(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 12.03.08 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 13 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FA 13.01 GENERAL

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 3-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 categorized 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 13.02 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 13.02/1, FA 13.02/2, FA 13.02/3, FA 13.02/4, FA 13.02/5 and FA 13.02/6 below under the respective headings.

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

TABLE FA 13.02/1: DAILY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION ACTION	ACTION RESPONSIBILITY
1	Measure CO_2 content of exhaust with CO_2 analyzer.	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. 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; Check/Record
7	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
8	Complete log book actions as specified in FA 05, FA 09, FA 10, FA 11 and FA 12. Boiler house supervisor	Boiler house supervisor; Check/Record

TABLE FA 13.02/2: WEEKLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION ACTION	ACTION RESPONSIBILITY
1	All as listed under table FA 13.02/1	Boiler house supervisor and Contractor; Check/Record/Adjust/Repair
2	Test safety valves as described by the boiler manufacturer.	Contractor; Check/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 soot blowers, stoker drive shaft bearings, guillotine door and check stoker	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 13.02/3: MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION ACTION	ACTION RESPONSIBILITY
1	All as listed under tables FA 13.02/1 and FA 13.02/2	Boiler house supervisor and Contractor; Check/Record/Adjust/Repair
2	Clean out all strainers.	Contractor; Check/Service/Record
3	Inspect and test soot blowers 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/Replace
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/Record/Replace
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; Check/Record/Repair
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 13.02/4: THREE-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION ACTION	ACTION RESPONSIBILITY
1	All as listed under tables FA 13.02/1, FA 13.02/2 and FA 13.02/3	Boiler house supervisor and Contractor; Check/Record/Adjust/Repair
2	Lubricate ID and FD damper control units.	Contractor; Check/ Record Service
3	Replace ID and FD fan bearing grease.	Contractor; Check/ Record Service
4	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	Check boiler water side for scale deposits and clean and de-scale.	Contractor; Check/ Record/Service/Repair
6	Replace stoker gear box and drive oils.	Contractor; Check/ Record/Service/Repair
7	Check, inspect, service all coal conveying equipment and repair where necessary.	Contractor; Check/ Record/Service/Repair
8	Check, inspect, service and repair if necessary grit collectors and chimney stacks.	Contractor; Check/ Record/Service/Repair
9	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	ACTION RESPONSIBILITY
1	All as listed under tables FA 13.02/1, FA 13.02/2 and FA 13.02/3	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 13.02/6: ANNUAL ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION ACTION	ACTION RESPONSIBILITY
1	All as listed under tables FA 13.02/1, FA 13.02/2, FA 13.02/3 and FA 13.02/4	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	Contractor; Inspect/Test/Service/Repair

FA 13.03 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 13.04 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.

FA 14 MAINTENANCE, SERVICING AND REPAIRS TO INCINERATORS

FA 14.01 Applicable regulations

All applicable regulations regarding incinerators shall be adhered to including;

Department of Public Works specifications

- OWG 371 A&B Specification of materials and methods to be used (latest version)
- STD.PWD Standard Specification for incinerators

- 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.

- Manufacturers' specifications, codes of and practice and installation instructions.

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

- All 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 14.02 MAINTENANCE, SERVICING AND REPAIRS TO GAS & OIL FIRED BOILERS INCINERATORS

14.02.01. Description of installation in various areas

- South African Police Service Complex (SAPS) consist of, hot water systems, incinerators and heating plant equipment.
- Military Bases consists of hot water systems, incinerators and heating plant equipment
- Correctional Services: Prisons consist of hot water systems and incinerators.
- All Departments falling under others, such as Home Affairs, Labour, and smaller non - complex SAPS Stations will be attended to as is required.

14.02.02. The description of the service required entails the following:

The servicing of the units as per the attached checklist included under additional forms of this specification.

Prices for servicing include checking of equipment as stipulated in schedule and must, include, labour, transport, consumables, minor and incidental repairs and all other overheads.

FB: STEAM DISTRIBUTION INSTALLATIONS

CONTENTS

FB 01 SCOPE

This specification covers the general term contract 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 the User Client Department, associates, and maintenance staff.

This specification shall form part of the term contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document. In the event of any discrepancies between these documents, the contradiction must be brought to the attention of the relevant department official, who will make a decision for which contradictory statement will take precedence. The decision taken will be final, and the Contractor must adhere to such a decision.
The Contractor will at all times adhere to this specification, unless otherwise specified in writing by the department official.

FB 02 STANDARD SPECIFICATIONS AND REGULATIONS

The following standards and regulations are to be read in conjunction with this document;

a) SANS 10142: The wiring of premises.
b) SANS 10400: South Africa's National Building Regulations.
c) SANS 10140: Identification colour marking.
d) SANS 10044: Welding.
e) SANS 460: Plain-ended solid drawn copper tubes for potable water.
f) SANS 10103: The measurement and rating of environmental noise with respect to annoyance and to speech communication.
g) SANS 347: Categorization and conformity assessment criteria for all pressure equipment.
h) SANS 982: High-pressure high-vacuum steam sterilizers (autoclaves).
i) SANS 16528: Boilers and pressure vessels
j) Pressure Equipment Regulations 2009, Department of Labour.
k) Occupation Health and Safety Act, Act 85 of 1993.
l) National environmental management act: air quality act, 2004 (act no. 39 of 2004).
m) Department of Public Works standard specification: Boiler standard specifications for installations, maintenance, repair and operations.

n) Equipment manufacturers' standards, codes 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.

o) Municipal regulations (by-laws): All municipal regulations, by-laws and special requirements of the Local Authority will be adhered to unless otherwise stated.

The latest edition, including all amendments up to the date of tender, of the above standards and regulations, will be deemed to form part of this specification.

FB 03 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals for the complete installation. The operating manuals supplied shall include the operating a maintenance manuals from the manufacturer.

All requested information shall be recorded and produced in an electronic format on a CD, as well as three sets of hard copies are to be supplied to the Department. Proof of such a submission is to also be submitted.

Additionally to the manufacturers operating and maintenance manual, the compiled operating and maintenance manual shall be structured to include the following;

(a) System description;

i. Complete system description and the operation 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.

(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;

- Three copies of paper prints of all as-built mechanical and electrical drawings.
- CD of all as-built mechanical and electrical drawings.
- Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

FB 04 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this term contract institute a logging and recording system as part of his maintenance control plan. 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 Departmental Representative/Engineer and shall only be utilized by authorized maintenance personnel. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Departmental Representative/Engineer.

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 Departmental Representative/Engineer. This register shall be completed by all persons visiting the installation, including;

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

FB 05 TESTING AND INSPECTIONS ON COMPLETION OF REPAIR WORK

Unless otherwise stated in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and required calibrated and certified instruments necessary for conducting all required testing. The Contractor shall make arrangements for required testing and shall give a minimum of 72 hours written notice to the Departmental Representative/Engineer before the testing takes place.

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 Department or the Departmental Representative/Engineer to attend the repeated test.

The testing operation shall operate the entire system for a period specified by the manufacturer and as long as required to prove a satisfactory performance of the installation.

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

Once the installation is completed it shall be tested and adjusted 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 testing certificates shall contain, time details, the conditions of the test, the results obtained etc.

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

FB 06.01 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 Departmental Representative/Engineer. Where a new plant is installed, the Contractor shall run and operate the system for a period of time as specified by the Departmental Representative/Engineer 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 06.02 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 have been done in accordance with the 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 all control equipment such as pressure-reducing valves, heat control equipment, etc. And ensure they 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 installation and operation of all condensate trapping arrangements.

k) Check, test and inspect the 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 lagging 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 in equipment, piping 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 on 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 the period specified by the manufacturer to ensure free movement and correct operation. The feed pumps are to be only operated for a short interval to verify the rotation.

Commissioning of equipment;

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

a) All level and warning system checks are to be performed on the water-level control system.
b) During load conditions the equipment shall be readjusted and switched to automatic operation.
c) Check steam pressure valves under load conditions and readjust where necessary.
d) Check the operation of all steam trap arrangements.
e) Check the operation of the condensate pumping system and readjust where necessary.
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 will 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 07 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 term 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. 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 have access. 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 Departmental

Representative/Engineer. 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.

Spare pressure gauges, at least one of each range and type.

FB 08 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FB 08.01 GENERAL

During the term 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 term 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 08.02 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 expansion movement of not less than 150 % of the predicted maximum in the location for which they are intended, without damage. Bellows expansion joints which are strained during tests due to being wrongly located, etc., shall at the Departmental Representative / Engineer'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 Departmental Representative / Engineer 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 08.03 STEAM AND CONDENSATE PIPEWORK

FB 11.03.01 Steam and condensate piping and fittings

During the term 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 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 SANS 62 with threads complying with SANS 1109-1:2005 (ISO 7-1:1994).

All welded fittings shall be seamless carbon steel butt welded fittings complying with SANS 62.

(b) Condensate piping

All condensate pipes shall be copper tubing class 2 in accordance with SANS 460:2011 with capillary soldered copper fittings conforming to SANS 1067-2:2005

(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 Departmental Representative / Engineer a welder is not competent, the Departmental Representative / Engineer 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 SANS 1109-1:2005 (ISO 7-1:1994) 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 term 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 Departmental Representative / **Engineer** 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 08.04 LAGGING AND CLADDING

The Contractor shall at the start of the term 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 fiberglass 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

Fiberglass must be of 88 to 96 kg/m^3 density. Mineral wool must have a density in the range 160 - 185 kg/m^3.

FB 08.05 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 Departmental Representative / Engineer.

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 08.06 STEAM TRAP ARRANGEMENTS

The Contractor shall at the start of the term 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 at the 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
Finned radiation and pipe coils (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
Process air heaters (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	IB or F & T	2:1

(Constant pressure)		
(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
Jacketed kettles (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 08.06.01 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 reseat 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 08.06.02 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 08.07 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 Departmental Representative / Engineer 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 reseated.
(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 reseat 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 08.08 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the term 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 08.08.01 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 08.08.02 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 08.09 CONDENSATE PUMPING INSTALLATIONS

The Contractor shall at the start of the term 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 08.09.01 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 08.09.02 Electrical operated automatic condensate pumps

The condensate 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 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, and readjust the level controls on the condensate tank.

FB 08.10 STEAM AND CONDENSATE PIPING ANCILLARY EQUIPMENT

The Contractor shall at the start of the term 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 08.11 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS

FB 08.11.01 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 08.11.02 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 09 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FB 09.01 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 3-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 09.02 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 09.02/1, FB 09.02/2, FB 09.02/3 and FB 09.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FB 09.02/1: 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 Departmental Representative / Engineer.	User Client	Check/Record/Report

TABLE FB 09.02/2: MONTHLY ACTIONS AND MAINTENANCE

Item	Maintenance description	Action Responsibility	Action
1	All as listed under table FB 09.02/1	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 09.02/3: SIX-MONTHLY ACTIONS AND MAINTENANCE

Item	Maintenance Description	Action Responsibility	Action
1	All as listed under tables FB 09.02/1 and FB 09.02/2	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 09.02/4: ANNUAL ACTIONS AND MAINTENANCE

Item	Maintenance Description	Action responsibility	Action
1	All as listed under tables FB 09.02/1, FB 09.02/2 and FB 09.02/3	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 09.03 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 09.04 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.

FC - HOT-WATER GENERATING INSTALLATIONS

CONTENTS

FC 01 SCOPE

This specification covers the general term contract 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 term 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 deemed to form part thereof:

FC 02.01.01 SANS and other specifications and codes

SANS 10400	- The applications of the building regulations
SANS 10142	- Code of practice for the wiring of premises
SANS 10140	- Identification colour marking
SANS 10044-1	- Parts I to IV: Welding
SANS 460	- Copper tubes for domestic plumbing
SANS 10252	- Parts I and II
SANS 10103	- 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 EN 12953-1:2002, BS EN 12953-2:2002, BS EN 12953-5:2002, BS EN 12953-6:2002, BS EN 12953-8:2001

BS 1740 - BS EN 10241:2000

BS 21 – BS EN 10226-1:2004, BS EN 10226-2:2005, BS EN 10226-3:2005

BS 1640 - BS EN 10253-2:2007

BS 5500 - BS PD 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 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 04 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this term 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 Departmental Representative / Engineer and shall only be utilized by the maintenance personnel, the Contractor and the Departmental Representative / Engineer. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Departmental Representative / Engineer.

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 Departmental Representative / Engineer. This register shall be completed by all persons visiting the installation, including:

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

FC 05 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 Departmental Representative / Engineer 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 Departmental Representative / Engineer 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 a readjusted until it operates to the satisfaction and approval of the Departmental Representative / Engineer. 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 06 COMMISSIONING AND RE-COMMISSIONING OF PLANT AND INSTALLATION

FC 06.01 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 Departmental Representative / Engineer. Where new plant is installed the Contractor shall run and operate the system for a period of time as specified by the Departmental Representative / Engineer 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 06.02 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 06.03 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 07 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 term 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 Departmental Representative / Engineer. 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 08 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FC 08.01 GENERAL

During the term contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but no 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 categorized 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 term 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 08.02 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 08.03 STEAM AND CONDENSATE PIPEWORK

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

FC 08.04 HOT-WATER STORAGE VESSELS

FC 08.04.01 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 Departmental Representative / Engineer in advance to allow the Departmental Representative / Engineer 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 Departmental Representative / Engineer. 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 FC08.06.

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 08.04.02 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) Spurge 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 Departmental Representative / Engineer for approval.

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

FC 08.04.03 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 term contract.

All the thermostat controls and safety cut outs shall be cleared, inspected, tested, and 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 08.05 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 term contract. The Contractor shall report his findings to the Departmental Representative / Engineer 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

fiberglass 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 fiberglass rope covered with a 12 mm thick layer of self-setting fiber cement. A reinforcing gauze shall be wrapped over the fiber cement while wet and then painted with mastic paint when dry.

Table FC 08.05/1 below provides a guideline for the preformed fiberglass section thickness to be used.

The fiberglass sections shall have a density of 88 at least kg/m^3.

TABLE FC 08.05/1: 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 08.06 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 Departmental Representative / Engineer 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 Departmental Representative / Engineer.

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 08.07 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 (Dry Film Thickness) of one millimetre, similar or equal to a Polygrass VE lining as supplied by Corrocoat, 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 08.08 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 Departmental Representative / Engineer 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 Departmental Representative / Engineer.

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 Departmental Representative / Engineer 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 08.08/1.

TABLE FC 08.08/1: 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 08.09 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the term 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 08.09.01 Steam 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 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 reseat.

(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 08.09.02 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 08.10 PRIMARY AND SECONDARY PUMP INSTALLATIONS

The Contractor shall at the start of the term 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 08.11 DOMESTIC HOT AND COLD WATER INSTALLATIONS

The Contractor shall at the start of the term 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 Departmental Representative / Engineer 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 08.12 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS

FC 08.12.01 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 08.12.02 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 09 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FC 09.01 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 3-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 09.02 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 09.02/1, FC 09.02/2, FC 09.02/3 and FC 09.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FC 09.02/1: WEEKLY ACTIONS AND MAINTENANCE

Item	Maintenance description action	Action responsibility
01.	Inspect equipment, components and installations for any visible defects, leaks, damages and/or pending faults.	Contractor: Check/Record
02.	Check and record all pressure gauge temperature and flow meter readings, and readjust equipment if necessary.	Contractor: Adjust/Check/Record
03.	Check operation of pumps, heating equipment and controls for correct functioning.	Contractor: Check/Record
04.	Check electrical control panels for any faults.	Contractor: Check/Record
05.	Report any faults, defects, leaks, damages, etc., to Engineer/Departmental Representative.	User/Client: Check/Record/Report

TABLE FC 09.02/2: MONTHLY ACTIONS AND MAINTENANCE

Item	Maintenance description action	Action responsibility
01.	All as listed under table FC 09.02/1	Contractor/User Client: Check/Record/Adjust/Repair/Report
02.	Blow down all dirt pockets and record.	Contractor: Service/Record
03.	Clean out all strainers and record.	Contractor: Service/Record
04.	Check all valve gland seals and packings for leaks and replace and repair if necessary.	Contractor: Check/Service/Repair/Record
05.	Check, inspect and repair if necessary all expansion joints for leaks and damages	Contractor: Check/Repair/Record
06.	Check all safety devices for correct operation and repair and replace where necessary.	Contractor: Check/Service/Repair/Record
07.	Check and test all electrical control functions and operations. Repair and report any faults and defects.	Contractor: Check/Service/Repair/Record
08.	Complete logbook and report.	Contractor: Report

TABLE FC 09.02/3: FOUR-MONTHLY ACTIONS AND MAINTENANCE

Item	Maintenance description action	Action responsibility
01.	All as listed under tables FC 09.02/1 and FC 09.02/2.	User Client/ Contractor: Check/Record/Adjust/Repair
02.	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
03.	Service, repair, replace glasses and gaskets where necessary and clean all sight glasses	Contractor: Check/Service, Repair, Report
04.	Repair lagging and cladding where necessary.	Contractor: Check/Repair/Report
05.	Repair all steam leaks	Contractor: Check/Repair/Report
06.	Repair all water leaks.	Contractor: Check/Repair/Report
07.	Inspect and test all heating equipment Repair where necessary.	Contractor: Check/Repair/Report

08.	Inspect all hot -water storage vessels for any leaks and packing faults. Repair if necessary.	Contractor: Check/Repair/Report
09.	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 09.02/4: ANNUAL ACTIONS AND MAINTENANCE

Item	Maintenance description action	Action responsibility
01.	All as listed under tables FC 09.02/1, FC 09.02/2 and FC 09.02/3.	User Client / Contractor: Check/Record/ Adjust/Repair
02.	Drain, clean out, inspect and repair all defects and linings on hot-water storage vessels.	Contractor: Inspect / Test / Service / Repair
03.	Inspect and repaint all equipment where required.	Contractor: Inspect / Test / Service / Repair
04.	Remove, strip, service, repair, adjust and replace where necessary all pressure control and safety valve equipment.	Contractor: Service / Repair / Adjust / Report
05.	Complete logbook and report.	Contractor: Report

FC 09.03 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.

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.

PARTICULAR SPECIFICATION

The Particular Specification of the document contains the particulars of the repair and maintenance work related to Boilers.

PFA - STEAM GENERATING INSTALLATION

CONTENTS

PFA 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the steam generating installation at DCS - Ncome 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. The Departmental representative / Engineer shall instruct the contractor to conduct repair or maintenance work that is to be completed and maintained by the Contractor for the full duration of the 24 months Contract period.

(b) The installations to be maintained under this Contract includes the following:

(i) 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 at DCS - Ncome Prison, entry is via Client Representative. This installation generates steam by means of Coal fired Boiler, which is distributed via a steam and condensate reticulation network to all steam consumption equipment at this facility.

This installation provides the following plant and installations with steam:

(a) Central laundry
(b) Central kitchen
(c) Hot-water calorifier installation which serves the kitchen, laundry and ablution facilities

NB: The laundry and kitchen do not form part of this contract.

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.

	Manufacturer	
2	Model no.	
3	Boiler Serial no.	
4	Registration Certificate no.	
5	Boiler type	
6	Design code	
7	Factory no.	
8	Manufacturing date	
9	Maximum continuous rating	
10	Design pressure rating	
11	Authorised working gauge pressure	
12	Normal operating pressure	
13	Safety blow-off pressure	
14	Stoker make & type	
15	Stoker motor capacity	
16	Feed pumps	
17	Feed pump power capacity	
18	Chimney stack type	
19	Boiler control panel	
20	Level controls	

NB: All the technical details must be filled in and if more than one boiler is maintained or repaired under this contract, the table must be duplicated accordingly to ensure technical details of all boilers are captured.

PFA 03.03 TECHNICAL DETAILS: FEED-WATER TANK

1	Dimensions	
2	Division wall	
3	Quantity	
4	Capacity	
5	Make-up water	
6	Insulation	
7	Heating equipment	

PFA 03.04 TECHNICAL DETAILS: WATER SOFTENER PLANT

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

PFA 03.05 TECHNICAL DETAILS: CHEMICAL TREATMENT EQUIPMENT

1	Type	
2	Quantity	
3	Model no	
4	Service provider	
5	Chemical container	

PFA 03.06 TECHNICAL DETAILS: OPERATOR TOOLS AND SPARES

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

	Tool	Quantity
1	Coal spades	
2	Coal rakes	
3	Grease gun	
4	Step ladders	
5	Blow-down spanners	
6	Goggles	

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:

- 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 diameter 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 as follows:

(a) Boiler no 1

(i) Boiler approximate age
(ii) Brief description of how the boiler has been maintained
(iii) Brief description of the boiler overall condition

(b) General

(i) Feed-water tank and pumps condition
(ii) Pumps condition
(iii) Chemical dosing equipment and water softener condition

NB: If more than one boiler is repaired or maintained under this contract, part (a) (boiler status) must be duplicated accordingly to ensure the status of all boilers is captured. All other equipment or systems should be included under part (b) (General) to ensure a complete status of the whole installation is provided to the department.

PFA 05 DETAILS OF REPAIR WORK REQUIRED

The following work shall form part of the repair work to the steam generator 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 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):

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

No work shall be done to decommission any boiler unless there is a fully operational boiler in the boiler house i.e. 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) Testing and re-commissioning of all equipment and installations as may be required and directed by the Departmental Representative/Engineer.
(b) Implementation of control plans for fuel delivery, water treatment and boiler efficiency by the Contractor.
(c) Supply and compilation of maintenance manuals.

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 and external inspection and hydraulic pressure test in accordance with the manufacturer's specification, the Occupational Health and Safety Act, no 85 of 1993 (as amended) and as specified in Technical Specification FA, on the boiler(s) inside the plant room. During this period all boiler ancillary equipment and components shall be repaired as may be required, serviced, adjusted and tested. The work shall include:

PFA 05.02.01 Internal and external inspection

(a) Decommissioning of boiler(s) and electrical isolation;

(b) All required preparation work for the internal and external inspection to the boiler(s), 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;

(f) Reassembling, recasting, refitting and adjustment of all boiler equipment components and ancillary equipment.

PFA 05.02.02 Hydraulic pressure tests

(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;

(e) Reassembling, recasting, refitting and adjustment of all boiler equipment, components and ancillary equipment.

PFA 05.03 REPAIR WORK TO BOILERS AND ANCILLARY EQUIPMENT

The following refers to work required in preparing boilers for statutory inspections. Refer to Standard Specification FA clause FA 13.03.

PFA 05.03.01 Coal-fired boilers

(a) Boiler shell water side:

(i) Clean out and descale boiler.

(ii) Inspect boiler water side and integral pipework.

(iii) Replace all manhole, hand hole and mud hole cover seals and joint rings.

(iv) Replace fusible plug.

(v) Execute any required repair work to boiler as directed by the Inspection Authority or the Departmental representative/Engineer.

(b) Boiler shell gas side:

(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:

(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:

(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:

(i) Remove and break down all refractories and brickwork.

(ii) Recast and install new brick work on completion of inspection.

(f) Lagging and cladding:

(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:

(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:

(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:

(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:

(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:

(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:

(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:

(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

(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.

PFA 05.03.05 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.

(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.

(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:

(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:

(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:

(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 penal 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:

(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:

(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.

(ii) 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:

(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:

(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:

(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

Refer to Technical Specification FB: Steam Distribution Installations.

(a) Steam and condensate installation:

(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:

(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
(b) Corrective maintenance
(c) Breakdown maintenance

The actions will not be limited to only the guidelines provided in the Technical Specification FA, but shall also include all additional actions, work, materials, etc., necessary to maintain this installation at an acceptable level.

For this particular installation fatal breakdown shall be defined as all boilers in the boiler house 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 24 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
(vi)	Calcium hardness	Zero
(vii)	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 11 and the boiler manufacturer's requirements.

PFA 06.03 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 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 boilers and however only rated to 1800 kg's per hour.

The current facility requires that steam be available for cooking purposes, laundry operation and domestic hot water production at least between the hours of 2h00 A.M and 17h30 P.M 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 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 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.

PFB - STEAM DISTRIBUTION INSTALLATION

CONTENTS

PFB 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the steam distribution installation at the **Dcs: Ncome 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. The Departmental representative / Engineer shall instruct the contractor to conduct repair / maintenance work that is to be completed and maintained by the Contractor for the full duration of the 3-month Contract period.

(b) The installations to be maintained under this Contract include 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.

NB: The above installations must be adjusted according to the site requirements.

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

NB: The above installations are site specific and must be adjusted accordingly.

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 ± 25 metres;

(b) From the boiler house to the central laundry supported from wall/pole brackets ± 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

No.	Item	Technical Details
01.	Pipe material	Schedule 40 seamless steam piping
02.	Lagging and cladding	Fiberglass pre-formed sections with galvanized sheet metal muffs
03.	Pipe route distances	± 900 meters
04.	Supports	Galvanized post type pole supports and wall brackets with chain hangers.

PFB 03.02 CONDENSATE DISTRIBUTION PIPING

No.	Item	Technical Details
01.	Pipe material	Steal welded/flanged and Copper to SANS 460 with capillary solder fittings
02.	Lagging and cladding	Fiberglass pre-formed sections with galvanized sheet metal muffs
03.	Pipe route distances	± 900 meters
04.	Supports	From steam support posts and hangers from steam lines

PFB 03.03 STEAM TRAP ARRANGEMENTS

No.	Item	Technical Details
01.	Manufacturers	Armstrong & Spirax-Sarco
02.	Type	Inverted bucket & float thermostatic
03.	Model no	Various
04.	Size	15 & 20mm
05.	Total number installed	± 55

PFB 03.04 PRESSURE-REDUCING VALVES

No.	Item	Technical Details
01.	Manufacturers	Armstrong & Spirax-Sarco
02.	Type	External Pilot operated PRV
03.	Model no	Not available
04.	Size	40 mm dia
05.	Quantity	± 6
06.	Down steam pressure	100 kPa

PFB 03.05 CONDENSATE PUMP SYSTEMS

1. Prison Kitchen

No.	Item	Technical Details
01.	Type	Electrically driven pumps with condensate tank
02.	Pump Model no	TBA
03.	Pump manufacturer	Calpeda
04.	Pump motor	0.75 kW 3-phase 230 V 50 Hz
05.	Condensate tank size	TBA litre
06.	Number of tanks	1
07.	Number of pumps	2
08.	Electrical control panel	1

NB: The table above must be duplicated as required and the information in red must be

applicable to the equipment referred to in the table.

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.

NB: The above information must be adjusted according to the project and site requirements.

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/Departmental Representative 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 09

(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 09

(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 09

(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 09

(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 09

(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 09

(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 09.09.02.

(e) Inspect, service, test and repair electrical control panels as described in FB 09.11.02.

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 05.04.01 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 (meters 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 (Polytetrafluoroethylene) 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 a 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 SANS specifications (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.

PFC - HOT-WATER GENERATING INSTALLATION

CONTENTS

PFC 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the hot-water generating installation at the **DCS: Ncome 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. The Departmental representative / Engineer shall instruct the contractor to conduct repair / maintenance work that is to be completed and maintained by the Contractor for the full duration of the 3-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 ± 10000 inmates
(c) Boiler house also provides hot water to the central laundry and kitchen.

NB: The information in red above is site specific and should be adjusted accordingly.

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

No.	Item	Technical Detail
01.	Storage capacity	5 000 / 2500 litres/vessels
02.	Number of vessels	11
03.	Steam heater banks	
	03.01. Manufacturer	
	03.02. Factory no	MTSB005
	03.03. Capacity	± 0.001 m^3/heater bank
	03.04. Number of heater banks	1/vessel
	03.05. Steam W.P	700 kPa
	03.06 Steam T.P	1050 kPa
	03.07. Manufacturing date	2011
04.	Steam heating control valve	Horne 20 mm dia.
05.	Water pressure	±450 kPa

PFC 03.02 CIRCULATING PUMPS

PFC 03.02.01 Boiler House

No.	Item	Technical Detail
01.	Type	In-line canned motor HW circulating pump
02.	Number of pumps	2
03.	Manufacturer	TBA
04.	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/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 meters/hour at heads up to 6 meters and be of an approved manufacturer.

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 06.01 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.

TECHNICAL DETAILS: BOILER(S)

BOILER TECHNICAL DETAILS		
1	Manufacturer	
2	Model no	
3	Boiler serial no	
4	Registration certificate no	
5	Boiler type	
6	Design code	
7	Factory no	
8	Manufacturing date/year	
9	Maximum continuous rating	
10	Design pressure rating	
11	Authorized working gauge pressure	
12	Normal operation pressure	
13	Safety blow-off pressure	
14	Test pressure	
15	FD fan model no	
16	FD fan power capacity	
17	Stoker Make & type	
18	Stoker pulling motor capacity	
19	Chain grade stoker	
19	ID fan power capacity	
20	Feed pump	
21	Feed pump power capacity	

22	Grit collector	
23	Chimney stack type	
24	Boiler control panel	
25	Level control	

ANNEXURE

ANNEXURE A: PREVENTATIVE MAINTENANCE SERVICE SCHEDULES

BID FOR NCOME CORRECTIONAL SERVICES MAINTENANCE, REPAIRS AND OPERATION TO BOILERS AND ALL STEAM RELATED GENERATION COMPONENTS FOR THE PERIOD OF 3 MONTHS

Table A1: Period Boiler Inspection Schedule (Steam and Hot water)

Frequency						Accomplished By		
Daily	Weekly	Monthly	Quarterly	Yearly	Recommended test	Boiler Operator	Service Technician	Checked
X					Look around the machine and check for leaks around the boiler	X		
X					Read the boiler's gauge and check results against owners manual's	X		
X					Listen for noises that are out of the ordinary for the machine	X		
X					Ensure that the machine is running smoothly without extra vibrations	X		
X					Check to ensure the combustion air opening is unobstructed	X		
X					Check pressure and/or temperature readings to ensure they are within the design range	X		
X					Check feed-water and condensate pumps for proper operation	X		

					and leaky packing			
X					Examine traps, check all valves(boiler drain valve, steam valve etc.), expansion tank or condensate tank and other parts of the system	X		
X					Check the condition of the chain grate stocker/ coal screw	X		
X					Check the mobrey valve float is operational	X		
X					Check the hourly log book and compare results from previous day	X		
X					Check condition of the exhausted through the chimney and report any fugitive emissions.	X		

Frequency						Accomplished By		
Daily	Weekly	Monthly	Quarterly	Yearly	Recommended test	Boiler Operator	Service Technician	Checked
X					Check coal soot blower if it is clean or dirty	X		
X					Check the rate at which the CO_2 is exhausted	X		
X					Check dirt and cladding	X		
X					Check the delivery pressure (hot or warm water)	X		
X					Check the steam pressure to the calorifier and the warm water temperature from the calorifier.	X		
X					Check the hot water circulation pumps	X		
X					Check the condition of the gearbox which controls the stoker	X		
X					Check the rate at which the coal is delivered into the boiler	X		

	X				Check the type of coal if it's within the specification as stated by the department.	X		
	X				Observe condition of the flame	X		
	X				Check all relief valves for any leaks	X		
	X				Check water level control	X		
	X				Inspect boiler for air leaks. Check damper seals	X		
	X				Inspect all linkages on combustion air dampers and fuel valves	X		
	X				Check pilot and burner assemble. Clean pilot and burner following manufacture's guidelines. Examine for mineral or corrosion buildup	X		

Frequency						Accomplished By		
Daily	Weekly	Monthly	Quarterly	Yearly	Recommended test	Boiler Operator	Service Technician	Checked
	X				Inspect system for water/steam leaks and leakage opportunities. Look for leaks, defective valves and traps, corroded piping and condition of insulation	X		
		X			Inspect steam supply and condensate return piping	X		
		X			Inspect the boiler relief valve and the relief valve discharge pipe for signs of weeping or leakage	X		
		X			Check blow-down and water treatment procedures in order to determine if blow-down is adequate to prevent solid buildup	X		

		X			Measure and compare last month's readings flue gas composition over entire firing range	X		
		X			Inspect all boiler insulation and casing for hot spots.	X		
		X			Check combustion air intake to boiler room and boiler to make sure openings are adequate and clean	X		
		X			Check V-belts for proper tension. Check packing glands for compression leakage	X		
		X			Check pressure gauge, pump, filters and transfer lines. Clean filters as required	X		
		X			Check for air leaks around access openings and flame scanner assembly	X		
		X			Check all blower belts for tightness and minimum slippage	X		
		X			Check all gaskets for tight sealing, replace if do not provide tight seal	X		
		X			Perform water quality test for proper chemical balance.	X		
		X			Check for proper operation valves (Pressure reducing/regulating)	X		
				X	Thoroughly inspect heating system and address any problems	X		
				X	Inspect and clean the boiler heat exchanger	X		

Frequency						Accomplished By		
Daily	Weekly	Monthly	Quarterly	Yearly	Recommended test	Boiler Operator	Service Technician	Checked
				X	Check bracket and the lagging on steam delivery pipes	X		
				X	Check all boiler wiring and connections	X	X	
				X	Inspect condensate system and clean and flush as necessary	X		
				X	Check water PH level	X		
				X	Inspect condensate system and clean and flush as necessary	X		
				X	Inspect and clean burner assembly	X		
				X	Inspect venting system for blockage, corrosion or deterioration and ensure all joint and pipe connections are tight	X		
				X	Inspect air inlet and vent terminations to ensure they are clear and unobstructed	X		
				X	Check control setting and test operating and safety controls	X		
			X		Check oil preheaters by removing the heating element and inspect for sludge or scale	X		
			X		Repair refractory. Immediately upon opening the fireside, give the refractories an inspection and repair necessary	X	X	
			X		Check pump coupling alignment. Check alignment to ensure the tolerance are within the manufactures recommendations	X		

			X		Reset combustion. The entire combustion process should be carefully checked, Oxygen readings taken and necessary burner adjustment made	X		
Frequency						Accomplished By		
Daily	Weekly	Monthly	Quarterly	Yearly	Recommended test	Boiler Operator	Service Technician	Checked
			X		Inspect mercury switches. Inspect mercury switches for contamination, loss of mercury, and crack or broken wires. Replace if necessary	X		
				X	Check for proper boiler operation after it has been cleaned and inspected	X		
				X	Check if tubes are blocked and if so clean them as part of the shutdown procedure		X	
				X	Clean water side surface by following manufacture's recommendation on cleaning and preparing water side surface	X	X	
				X	Clean fire side by following the manufacture's recommendation on cleaning and preparing fire side surface	X		
				X	Inspect and repair refractories on the fire side. Use recommended material and procedures		X	
				X	Remove and recondition or replace relief valve depending on their condition	X		
				X	Clean and recondition feed-water pumps. Clean condensate receivers and deaeration system	X		
				X	Check operation and repair any hydraulic and pneumatic valves	X		

				X	Conduct Eddy current test in order to assess tube wall thickness		X	
				X	Clean all electrical terminals. Check electronics controls and replace any defective parts		X	

NOTE: All minor and incidental repairs such as the replacement of nuts, bolts, washers, and self-tapping screws, pop rivets etc. shall form part of the service. The Contractor shall allow for such repairs, (material and labor cost), in his price for servicing.

REMARKS:

NOTE:

All minor and incidental repairs such as the replacement of nuts, bolts, washers, self-tapping screws, pop rivets etc. shall form part of the service. The Contractor shall allow for such repairs, (material and labor cost), in his price for servicing.

Artisan Sign-off: Name:	Date
Superintendent Sign-off: Name:	Date
Client Department Sign-off: Name:	Date

STAMP