, ensuring the minimum shut-down period. Where dual feed-water tanks are present, only one tank at a time shall be taken out of operation for the necessary repair and service work.

The repair work to these tanks shall include at least the following:

- (i) Inspect and test the feed-water tank and associated equipment and pipework for any leakages.
- (ii) Isolate supply water, condensate inlets and feed-water outlet to tank.

- (iii) Empty tank by means of draining it through the drain valves.
- (iv) Remove and clean tank of all mud, sediment, scale deposits and foreign matter by means of approved methods.
- (v) Carry out all necessary repair work to the tanks and associated equipment and pipework.
- (vi) Inspect tank lining for any defects and corrosion and if necessary carry out any required repair actions.
- (vii) Inspect, test, repair and replace if necessary the filling mechanism.
- (viii) Inspect tank stand for any defects and damages, and carry out the necessary repair work if any.
- (ix) Inspect lagging and cladding to feed-water tanks and carry out the necessary repair or/and replacement work.
- (x) Refill feed-water tank with clean water and open feed-water supplies to boilers.
- (xi) Inspect painting to tank and tank stand and if necessary prepare and repaint.

(b) Feed-water pumps

The feed-water pumps to the boilers are to be inspected, tested, serviced, repaired together with their associated equipment and pipe work. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the feed-water pumps and equipment shall include at least the following:

- (i) Inspect and test the feed-water pumps for correct operation.
- (ii) Replace gland packings, seals and gaskets.
- (iii) Inspect and test for any bearing noise and replace if necessary.
- (iv) Clean out pump strainers, check non-return valves, valves, etc.
- (v) Test pump motor windings for balance phases, insulation test and check wiring.
- (vi) Inspect pump mountings and repair if necessary.

(c) Water level equipment and controls

The boiler water level and feed pump controls are to be inspected, tested, adjusted, serviced and repaired in accordance with the manufacturer's specification. This shall include at least the following:

- (i) Float type water level controls are to be dismantled, stripped, de-scaled, cleaned, serviced, repaired and where necessary replaced.
- (ii) All water level controls are to be reassembled, refitted, tested and adjusted in accordance with the manufacturer's specification. The adjustments shall be in accordance with the manufacturer's specification for starting and stopping the pumps.
- (iii) Low water level alarms shall be tested, inspected and adjusted to the correct level ensuring that the alarms are sound and indicated.
- (iv) Where modulating valves are fitted these shall be inspected, tested, serviced and repaired in accordance with the manufacturer's specification. The pressure relief valve on pump discharge shall be cleaned, serviced, overhauled and readjusted to the correct blow-off level.
- (v) Replace water level gauge glasses and gaskets.

FA 15.03.03 Combustion and water treatment

(a) Stoker and stoker controls

The stoker and stoker controls are to be inspected, tested, serviced, repaired together with their associated equipment. All repair and service work shall be done

strictly in accordance with the manufacturer's specification.

- (i) The repair work to the stoker, stoker controls and equipment shall include at least the following:
- (ii) Remove stoker from boiler furnace during the statutory inspections.
- (iii) Inspect and replace burnt or/and damaged chain grate links and rods where necessary.
- (iv) Replace chain grate bearings.
- (v) Inspect sprockets and replace if required.
- (vi) Inspect shafts, rear roller and re-machine or replace if necessary.
- (vii) Inspect stoker chassis for straightness, alignment and possible damages, and repair if necessary.
- (viii) Inspect undergrate damper guide vanes and ensure that they are clean of any dust, slag and foreign matter.
- (ix) Renew and recast all refractories and brickwork in accordance with the manufacturer's specification.
- (x) Inspect main worm wheel for any defects and replace if necessary.
- (xi) Replace all joint seals with new.
- (xii) Reassemble stoker and stoker components.
- (xiii) Replace guillotine door support cables.
- (xiv) Inspect, service and overhaul stoker drive and gearbox in accordance with the manufacturer's specification.
- (xv) Replace shearpin.
- (xvi) Adjust and readjust grate tension.
- (xvii) Check and adjust fuel bed depth indicator.
- (xviii) Lubricate all required lubrication points as directed by the manufacturer.
- (xix) Mount FD fan and controls onto stoker.
- (xx) Reinstall stoker into boiler furnace in accordance with manufacturer's specification.

(b) Fans and damper controls

The FD and ID fans and associated dampers and damper controls are to be dismantled, stripped, inspected, serviced, repaired and, where necessary, components have to be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the FD and ID Fans, dampers and damper controls shall include at least the following:

- (i) Dismantle and strip down above equipment during the statutory inspections.
- (ii) Inspect fan impeller blades, clearances, etc, for correct curvature and clearance adjustment.
- (iii) Replace V-belts.
- (iv) Replace FD and ID fan bearings with new.
- (v) Inspect fan casings and repair if required.
- (vi) Clean casing and repaint.
- (vii) Inspect damper controls and dampers for free movement, fan impeller clearance adjustment, linkage adjustments, control movements and settings. Repair, service and replace any defective equipment.
- (viii) Test fans and pulling motor windings for balance phases, insulation test and check wiring.
- (ix) Lubricate all required lubrication points and replace oils as directed by the manufacturer.
- (x) Inspect fan mountings and repair if necessary.
- (xi) Reassemble and refit fans, damper controls and dampers.

(c) Combustion controls

The combustion control equipment shall be dismantled, stripped, inspected, serviced, repaired and, where necessary, components be replaced. All repair and

service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the combustion control equipment shall include at least the following:

- (i) Dismantle and strip down above equipment during the statutory inspections.
- (ii) Inspect, service, adjust and repair combustion control equipment.
- (iii) Inspect, service, repair and adjust chain drives and linkages.
- (iv) Test motor windings for balance phases, insulation and check wiring.
- (v) Lubricate all required lubrication points and replace oils as directed by the manufacturer.
- (vi) Inspect mountings and repair if necessary.

(d) Chimneys

The chimney stacks shall be inspected and repaired where required. This shall include at least the following:

For self-supporting stacks check torque tension of holding-down bolts, check access door and reseal, inspect chimney stack for any defects and repair if required, clean out the base of the stack, check and repair lagging and cladding if fitted, prepare and repaint where required.

For guyed type chimneys inspect and replace, if necessary, guy cables and securing points, re-tension guy cables, check and repair lagging and cladding if fitted, prepare and repaint where required.

(e) Ducting

The gas ducting shall be inspected and repaired where necessary. This shall include replacing all joint and expansion seals, cleaning out of ducting of all foreign matter, repairing and/or replacing any defective ducting, prepare and repaint ducting.

FA 15.03.04 Coal handling and conveying equipment

(a) Coal bunker

The coal bunkers or coal storage shall be inspected, cleaned out, and damaged structural elements and brickwork be repaired.

For coal bunkers the coal gratings and supports shall be inspected and all defective and/or damaged sections be repaired and/or replaced as might be necessary. Clear the coal storage area of any foreign objects.

(b) Coal conveying equipment

The coal conveying equipment shall be inspected, serviced, tested, repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the coal conveying equipment shall include at least the following:

- (i) Test all equipment for correct functioning.
- (ii) For en masse conveyors open covers, inspect links, chains and travelling ducting for any defects and/or damages, repair and/or replace

- components where necessary.
- (iii) For screw elevators inspect bushes, screw, casing, etc, for any defects and/or damages, repair and/or replace components where necessary.
 - (iv) Inspect, service, lubricate and where necessary repair gear boxes and drives.
 - (v) Test conveying equipment motor windings for balance phases, insulation and check wiring. Where necessary motors shall be reconditioned.
 - (vi) Inspect, test, service, adjust and where necessary repair and/or replace hopper coal level equipment.
 - (vii) Inspect, test, service and repair coal conveying electrical control panel ensuring that all controls function properly in accordance with the design.

FA 15.03.05 Ash and grit removal equipment

(a) Grit collectors

The grit collector shall be inspected, serviced, tested, repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the grit collector shall include at least the following:

- (i) Inspect grit collector supports and mountings for sturdiness, and repair and/or replace where necessary.
- (ii) Clear out grit collector of all grit, dust and foreign matter.
- (iii) Inspect all discharge port and other access opening seals and replace with new ones, ensure that grit trolley seals seat tightly onto grit trolley. Check flap operation.
- (iv) Prepare and repaint grit collector casing and supports.

(b) Ash conveying equipment

If ash conveying equipment are installed these equipment shall be inspected, serviced, tested, repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the ash conveying equipment shall include at least the following:

- (i) Test all equipment for correct functioning.
- (ii) For submerged belt ash conveyors drain sump, clean out, inspect belt, roller bearings, frame, etc, any defects and/or damages, repair and/or replace components where necessary.
- (iii) For screw ash elevators inspect bushes, screw, casing, etc, for any defects and/or damages, repair and/or replace components where necessary.
- (iv) Inspect, service, lubricate and where necessary repair gear boxes and drives.
- (v) Test ash conveying equipment motor windings for balance phases, insulation test and check wiring. Where necessary motors shall be reconditioned.
- (vi) Inspect, test, service, adjust and where necessary repair and/or replace control equipment.
- (vii) Inspect, test, service and repair ash conveying electrical control panel ensuring that all controls function properly in accordance with the design.

(c) Ash and grit trolleys

All ash and grit trolleys are to be inspected, serviced and repaired where necessary.

FA 15.03.06 Electrical installation, wiring and control panels

(a) Instrumentation and controls

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the instrumentation and control equipment shall include at least the following:

- (i) Test all equipment for correct operation.
- (ii) Inspect, test, service, adjust setting and if necessary repair and/or replace steam detector.
- (iii) Inspect, recalibrate and if beyond repair replace steam pressure gauge.

(b) General electrical power and lighting installation

The Contractor shall be responsible for the repair and maintenance work of the general power and lighting installation inside the boiler house. All repair work to this installation shall be done in accordance with the Standard Specification for Electrical Installations and Equipment pertaining to Mechanical Services of the Department of Public Works. This work shall include all repair work to the existing power sockets, cabling, wiring, lighting, and distribution boards.

(c) Electrical control panels

All electrical control panels shall be inspected, tested, and repaired, including all equipment inside the control panel. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the electrical control panels shall at least include the following:

- (i) Test all control equipment for correct operation.
- (ii) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points; where equipment is found to be faulty these shall be replaced with new approved equipment.
- (iii) Check all wiring and connections for proper conducting and replace where hot connections are found.
- (iv) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

FA 15.03.07 Water treatment equipment

(a) Water softener

The water softener shall be inspected, tested, repaired, adjusted and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the water softener shall at least include the following:

- (i) Test all equipment for correct operation.
- (ii) Sample of feed-water shall be taken and analyzed to ensure that water softener is adjusted to the correct percentage. The hardness of the water shall be within the boiler manufacturer's specification.
- (iii) Check control and mixing equipment and salt container.

(b) Chemical dosing equipment

The chemical dosing units and containers shall be inspected, tested, repaired, adjusted and where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the chemical dosing units and containers shall include at least the following:

- (i) Test all equipment for correct operation.
- (ii) Sample of feed-water shall be taken and analysed to ensure that the chemical dosing rate and chemicals conform to the requirements of the boiler manufacturer.
- (iii) Check, inspect, service and repair control and dosing pump equipment.
- (iv) The above work shall be done in collaboration with the water treatment supplier company.

FA 15.03.08 Boiler house ancillary equipment

(a) Blow-down sump

The blow-down sump shall be emptied, cleaned out, inspected and any repair work to the structure, manhole covers and frames, vent pipes, sparge pipes, etc, to be carried out.

(b) Ladders and galleries

The ladders and galleries inside the plant room shall be inspected and any defects and/or damages repaired. Ladders and galleries shall be prepared and repainted. All mountings and fixing points shall be inspected and repaired if necessary.

(c) Painting of equipment, plant and building

The Contractor shall on completion of the repair work clean and repaint the complete plant room and equipment as specified in accordance with the Department's Specification.

FA 16 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FA 16.01 GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

- (a) Routine preventative maintenance;
- (b) Corrective maintenance, and
- (c) Breakdown maintenance,

as defined in General Maintenance, for the specified installations described under FA 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFA and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorised for each maintenance activity under the following headings:

- (a) Coal-fired boiler
- (b) Combustion equipment
- (c) Coal handling equipment
- (d) Ash handling equipment
- (e) Grit collection and draught equipment
- (f) Water treatment and feed-water tanks
- (g) Steam and condensate installation
- (h) Electrical installation and controls.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

FA 16.02 ROUTINE PREVENTATIVE MAINTENANCE

This routine maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance and the Particular Specification related to this work.

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed in tables FA 16.02/1, FA 16.02/2, FA 16.02/3, FA 16.02/4, FA 16.02/5 and FA 16.02/6 below under the respective headings.

These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FA 16.02/1: DAILY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	Measure CO2 content of exhaust with CO2 analyser.	Boiler house supervisor	Check/Record
2	Blow-down gauge glasses.	Boiler house supervisor	Check/Record
3	Test level controls for correct functioning.	Boiler house supervisor	Check/Record
4	Inspect boiler valves for leakages.	Boiler house supervisor	Check/Record
5	Inspect boiler feed-water pumps for leakages, correct functioning and bearing noises.	Boiler house supervisor	Check/Record
6	Clean exterior of boiler and keep boiler plant room clean.	Boiler house supervisor	Check/Record
	Check stoker grate tension and report to Contractor if need to be adjusted. to adjust tension in accordance with manufacturer's specification, if reported.	Boiler house supervisor and Contractor	Check/Record
8	Check stoker grate links and rods for any damages. All damages to be reported to Contractor who shall replace any damaged links or/and rods.	Boiler house supervisor and Contractor	Check/Record
9	Complete log book actions as specified in FA 06, FA 12, FA 13, FA 14 and FA 15. Boiler house supervisor	Boiler house supervisor	Check/Record

TABLE FA 16.02/2: WEEKLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
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1	All as listed under table FA 16.02/1	Boiler house supervisor and Contractor	Check/Record/Adjust/Repair
2	Test safety valves as described by the boiler manufacturer.	Contractor	Test/Record
3	Check the furnace draught gauge for correct operation in accordance with the manufacturer's specification.	Contractor	Check/Record
4	Inspect stoker brickwork and refractories and if found to be damaged it must be repaired.	Contractor	Check/Record
5	Lubricate all required lubrication points, including sootblowers, stoker drive shaft bearings, guillotine door and check stoker drive oil level.	Boiler house supervisor and Contractor	Check/Service/Record
6	Visual inspection of all boiler house equipment and installations for any pending defects, faults, etc.	Boiler house supervisor and Contractor	Check/Record
7	Inspect and test all control functions and readjust if necessary.	Contractor	Test/Record/Adjust

TABLE FA 16.02/3: MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FA 16.02/1 and FA 16.02/2	Boiler house supervisor and Contractor	Check/Record Adjust/Repair
2	Clean out all strainers.	Contractor	Check/Service/Record
3	Inspect and test sootblowers for correct operation.	Contractor	Check/Record
4	Inspect all V-Belts and replace if necessary.	Contractor	Check/Record/Replace
5	Inspect all brickwork and refractories and repair and/or replace where necessary.	Contractor	Check/Record Repair
6	Inspect all seals and joints for leakages and replace if necessary.	Contractor	Check/Record Replace
7	All grease nipples to be greased with specified grease in accordance with equipment manufacturer's specification.	Contractor	Check/Service/Record
8	Test and analyse water quality, adjust and repair water treatment equipment if necessary and where specified, supply and deliver chemicals and salts.	Contractor and chemical supplier	Test/Record Adjust/Repair
9	Sample and analyse coal quality.	Boiler house supervisor, coal supplier and Contractor	Check/Record/Test
10	Check ash removal implementation and report.	Boiler house supervisor, ash removal company and Contractor	Check/Record
11	Test and record boiler efficiency.	Boiler house supervisor and Contractor	Test/Record
12	Check coal conveying equipment for correct functioning and check for any visual faults or defects and repair if necessary.	Contractor Contractor	Check/Record/Repair Check/Record
13	Inspect, service, repair and replace where required all electrical equipment and installations.	Contractor	Test/Record Adjust/Repair
14	Inspect, service all steam and condensate piping and equipment.	Contractor	Test/Record Adjust/Repair

TABLE FA 16.02/4: THREE-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1.0	All as listed under tables FA 16.02/1, FA 16.02/2 and FA 16.02/3	Boiler house supervisor and Contractor	Check/Record/Adjust/Repair
2.00	Lubricate ID and FD damper control units.	Contractor	Check/ Record Service
3.00	Replace ID and FD fan bearing grease.	Contractor	Check/ Record Service
4.00	Brush and clean fire tubes and clean flue, back plate, combustion chamber and remove all grit and soot deposits. Inspect and repair where necessary.	Contractor	Check/Record/Service/Repair
5.00	Check boiler water side for scale deposits and	Contractor	Check/Record/Service/Repair

	clean and de-scale.		
6.00	Replace stoker gear box and drive oils.	Contractor	Check/Record Service/Repair
7.00	Check, inspect, service all coal conveying equipment and repair where necessary.	Contractor	Check/Record Service/Repair
8.00	Check, inspect, service and repair if necessary grit collectors and chimney stacks.	Contractor	Check/Record Service/Repair
9.00	Inspect, repair and replace where necessary all lagging and cladding.	Contractor	Check/Record Service/Repair

TABLE FA 16.02/5: SIX-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FA 16.02/1, FA 16.02/2 and FA 16.02/3	Boiler house supervisor and Contractor	Check/Record/Adjust/Repair
2	Inspect stoker chassis, repair and replace as required.	Contractor	Check/Record/Service/Repair
3	Fully test, inspect, service, adjust, repair and replace as required ID and FD dampers.	Contractor	Check/Record/Service/Repair
4	Inspect, descale, clean out, repair and replace as required feed-water tanks.	Contractor	Check/Record/Service/Repair

TABLE FA 16.02/6: ANNUAL ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FA 16.02/1, FA 16.02/2, FA 16.02/3 and FA 16.02/4	Boiler house supervisor and Contractor	Check/Record/Adjust/Repair
2	Annual survey by Occupational, Health and Safety Inspector.	Contractor, Department and Inspector	Inspect/Test/Service/Repair
3	Inspect and repaint all equipment and building elements where required.	Contractor	Inspect/Test/Service/Repair
4	Inspect, clean, repair blow-down sump.	Contractor	Inspect/Test/Service/Repair
5	Remove, strip, service, repair, adjust and repair level controls, alarms and safety equipment.	Contractor	Inspect/Test/Service/Repair

FA 16.03 CORRECTIVE MAINTENANCE

This corrective maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such shortfall.

FA 16.04 BREAKDOWN MAINTENANCE

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance specifications.

All breakdown maintenance shall be done in accordance with the relevant specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

TECHNICAL SPECIFICATION FB - STEAM DISTRIBUTION INSTALLATIONS

CONTENTS

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FB 01 SCOPE

This specification covers the general repair and maintenance of steam distribution installations, which include the following:

- (a) Steam distribution piping, insulation and associated equipment
- (b) Condensate return piping, fittings, insulation and associated equipment
- (c) Condensate pumping systems
- (d) Steam control equipment
- (e) Steam trapping systems.

This specification also addresses the training of User Client and associates, and maintenance staff.

This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

The Contractor shall at all times adhere to this specification, unless otherwise specified in the Particular Specification.

FB 02 STANDARD SPECIFICATIONS

FB 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof:

FB 02.01.01 SANS and other specifications and codes

- SANS 0400 - The applications of the building regulations
- SANS 0142 - Code of practice for the wiring of premises
- SANS 0140 - Identification colour marking
- SANS 044 - Parts I to IV: Welding
- SANS 460 - Copper tubes for domestic plumbing
- SANS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications

SANS Specifications listed on page 3 of the DPW Specification OWG 371

Atmospheric Pollution Prevention Act, No 45 of 1965

BS 2790
BS 1740
BS 21
BS 1640

FB 02.01.02 Department of Public Works Specifications

- OWG 371 - Specification of materials and methods to be used
- STD.PWD.VII - Standard specification for steam boiler installations (Issue VII 1997)
- Standard Specification for electrical installations and equipment pertaining to mechanical installations (Issue IX December 1998)

FB 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FB 02.01.04 Manufacturers' specifications, codes of and practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' specifications, instructions and codes of practice.

FB 02.01.05 Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

FB 03 **VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS**

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

FB 03.01 General repair and installations requirements

All materials and equipment supplied and installed shall be of new high quality, design and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

All work shall be executed in a first-class workman-like manner by qualified tradesmen.

All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SANS specifications and codes, except where otherwise specified or approved by the Engineer/Departmental Representative in writing.

All materials and workmanship which, in the opinion of the Engineer/Departmental Representative, is inferior to that specified for the work, will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer/Departmental Representative,

The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer/Departmental Representative for approval before placing orders or commencing installation.

All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.

Repair work shall be programmed in accordance with General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

FB 04 **OPERATING AND MAINTENANCE MANUALS**

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Operating and Maintenance Manuals.

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

- (a) System description
 Complete system description and the working of the plant.
- (b) Commissioning data
 Complete commissioning, test and inspection data of systems and equipment.
- (c) Operating data
 - (i) Systems and equipment running check list and frequency of servicing required;
 - (ii) Safety precautions to be implemented;
 - (iii) Operator's duties (logging requirements);
 - (iv) Lubricating oils and service instructions.
- (d) Mechanical equipment
 - (i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;
 - (ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
 - (iii) Manufacturer's brochures and pamphlets;

- (iv) Schedule of spares with part numbers recommended to be held as stock.

- (e) Maintenance instructions
 - (i) Schedule of maintenance particulars, frequency of services and replacements;
 - (ii) Trouble-shooting guide;
 - (iii) Part numbers of all replacement items and spares;
 - (iv) Capacity curves of condensate pumps;
 - (v) Serial numbers of all items of equipment.

- (f) Electrical equipment
 - (i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (ii) Maintenance instructions;
 - (iii) Manufacturer's brochures and pamphlets;
 - (iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

- (g) Instrumentation and control
 - (i) Description of each control system;
 - (ii) Schedule of control equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (iii) Maintenance instructions;
 - (iv) Manufacturer's brochures and pamphlets.

- (h) Drawings
 - (i) Paper prints of all as-built mechanical and electrical drawings;
 - (ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

FB 05 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in General Maintenance. This shall consist of a log and record book, which shall be utilized to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, etc.

The logbook shall be kept in a safe place as agreed with the User Client and the Engineer/Departmental Representative and shall only be utilized by the maintenance personnel, the Contractor and the Engineer/Departmental Representative. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Engineer/Departmental Representative.

The logbook shall be structured to include at least the following:

- (a) Daily inspection and maintenance actions;
- (b) Monthly inspection and maintenance actions;
- (c) Three-monthly inspection and maintenance actions;
- (d) Six-monthly inspection and maintenance actions;
- (e) Annual inspection and maintenance actions;
- (f) Breakdown reports;
- (g) Daily system and equipment operating conditions, observations, recordings and measurements;
- (h) Inspection and test comments and reports.

The Contractor shall also institute an attendance register, which shall be kept in a safe place as agreed with the User Client and the Engineer/Departmental Representative. This register shall be completed by all

persons visiting the installation, including:

- (a) Maintenance personnel
- (b) Contractor
- (c) Inspectors
- (d) Department personnel
- (e) Engineer/Departmental Representative.

The register shall state the date, time-in, time-out, name, company and reason for visit.

A copy of the register shall be submitted by the Contractor together with his monthly report.

FB 06 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours written notice to the Engineer/Departmental Representative before commencing the test.

In the event of the plant or installation not passing the test, the Employer shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer/Departmental Representative attending the repeated test.

Whenever any installation or equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer/Departmental Representative.

The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.

The Contractor shall allow for all required inspections, tests and certification by an approved inspection authority on repair work where required by the Occupational Health and Safety Act.

FB 07 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Employer and/or the Engineer/Departmental Representative for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer/Departmental Representative at regular intervals as required.

FB 08 COMMISSIONING AND RE-COMMISSIONING OF PLANT AND INSTALLATION

FB 08.01 GENERAL

On completion of the repair work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer/Departmental Representative. Where new plant is installed, the Contractor shall run and operate the system for a period of time as specified by the Engineer/Departmental Representative and train the User Client's representatives to operate and maintain the system.

The work shall be done in accordance with General Decommissioning, Testing and Commissioning Procedures.

Logging of the operation of the installations shall commence immediately upon start-up.
The Contractor shall submit a full commissioning report.

FB 08.02 RE-COMMISSIONING OF STEAM DISTRIBUTION INSTALLATION AND ANCILLARY EQUIPMENT

On completion of any repairs the Contractor shall re-commission the systems, installation and/or equipment influenced by such repairs.

This operation shall be done strictly in accordance with the manufacturer's specification and applicable standards, norms and specifications of the relevant body, authority and/or department. The operation shall include but not be limited to the following:

- (a) All required pre-commissioning mechanical checks
- (b) Check all steam, water and drain connections.
- (c) Check all moving parts.
- (d) Check seals, gaskets and joints.
- (e) Reinstall all plugs and covers and check that they are properly secured.
- (f) Check and record that all lubrication to equipment and components has been done in accordance with manufacturer's specification.
- (g) Check and ensure that all valves and safety valves are correctly installed and in the correct operating position. Safety valves are to be set in accordance with the required blow-off pressure for the installation.
- (h) Check and ensure that all control equipment such as pressure-reducing valves, heat control equipment, etc, are set and adjusted to the correct controlling value in accordance with the system parameters and manufacturer's specification.
- (i) Check and clean out condensate tanks and storage facilities.
- (j) Check, test and inspect the correct installation and operation of all condensate trapping arrangements.
- (k) Check, test and inspect the correct installation and operation of all condensate pumping installations.
- (l) Check that all the required pressure testing to the repaired installations and/or new equipment has been done, witnessed and recorded in accordance with the relevant specifications.
- (m) Check, test and inspect all bracketing and supports for the relevant installations and equipment to ensure that they are properly secured and installed in accordance with the manufacturer's specifications and installation specification of the relevant controlling authority.
- (n) Check, inspect and ensure that all logging and cladding are installed and repaired in accordance with the applicable specifications of the relevant controlling authority.
- (o) Check, inspect and ensure that no leaks to equipment, systems and installations occur.

All required pre-commissioning electrical checks

- (a) Check all wiring connections for tightness and repair any hot connections.
- (b) Check that all electrical equipment has been properly reconnected in accordance with the manufacturer's specification.
- (c) Perform and record all required electrical insulation tests on equipment.
- (d) Check and test all controls without livening up electrical equipment.
- (e) Check all motor-driven equipment for correct rotational directions.
- (f) Check and test the operation of all indication and warning lights.
- (g) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specifications.
- (h) Run all motor-driven equipment for a period to ensure free movement and correct operation, feed pumps only to be operated for a short interval to check rotation.

Commissioning of equipment

On completion of the pre-commissioning checks the Contractor shall proceed with the commissioning of the equipment. This shall be done strictly in accordance with the manufacturer's specification and system parameters and shall include but not be limited to the following:

- (a) During the commissioning process all level and warning system checks are to be performed on the water-level control system where applicable.
- (b) During load conditions the equipment shall be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation where applicable.
- (c) Check steam pressure valves and readjust them where necessary to the correct set point under load conditions.
- (d) Check the operation of all steam trap arrangements.
- (e) Check the correct operation of all condensate pumping systems. Readjust level controls and/or other control equipment where applicable.
- (f) Test and check for any leaks to the system, equipment and installation.
- (g) Check for any unnecessary strain to system, equipment and installation due to expansion and contraction.

The Contractor shall visit, inspect, test and readjust the systems, equipment and installation during the week following the re-commissioning to ensure the correct functioning of the equipment and its associated components.

FB 09 GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair contract, complies with the required performance and will function as part of the complete system.

All new equipment, including the complete new installations and the systems as a whole, shall be guaranteed for a period of 12 (twelve) months commencing on the day of issue of a certificate of completion for the repair work of the installation.

FB 10 MAINTENANCE TOOLS AND SPARES

Each installation shall be equipped with the necessary maintenance tools and spares required by the specific type of equipment and installation for the daily operation and maintenance of the system. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the maintenance supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the maintenance supervisor and Contractor and record and report to the Engineer/Departmental Representative. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

- (a) Tools
 - (i) Grease and oil lubrication equipment;
 - (ii) Equipment operating keys and tools.
- (b) Spares
 - (i) Spare sight glasses for sight glass indicators, glass seals and gaskets;
 - (ii) Spare seats, gaskets and gland packing for valves, etc;
 - (iii) Spare steam traps, at least one of each type present on the installation;

- (iv) Spare pressure gauges, at least one of each range and type.

FB 11 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FB 11.01 GENERAL

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in the Particular Specification and Schedule of Quantities with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate of completion for the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the steam generating installations are categorised under the following headings:

- (a) General requirements for steam and condensate installations
- (b) Steam and condensate pipework
 - (i) Steam and condensate piping and fittings
 - (ii) Jointing methods and specification
 - (iii) Bracketing and support work
- (c) Lagging and cladding
 - (i) Lagging and cladding materials and installation requirements
- (d) Pressure testing
- (e) Steam trap arrangements
 - (i) Steam trap equipment
 - (ii) Steam trap installation requirements
- (f) Pressure-reducing equipment and requirements
 - (i) Pressure-reducing equipment
 - (ii) Pressure-reducing requirements
- (g) Heating control equipment
 - (i) Steam heating equipment
 - (ii) Steam heating requirements
- (h) Condensate pumping installations
 - (i) Steam operated condensate pumping installations
 - (ii) Electrically operated, steam operated installations

- (i) Steam and condensate piping ancillary equipment
 - (i) Strainers
 - (ii) Valves
 - (iii) Air vents
 - (iv) Separators
 - (v) Expansion equipment
 - (vi) Flow meters
 - (vii) Check valves
 - (viii) Vacuum breakers
 - (ix) Sight glasses
 - (x) Safety valves
 - (xi) Pressure gauges
 - (xii) Electrical installation, wiring and control panels

- (j) Electrical installation, wiring and control panels
 - (i) Electrical control panels
 - (ii) Wiring and cabling
 - (iii) Instrumentation and controls.

Any repair work, which may be required on the systems, equipment and installations, shall be executed using approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturer's specifications and codes of practice and as specified in all additional and particular specifications included in this document.

During the repair and maintenance contract, the specified repair work in the Particular Specification shall be done in accordance with the items listed below. Any repair work during the maintenance period shall also adhere to this specification.

FB 11.02 GENERAL REQUIREMENTS FOR STEAM AND CONDENSATE INSTALLATIONS

All repair work and new installation of steam and condensate installations shall adhere to the standard specifications of the Department of Public Works and the following general requirements:

All steam pipes shall be installed with a fall towards the steam traps of not less than 1:250. Pipes shall be so arranged that the piping can drain completely and no pockets of condensate shall be formed at points other than the trap points.

A sufficient amount of expansion loops and/or bellows are to be installed on all pipe runs to ensure the containment of expansion and contraction on the system thus ensuring that no unnecessary strain is enforced on the brackets, supports, pipe system and any structural element. These offsets or expansion bellows shall be installed with sufficient cold draw to allow pipes to return to normal when hot. All bellows expansion joints shall be capable of withstanding without damage, expansion movement of not less than 150 % of the predicted maximum in the location for which they are intended. Bellows expansion joints which are strained during tests due to being wrongly located, etc, shall at the Engineer/Departmental Representative's discretion be replaced by the Contractor at no extra cost to the Department.

Each bellow expansion joint shall be fitted with a clearly inscribed plate showing maximum working pressure, maximum and minimum operating lengths and direction of steam flow. They shall be installed strictly in accordance with the manufacturer's recommendations.

All branch pipes shall be taken off from the top of the steam mains.

Where it is necessary to reduce pipes in size on horizontal runs only eccentric reducing fittings shall be used. On vertical runs, only reducing sockets shall be used. Reducing bushes will not be allowed on any steam reticulation system.

All steam piping above 50 mm diameter shall be jointed to fittings by means of welding and to weld on flanges shall be used. Screwed and socketed joints shall only be permitted on piping smaller than and equal to 50 mm diameter. Sufficient flanged joints on pipes larger than 50 mm diameter and unions on pipes smaller than and equal to 50 mm diameter shall provide sufficient flexibility to the system for maintenance purposes.

Only full reduced levels are to be utilized on steam distribution networks. Elbows shall only be used with prior approval by the Engineer/Departmental Representative and/or if otherwise specified in the Particular Specification.

Pipes shall be neatly and properly supported. Where beams, stanchions, etc, interfere with the straight running of pipes, suitable offsets shall be provided so that pipes may follow the line of the walls both vertically and horizontally.

Where pipes pass through structures, walls and partitions, the pipe shall be sleeved with medium class black steel pipes, large enough to leave a clearance of at least 10 mm around the pipe, including lagging and cladding. Exposed pipes passing through floors or walls shall be provided with floor, ceiling and wall finishing plates. Plates shall allow for expansion and contraction and shall be securely fixed to the sleeves.

Dirt pockets shall be installed at all low points and before the trap take-off. These pockets shall extend at least 700 mm below the line trap take-off and shall be the same pipe size as the main steam line and equipped with a plugged 15 mm diameter globe valve for blow-down purposes.

Piping shall be so arranged that it will not obstruct other equipment.

Piping shall be connected to equipment in such a way as to permit the easy removal of the equipment with the minimum of dismantling of pipework.

Gravity condensate lines shall be laid to a fall of a minimum of 1:200 towards the discharge end. Pumped condensate lines shall have a minimum fall of 1:400 towards drain points.

Automatic air vents shall be installed at high points of the pipework as required or as indicated on the drawings.

Condensate lines supported off steam mains shall be installed with due regard to cold draw requirements for steam lines and relative expansion/construction that will occur between two lines. Condensate branch lines shall connect into the top of condensate mains.

FB 11.03 STEAM AND CONDENSATE PIPEWORK

FB 11.03.01 Steam and condensate piping and fittings

During the repair and maintenance contract all the steam lines shall be inspected for any defects and/or damages. This system shall also be pressure tested to the required system test pressure to inspect it for any possible leaks. All dirt pockets shall be blown clear. Any repair and/or new piped installations shall be done to suit the existing installations with the appropriate materials and methods. The following materials shall be used:

(a) Steam piping

All steam pipes shall be uncoated seamless steam class schedule 40 pipe in accordance with SANS 62 or BS 1387, and shall be suitable for an operating pressure of at least 1000 kPa. All piping above 50 mm diameter must be welded and flanged. Piping smaller and equal to 50 mm diameter may be screwed and socketed.

All screwed and socketed fittings shall be heavy steam quality wrought steel fittings in accordance with BS 1740 with threads complying with ISO-R7.

All welded fittings shall be seamless carbon steel butt welded fittings complying with BS 1640 schedule 40.

(b) Condensate piping

All condensate pipes shall be copper tubing class 2 in accordance with SANS 460 with capillary soldered copper fittings conforming to BS 864, ISO 2016 or DIN 2856.

(c) Jointing methods

All pipe joints shall be prepared and executed in accordance with the accepted norms and standards applicable.

(i) Welded joints

All steel welded joints shall be performed by a qualified coded welder. All welding shall fully comply with SANS 044.

The Department reserves the right to randomly select one out of ten pipe welds to be cut out of the system for examination purposes. These pipe welds shall then be tested in accordance with SANS 044.

After removal of the joints, the Contractor shall make the piping good. Should any of the welds prove unsatisfactory, the Contractor will be called upon at his own cost to have all welds examined by X-ray and to have X-ray plates examined by the SANS or other approved authority. All welding proven unacceptable shall be put right at the Contractor's cost.

All flanges shall be welded both internally and externally.

Where in the opinion of the Engineer/Departmental Representative a welder is not competent, the Engineer/Departmental Representative shall request the authority to ask that such welder be replaced with a competent welder.

(ii) Threaded joints

All pipe threads shall be right-handed Whitworth standard taper pipe threads and shall comply with BS 21 or IS-R7. Threaded pipe joints shall be made with either an approved steam pipe jointing compound or PTFE tape.

All surplus compound or tape shall be cleaned off the joints before painting or finishing-off.

(iii) Copper soldered joints

All class 2 copper tubing shall be jointed to capillary soldered fittings by utilizing self-fluxing copper/phosphorus/7 % mm silver or eutectic 1504 solder rods jointed by means of an oxygen acetylene flame to the correct soldering temperature. Care must be taken not to overheat fittings and tubing.

(d) Bracketing and support work

The Contractor shall at the start of the repair and maintenance contract inspect and examine all steam and condensate pipe supports, brackets and hangers for compliance to the pipe loads and stresses exerted onto them, taking into account the expansion and contraction of the pipe system. Where any defects, damages and/or a shortfall of supports and bracketing exist, the Contractor shall rectify, remedy or upgrade the support and bracketing system to the acceptable norms and

standards. All supports, brackets and hangers shall be in accordance with the Department's specification and approved by the Engineer/Departmental Representative before installation.

Distances between pipe supports and horizontal pipe runs unless otherwise specified or indicated, shall be not more than those shown below:

STEEL PIPING

Pipe size	Maximum span
15 - 20 mm	2,5 m
25 - 40 mm	3,0 m
40 - 50 mm	3,5 m
65 - 80 mm	4,5 m
100 - 150 mm	6,0 m

COPPER PIPING

Pipe size	Maximum span
15 - 20 mm	1,5 m
25 - 32 mm	2,0 m
40 - 50 mm	2,5 m
65 - 80 mm	3,5 m

All vertical steam pipes and condensate pipes shall be supported at intervals not larger than 2 m. Where horizontal steam pipe support distances are larger than the condensate support distances, condensate pipes shall be supported from the steam pipe by means of two brackets lined by a chain.

Clearance heights at road crossings shall be in accordance with the road ordinance for the applicable road and shall be approved in writing by the relevant parties before installation.

FB 11.04 LAGGING AND CLADDING

The Contractor shall at the start of the repair and maintenance contract inspect all lagging and cladding of the steam and condensate pipe installations for any defects, damages, missing sections and/or shortfall of lagging and cladding. All defects, damages, repairs, replacement and/or new sections of lagging and cladding work shall be attended to in accordance with the relevant specifications and accepted norms and standards.

(a) Lagging and cladding materials and installation requirements

All steam and condensate piping shall be insulated with preformed canvas covered fibreglass or mineral wool sections. All bends, tees, etc, shall be insulated with preformed insulation. All thermal insulation shall be applied and installed by a recognised specialist firm.

Where preformed bends and tees are not available loose lagging material such as asbestos-free composition may be used and bound with wire netting, then plastered to a smooth finish to the same size as the basic insulation.

All exposed piping insulation shall be insulated using valve boxes. Spindles, hand wheels and reducing valves to be left exposed. All exposed insulation ends to be weatherproofed.

All exposed piping insulation shall be provided with a covering of 0,6 mm thick galvanised pre-rolled cladding. The cladding sections shall be secured by 10 mm wide galvanised sheet metal strips spaced at not more than 500 mm centres. All items requiring routine inspection/maintenance shall be fitted with removable cladding secured with stainless steel self-tapping screws. The overlap of the cladding shall be not less than 40 mm and shall be arranged to be water shedding. All longitudinal joints, where possible, shall be made where they are least noticeable.

Sheet-metal cladding inside buildings shall be painted with a suitable primer, then painted the same colour as the walls with two coats of good quality paint.

The Tenderer shall state recommended thickness based on the table below. The Tenderer shall give heat losses and thermal conductivity of the proposed material so that the merits of insulating material can be assessed. Surface temperatures of insulation shall not exceed 40°C.

INSULATION THICKNESS GUIDE

STEAM PIPING

Pipe size	Preformed section thickness
15 - 25 mm dia	40 mm
32 - 50 mm dia	50 mm
65 - 150 mm dia	60 mm

CONDENSATE PIPING

Pipe size	Preformed section thickness
15 - 54 mm dia	30 mm
65 - 100 mm dia	40 mm

Fibreglass must be of 88 to 96 kg/m³ density. Mineral wool must have a density in the range 160 - 185 kg/m³.

FB 11.05 PRESSURE TESTING

The Contractor shall at completion of the repair work arrange for a complete pressure test to be executed on the steam and condensate installation. This shall be done in collaboration with the User Client and/or Department to ensure the minimum down-time of the installation, as well as to establish a suitable period for this pressure test. All leaks shall be repaired and the system shall be tested at the cost of the Contractor. This test shall be witnessed by the Engineer/Departmental Representative.

The system shall be tested to a pressure of 1,5 times the operating pressure.

On completion the total system shall be flushed out to ensure it is left without welding slug, dust, etc.

FB 11.06 STEAM TRAP ARRANGEMENTS

The Contractor shall at the start of the repair and maintenance contract inspect, service, repair and if rendered irreparable replace all steam trap arrangements. All defects, damages, leaks, etc, shall be repaired in accordance with the manufacturer's specification.

Servicing and repair of steam traps shall be done strictly in accordance with the manufacturer's specification.

The Contractor shall also table all steam traps with their relevant details. The Contractor shall at the same time investigate and report on the suitability of the existing steam traps in the installation according to the condensate load and application, taking cold start-up into account.

The following table provides a guideline for the type of trap and the safety factor selection for various applications:

Application	Preferred trap type	Safety factor
Boiler header	IBLV and F&T	1.5:1
Steam mains and branch lines	IB or F&T	2:1 for along line and 3:1 if @ end of mains or before valve on branch
Steam separator	IBLV or F&T	3:1
Steam quality 90 % or less	F&T	3:1
Tracer lines	IB	2:1

Unit heaters and air handlers (Variable pressure)	IBLV or F&T F & T or IBLV	3:1 2:1 @ « psi differential
Finned radiation and pipe coils (Constant pressure)	IB	3:1 for quick heating 2:1 normally
(Variable pressure)	F & T or IB	3:1 for quick heating 2:1 normally
Process air heaters (Constant pressure)	IB or F & T	2:1
(Variable pressure)	F & T or IBLV	3:1 @ « max. pressure differential
Steam absorption machine (Chiller)	F & T	2:1
Shell and tube heat exchangers, pipe and embossed coils (Constant pressure)	IB or F & T	2:1
(Variable pressure)	F & T	2:1
Evaporator single effect and multiple effect	F&T	2:1
Jacketed kettles (Gravity drain)	IBLV or thermostatic	3:1
(Syphon drain)	IBLV	3:1
Rotating dryers	DC or IBLV	3:1 for DC. 8:1 for IB constant pressure. 10:1 for IB variable pressure
Flash tanks	IBLV	3:1
IBLV =	Inverted bucket with large vent	
IBCV =	Inverted bucket with internal check valve	
IBT =	Inverted bucket with thermal vent	
F&T =	Float and thermostatic	
DC =	Differential condensate controller	
Thermo.=	Thermostatic	

FB 11.06.01 Steam trap equipment

The following repairs and servicing shall be performed on the various types of steam traps:

- (1) Inverted bucket steam trap
 - (a) Dismantle and strip down trap assembly.
 - (b) Clean out strainers and trap.
 - (c) Replace the following:
 - (i) Valve and seat assembly
 - (ii) All gaskets
 - (iii) Bucket
 - (iv) Bolts and nuts if necessary
 - (v) Strainer elements.
 - (d) Reassemble and put back into operation.
- (2) Float and thermostatic steam traps
 - (a) Dismantle and strip down trap assembly.
 - (b) Clean out all parts.
 - (c) Replace the following:
 - (i) Valve and seat assembly including ball float
 - (ii) Air vent assembly
 - (iii) Steam lock releases if installed
 - (iv) All gaskets.
 - (d) Reassemble and put back into operation.

- (3) Thermodynamic steam traps
- (a) Dismantle and strip down trap assembly.
 - (b) Clean out strainer trap body.
 - (c) Replace the following:
 - (i) Replace disc and reseal body face
 - (ii) Strainer
 - (iii) All gaskets
 - (iv) Cap and strainer caps only if necessary.
 - (d) Reassemble steam trap and put back into operation.
- (4) Balanced pressure thermostatic steam trap
- (a) Dismantle and strip down trap assembly.
 - (b) Clean out all parts.
 - (c) Replace the following components:
 - (i) Element or capsule and seat assembly where applicable.
 - (ii) All gaskets and O-rings.
 - (iii) Strainer screen if installed.
 - (iv) Cover bolts if applicable.
 - (d) Reassemble and put back into operation.
- (5) Bimetallic thermostatic steam trap
- (a) Dismantle and strip down trap assembly.
 - (b) Clean out all parts.
 - (c) Replace the following components:
 - (i) Element set, and ensure that the joint faces are clean
 - (ii) Strainer screen
 - (iii) All gaskets
 - (iv) Cover bolts if necessary and where applicable.
 - (d) Reassemble and put back into operation.

All the above steam traps and those not mentioned in this specification shall be repaired and serviced in accordance with manufacturer's specification. The steam traps described above shall be regarded as a guideline to the required repairs and servicing.

FB 11.06.02 Steam trap installation requirements

The Contractor shall ensure that all steam traps are installed in accordance with the required installation norms and the manufacturer's specification.

This shall include the incorporation of strainers where necessary, sight glasses, shut-off valves on both sides, check valves where necessary, unions for maintainability, test valves, dirt pockets and ensuring that pipe sloping and connections are in accordance with specifications.

FB 11.07 **PRESSURE-REDUCING VALVE INSTALLATIONS**

The Contractor shall at the start of the maintenance and repair contract inspect, service, repair, readjust and overhaul, if required, all pressure-reducing valves. Servicing, repairs and overhauling shall be done strictly in accordance with the manufacturer's specification.

The pressure-reducing valves shall be tested under load and under no load to ensure that no creepage takes place, as well as that downstream pressure is maintained within the operating parameters.

The overhauling of the pressure-reducing valves shall preferably be performed by an Engineering works firm or manufacturer qualified to do so.

Where no duplicate pressure-reducing valve is installed at a control point, the Contractor shall collaborate with the User Client and the Engineer/Departmental Representative to service and repair the valve at a pre-arranged suitable time and to minimize the down-time of the steam supply to the system.

All pressure-reducing valve pressure set points, details and positions shall be logged by the Contractor.

The Contractor shall also report on the suitability of each pressure-reducing valve to serve the particular system.

The following service, repair and overhaul work shall be regarded as a guideline for the following types of pressure-reducing valves:

- (a) Direct acting pressure-reducing valve
 - (i) Dismantle and strip down pressure-reducing valve.
 - (ii) Clean out all parts, body, etc, and inspect.
 - (iii) Replace the pressure adjustment spring assembly.
 - (iv) Replace bellows assembly if necessary.
 - (v) Replace valve and seat assembly and ensure that seat faces are clean and resealed.
 - (vi) Replace strainer element.
 - (vii) Replace all gasket sets.
 - (viii) Reassemble, set, test and adjust to the correct downstream pressure.

- (b) Pilot operated pressure-reducing valve
 - (i) Dismantle and strip down pressure-reducing valve.
 - (ii) Clean out all parts, body, etc, and inspect.
 - (iii) Replace the pressure adjustment spring assembly.
 - (iv) Inspect balance and control pipe assemblies and if leaks exist and screw parts are worn, replace with new.
 - (v) Replace main valve assembly, spring and strainer.
 - (vi) Inspect main and pilot diaphragms and if required, replace with new.
 - (vii) Replace all gaskets and seals.
 - (viii) Inspect, clean and reseal valve seats.
 - (ix) Reassemble, set, test and adjust pressure-reducing valve to the correct downstream pressure.

- (c) Pressure reducing valve installation requirements

The Contractor shall ensure that all pressure-reducing valves are installed in accordance with the manufacturer's requirements. This shall also include the incorporation of strainers, non-return valves, pressure gauges, correctly sized safety valves, shut-off valves for maintenance purposes; steam trap take-offs before pressure-reducing valve, etc.

FB 11.08 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, test, repair, readjust, and if necessary replace heating controls for steam heating equipment.

This shall include the following:

- (a) Check for correct switching and/or control operating points.
- (b) Check, test and ensure that the safety cut-out mechanisms are in place and that switching controls control at the correct level.
- (c) Ensure that equipment has been installed in accordance with the manufacturers' specification.
- (d) Ensure that all pockets are descaled and free of any defects.

The following control equipment shall be serviced, repaired and when required, replaced if damaged beyond repair.

FB 11.08.01 Direct heating control equipment

Where immersed type thermostatic steam control valves are utilized, they shall be serviced and repaired as follows:

- (a) Dismantle and strip down thermostatic control valve including removal of pocket.
- (b) De-scale and clear all equipment.
- (c) Replace element subassembly if necessary.
- (d) Replace cover joint, gland packing, heater coupling joint and all gaskets where applicable.
- (e) Check valve seat and if necessary re-seat.
- (f) Reassemble control valve and reinstall, test and adjust to correct level.

FB 11.08.02 Remote capillary control equipment

Where remote control equipment are utilized for heating purposes, these shall be serviced, repaired and overhauled in accordance with the manufacturers' specification.

FB 11.09 CONDENSATE PUMPING INSTALLATIONS

The Contractor shall at the start of the repair and maintenance contract inspect all condensate pumping installations for any defects, damages, and/or shortfall. All defects, damages, repairs, replacement and/or pumps are to be serviced, repaired, overhauled and installed in accordance with the relevant specifications, accepted norms and standards, and manufacturer's specifications.

The following two types of condensate pumping systems shall be regarded as a guideline for repairs, services and overhauling.

FB 11.09.01 Steam operated automatic condensate pumps

The Contractor shall inspect and service these units as follows:

- (a) Inspect receiver for any defects and corrosion and clean out.
- (b) Inspect steam-driven pumps for any defects and clean out.
- (c) Replace steam inlet valve assembly.
- (d) Inspect and clean float and replace if necessary.
- (e) Inspect guides and replace if necessary.
- (f) Replace all gaskets and seals.
- (g) Inspect and replace the lever assembly mechanism if necessary.
- (h) Inspect and service check valves including replacing of gaskets.
- (i) Inspect all steam piping, clean out and replace when necessary.
- (j) Clean out strainers and replace strainer elements if necessary.
- (k) Replace steam and condensate valve seals and gland packings.
- (l) Inspect vent pipe installation and repair where necessary.
- (m) Check all inlet and outlet pipe connections.
- (n) Service and repair steam traps.
- (o) Service and repair sight glasses.

- (p) Reassemble and put steam operated pumps back into operation.

FB 11.09.02 Electrically operated automatic condensate pumps

The condensate pumps are to be inspected, tested, serviced, repaired together with their associated equipment and pipework. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the condensate pumps and equipment shall include at least the following:

- (a) Inspect and test the pumps for correct operation.
- (b) Replace gland packings, seals and gaskets.
- (c) Inspect and test for any bearing noise and replace if necessary.
- (d) Clean out pump strainers, check non-return valves, valves, etc.
- (e) Test pump motor windings for balance phases, insulation test and check wiring.
- (f) Inspect pump mountings and repair if necessary.
- (g) Inspect, clean out and repair the condensate tank where necessary.
- (h) Inspect, test, service, readjust the level controls on the condensate tank.

FB 11.10 STEAM AND CONDENSATE PIPING ANCILLARY EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, service, repair all ancillary steam and condensate equipment using the following as guideline:

- (a) Replace damaged, broken, leaking, corroded equipment.
- (b) Repair, replace and service valves including new gaskets, gland packings, seals, bolt and nuts, etc.
- (c) Test the proper closing of all valves and where not satisfactory, valves are to be refurbished, de-scaled and replaced if necessary.
- (d) Repair, clean and service all strainers including replacement of strainer elements where corroded and installation of new gaskets.
- (e) Repair, service and check the proper functioning of all non-return valves.
- (f) Repair, service, readjust and calibrate all safety release valves.
- (g) Repair, service and clean out all air release valves and vacuum breakers.
- (h) Repair, service and log readings of flow meters including cleaning of integral strainers.
- (i) Repair, service and check for any damages to the expansion bellows and expansion joints.
- (j) Repair, service and clean out all steam separators.
- (k) Repair, service and replace glasses and gaskets on sight glass equipment.
- (l) Check, service, readjust and calibrate test pressure and temperature gauges.
- (m) Pressure test and sterilize repaired new installation and equipment.
- (n) Reinstate and make good walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc. to an acceptable level where any repair, upgrade and/or service work have been executed.
- (o) Prepare and repaint all piping equipment, brackets, supports, etc.

FB 11.11 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS

FB 11.11.01 Instrumentation and controls

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the instrumentation and control equipment shall include at least the following:

- (a) Test all equipment for correct operation.
- (b) Inspect, test, service, adjust setting and if necessary repair and/or replace steam detector.
- (c) Inspect, recalibrate and if beyond repair, replace steam pressure gauge.

FB 11.11.02 Electrical control panels

All electrical control panels shall be inspected, tested, and repaired, including all equipment inside the control panel. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the electrical control panels shall include at least the following:

- (a) Test all control equipment for correct operation.
- (b) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points. Where equipment is found to be faulty it shall be replaced with new approved equipment.
- (c) Check all wiring and connections for proper conducting and replace where hot connections are found.
- (d) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

FB 12 **MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT**

FB 12.01 **GENERAL**

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

- (a) Routine preventative maintenance;
- (b) Corrective maintenance, and
- (c) Breakdown maintenance,

as defined in General Maintenance, for the specified installations described under FB 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with General Maintenance, and as specified in Particular Specification PFB and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorized by the Contractor for each maintenance activity under the following headings:

- (a) Steam piping installation
- (b) Condensate piping installation
- (c) Supports and bracketing
- (d) Lagging and cladding
- (e) Steam ancillary equipment
- (f) Condensate ancillary equipment

- (g) Condensate pumping systems
- (h) Electrical controls, panels and wiring.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

FB 12.02 ROUTINE PREVENTATIVE MAINTENANCE

The routine maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance, and the Particular Specification related to this work.

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed in tables FB 12.02/1, FB 12.02/2, FB 12.02/3 and FB 12.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FB 12.02/1: WEEKLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	Inspect all steam and condensate installations for any visible defects, leaks, damages or/and pending faults.	Contractor	Check/Record
2	Check and record all pressure gauge readings and readjust equipment if necessary.	Contractor	Adjust/Check/Record
3	Check operation of condensate pumps and controls for correct functioning.	Contractor	Check/Record
4	Check steam trap arrangements for correct operation.	Contractor	Check/Record
5	Report any faults, defects, leaks, damages, etc, to Engineer/Departmental Representative.	User Client	Check/Record/Report

TABLE FB 12.02/2: MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under table FB 12.02/1	Contractor/User/Client	Check/Record/Adjust/Repair/Report
2	Blow down all dirt pockets and record.	Contractor	Service/Record
3	Clean out all strainers and record.	Contractor	Service/Record
4	Check all valve gland seals and packings for leaks and replace and repair if necessary.	Contractor	Check/Service/Repair/Record
5	Check, inspect and repair if necessary all expansion joints for leaks and damages.	Contractor	Check/Repair/Record
6	Check sight glasses and repair, clean and replace where necessary.	Contractor	Check/Service/Repair/Record
7	Check all safety devices for correct operation and repair and replace where		

	necessary.	Contractor	Check/Service/Repair/Record
8	Check and test all electrical control functions and operations. Repair and report any faults and defects.	Contractor	Check/Service/Repair/Record
9	Complete logbook and report.	Contractor	Report

TABLE FB 12.02/3: SIX-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FB 12.02/1 and FB 12.02/2	User Client/Contractor	Check/Record/Adjust/Repair
2	Service, repair, clean, replace seals, gaskets, reset and/or replace worn parts as directed by the manufacturer of all steam traps.	Contractor	Check/Service/Repair/Report
3	Service, repair, replace glasses and gaskets where necessary and clean all sight glasses.	Contractor	Check/Service/Repair/Report
4	Repair lagging and cladding where necessary.	Contractor	Check/Repair/Report
5	Repair all steam leaks.	Contractor	Check/Repair/Report
6	Clean out and repair all condensate tanks.	Contractor	Check/Service/Report
7	Test, inspect and repair all condensate pumps.	Contractor	Check/Service/Repair/Report
8	Lubricate all lubrication points in accordance with the manufacturer's specification.	Contractor	Check/Service/Report
9	Complete logbook and report.	Contractor	Report

TABLE FB 12.02/4: ANNUAL ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FB 12.02/1, FB 12.02/2 and FB 12.02/3	User Client / Contractor	Check/Record/Adjust/Repair
2	Annual survey by inspector	Contractor / Department	Inspect / Test / Service / Repair
3	Inspect and repaint all equipment where required.	Contractor	Inspect / Test / Service / Repair
4	Remove, strip, service, repair, adjust and replace where necessary all pressure control and safety valve equipment.	Contractor	Service / Repair / Adjust / Report
5	Complete logbook and report.	Contractor	Report

FB 12.03 CORRECTIVE MAINTENANCE

This corrective maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance, and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such shortfall.

FB 12.04 BREAKDOWN MAINTENANCE

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance specifications.

All breakdown maintenance shall be done in accordance with the relevant specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

TECHNICAL SPECIFICATION FC - HOT-WATER GENERATING INSTALLATIONS

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FC 01 SCOPE

This specification covers the general repair and maintenance of hot-water generating installations, which include the following:

- (a) Steam generated hot-water heating equipment
- (c) Primary and secondary pumps
- (d) Hot-water storage vessels
- (e) Lagging and cladding of vessels and piping systems
- (f) Hot-water reheating vessels
- (g) Corrosion protection linings to storage vessels and re-heaters
- (h) Hot, cold and drainage pipework to the plant room installation
- (i) Electrical control systems, wiring and control panels
- (j) Thermostats and safety equipment.

This specification also addresses the training of User Client and associates, and maintenance staff.

This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the particular specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

The Contractor shall at all times adhere to this specification, unless otherwise specified in the Particular Specification.

FC 02 STANDARD SPECIFICATIONS

FC 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender of the following specifications,

publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

FC 02.01.01 SANS and other specifications and codes

- SANS 0400 - The applications of the building regulations
- SANS 0142 - Code of practice for the wiring of premises
- SANS 0140 - Identification colour marking
- SANS 044 - Parts I to IV: Welding
- SANS 460 - Copper tubes for domestic plumbing
- SANS 0252 - Parts I and II
- SANS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications

SANS Specifications listed on page 3 of the DPW specification OWG 371
Atmospheric Pollution Prevention Act, No 45 of 1965
BS 2790
BS 1740
BS 21
BS 1640
BS 5500

FC 02.01.02 Department of Public Works specifications

- OWG 371 - Specification of materials and methods to be used
- STD.PWD.VII - Standard Specification for steam boiler installations (Issue VII 1997)
- Standard Specification for electrical installations and equipment pertaining to mechanical installations (Issue IX 1998)

FC 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FC 02.01.04 Manufacturers' specifications, codes of and practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' specifications, instructions and codes of practice.

FC 02.01.05 Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

FC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

FC 03.01 General repair and installations requirements

All materials and equipment supplied and installed shall be of new high quality, design and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

All work shall be executed in a first-class workman-like manner by qualified tradesmen. All equipment, component parts, fittings and materials supplied and/or installed, shall conform in

respect of quality, manufacture, test and performance to the requirements of the applicable current SANS specifications and codes, except where otherwise specified or approved by the Engineer/Departmental Representative in writing.

All materials and workmanship which, in the opinion of the Engineer/Departmental Representative, is inferior to that specified for the work, will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer/Departmental Representative.

The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer/Departmental Representative for approval before placing orders or commencing installation.

All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.

Repair work shall be programmed in accordance with General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

FC 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Operating and Maintenance Manuals.

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

- (a) System description
 - (i) Complete system description and the working of the plant.
- (b) Commissioning data
 - (i) Complete commissioning, test and inspection data of systems and equipment.
- (c) Operating data
 - (i) Systems and equipment running check list and frequency of servicing required;
 - (ii) Safety precautions to be implemented;
 - (iii) Operator's duties (logging requirements);
 - (iv) Lubricating oils and service instructions.
- (d) Mechanical equipment
 - (i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;

- (ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
 - (iii) Manufacturer's brochures and pamphlets;
 - (iv) Schedule of spares with part numbers recommended to be held as stock;
 - (v) Vessels pressure test and certification certificates.
- (e) Maintenance instructions
- (i) Schedule of maintenance particulars, frequency of services and replacements;
 - (ii) Trouble-shooting guide;
 - (iii) Part number of all replacement items and spares;
 - (iv) Capacity curves of all pumps;
 - (v) Serial numbers of all items of equipment.
- (f) Electrical equipment
- (i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (ii) Maintenance instructions;
 - (iii) Manufacturer's brochures and pamphlets;
 - (iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.
- (g) Instrumentation and control
- (i) Description of each control system;
 - (ii) Schedule of control equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
 - (iii) Maintenance instructions;
 - (iv) Manufacturer's brochures and pamphlets.
- (h) Drawings
- (i) Paper prints of all as-built mechanical and electrical drawings;
 - (ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

FC 05 **LOGGING AND RECORDING PROCEDURES**

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in General and Maintenance. This shall consist of a log and record book, which shall be utilized to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, etc.

The logbook shall be kept in a safe place as agreed with the User Client and the Engineer/Departmental Representative and shall only be utilized by the maintenance personnel, the Contractor and the Engineer/Departmental Representative. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Engineer/Departmental Representative.

The logbook shall be structured to include at least the following:

- (a) Weekly inspection and maintenance actions;
- (b) Monthly inspection and maintenance actions;
- (c) Four-monthly inspection and maintenance actions;
- (d) Annual inspection and maintenance actions;
- (e) Breakdown reports;
- (f) Daily system and equipment operating conditions, observations, recordings and measurements;
- (g) Inspection and test comments and reports.

The Contractor shall also institute an attendance register, which shall be kept in a safe place as agreed with the User Client and the Engineer/Departmental Representative. This register shall be completed by all persons visiting the installation, including:

- (a) Maintenance personnel
- (b) Contractor
- (c) Inspectors
- (d) Department personnel
- (e) Engineer/Departmental Representative.

The register shall state the date, time-in, time-out, name, company and reason for visit.

A copy of the register shall be submitted by the Contractor together with his monthly report.

FC 06 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours written notice to the Engineer/Departmental Representative before commencing the test.

In the event of the plant or installation not passing the test, the Employer shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer/Departmental Representative attending the repeated test.

Whenever any installation or equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer/Departmental Representative. The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.

FC 07 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system that shall be submitted to the Engineer/Departmental Representative for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer/Departmental Representative at regular intervals as required.

FC 08 COMMISSIONING AND RE-COMMISSIONING OF PLANT AND INSTALLATION

FC 08.01 GENERAL

On completion of the repair work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer/Departmental Representative. Where new plant is installed the Contractor shall run and operate the system for a period of time as specified by the Engineer/Departmental Representative and train the staff of the User Client to operate and maintain the system.

Logging of the operation of the installations shall commence immediately upon start-up. The Contractor shall submit a full commissioning report.

FC 08.02 RE-COMMISSIONING OF HOT-WATER GENERATING INSTALLATION AND ANCILLARY EQUIPMENT

On completion of any repairs the Contractor shall re-commission the systems, installation and/or equipment influenced by such repairs.

This operation shall be done strictly in accordance with the manufacturer's specification and relevant standards, norms and specifications from the applicable body, authority and/or department. The operation shall include but not be limited to the following:

- (a) All required pre-commissioning mechanical checks
- (b) Check all steam, water and drain connections (when applicable).
- (c) Check all moving parts.
- (d) Check seals, gaskets and joints.
- (e) Reinstall all plugs and covers and check that they are properly secured.
- (f) Check and record that all lubrication to equipment and components has been done in accordance with manufacturer's specification.
- (g) Check and ensure that all valves and safety valves are correctly installed and in the correct operating position. Safety valves are to be set in accordance with the required blow-off pressure for the installation.
- (h) Check and ensure that all control equipment such as pressure-reducing valves, heat control equipment, etc, are set and adjusted to the correct controlling value in accordance with the system parameters and manufacturer's specification.
- (i) All steam and condensate pre-commissioning checks shall be done in accordance with Technical Specification FB (where applicable).
- (j) Check and confirm that all required tests and inspections to storage vessels, primary heater vessels and re- heater vessels have been done and that all required certificates are in place.
- (k) Check and ensure that the domestic hot-water and cold-water piping system is operational and that no leaks are present.
- (l) Check, test and inspect the correct installation and operation of all primary and secondary pumping (where applicable).
- (m) Check that all the required pressure testing to the repaired installations and/or new equipment has been done, witnessed and recorded in accordance with the relevant specifications.
- (n) Check, test and inspect all bracketing and supports for the relevant installations and equipment to ensure that they are properly secured and installed in accordance with the manufacturer's specifications and installation specification.
- (o) Check, inspect and ensure that all lagging and cladding to the vessels and piping installation are installed and repaired in accordance with the applicable specifications from the relevant controlling authority.
- (p) Check, inspect and ensure that no leaks to equipment, systems and installations occur.
- (q) All required pre-commissioning electrical checks
 - (i) Check all wiring connections for tightness and repair any hot connections.
 - (ii) Check that all electrical equipment has been properly reconnected in accordance with the manufacturer's specification.
 - (iii) Perform and record all required electrical insulation tests on equipment.
 - (iv) Check and test all controls without livening up electrical equipment.
 - (v) Check all motor-driven equipment for correct rotational directions.
 - (vi) Check and test the operation of all indication and warning lights.
 - (vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specifications.
 - (viii) Run all motor-driven equipment for a period to ensure free movement and correct operation.

FC 08.03 Commissioning of equipment

On completion of the pre-commissioning checks the Contractor shall proceed with the commissioning of the equipment. This shall be done strictly in accordance with the manufacturer's specification and system parameters and shall include but not be limited to the following:

- (a) During the commissioning process all safety and warning system checks are to be performed on the thermostatic control system where applicable.
- (b) During load conditions the equipment shall be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation where applicable.
- (c) Check that steam pressure valves are readjusted where necessary to the correct set point under load conditions where applicable.
- (d) This shall be done in accordance with Technical Specification FB: Steam Generating Installations.
- (e) Check the operation of all steam trap arrangements where applicable.
- (f) This shall be done in accordance with Technical Specification FB: Steam Generating Installations.
- (g) Check that water pressure-reducing valves are adjusted and set to the correct operating value for the specific system.
- (h) Check the correct operation of all systems. Readjust primary and secondary pumping control equipment where applicable.
- (i) Test and check for any leaks to the system, equipment and installation.
- (j) Check for any unnecessary strain to system, equipment and installation due to expansion and contraction.
- (k) Check the correct functioning of all heating temperature control equipment to ensure the correct switching levels and that all safeties are operational.
- (l) Record temperatures and flow conditions.

The Contractor shall visit, inspect, test and readjust the systems, equipment and installation during the week following the re-commissioning to ensure the correct functioning of the equipment and its associated components.

FC 09 GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair contract, complies with the required performance and will function as part of the complete system.

All new equipment, including, the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing upon the day of issue of a certificate of completion for the repair work of the installation.

FC 10 MAINTENANCE TOOLS AND SPARES

Each installation shall be equipped with the necessary maintenance tools and spares required by the specific type of equipment and installation for the daily operation and maintenance of the system. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the maintenance supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the User Client's maintenance supervisor and record and report to the Engineer/Departmental Representative. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

- (a) Tools
 - (i) Grease and oil lubrication equipment;
 - (ii) Equipment operating keys and tools.
- (b) Spares

- (i) Spare sight glasses for sight glass indicators, seals and gaskets (where applicable);
- (ii) Spare seats, gaskets and gland packings for valves, etc;
- (iii) Spare steam traps, at least one of each type present on the installation (where applicable);
- (iv) Spare pressure gauges, at least one of each range and type;
- (v) Spare electrical elements (where applicable);
- (vi) Spare thermostats, at least one of each type present on the installation (where applicable);
- (vii) Spare pilot lights, contactors, circuit brackets, relays, thermal overloads, etc, for electrical control panels;
- (viii) Spare temperature gauges, at least one of each range and type.

FC 11

REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FC 11.01 GENERAL

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in the Particular Specification and Schedule of Quantities with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate for completion of the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the hot water generating installations shall be categorised under the following headings:

- (a) General requirements for hot-water generating installations
- (b) Steam and condensate pipework (where applicable) Refer to Technical Specification FB: Steam Distribution Installations.
- (c) Hot-water storage vessels
 - (i) Existing hot-water storage vessels
 - (ii) Electrically driven storage vessels, new hot-water storage vessels
 - (iii) Heating services for hot-water storage vessels.
- (d) Lagging and cladding of vessels and piping
 - (i) Vessel lagging and cladding
 - (ii) Hot-water and hot-water return pipe lagging and cladding
- (e) Pressure testing
- (f) Corrosion protection linings
- (g) Sterilization of installation
- (h) Heating control equipment
 - (i) Steam heating equipment
 - (ii) Electrical heating equipment
- (i) Instruments and controls
 - (i) Type of instrumentation and controls
 - (ii) Instrumentation and controls, installation requests
- (j) Primary and secondary pumping installations
 - (i) Primary pumping equipment
 - (ii) Secondary pumping equipment
- (k) Domestic hot-water and cold-water pipe installations
 - (i) Strainers
 - (ii) Valves

- (iii) Air vents
 - (iv) Thermostatic water flow control valve
 - (v) Expansion equipment
 - (vi) Flow meters
 - (vii) Check valves
 - (viii) Vacuum breakers
 - (ix) Expansion release valve
 - (x) Safety valves
 - (xi) Pressure gauges
- (l) Electrical installations
- (i) Electrical control panels
 - (ii) Wiring and cabling.

Any repair work, which may be required on the systems, equipment and installation, shall be executed using approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturer's specifications and codes of practice and as specified in all additional and particular specifications included in this document.

At the start of the repair and maintenance contract, the repair work specified in the Particular Specification shall be done in accordance with the items listed. Any repair work during the maintenance period shall also adhere to this specification.

FC 11.02 GENERAL REQUIREMENTS FOR HOT-WATER GENERATING INSTALLATIONS

All repair work and new installation of hot-water generating installations shall adhere to the standard specifications of the Department of Public Works and all relevant specifications, norms, standards and regulations applicable to this type of installation, including the following general requirements:

The hot-water generating installation shall be repaired, installed and maintained as a complete functional unit, with all the responsibilities, functions and operating parameters taken into account to ensure the continuous supply of hot water to the consumer points.

The hot-water generating installation shall be capable of providing ample supply of hot water to the consumer points by means of ensuring the correct sizing of the hot-water storage and production.

FC 11.03 STEAM AND CONDENSATE PIPEWORK

All steam and condensate installations shall be done in accordance with Technical Specification FB: Steam Distribution Installations.

FC 11.04 HOT-WATER STORAGE VESSELS

FC 11.04.01 Existing hot-water storage vessels

At the start of the maintenance and repair contract the Contractor shall inspect, repair, service, clean out and test all hot-water storage vessels.

The inspection shall include the following:

- (a) Isolate drain, open manholes and clean out hot-water vessels.
- (b) Inspect vessel welds.
- (c) Inspect internal corrosion lining and check for any pit holes and damages to the vessel material and connections.
- (d) Inspect lagging and cladding.
- (e) Inspect condition of all elements, steam heating coils, controls, safety valves, etc.
- (f) During this inspection the Contractor shall notify the Engineer/Departmental Representative in advance to allow the Engineer/Departmental Representative to

witness the Contractor's findings. The Contractor shall submit a written report on the findings.

- (g) All manhole and pipe gaskets shall be replaced.

No repair work shall be proceeded prior to approval from the Engineer/Departmental Representative. Should any welding repair work be required it shall be performed by a coded welder in accordance with acceptable practices, codes and norms.

Should the corrosion lining be damaged or corroded, thus necessitating the relining of the vessel, this shall be done with an approved lining suitable for the water quality and operating temperature under which this system is functioning.

For further details on repair to resisting linings and installation of new linings refer to FC11.06.

All safety valves shall be serviced, overhauled and readjusted to the correct safety pressure blow-off part.

All lagging and cladding shall be inspected, repaired and where necessary replaced.

On completion of all repair and service work the Contractor shall reinstate all equipment, fill the hot-water vessel with water and pressure test it to 1,5 times the permissible operating pressure or allowable test pressure.

On passing of the pressure test the Contractor shall re-commission the hot-water vessels and put it back on line.

FC 11.04.02 New hot-water storage vessels

Where new hot-water storage vessels are to be installed it shall be done in accordance with the following specification and on approval of the necessary workshop drawings to be provided by the Contractor.

The storage vessels shall be of the vertical cylindrical type with dished ends on both sides, and shall be manufactured to BS 5500 Category II in mild steel for a working pressure as indicated for the three systems. A pressure test certificate for each vessel shall be supplied by the manufacturer.

The vessel shall be equipped with at least the following :

- (a) Properly sized flanged manhole for easy access
- (b) Flanged inlets and outlets to SANS 1123 Table 10
- (c) Sparge pipe on the cold-water inlet
- (d) Correctly sized thermometer
- (e) Correctly sized temperature and pressure relief valve
- (f) Air release valve
- (g) Correctly sized pressure gauge
- (h) BSP threaded sockets for thermostats
- (i) 40 mm diameter BSP threaded socket at the lowest point of the storage tank for draining purposes
- (j) 50 mm diameter boss element segments for auxiliary elements.

An expansion relief valve shall be installed on the inlet to the storage vessels for thermal expansion.

Where pipe connections to the storage vessel are done by dissimilar materials (such as copper), isolating flanges shall be used (dielectric coupling).

Before ordering and manufacturing of storage vessels a workshop drawing shall be submitted to the Engineer/Departmental Representative for approval.

The Contractor shall satisfy himself that access and plantroom sizes are to the dimensions on the drawings and that the equipment will fit into the space allowed.

FC 11.04.03 Heating sources for hot-water storage vessels

(a) Electrical elements

Where electrical immersion elements are used to heat the water inside the hot-water storage vessel, these elements shall be replaced at the start of the repair and maintenance contract.

All the thermostat controls and safety cut outs shall be cleared, inspected, tested, adjusted to the correct valve and where necessary replaced.

(b) Steam heating

Where steam heat exchangers are used to heat the water inside the storage vessel, these coils shall be removed together with the steam chest and associated equipment. The coils shall be de-scaled, cleaned, inspected and tested.

Where necessary the heat exchanger and/or coils shall be replaced.

FC 11.05 LAGGING AND CLADDING

All lagging and cladding to hot-water vessels, primary heaters, secondary heaters and hot and circulation water piping shall be inspected for defects, damages and shortages at the start of the repair and maintenance contract. The Contractor shall report his findings to the Engineer/Departmental Representative in writing.

All repairs to be done shall match the existing installation and the Contractor shall ensure that no sharp edges from the metal cladding pose a danger to anybody.

The following specification shall be adhered to:

(a) Vessel lagging and cladding

The storage vessels shall be insulated with a 80 mm thick layer of mineral glass wool with a density of 88 kg/m³ and finally covered with 0,6 mm thick galvanized sheet metal. The sheet-metal work has to be done by a specialist. (All edges are to be rolled and no sharp edges will be allowed.)

(b) Hot-water and return water pipe lagging and cladding

All hot water and hot-water return pipes shall be insulated with preformed fibreglass sections covered with galvanized sheet-metal muffs in a water tight manner. Sheet-metal muffs shall be installed with the joints overlapping at least 50 mm and the longitudinal overlap pointing downwards to prevent ingress of water. The sheet-metal muff shall be strapped with 10 mm galvanized straps by means of a strapping tool with a minimum of 2 straps/section. All pipe bends, T-pieces, etc, shall be insulated with 25 mm diameter fibreglass rope covered with a 12 mm thick layer of self-setting fibre cement. A reinforcing gauze shall be wrapped over the fibre cement while wet and then painted with mastic paint when dry.

Table FC 11.05/1 below provides a guideline for the preformed fibreglass section thickness to be used.

The fibreglass sections shall have a density of 88 at least kg/m³.

TABLE FC 11.05/1: FIBREGLASS SECTION THICKNESS

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	THERMAFLEX THICKNESS
100 mm dia	108 mm dia	50 mm
80 mm dia	76 mm dia	40 mm
65 mm dia	67 mm dia	40 mm
50 mm dia	54 mm dia	25 mm
40 mm dia	42 mm dia	25 mm
32 mm dia	35 mm dia	25 mm
25 mm dia	28 mm dia	20 mm
20 mm dia	22 mm dia	20 mm
15 mm dia	15 mm dia	15 mm

FC 11.06 **PRESSURE TESTING**

The Contractor shall at the completion of the repair contract arrange for a complete pressure test to be executed on the hot-water generating installation. This shall be done in collaboration with the User Client and Engineer/Departmental Representative to ensure the minimum down-time of the installation, as well as to establish a suitable period for this pressure test. All leaks shall be repaired and the system shall be tested at the cost of the Contractor. This test shall be witnessed by the Engineer/Departmental Representative.

The tests shall be performed on all hot-water storage vessels, primary heating vessels, secondary heater vessels and domestic water pipe systems.

All safety and expansion release valves shall be removed and plugged, and on completion these shall be reinstalled.

The systems shall be filled with water after all branches have been plugged, sealed or closed.

The systems shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump.

A pressure of at least 1,5 times the working pressure of the class rating of pipes or fittings shall be applied for a period of time specified in the specifications or as recommended by the manufacturers. (Refer to SANS 1200 for minimum and maximum test pressures.)

Tests should not be performed against closed valves.

Leakage which occurs shall be measured, calculated and checked against the allowable losses, as specified in SANS 1200.

If the completed sections comply with all specifications and pass the tests and inspection, it can be approved and the Contractor may be instructed to re-commission the plant.

FC 11.07 **CORROSION PROTECTION LININGS**

All vessel corrosion protection linings shall be inspected and repaired and/or replaced where necessary.

Repairs shall only be done to linings where the supplier and installer of these linings approve of such repairs. These repairs shall then be done strictly in accordance with the manufacturer's specification and shall be certified by an approved inspection authority.

Where new linings are to be installed, the required preparation work including sand blasting and removed of old lining shall be done in accordance with the recommendation of the supplier of the new lining.

Where new linings are to be introduced they shall be similar or equal to the following:

Internally coated with a durable, high operating temperature glass flake lining with DTF of one

millimetre, similar or equal to a Polygrass VE lining as supplied by Corrocoate, suitable for an operating temperature of 95°C at the indicated working pressures.

The applications of these linings shall be witnessed and certified to the manufacturer's application standards by an approved inspection authority.

Externally the vessels shall be coated with two coats of red oxide paint.

FC 11.08 **STERILISATION OF WATER SIDE OF INSTALLATION**

The Contractor shall at the completion of the repair contract sterilize the complete water side of the hot-water system including vessels and pipes.

This shall be done as described in the following guidelines.

The complete system shall be filled with potable water chlorinated to a concentration of 15 mg of chlorine per litre of water which shall remain in contact with the inner surface of the pipeline for a period of not less than 24 hours. The pipeline shall be filled for sterilizing in such a manner that no chlorine shock is created or air is trapped in the pipeline.

The Contractor shall submit full details of the proposed method for sterilizing the pipeline to the Engineer/Departmental Representative for approval at least 14 days before commencing sterilizing. The cost of water for filling the pipeline for sterilizing shall be borne by the Contractor.

The Contractor shall provide all materials, tools, equipment and labour necessary to sterilize the pipeline. After sterilizing the pipeline the Contractor shall, at no extra cost, empty the pipeline and dispose of the water in a manner approved by the Engineer/Departmental Representative.

The Contractor may use the following products as a source of chlorine:

- (i) Chloride of lime to SANS 295 yielding 33 % free chlorine by mass;
- (ii) Calcium hypochlorite to SANS 295 yielding 70 % free chlorine by mass;
- (iii) Chlorine gas applied by chlorinator.

After sterilization, an approved water quality test to a minimum number of 10 % of the total water points, randomly selected, evenly spread and marked on drawings, shall be carried out. This test shall include a full bacteriological test as per SANS 241 and the results shall be submitted to the Engineer/Departmental Representative for inclusion in the Contract documents. Each abortive test shall be for the Contractor's cost.

When tested the water shall comply with the limits given in column 2 or 3, as relevant, of table FC 11.08/1.

TABLE FC 11.08/1: BACTERIOLOGICAL REQUIREMENTS

PROPERTY	RECOMMENDED MAXIMUM LIMIT	MAXIMUM ALLOWABLE LIMIT
Total coliform bacteria count per 100 millilitre	Nil*	5
Faecal coliform bacteria count per 100 millilitre	Nil	Nil
Standard plate count per millilitre	100	Not specified

Note:

* If any coliform bacteria are found in a sample, take a second sample immediately after the tests on the first sample have been completed; this sample shall be free from coliform bacteria.

Not more than 5 % of the total number of water samples (from any one reticulation system) tested per year may contain coliform bacteria.

FC 11.09 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, test, repair, readjust, and if necessary replace heating controls for the hot-water system.

This shall include the following:

- (a) Check for correct switching and/or control temperature operating points.
- (b) Check, test and ensure that the safety cut-out mechanisms are in place and switch and/or control at the correct level.
- (c) Ensure that equipment has been installed in accordance with the manufacturer's specification.
- (d) Ensure that all pockets are de-scaled and free of any defects.

The following control equipment shall be serviced, repaired and where required replaced if damaged beyond repair.

FC 11.09.01 Steam heating control equipment

Where immersed type thermostatic steam control valves are utilised they shall be serviced and repaired as follows:

- (a) Dismantle and strip down thermostatic control valve including removal of pocket.
- (b) De-scale and clean all equipment.
- (c) Replace element subassembly if necessary.
- (d) Replace cover joint, gland packing, heater joint, coupling joint and all gaskets where applicable.
- (e) Check valve seat and if necessary reseal.
- (f) Reassemble control valve and reinstall, test and adjust to correct level.

All other type of thermostatic heating control valves shall be serviced, repaired and overhauled in accordance with the manufacturer's specification.

FC 11.09.02 Electrical heating control equipment

All electrical thermostat control equipment shall be serviced and repaired in accordance with the manufacturer's specification. This shall include the following:

- (a) Dismantle, clean and de-scale thermostat pockets.
- (b) Test switching actions for correct operation.
- (c) Test safety cut-out switching points for correct operation.

Replace thermostat if the switching does not take place in accordance with the manufacturer's specification.

FC 11.10 PRIMARY AND SECONDARY PUMP INSTALLATIONS

The Contractor shall at the start of the repair and maintenance contract inspect, test, service and if required replace primary and secondary circulating pumps.

The pumps are to be inspected, tested, serviced and repaired together with their associated equipment and pipework. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the pumps and equipment shall include at least the following:

- (a) Inspect and test the pumps for correct operation.
- (b) Replace gland packings, seals and gaskets.
- (c) Inspect and test for any bearing noise and replace if necessary.

- (d) Clean out pump strainers, check non-return valves, valves, etc.
- (e) Test pump motor windings for balance phases, insulation test and check wiring.
- (f) Inspect pump mountings and repair if necessary.

Where in-line glandless canned pumps are used, these shall be inspected, tested, serviced where possible, impeller inspected and cleaned and if found beyond repair, replace with a suitable replacement in accordance with the operating parameters.

FC 11.11 DOMESTIC HOT AND COLD WATER INSTALLATIONS

The Contractor shall at the start of the repair and maintenance contract inspect, tests, service, repair and if required, replace damaged items on the complete hot and cold-water piping installation inside the hot-water generating plant rooms.

The repair work specification shall be read in conjunction with Technical Specification AA: Plumbing and Drainage Installations.

Repair work to the domestic hot and cold-water installation networks shall be as detailed in the Particular Specification and shall include, but not be limited to the following:

- (a) Replace damaged, broken, leaking and corroded above and underground pipework, fittings and equipment.
- (b) Repair, replace and service valves, including new gaskets, gland packings, seals, bolt and nuts, etc.
- (c) Test the proper closing of all valves and where valves do not close properly, the valves shall be refurbished, de-scaled and if necessary replaced.
- (d) Repair, clean and service all strainers including replacement of strainer elements where corroded and installation of new gaskets.
- (e) Repair, service, test and readjust pressure-reducing valves. Pressure gauges shall be recalibrated and checked. Up and downstream pressures are to be logged. Downstream pressure to be adjusted to an acceptable level taking the allowable working pressure of the system and its components into account.
- (f) Repair, service and check the proper functioning of all non-return valves.
- (g) Repair, service, readjust and calibrate all safety and expansion relief valves.
- (h) Repair, service and clean out all air release valves and vacuum breakers.
- (i) Do repair work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required.
- (j) Hot-water pipe lagging and cladding shall be inspected, repaired, sealed and replaced where required.
- (k) Repair, service and log readings of water meters including cleaning of integral strainers.
- (l) Water pipes are to be sampled for corrosion and scaling. The Engineer/Departmental Representative shall evaluate the actions to be carried out if the outcome of this sampling requires attention.
- (m) Water supply shall be sampled and chemically analyzed for the suitability to the systems and materials it serves.
- (n) Pressure test and sterilize repaired new installation and equipment.
- (o) Reinstate and make good walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where any repair, upgrade and/or service work has been executed.

FC 11.12 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS

FC 11.12.01 Instrumentation and controls

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the instrumentation and control equipment shall include at least the following:

- (a) Test all equipment for correct operation.
- (b) Inspect, test, service, adjust setting and if necessary repair, and/or replace steam detector.
- (c) Inspect, recalibrate and, if beyond repair, replace steam pressure gauge.

FC 11.12.02 Electrical control panels

All electrical control panels shall be inspected, tested, and repaired, including all equipment inside the control panel. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the electrical control panels shall include at least the following:

- (a) Test all control equipment for correct operation.
- (b) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points; where equipment is found to be faulty these shall be replaced with new approved equipment.
- (c) Check all wiring and connections for proper conducting and replace where hot connections are found.
- (d) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

FC 12 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FC 12.01 GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work. Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

- (a) Routine preventative maintenance;
- (b) Corrective maintenance, and
- (c) Breakdown maintenance,

as defined in for the specified installations described under FC 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with General Maintenance, and as specified in Particular Specification PFC and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorized by the Contractor for each maintenance activity under the following headings:

- (a) Steam and condensate pipework (where applicable)
- (b) Hot-water storage vessels
- (c) Heating equipment
- (d) Lagging and cladding of vessels and piping
- (e) Corrosion protection linings
- (f) Circulating pumps
- (g) Domestic hot and cold-water piping systems
- (h) Electrical controls, panels and wiring.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

FC 12.02 ROUTINE PREVENTATIVE MAINTENANCE

The routine maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance and the Particular Specification related to this work:

The routine maintenance work to be performed and executed shall include but not be limited to the items listed in tables FC 12.02/1, FC 12.02/2, FC 12.02/3 and FC 12.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FC 12.02/1: WEEKLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	Inspect equipment, components and installations for any visible defects, leaks, damages and/or pending faults.	Contractor	Check/Record
2	Check and record all pressure gauge temperature and flow meter readings, and readjust equipment if necessary.	Contractor	Adjust/Check/Record
3	Check operation of pumps, heating equipment and controls for correct functioning.	Contractor	Check/Record
4	Check electrical control panels for any faults.	Contractor	Check/Record
5	Report any faults, defects, leaks, damages, etc, to Engineer/Departmental Representative.	User/Client	Check/Record/Report

TABLE FC 12.02/2: MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under table FC 12.02/1	Contractor/User Client	Check/Record/Adjust/Repair/Report
2	Blow down all dirt pockets and record.	Contractor	Service/Record
3	Clean out all strainers and record.	Contractor	Service/Record
4	Check all valve gland seals and packings for leaks and replace and repair if necessary.	Contractor	Check/Service/Repair/Record
5	Check, inspect and repair if necessary all expansion joints for leaks and damages.	Contractor	Check/Repair/Record
6	Check all safety devices for correct operation and repair and replace where necessary.	Contractor	Check/Service/Repair/Record
7	Check and test all electrical control functions and operations.		

8	Repair and report any faults and defects. Complete logbook and report.	Contractor Contractor	Check/Service/Repair/Record Report
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TABLE FC 12.02/3: FOUR-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FC 12.02/1 and FC 12.02/2.	User Client/ Contractor	Check/Record/Adjust/Repair
2	Service, repair, clean, replace seals gaskets, reset and/or replace worn parts as directed by the manufacturer of all steam traps (where applicable).	Contractor	Check/Service/Repair/Report
3	Service, repair, replace glasses and gaskets where necessary and clean all sight glasses.	Contractor	Check/Service, Repair, Report
4	Repair lagging and cladding where necessary.	Contractor	Check/Repair/Report
5	Repair all steam leaks.	Contractor	Check/Repair/Report
6	Repair all water leaks.	Contractor	Check/Repair/Report
7	Inspect and test all heating equipment Repair where necessary.	Contractor	Check/Repair/Report
8	Inspect all hot -water storage vessels for any leaks and packing faults. Repair if necessary.	Contractor	Check/Repair/Report
9	Test, inspect and repair all pumps.	Contractor	Check/Service/ Repair/Report
10	Lubricate all lubrication points in accordance with the manufacturer's specification.	Contractor	Check/Service/ Report
11	Complete logbook and report.	Contractor	Report

TABLE FC 12.02/4: ANNUAL ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FC 12.02/1, FC 12.02/2 and FC 12.02/3.	User Client / Contractor	Check/Record/ Adjust/Repair
2	Drain, clean out, inspect and repair all defects and linings on hot-water storage vessels.	Contractor	Inspect / Test / Service / Repair
3	Inspect and repaint all equipment where required.	Contractor	Inspect / Test / Service / Repair
4	Remove, strip, service, repair, adjust and replace where necessary all pressure control and safety valve equipment.	Contractor	Service / Repair / Adjust / Report
5	Complete logbook and report.	Contractor	Report

FC 12.03 CORRECTIVE MAINTENANCE

This corrective maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance, and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such shortfall.

FC 12.04 BREAKDOWN MAINTENANCE

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance specifications.

All breakdown maintenance shall be done in accordance with the relevant specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

PARTICULAR SPECIFICATION PFA - STEAM GENERATING INSTALLATION

CONTENTS

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PFA 01 SCOPE

- (a) This specification covers the particulars of the repair and maintenance work to the steam generating installation at the St Albans Prison. This Particular Specification shall be read in conjunction with the Technical Specification FA: Steam Generating Installation; and all additional and technical specifications compiled as part of this document.

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Monthly maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after practical completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

- (b) The installations to be maintained under this Contract includes the following:
- (i) Two coal fired horizontal boilers;
 - (ii) Coal storage and handling equipment;
 - (iii) Feed-water storage and control equipment;
 - (iv) Water-treatment equipment;
 - (v) Steam and condensate piping and equipment inside the boiler house;
 - (vi) Electrical control equipment wiring, cabling, panels and general electrical installation inside the boiler house.

PFA 02 GENERAL DESCRIPTION OF INSTALLATION

The central steam generating installation is situated in the east corner of the prison, entry is via the gate to the enclosed complex. This installation generates steam by means of two coal fired boilers, which is distributed via a steam and condensate reticulation network to all steam consumption equipment at this prison.

This installation provides the following plant and installations with steam:

- (a) Central laundry. The laundry does not form part of this contract.
- (b) Central kitchen. The kitchen does not form part of this contract.
- (c) Hot-water calorifier installation at the boiler house which serves the kitchen, laundry and ablution facilities

PFA 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

At the time of compilation of this document the existing installation consisted of the equipment and plant listed below with their relevant technical details.

PFA 03.01 TECHNICAL DETAILS: COAL-FIRED BOILER NO 1

1	Manufacturer	John Thompson
2	Model no	826
3	Boiler Serial no	71456
4	Registration certificate number	Not available
5	Boiler type	Horizontal coal fired multi-tubular
6	Design code	BS 2790-1992 Class 1
7	Factory no	71456
8	Manufacturing date	1976
9	Maximum continuous rating	ca 1800kg/hr from and at 100°C
10	Design pressure rating	1040 kPa
11	Authorised working gauge pressure	1040 kPa
12	Normal operating pressure	1000 kPa
13	Safety blow-off pressure	1000 kPa
14	Stoker make & type	JTA – chain grate type
15	Stoker motor capacity	TBA
16	Feed pumps	2 no Grundfoss multistage
17	Feed pump power capacity	ca 11 kW 400 volt three-phase 50 Hz per pump
18	Chimney stack type	Guyed 350 mm dia. supported from boiler
19	Boiler control panel	Standard - mounted against boiler
20	Level controls	Single and dual switch float operated level switches (Mobrey)

PFA 03.02 TECHNICAL DETAILS: COAL-FIRED BOILER NO 2

1	Manufacturer	John Thompson
2	Model no	826
3	Boiler Serial no	71456
4	Registration certificate number	Not available
5	Boiler type	Horizontal coal fired multi-tubular
6	Design code	BS 2790-1992 Class 1
7	Factory no	71456
8	Manufacturing date	1976
9	Maximum continuous rating	ca 1800kg/hr from and at 100°C
10	Design pressure rating	1034 kPa
11	Authorised working gauge pressure	1034 kPa
12	Normal operating pressure	1000 kPa
13	Safety blow-off pressure	1000 kPa
14	Stoker make & type	JTA – chain grate type
15	Stoker motor capacity	TBA
16	Feed pumps	2 no Grundfoss multistage
17	Feed pump power capacity	ca 11 kW 400 volt three-phase 50 Hz per pump
18	Chimney stack type	Guyed 350 mm dia. supported from boiler
19	Boiler control panel	Standard - mounted against boiler
20	Level controls	Single and dual switch float operated level switches (Mobrey)

PFA 03.03 TECHNICAL DETAILS: FEED-WATER TANK

1	Dimensions	2000 x 2000 x 1400 mm
2	Division wall	No
3	Quantity	1
4	Capacity	4500 litre
5	Make-up water	40 mm dia. with ball-float valve
6	Insulation	Insulation wool with galvanised cladding
7	Heating equipment	Steam heating coil in bottom of tank

PFA 03.04 TECHNICAL DETAILS: WATER SOFTENER PLANT

1	Manufacturer	TBA
2	Model no.	TBA
3	Pipe size	TBA
4	Serial no.	TBA
5	Service provider	TBA
6	Salt container	TBA

PFA 03.05 TECHNICAL DETAILS: CHEMICAL TREATMENT EQUIPMENT

1	Type	Dosing pumps (pulsating type)
2	Quantity	1
3	Model no	NA
4	Service provider	None at present
5	Chemical container	25 litre

PFA 03.06 TECHNICAL DETAILS: OPERATOR TOOLS AND SPARES

The following tools and spares are currently in the plant room.

Coal spades	4
Coal rakes	3
Grease gun	1
Step ladders	0
Blow-down spanners	2
Goggles	1

PFA 03.07 TECHNICAL DETAILS: ELECTRICAL SUPPLY AND EQUIPMENT

- 1 Main electrical control panel 150 kW 400 volt plus Neutral 50 Hz feeding the following equipment:
 - Two coal-fired boiler control panels
 - Water softener plant
 - Feed water pumps
- 2 Plant room DB providing power to the following:
 - Boiler house lighting
 - Boiler house switched socketed outlets
 - Four 450mm dia propeller type extract fans

PFA 04 STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the equipment and installation was briefly as follows:

PFA 04.01 COAL-FIRED BOILERS

- (a) Boiler no 1
 - (i) Boiler is approximately 38 years old, has been maintained and is in reasonable condition
- (b) Boiler no 2
 - (i) Boiler is approximately 38 years old, has been maintained and is in reasonable condition
- (c) General
 - (i) Feed-water tank and pumps are in reasonable condition
 - (ii) Pumps are in good condition
 - (iii) Chemical dosing equipment and water softener are in reasonable condition

These equipment were serviced and maintained in terms of a previous repair and maintenance contract.

PFA 05 DETAILS OF REPAIR WORK REQUIRED

The following work shall form part of the repair work to the coal-fired boiler plant room installation. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FA: Steam Generating Installation, as set out in this document. The work to be included is set out in PFA 05.01, PFA 05.02 and PFA 05.03 below:

The repair work shall be carried out in the following sequence in accordance with the requirements of General Decommissioning, Testing and Commissioning Procedures (SC 02 - Phased repairs and upgrading of the installation):

1. Decommission, test and re-commission coal-fired boiler no 1.
2. Decommission, test and re-commission coal-fired boiler no 2.

No work shall be done to decommission any boiler unless the previous boiler in the sequence has been tested and commissioned. A minimum of one boiler shall always be in full operation at any one time.

PFA 05.01 GENERAL DESCRIPTION OF REPAIR WORK

The repair work to this installation shall at least include, but not be limited to the work listed below. Any items, components, installations and systems not detailed in particular shall be repaired and/or replaced if found to be defective and/or inoperative.

- (a) Statutory internal and external inspections and hydraulic pressure tests on both boilers at the commencement of the contract.
- (b) Testing and re-commissioning of all equipment and installations as may be required and directed by the Departmental representative/Engineer /Departmental Representative.
- (c) Implementation of control plans for fuel delivery, water treatment and boiler efficiency by the Contractor.
- (d) Supply and compilation of maintenance manuals. (Should it be required)

PFA 05.02 STATUTORY INSPECTIONS AND TESTS

The Contractor shall at the start of the Maintenance portion of the Contract perform the required statutory internal/external inspection and hydraulic pressure test in accordance with the Occupational Health and Safety Act, no 85 of 1993 (as amended) and as specified in Technical Specification FA: Steam generating installation, on each of the boilers inside the plant room. During this period all boiler ancillary equipment and components shall be repaired as may be required, serviced, adjusted and tested.

PFA 05.02.01 Internal and external inspection

This work shall be performed in accordance with FA 16.02 of the Technical Specification FA: Steam Generating Installation, the manufacturer's specification and the requirements of the Occupational Health and Safety Act of 1993 and shall include:

- (a) Decommissioning of boilers and electrical isolation;
- (b) All required preparation work for the internal and external inspection to the two boilers including all items listed under item PFA 05.03;
- (c) Repairs of all defects, replacement of defective equipment/components and servicing of all equipment/components;
- (d) Rendering all the necessary assistance, providing the required equipment and tools for the inspection by the approved Inspection Authority;
- (e) Providing and making sure that all record books and inspection reports and certificates are completed in full and submitted to the Departmental representative/Engineer /Departmental Representative;
- (f) Reassembling, recasting, refitting and adjustment of all boiler equipment components and ancillary equipment in accordance with the manufacturer's specification and Technical Specification FA: Steam Generating Installation.

PFA 05.02.02 Hydraulic pressure tests

This work shall be performed in accordance with FA 16.02 of Technical Specification FA: Steam installation, the manufacturer's specification and the requirements of the Occupational Health and Safety Act of 1993 and shall include:

- (a) All preparation work required for the hydraulic pressure test to the boilers;
- (b) Rendering all the necessary assistance, providing the required equipment and tools for the test by the approved Inspection Authority;
- (c) Putting the boilers under the required pressure for witnessing by the Inspection Authority;
- (d) Providing and making sure that all record books and inspection reports and certificates are completed in full and submitted to the Departmental representative/Engineer /Departmental Representative;
- (e) Reassembling, recasting, refitting and adjustment of all boiler equipment, components and ancillary equipment in accordance with the manufacturer's specification and Technical Specification FA: Steam generating installation.

PFA 05.03 REPAIR WORK TO BOILERS AND ANCILLARY EQUIPMENT

The following refers to work required in preparing boilers for statutory inspections

PFA 05.03.01 Coal-fired boilers

- (a) Boiler shell water side - Refer to Standard Specification FA clause FA 16.03.01(a)
 - (i) Clean out and descale boiler.
 - (ii) Inspect boiler water side and integral pipework.
 - (iii) Replace all manhole, handhole and mudhole cover seals and joint rings.

- (iv) Replace fusible plug with new.
 - (v) Execute any required repair work to boiler as directed by the Inspection Authority or the Departmental representative/Engineer.
- (b) Boiler shell gas side - Refer to Standard Specification FA clause FA 16.03.01(b)
- (i) Clear and clean out all dust, slag, ash, grit and foreign matter.
 - (ii) Brush and clean out all fire tubes.
 - (iii) Inspect boiler gas side.
 - (iv) Allow for any replacement of tubes and required repairs as result of the inspection as directed by the Inspection Authority or the Departmental representative/Engineer.
 - (v) Replace all smoke box covers and door joint seals and insulation with new approved joint seals and insulation.
- (c) Integral pipework - Refer to Standard Specification FA clause FA 16.03.01(c)
- (i) Clear and clean out all integral pipework and fittings.
 - (ii) Inspect boiler gas side.
 - (iii) Allow for any required repairs as result of the inspection as directed by the Inspection Authority or the Departmental representative/Engineer.
- (d) Boiler valves and mountings - Refer to Standard Specification FA clause FA 16.03.01(d)
- (i) Dismantle, remove and strip down all boiler valves.
 - (ii) De-scale and clean all boiler valves and mountings.
 - (iii) Inspect boiler valves and mountings.
 - (iv) Overhauling all boiler valves by approved Departmental Representative/Engineer.
 - (v) Hydraulic testing, setting, adjustment and reassembling of all boiler valves.
 - (vi) Certification of boiler valves in accordance with manufacturer's specification.
 - (vii) Replace boiler mountings.
 - (viii) Test and adjust safety valves.
 - (ix) Refitting, installing, testing and adjustment of all boiler valves and mountings.
- (e) Refractories and brickwork - Refer to Standard Specification FA clause FA 16.03.01(e)
- (i) Remove and break down all refractories and brickwork.
 - (ii) Recast and install new brick work on completion of inspection.
- (f) Lagging and cladding - Refer to Standard Specification FA clause FA 16.03.01(g)
- (i) Replace lagging and cladding to oil-fired boilers on completion of statutory inspections and tests with new stainless steel cladding as specified by the manufacturer.

PFA 05.03.02 Feed-water equipment and controls

- (a) Feed-water tank - Refer to Standard Specification FA clause FA 16.03.02(a)
- (i) Isolate, empty, clean out, de-scale and inspect feed-water tank.
 - (ii) Check make-up water ball float valve and adjust to correct level.
 - (iii) Internally line tank with anti-corrosion coating suitable for 110°C operating temperature.
 - (iii) Refill tank with treated make-up water.
 - (iv) Prepare and repaint tank stand and exposed steel parts.

- (v) Allow for temporary feed-water tank during repairs to feed-water tank including all temporary pipes and fittings.
- (b) Feed-water pumps - Refer to Standard Specification FA clause FA 16.03.02(b)
 - (i) Isolate, strip, dismantle, de-scale and clean out feed-water pumps.
 - (ii) Inspect, and report on condition of pump and motor components.
 - (iii) Replace packings, seals, bearings and gaskets.
 - (iv) Replace any worn-out or/and damaged parts and components on report back as directed by the Departmental representative/Engineer.
 - (v) Clean out pump strainers.
 - (vi) Inspect and repair pump mountings.
 - (vii) Refit, install and test feed-water pumps.
- (c) Water level equipment and controls - Refer to Standard Specification FA clause FA 16.03.02(c)
 - (i) Dismantle, strip, de-scale and clean dual and single switch float operated controls (Mobrey type).
 - (ii) Dismantle, strip, descale and clean water level gauge glasses and replace gauge glasses and gaskets. Refit to boiler.
 - (iii) Dual and single level controls to be overhauled, inspected, tested, adjusted and refitted.
 - (iv) Test alarm levels and operation.
 - (v) Test blow-down valves and operation.

PFA 05.03.03 Combustion and draught equipment

- (a) Stoker and stoker controls - Refer to Standard Specification FA clause FA 16.03.03(a)
 - (i) Remove stoker from boiler furnace during the statutory inspections.
 - (ii) Inspect and replace burnt or/and damaged chain grate links and rods where necessary.
 - (iii) Replace chain grate bearings.
 - (iv) Inspect sprockets and replace if required.
 - (v) Inspect shafts, rear roller and re-machine or replace if necessary.
 - (vi) Inspect stoker chassis for straightness, alignment and possible damages, and repair if necessary.
 - (vii) Inspect under grate damper guide vanes and ensure that they are clean of any dust, slag and foreign matter.
 - (viii) Renew and recast all refractories and brickwork in accordance with the manufacturer's specification.
 - (ix) Inspect main worm wheel for any defects and replace if necessary.
 - (x) Replace all joint seals with new.
 - (xi) Reassemble stoker and stoker components.
 - (xii) Replace guillotine door support cables.
 - (xiii) Inspect, service and overhaul stoker drive and gearbox in accordance with the manufacturer's specification.
 - (xiv) Replace shear pin.
 - (xv) Adjust and readjust grate tension.
 - (xvi) Check and adjust fuel bed depth indicator.
 - (xvii) Lubricate all required lubrication points as directed by the manufacturer.
 - (xviii) Mount FD (Forced Draft) fan and controls onto stoker.
 - (xix) Reinstall stoker into boiler furnace in accordance with manufacturer's specification.
- (b) Fan and damper controls - Refer to Standard Specification FA clause FA 16.03.03(b)

- (i) Dismantle, strip down FD (Force Draft) and ID induction fan and damper control equipment during the statutory inspections.
 - (ii) Inspect fan impeller blades, clearances, etc, for correct curvature and clearance adjustment. Replace damaged parts and components.
 - (iii) Replace FD and ID fan bearings with new if required
 - (iv) Inspect fan casings and repair if required.
 - (v) Clean casings, prepare and repaint.
 - (vi) Inspect damper controls and dampers for free movement, fan impeller clearance adjustment, control movements and settings. Repair, service and replace any defective equipment.
 - (vii) Test fan motor windings for balanced phases, insulation test and check wiring.
 - (viii) Lubricate all required lubrication points as directed by the manufacturer.
 - (ix) Inspect fan mountings and repair if necessary.
 - (x) Reassemble and refit fans, damper controls and dampers.
- (c) Combustion controls - Refer to Standard Specification FA clause FA 16.03.03(c)
- (i) Inspect, service, adjust and repair where necessary combustion control equipment.
 - (ii) Lubricate all required lubrication points and replace oils as directed by the manufacturer.
 - (iii) Inspect mountings and repair if necessary.
- (d) Chimneys - Refer to Standard Specification FA clause FA 16.03.03(d)
- (i) Inspect and clean chimney stacks.
 - (ii) Inspect guyed cables securing points, repair if necessary and re-tension and secure fixing points.
 - (iii) Repair flashing and seal chimney stack roof penetrations.
 - (vi) Prepare and repaint chimney stacks.

PFA 05.03.04 Coal Handling and Conveying Equipment

Refer to clause FA 16.03.04

(a) Coal Bunkers

The coal bunkers or coal storage shall be inspected, cleaned out, and damaged structural elements and brickwork be repaired.

(b) Coal Conveying Equipment

The coal conveying equipment shall be inspected, serviced, tested, and repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the coal conveying equipment shall include at least all items listed in clause FA 16.03.04(b)

PFA 05.03.05 Ash and Grit Removal Equipment

Refer to clause FA 16.03.05

(a) Grit Collectors

The grit collector shall be inspected, serviced, tested, repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the grit collector shall include at least all items listed in clause FA 16.03.05(a)

(b) Ash Conveying Equipment

If ash conveying equipment are installed these equipment shall be inspected, serviced, tested, repaired and, where necessary, components be replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the ash conveying equipment shall include at least all items listed in clause FA 16.03.05(b)

(c) Ash and Grit Trolleys

All ash and grit trolleys are to be inspected, serviced and repaired where necessary.

PFA 05.03.06 Electrical installation, wiring and control panels

(a) Instrumentation and controls - Refer to Standard Specification FA clause FA 16.03.06(a)

- (i) Inspect, test, service and clean all instrumentation and control equipment.
- (ii) Inspect, test, service, recalibrate and adjust steam pressure detector and pressure gauge.
- (iii) Inspect all access ports and discharge ports and replace all joint seals and gaskets with new.
- (iv) Repair and/or replace any defective parts or/and components.

(b) General electrical power and lighting installation - Refer to Standard Specification FA clause FA 16.03.06(b)

- (i) Inspect, test, service and clean the complete general electrical power installation, including distribution boards, lighting, power points, etc.
- (ii) Repair and/or replace any defective parts or/and components, including replacing light fitting globes.

(c) Electrical control panels - Refer to Standard Specification FA clause FA 16.03.06(c)

- (i) Inspect, test, service and clean all the electrical control panels.
- (ii) Inspect and test the operation and condition of all MCBs, motor starters, overloads, indication lights, control equipment, selector switches, etc, and replace where necessary.
- (iii) Check and repair/replace all primary and secondary control panel wiring for proper conducting and replace where required.
- (iv) Clean out control panels interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

(d) Extract fans

- (i) Clean, check and repair

PFA 05.03.07 Water treatment equipment

- (a) Water softener - Refer to Standard Specification FA clause FA 16.03.07(a)
 - (i) Inspect, test, descale, service and clean the water softener equipment.
 - (ii) Sample and analyze feed-water, and adjust water softener to the correct water hardness as specified by boiler manufacturer.
 - (iii) Check and clean out salt container and recharge with salt.
- (b) Chemical dosing equipment - Refer to Standard Specification FA clause FA 16.03.07(b)
 - (i) Inspect, test, service, clean and re-commission the chemical dosing equipment and re-connect to the feed-water supplies.
 - (ii) Sample and analyze feed-water, and adjust chemical dosing equipment to the correct water quality as specified by boiler manufacturer.
 - (iii) Ensure that each chemical container is filled with the correct chemicals for this application.

PFA 05.03.08 Boiler house ancillary equipment

- (a) Blow-down sump - Refer to Standard Specification FA clause FA 16.03.08(a)
 - (i) Empty, clean out, de-sludge and inspect blow-down sump, manhole covers and frames, sparge pipe, vent and other piping for any defects and damages.
 - (ii) Repair/replace all defects and damages.
 - (iii) Put blow-down sump back into operation.
- (b) Ladders and galleries - Refer to Standard Specification FA clause FA 16.03.08(b)
 - (i) Clean and inspect ladders and galleries for any defects, corrosion, mountings and supports.
 - (ii) Repair/replace all defects and damage.
 - (iii) Prepare and repaint ladders and galleries.
- (c) Painting of equipment, plant and building - Refer to Standard Specification FA clause FA 16.03.08(c)
 - (i) Clean, prepare and repaint boiler house interior walls, structure, doors, frames, inside roof, etc, in accordance with Specification OWG 371: Specification of Materials and Methods to be used (Fourth edition, October 1993 or latest version).

PFA 05.03.09 Piped installations

- (a) Steam and condensate installation - Refer to Technical Specification FB: Steam Distribution Installations.
 - (i) Clean, test, inspect, service and repair all steam and condensate pipe fittings, accessories, components and equipment inside the boiler house.
 - (ii) Supply, deliver, install, test, commission, and hand over a water meter on the feed water line to each boiler inside the boiler house. This shall include all cutting into existing pipework, fixing, bracketing, fittings, testing and putting back into operation of the feed water line. This water flow meter shall be of Kent or equal and approved manufacture. This equipment shall be installed and commissioned as directed by the manufacturer complete with all ancillary equipment and components.
 - (iii) Repair/replace all defective and damaged equipment and components.
 - (iv) Fit a steam flow and pressure recorder. The recorder shall be capable of

graphically showing steam pressure in kilo-Pascals and flow in kg/hr on a monthly basis. In addition the recording system shall be capable of printing out the average steam pressure for the month as well as the total quantity of steam supplied either in kilograms or tonnes. The unit shall be complete with orifice plate and electronic data capturing equipment and all electrical connections and equipment required to enable it to function reliably under the conditions of high temperature imposed on it. It shall be a continuously rated device. Provision shall be made for easy and quick replacement of any component should it be required. A calibration certificate from a recognized testing authority competent to check the accuracy of the unit shall be supplied with it.

- (b) Blow-down pipe installation - Refer to Technical Specification FB: Steam Distribution Installations.
 - (i) Clean out blow-down pipe channel and replace all blow-down and drain pipework and accessories.
 - (ii) All blow-down and drain pipework shall be done with steam schedule 40 piping and welded fittings.
 - (iii) Check that the drainage point to the channel is open and functioning properly.
 - (iv) Test and hand over pipe system.

PFA 06 **DETAILS OF MAINTENANCE WORK**

PFA 06.01 **GENERAL**

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this repair and maintenance contract for Steam Boiler Plant from the commencement of the contract until final completion. The Contractor shall strictly adhere to Technical Specification FA: Steam Generating Installations, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

- (a) Routine preventative maintenance: A guideline to the required actions is provided in Specification FA. The actions will not be limited to these guidelines, but shall include all additional actions, work, materials, etc, necessary to maintain this installation at an acceptable level.
- (b) Corrective maintenance as described and defined in General Maintenance.
- (c) Breakdown maintenance as described and defined in General Maintenance.

For this particular installation fatal breakdown shall be defined as both boilers being unable to provide steam to the system.

Emergency breakdown shall be defined as any other equipment, components, and systems preventing the provision of steam at the required pressure and flow to the system.

PFA 06.02 **ADDITIONAL MATERIALS**

For this particular installation the contractor shall be responsible for providing the required quality and quantity of chemicals and salts to operate and maintain the boilers for a period of 36 months. The Contractor shall ensure that the boiler feed water supply to the boiler conforms to the following by providing the required water treatment.

- | | | |
|-------|------------------------|--------------------|
| (i) | Total dissolved solids | 350 mg/litre (max) |
| (ii) | Total alkalinity | 350 to 700 |
| (iii) | Caustic alkalinity | 350 mg litre (max) |

		150 mg/litre (min)
(iv)	Phosphate residual	30 to 60 mg/litre
(v)	Sulphate residual	30 to 50 mg/litre
(vii)	Calcium hardness	Zero
(viii)	pH	10.5 to 11.4

Sampling and analysis of feed water shall form part of the Contractor's routine preventative maintenance responsibilities. The chemicals and water treatment system shall comply in all respects with the specification FA 14 and the boiler manufacturer's requirements.

PFA 06.04 OPERATION OF THE BOILERS

a) Introduction

It is required in terms of this contract that the successful contractor, in addition to the functions described before, take over the day-to-day operation of the complete boiler house at the prison site.

b) Occupational Health and Safety Act

It is required that the boilers be operated at all times strictly in accordance with the regulations and requirements of the Occupational Health and Safety Act (as amended). This covers the following:

- (i) The boiler operators shall be qualified to operate the boilers in terms of the Act.
- (ii) The minimum number of operators required in terms of the regulations shall be adhered to at all times.
- (iii) Gauge glasses shall be blown down on a shift basis.
- (iv) The boilers shall be blown down on a regular basis as dictated by chemical water treatment requirements.
- (v) A comprehensive log book shall be kept of all operations carried out on the boilers.
- (vi) All statutory tests and requirements shall be met and recorded.

c) Steam Quality and Availability

It is required that steam be produced and be available immediately upstream of all pressure reducing valves and steam using appliances that operate at boiler pressure at a pressure in the range 600 - 750 kPa gauge at all times. It is estimated that the steam draw-off will amount to approximately 2300 kg's per hour at the St Albans Prison, boilers are however only rated to 1800 kg's per hour.

The current prison regime requires that steam be available for cooking purposes, laundry operation and domestic hot water production at least between the hours of 2h00 and 17h30 daily. Firing of the boilers will thus have to commence sufficiently in advance of this time to ensure sufficient steam supply to the kitchen for the morning meals to be prepared. To this end it is recommended (but not an absolute requirement) that a timer be fitted and wired into the boiler control panels to enable the boiler(s) on line to be "banked" overnight and to maintain pressure and temperature ready for the early morning steaming requirements.

d) Change-over of Boilers

It will be required that the boilers in use be changed on a minimum of a monthly basis in order that the steaming load be spread evenly between the two boilers and to provide adequate time for routine maintenance, cleaning and repair (as may be required from time to time). Maintenance and repair of the boilers shall be carried out as specified elsewhere in this document.

e) **Coal Supply**

It will be the **Department of Correctional Services'** responsibility to purchase an appropriate grade of coal suitable for firing in these boilers.

The **Department of Correctional Services** will be required to ensure that fuel is ordered in good time so as to ensure continuity of operation of the boiler plant.

f) **Method of Payment**

once approved a recording steam pressure/flow meter shall be installed in the boiler house to sense the steam pressure and flow in the main steam delivery line immediately outside the boiler house. The meter shall be capable of graphically recording the steam pressure over a monthly period together with the steam flow in tones per hour. In addition a facility shall be included to print out the average steam pressure for the period in question together with the total quantity of steam supplied during that period. It is recommended that the contractor have a spare or standby recorder available in case of breakdown of the steam flow recorder as payment will be dependant on these recordings.

Copies of these print-outs together with the graphical recordings shall be attached to claims for payment. Payment will thus be on the basis of a tendered rate per tonne of steam supplied. This rate shall include for the cost of boiler operators, supervisory staff, overheads and profit.

g) **Penalties**

Penalties for non-performance, lack of steam, etc will be levied as follows:

- (i) Steam leaks from piping, valves and fittings left unattended and not repaired for more than five days from the date of such leak being reported and noted - 5% of the tendered monthly operating rate or R 500-00 per day in excess of the five day period, whichever is the greater.

To this end it will be required that an incident book be kept in the boiler house and which shall be accessible for Department of Correctional Services personnel or the Departmental representative/Engineer /Department Representative to note the date and time of steam leaks being observed and reported to the contractor for repair. Penalties will only be levied in respect of leaks entered in the book and signed in acknowledgement by the contractor.

- (ii) Failure of steam supply – R 2 000-00 per day or part thereof should the lack be due to ineffective or inefficient boiler operation.

It is recognised that a lack of sufficient steam in, say, the kitchen could be due to damaged steam lines with the cause being beyond the boiler operators' control. The Departmental representative/Engineer /Department Representative will be required to take all relevant factors into consideration in determining whether penalties and in what amount are to be applied. In this respect the Departmental representative/Engineer 's/Department Representative's decision will be final.

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

PARTICULAR SPECIFICATION PFB - STEAM DISTRIBUTION INSTALLATION

CONTENTS

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PFB 01 SCOPE

- (a) This specification covers the particulars of the repair and maintenance work to the steam distribution installation at the St Albans Prison. This Particular Specification shall be read in conjunction with the Technical Specification FB: Steam Distribution Installations, and all additional and technical specifications compiled as part of this document, in particular the following Additional Specifications:

- SA: General Maintenance
SB: Operating and Maintenance Manuals
SC: General Decommissioning, Testing and Commissioning Procedures

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

- (b) The installations to be maintained under this Contract includes the following:
- (i) Steam and condensate distribution network on site;
 - (ii) Condensate pump systems;
 - (iii) Steam and condensate secondary piping systems to the following installations:
 - Laundry
 - Prison kitchens
 - Hot-water storage calorifier installations in boiler house.
 - Boiler plant room.
 - (iv) Hot-water calorifier installations form part of Installation B. The maintenance responsibilities of hot-water calorifier installations shall form part of this installation. Reference must be made to Technical Specification FC.

PFB 02 GENERAL DESCRIPTION OF INSTALLATION

PFB 02.01 EXISTING INSTALLATION

The existing steam distribution network on site is reticulated by means of an overhead pipe system from the Central Boiler House, situated adjacent to the main kitchen, to the various steam consumer installations listed as follows.

- (a) Central laundry (should it be required)
- (b) Kitchen (should it be required)
- (c) Hot-water calorifier installations in the boiler house

PFB 02.02 CONDENSATE RETURN

From these installations and all the steam trap arrangements, a condensate return gravity installation is installed along the same route as the steam distribution network, leading both to the boiler feeder tank inside the boiler house.

PFB 02.03 ROUTING OF PIPEWORK

The routing of this steam distribution network is as follows:

- (a) From the boiler house to the prison kitchen supported from wall/pole brackets \pm 25 metres;
- (b) From the boiler house to the central laundry supported from wall/pole brackets \pm 30 metres;

PFB 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

At the time of compilation of this document the existing installation consisted of the equipment and plant as listed below with their relevant technical details.

PFB 03.01 STEAM DISTRIBUTION PIPING

- 1 Pipe material: Schedule 40 seamless steam piping
- 2 Lagging and cladding: Fibreglass pre-formed sections with galvanised sheet metal muffs
- 3 Pipe route distance: \pm 1100 metres
- 4 Supports: Galvanised post type pole supports and wall brackets with chain hangers.

PFB 03.02 CONDENSATE DISTRIBUTION PIPING

- 1 Pipe material: Steel welded/flanged and Copper to SANS 460 with capillary solder fittings
- 2 Lagging and cladding: Fibreglass pre-formed sections with galvanise muffs
- 3 Pipe route distance: \pm 1100 metres
- 4 Supports: From steam support posts and hangers from steam lines

PFB 03.03 STEAM TRAP ARRANGEMENTS

- 1 Manufacturers: Armstrong & Spirax-Sarco
- 2 Type: Inverted bucket & float thermostatic
- 3 Model no: Various
- 4 Size: 15 & 20mm
- 5 Total number installed: \pm 55

PFB 03.04 PRESSURE-REDUCING VALVES

1	Manufacturer:	Armstrong or Spirax
2	Type:	External Pilot operated PRV
3	Model no:	Not available
4	Size:	40 mm dia
5	Quantity:	± 6
6	Down steam pressure:	100 kPa

PFB 03.05 CONDENSATE PUMP SYSTEMS

1.	Prison Kitchen	
1.1	Type:	Electrically driven pumps with condensate tank
1.2	Pump Model no:	TBA
1.3	Pump manufacturer:	Calpeda
1.4	Pump motor:	0,75 kW 3-phase 230 V 50 Hz
1.5	Condensate tank size:	TBA litre
1.6	Number of tanks:	1
1.7	Number of pumps:	2
1.8	Electrical control panel:	1

PFB 04 STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the existing installation has been noted as follows:

- (a) Some steam leaks exist on the distribution network.
- (b) The steam and condensate reticulation is generally in a good condition.
- (c) Some line trap sets on the distribution network discharge directly into the atmosphere.

PFB 05 DETAILS OF REPAIR WORK

The following work shall form part of the repair work to the steam distribution installation. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FB: Steam Distribution Installations, as set out in this document. The following work shall be included:

PFB 05.01 GENERAL

The Contractor shall at the start of the Repair and Maintenance Contract inspect the following items, systems, equipment, components and installations. This inspection shall include the establishing of any defects, leaks, conditions, damages, short falls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose it serves, etc. The Contractor shall report back to the Engineer/Departmental Representative in writing on all of the above and the following items. No repair work shall commence prior to approval by the Engineer/Departmental Representative:

- (a) Main and secondary steam and condensate pipe distribution network including all steam valves, expansion joints, pipe fittings, piping, air release valves, dirt pockets, etc;
- (b) Steam trap arrangements including steam traps, sight glasses, non-return valves, test valves, pipe connections, piping, etc;
- (c) Support and bracketing system to all steam and condensate pipe work;
- (d) Lagging and cladding of steam and condensate pipe work;
- (e) Pressure reducing valve installations;
- (f) Condensate pump installations.

The general scope of work at the time of going on tender is defined as follows:

- (a) Repair of all steam leaks;
- (b) The installation of blow-down valves and piping dirt pockets not equipped with blow-down valves.
- (c) Check, clean and repair condensate pump systems as required.
- (d) The servicing of all equipment including steam trap arrangements, PRV stations, valves, strainers, check-valves, pressure gauges, sight glasses, condensate pump system, control valves, safety valves, etc;
- (e) Flushing out of complete pipe system followed by a pressure test;
- (f) The Contractor shall allow for all required inspections and tests by an approved Inspection Authority on repair work where required by the Occupational Health and Safety Act as amended.
- (g) Preparation and painting of all exposed piping and equipment in accordance with the Department's painting specification; .
- (h) The introduction of a maintenance control plan, including logging, recording and control procedures;
- (i) Handing over of complete system to the satisfaction of the Engineer on completion of the repair work on which the maintenance period of this contract shall commence.

PFB 05.02 DETAIL WORK

PFB 05.02.01 Steam and condensate pipe reticulation network - Refer to Standard Specification FB clause FB 12

- (a) Repair and replace damaged and missing sections of lagging and cladding to the steam and condensate pipe system as directed by the Engineer/Departmental representative. This shall include new fibre glass pre-formed sections and sheet metal muffs for short runs of piping and fittings. Rates will be as entered in the Schedule of Quantities.
- (b) Clean and blow out all dirt pockets.
- (c) Install 15 mm diameter steam globe valves with plugged end as required to existing plugged dirt pockets on the steam distribution installation. This shall include reducing bush nipples, valves and plugs. Quantities will be as specified in the Schedule of Quantities.
- (d) Clean, service, repair and replace sight glasses to all sight glass units. This shall include gaskets and new glasses.
- (e) Service all steam traps and replace all gaskets, O-rings, seals, strainer elements, buckets, thermostatic elements, valve assemblies, etc, as specified necessary for a full service on the specific steam traps. Quantities will be as specified in the Schedule of Quantities.
- (f) Replace damaged and defective steam traps beyond repair. Quantities will be as specified in the Schedule of Quantities.
- (g) Service, all steam and condensate valves and replace seals, gaskets, and gland packings. Quantities as specified in the Schedule of Quantities.
- (h) Repair steam leaks to steam piping. This shall include cutting, preparing, welding, cleaning, testing and all required fittings and making good of lagging and cladding.
- (i) Blow down all dirt pockets.

PFB 05.02.02 Steam and condensate pipe installation to the calorifier plant installation in the boiler house - Refer to Standard Specification FB clause FB 12

- (a) Decommission, disconnect and dismantle existing steam and condensate pipes to each calorifier in turn, check and repair steam trap sets to each calorifier as required and check for correct operation.
- (b) Service and repair steam and condensate valves and fittings
- (c) Clean, service and repair condensate sight glasses
- (d) Test, commission and hand over the complete steam and condensate steam installation.
- (e) Repair all steam leaks
- (f) Blow down and clean all dirt pockets/drain points

- (g) Repair all damaged lagging and cladding
- (h) Put systems back on line

PFB 05.02.03 Steam and condensate installation to the calorifier plant installations at the single quarters - Refer to Standard Specification FB clause FB 12

- (a) Decommission, disconnect and dismantle existing steam and condensate pipes to each calorifier in turn, check and repair steam trap sets to each calorifier as required and check for correct operation.
- (b) Service and repair steam and condensate valves and fittings
- (c) Clean, service and repair condensate sight glasses
- (d) Test, commission and hand over the complete steam and condensate steam installation.
- (e) Repair all steam leaks
- (f) Blow down and clean all dirt pockets/drain points
- (g) Repair all damaged lagging and cladding
- (h) Put systems back on line

PFB 05.02.04 Steam and condensate installation to laundry - Refer to Standard Specification FB clause FB 12

- (a) Service and repair all steam traps.
- (b) Service and repair safety valve to existing PRV installation.
- (c) Service and repair pressure reducing valves
- (d) Repair and service all steam and condensate valves.
- (e) Service, repair and clean condensate sight glasses
- (f) Blow down all dirt pockets.
- (g) Re-commission and put system back on line.

PFB 05.02.05 Steam and condensate installation to kitchen - Refer to Standard Specification FB clause FB 12

- (a) Service and repair pilot operated PRVs.
- (b) Service and repair all steam traps.
- (c) Service and repair all steam and condensate valves.
- (d) Service, repair and overhaul steam pop-up safety valve.
- (e) Clean out, service, repair sight glasses including replacement of glasses and gaskets.
- (f) Blow down all dirt pockets.
- (g) Re-commission and put system both into operation.

PFB 05.02.06 Condensate pump installations - Refer to Standard Specification FB clause FB 12

- (a) Inspect and report back to the Engineer/Departmental Representative in writing on the condition and status of all the condensate pump installations and their associated equipment.
- (b) Drain, empty, clean out and inspect all condensate tanks for any defects or damages, and report to the Engineer/Department Representative. The Engineer/Department Representative shall inspect these tanks prior to any further work or/and put back into operation.
- (c) Inspect, service, tests and report on the condition and functionality of all level controls.
- (d) Inspect, service and report on electrical condensate pumps including the following as described in FB 12.09.02.
- (e) Inspect, service, test and repair electrical control panels as described in FB 12.11.02.

PFB 05.03 PAINTING

The Contractor shall prepare, clean and paint all steel surfaces and equipment where directed by the Engineer in accordance with Specification OWG 371: Specification of Materials and Methods to be used (Fourth edition, October 1993 or latest edition).

PFB 05.04 NEW EQUIPMENT

PFB 05.04.01 Condensate Pumps and Motors

(a) Condensate Pumps

Centrifugal pumps suitable for pumping hot, corrosive water are required for pumping condensate.

The required pump flow capacities and heads for each pump is 1,5 litres/sec at a head of approximately 20 - 25 metres.

It is essential that the following items of information be permanently marked on each pump:

- (i) flow capacity (l/sec);
- (ii) pump head (metres water gauge);
- (iii) impeller size;
- (iv) pump speed;
- (v) required motor power;
- (vi) make of pump;
- (vii) model;
- (viii) date of purchase.

Close coupled pumps/motors are not acceptable.

It is preferred that separate pumps and motors be supplied, mounted on a common rigid steel or cast iron frame.

Pumps must have shrouded impellers and replaceable wear rings. Impellers must be made of bronze or stainless steel and pump shafts must be of type 410 or 415 stainless steel.

Pump glands must be fully accessible without having to remove the motor. Gland packing must be PTFE and be readily replaceable.

Pump bearings, if not of the permanently lubricated type must be lubricated from an oil reservoir with sufficient capacity for at least six months operation.

The pump drive and coupling must be protected by a sturdy drive guard.

Pumps must be selected to operate at maximum efficiency. Pump speeds must not exceed 1450 rpm. and the installation must be quiet in operation.

Pumps must be mounted on drip trays neatly piped to the nearest drain point.

Pressure gauges must be fitted to pump discharge pipes. The normal operating pressure must be clearly marked on the dial face.

(b) **Motors**

Electric motors for condensate pump sets must be suitable for duty at ambient temperatures up to 60°C. Motors must be of the totally enclosed, drip proof, fan cooled type with life-time sealed bearings. Furthermore they must comply with the relevant BSI and SANS specifications. (SANS 948) (latest amendments.)

Motor control will be by means of the float/level switch specified in section 6.3 which will activate a direct-on-line starter.

Unless otherwise specified a suitably rated electrical supply will be brought into close proximity of the pump motor by others. The steam Contractor will be required to supply a switchboard containing a suitably rated isolator, circuit breaker, the necessary direct-on-line starter, etc. The steam Contractor will be required to terminate the cable brought in by others in the isolator and make the necessary connections to the motor.

It is essential that the board contain a low voltage release that will isolate the pump on voltage drop below 90% of the rated voltage. A timer is required to delay re-starting of the pump for 2 - 3 minutes after full power is restored. Similarly phase failure protection is required, again with the motor only restarting 2 - 3 minutes after restoration of full power. In both instances the motor must restart automatically.

A manual-auto switch is required on the board in order that the float switch can be over-ridden and the pump checked for maintenance purposes.

All electrical wiring must be done in accordance with the requirements of SANS 10142 (latest edition & amendments).

PFB 06 DETAILS OF MAINTENANCE WORK

PFB 06.01 GENERAL

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this repair and maintenance contract for Installation B. The Contractor shall strictly adhere to General Maintenance, and Technical Specification FB: Steam Distribution Installations, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

- (a) Routine preventative maintenance: A guideline to the required actions is provided in specification FB. The actions will not be limited to these guidelines, but shall include all additional actions, work, materials, etc, necessary to maintain this installation at an acceptable level.
- (b) Corrective maintenance as described in General Maintenance.
- (c) Breakdown maintenance as described in General Maintenance.

For this particular installation fatal breakdown shall be defined as no steam being available at all due to a failure of this system as a whole.

Emergency breakdown shall be defined as any other equipment, components, and systems preventing the provision of steam to the consumer points due to a failure of part of this system at the particular point of incident.

DEPARTMENT OF PUBLIC WORKS

FORT GLAMORGAN & MDANTSANE PRISON

REPAIR & MAINTENANCE PROGRAM - MECHANICAL INSTALLATIONS

PARTICULAR SPECIFICATION PFC - HOT-WATER GENERATING INSTALLATION

CONTENTS

PFC 01 SCOPE
PFC 02 GENERAL DESCRIPTION OF INSTALLATION
PFC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PFC 04 STATUS OF EXISTING INSTALLATION
PFC 05 DETAILS OF REPAIR WORK
PFC 06 DETAILS OF MAINTENANCE WORK

PFC 01 SCOPE

- (a) This specification covers the particulars of the repair and maintenance work to the hot-water generating installation at the St Albans Prison. This Particular Specification shall be read in conjunction with the Technical Specification FC: Hot-water Generating Installations, and all additional and technical specifications compiled as part of this document, in particular the following Additional Specifications:

- SA: General Maintenance
- SB: Operating and Maintenance Manuals
- SC: General Decommissioning, Testing and Commissioning Procedures

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Monthly maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after practical completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

- (b) The installations to be maintained under this Contract includes the following:
- (i) Storage calorifier installation in the Boiler House and various other installations;
 - (ii) All domestic water installations and equipment in the plant rooms;
 - (iii) All hot-water circulating pump sets;
 - (iv) Steam and condensate piping and equipment in the plant rooms;
 - (v) Electrical control equipment, wiring, cabling, panels and instrumentation associated with each installation.

PFC 02 GENERAL DESCRIPTION OF EXISTING INSTALLATION

The existing hot-water generating installations are situated in various plant rooms at the various prisons. These installations currently consist of storage calorifiers with steam heater batteries and a pipes distribution network from and to the storage calorifiers. These installations are equipped with in-line hot-water circulating pump sets. Steam is provided to the steam heater batteries by means of the steam distribution network on site.

These systems provide hot water for ablution facilities, consisting of wash-hand basins, wash troughs and showers to the following:

- (a) Main prison ± 900 inmates
- (c) Boiler house also provides hot water to the central laundry and kitchen.

The technical details of these installations are provided in section PFC 03.

PFC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

At the time of compilation of this document the existing installation consisted of the equipment and plant listed below with their relevant technical details.

PFC 03.01 TECHNICAL DETAILS: STORAGE CALORIFIERS

PFC 03.01.01 Various plant rooms on site positions on site

- | | | |
|----|------------------------------|-------------------------------------|
| 1. | Storage capacity: | 5 000 / 2500 litre/vessels |
| 2. | Number of vessels: | 10 |
| 3. | Steam heater banks | |
| | 3.1 Manufacturer: | Macrotec |
| | 3.2 Factory no: | MTSB005 |
| | 3.3 Capacity: | ± 0,001 m ³ /heater bank |
| | 3.4 Number of heater banks: | 1/vessel |
| | 3.5 Steam W.P.: | 700 kPa |
| | 3.6 Steam T.P.: | 1050 kPa |
| | 3.7 Manufacturing date: | 2011 |
| 4. | Steam heating control valve: | Horne 20 mm dia. |
| 5. | Water pressure: | ± 450 kPa |

PFC 03.02 CIRCULATING PUMPS

PFC 03.02.01 Boiler House

- | | | |
|----|------------------|--|
| 1. | Type: | In-line canned motor HW circulating pump |
| 2. | Number of pumps: | 2 |
| 3. | Manufacturer: | TBA |
| 4. | Model no.: | TBA |

PFC 04 STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the existing installations was noted as follows:

- (a) Boiler house installation:
 - (i) Generally in good condition
 - (ii) No condensate leaks
 - (iii) No water leaks from calorifiers
 - (iv) Circulating pump operational
 - (v) Lagging and cladding in good condition

PFC 05 **DETAILS OF REPAIR WORK**

The following work shall form part of the intended repair work to the hot-water generating installations. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FC: Hot-water Generating Installations, as set out in this document. The following work shall be included:

PFC 05.01 **GENERAL**

The Contractor shall at the start of the contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose they serve, etc. The Contractor shall report to the Departmental Representative/Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Departmental Representative/Departmental Representative/Engineer:

- a) Hot-water storage calorifiers, including lagging and cladding and steam heater batteries;
- b) Steam and condensate installation, including fittings, piping, valves, steam traps, lagging and cladding, etc;
- c) Bracketing system;
- d) Heating control equipment and instrumentation;
- e) Hot-water circulating pump sets;
- f) Electrical control panel and wiring.

The general scope of work at the time of going to tender is defined as follows:

- a) The servicing of all hot-water storage calorifiers
- b) Preparation and painting of all exposed piping and equipment in accordance with the manufacturer's specification;
- c) The servicing, repair and where necessary replacing of existing hot-water circulating pumps to all the storage calorifier installations, including all related electrical work;
- d) Handing over of complete systems, to the satisfaction of the Departmental Representative/Engineer, on completion of the repair work on which the maintenance period shall commence;
- e) The supply and compilation of operating and maintenance manuals;
- f) The testing, adjusting and commissioning of all systems;
- g) The introduction of a maintenance control plan, including logging, recording and control procedures.

PFC 05.02 **DETAIL WORK**

PFC 05.02.01 **Standby Hot Water Circulating Pumps**

Additional hot water circulating pumps complete with inlet and outlet valves, strainers and non-return valves are required. They shall have flow rates adjustable up to 5 cubic metres/hour at heads up to 6 metres wg and be of Salmson or equal and approved manufacture.

The additional pumps are required as standby units to the existing pumps and allowance must be made for cutting into the existing hot water return piping supplying and installing the necessary piping, fittings, valves, etc required to return the systems to full working condition.

PFC 05.03 **PAINTING**

The Contractor shall prepare, clean and paint all steel surfaces and equipment where directed by the Departmental Representative/Engineer in accordance with Specification OWG 371: Specification of Materials and Methods to be used (Fourth edition, October 1993 or latest version).

PFC 06 DETAILS OF MAINTENANCE WORK

PFC 06.01 GENERAL

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this repair and maintenance contract for Installation C. The Contractor shall strictly adhere to General Maintenance, and Technical Specification FC: Hot-water Generating Installations, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

- (a) Routine Preventative Maintenance. A guideline to the required actions is provided in specification FC. The actions will not be limited to these guidelines, but shall include all additional actions, work, materials, etc, necessary to maintain this installation at an acceptable level.
- (b) Corrective Maintenance as described and defined in General Maintenance.
- (c) Breakdown Maintenance as described and defined in General Maintenance.
- (d) For this particular installation no fatal breakdown is applicable.
- (e) Emergency breakdown shall be defined as no provision of hot water to the consumer points due to a failure of equipment, components and systems of this particular installation.

Section 1 OCCUPATIONAL HEALTH AND SAFETY

Definition : The “Principal Contractor” as defined in the Construction Regulations and used in this section of the specification shall mean the “Contractor” as defined in clause 1.1.8 of General Conditions of Contract 2004.

CONTENTS

1. Applicable legislation and regulations
2. Scope of work
3. The principle contractor’s general duties
4. The principle contractor’s specific duties
5. The principle contractor’s specific duties with regard to Hazardous work activities

1. APPLICABLE LEGISLATION AND REGULATIONS

This document was prepared to guide the Agent in the compilation of a Health and Safety Specification in terms of Sub-regulation 4(1)a of the Construction Regulation as published under Government Notice R.2003 of 18 July 2003. The content of this document or the fact it was made available for the use of the Agent will not relieve the Agent of any of his obligations in terms of the act.

The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) together with its applicable Regulations (“the Act”) forms part of this Health and Safety Specification. Any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned to it unless the context otherwise indicates

SCOPE OF WORK

All work forming part of this Contract is divided into various sites. The repair work to be performed as well as any installation work under this Contract mainly consists of the works described in the project specification C2.1.

THE PRINCIPAL CONTRACTOR’S GENERAL DUTIES

The Principal Contractor’s general duties in terms of this Health and Safety Specification are, but not limited to, the following:

1. Every Principal Contractor shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees and other contractors.
2. Without derogating from the generality of a Principal Contractor’s duties under subsection (1), the matters to which those duties refer include in particular -
 - a. the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;
 - b. taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees and other contractors, before resorting to personal protective equipment;
 - c. making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;
 - d. establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what

- precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;
- e. providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees and other contractors;
 - f. not permitting any employee or contractor to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;
 - g. taking all necessary measures to ensure that the requirements of this Health and Safety Specification are complied with by every person in his employment or on premises under his control where plant or machinery is used;
 - h. enforcing such measures as may be necessary in the interest of health and safety;
 - i. ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and
 - j. causing all employees and other contractors to be informed regarding the scope of their authority as contemplated in section 37(1)(b) of the Act.

THE PRINCIPAL CONTRACTOR’S SPECIFIC DUTIES

Principal Contractor’s specific duties in terms of this Health and Safety Specification are specified in the Construction Regulation as published under Government Notice R. 2003 of 18 July 2003. (Hereinafter referred to as “Construction Regulation, 2003”).

The Principal Contractor is specifically referred to the following sub regulations of the Construction Regulation, 2003:

	Applicable subregulation of the Construction Regulation, 2003.
	1
Scope of application	2
Notification of construction work	3
Principal Contractor and Contractor	5
Supervision of construction work	6
Risk assessment	7
Approved inspection authorities	29
Offences and penalties	30
Withdrawal of regulations	31

Principal Contractor will acquaint himself with these duties and will make provision in his Contract price for the implementation and supervision of these duties.

THE PRINCIPAL CONTRACTOR'S SPECIFIC DUTIES WITH REGARD TO HAZARDOUS WORK OR ACTIVITIES

The following work or activities are defined as hazardous in terms of the Construction Regulations, 2003 and it is the duty of the Principal Contractor to ensure that the said work and activities are performed or carried out in terms of the relevant sub regulations of the Construction Regulation, 2003 and other applicable Regulations.

Hazardous work or activity	Applicable subregulation of the Construction Regulation, 2003.	Other applicable Regulations
Fall protection	8	
Structures	9	
Formwork and support work	10	
Excavation	11	Precautionary measure as stipulated for confined spaces under the General Safety Regulations published under Government Notice R.1031 of 30 May 1986, as amended.
Demolition work	12	Asbestos related work will be conducted in accordance with the Asbestos Regulations published under Government Notice R. 155 of 10 February 2002 as amended. Lead related work will be conducted in accordance with the Lead Regulations published under Government Notice R. 236 of 28 February 2002 as amended.
Tunnelling	13	Any tunnelling activities will comply with the Tunnelling Regulations published under the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) as amended.
Scaffolding	14	Section 44 of the Act.
Suspended scaffolds	15	Section 44 of the Act.
Boatswains chairs	16	

Hazardous work or activity	Applicable subregulation of the Construction Regulation, 2003.	Other applicable Regulations
Material hoists	17	
Batch plants	18	<p>Precautionary measure as stipulated for confined spaces under the General Safety Regulations published under Government Notice R.1031 of 30 May 1986, as amended.</p> <p>The Principal Contractor will ensure that all lifting machines and lifting tackle used in the operation of batch plant complies with the requirements of the Driven Machinery Regulations as published under Government Notice R.295 of 26 February 1988, as amended.</p> <p>The Principal Contractor will ensure that all precautionary measures are adhered to regarding the usage of electrical equipment in explosive atmospheres when entering a silo, as stipulated in the Electrical Installation Regulations as published under Government Notice R.2271 of 11 October 1995, as amended.</p>
Explosive powered tools	19	
Cranes	20	Applicable provisions of the Driven Machinery Regulations as published under Government Notice R.533 of 16 March 1990, as amended.
Construction vehicles	21	
Electrical installations and machinery on construction sites.	22	Applicable provisions in the Electrical Installation Regulations published under Government notice R.2920 of 23 October 1992 and the Electrical Machinery Regulations published under Government Notice R.1953 of 12 August 1988 respectively as amended.

Hazardous work or activity	Applicable subregulation of the Construction Regulation, 2003.	Other applicable Regulations
Use and temporary storage of flammable liquids on construction sites.	23	Applicable provisions as stipulated in the General Safety Regulations published under Government Notice R.1031 of 30 May 1986, as amended.
Water environments	24	
Housekeeping on construction sites.	25	Applicable provisions as stipulated in the Environmental Regulations for Workplaces published under Government Notice R.2281 of 16 October 1987, as amended.
Stacking and storage on construction sites.	26	Applicable provisions as stipulated in the General Safety Regulations published under Government Notice R.1031 of 30 May 1986, as amended.
Fire precautions on construction sites.	27	Applicable provisions as stipulated in the Environmental Regulations for Workplaces published under Government Notice R.2281 of 16 October 1987, as amended.
Construction Welfare facilities	28	Applicable provisions as stipulated in the Facilities Regulations under Government Notice R.1593 of 12 August 1988, as amended.