(c) Integral pipe work

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

(d) Boiler valves and mountings

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

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

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

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

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

(e) Refractories and brickwork

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

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

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

(f) Soot blowers

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

(g) Lagging and cladding

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

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

FA 12.03.02 Feed-water equipment and controls

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Feed-water tanks

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

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

(i) Inspect and test the feed-water tank and associated equipment and pipework for any leakages.
(ii) Isolate supply water, condensate inlets and feed-water outlet to tank.
(iii) Empty tank by means of draining it through the drain valves.
(iv) Remove and clean tank of all mud, sediment, scale deposits and foreign matter by means of approved methods.
(v) Carry out all necessary repair work to the tanks and associated

equipment and pipework.

(vi) Inspect tank lining for any defects and corrosion and if necessary carry out any required repair actions.

(vii) Inspect, test, repair and replace if necessary the filling mechanism.

(viii) Inspect tank stand for any defects and damages, and carry out the necessary repair work if any.

(ix) Inspect lagging and cladding to feed-water tanks and carry out the necessary repair or/and replacement work.

(x) Refill feed-water tank with clean water and open feed-water supplies to boilers.

(xi) Inspect painting to tank and tank stand and if necessary prepare and repaint.

(b) Feed-water pumps

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

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

(i) Inspect and test the feed-water pumps for correct operation.

(ii) Replace gland packings, seals and gaskets.

(iii) Inspect and test for any bearing noise and replace if necessary.

(iv) Clean out pump strainers, check non-return valves, valves, etc.

(v) Test pump motor windings for balance phases, insulation test and check wiring.

(vi) Inspect pump mountings and repair if necessary.

(c) Water level equipment and controls

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

(i) Float type water level controls are to be dismantled, stripped, de-scaled, cleaned, serviced, repaired and where necessary replaced.

(ii) All water level controls are to be reassembled, refitted, tested and adjusted in accordance with the manufacturer's specification. The adjustments shall be in accordance with the manufacturer's specification for starting and stopping the pumps.

(iii) Low water level alarms shall be tested, inspected and adjusted to the correct level ensuring that the alarms are sound and indicated.

(iv) Where modulating valves are fitted these shall be inspected, tested, serviced and repaired in accordance with the manufacturer's specification. The pressure relief valve on pump discharge shall be cleaned, serviced, overhauled and readjusted to the correct blow-off level.

(v) Replace water level gauge glasses and gaskets.

FA 12.03.03 Combustion and water treatment

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Stoker and stoker controls

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

(i) The repair work to the stoker, stoker controls and equipment shall include at least the following:

(ii) Remove stoker from boiler furnace during the statutory inspections.

(iii) Inspect and replace burnt or/and damaged chain grate links and rods where necessary.

(iv) Replace chain grate bearings.

(v) Inspect sprockets and replace if required.

(vi) Inspect shafts, rear roller and re-machine or replace if necessary.

(vii) Inspect stoker chassis for straightness, alignment and possible damages, and repair if necessary.

(viii) Inspect undergrate damper guide vanes and ensure that they are clean of any dust, slag and foreign matter.

(ix) Renew and recast all refractories and brickwork in accordance with the manufacturer's specification.

(x) Inspect main worm wheel for any defects and replace if necessary.

(xi) Replace all joint seals with new.

(xii) Reassemble stoker and stoker components.

(xiii) Replace guillotine door support cables.

(xiv) Inspect, service and overhaul stoker drive and gearbox in accordance with the manufacturer's specification.

(xv) Replace shear pin.

(xvi) Adjust and readjust grate tension.

(xvii) Check and adjust fuel bed depth indicator.

(xviii) Lubricate all required lubrication points as directed by the manufacturer.

(xix) Mount FD fan and controls onto stoker.

(xx) Reinstall stoker into boiler furnace in accordance with manufacturer's specification.

(b) Fans and damper controls

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

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

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

(c) Combustion controls

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

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

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

(d) Smoke stack

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

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

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

(e) Ducting

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

FA 12.03.04 Coal handling and conveying equipment

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Coal bunker

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

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

(b) Coal conveying equipment

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

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

(i) Test all equipment for correct functioning.

(ii) For end masse conveyors open covers, inspect links, chains and travelling ducting for any defects and/or damages, repair and/or replace components where necessary.

(iii) For screw elevators inspect bushes, screw, casing, etc for any defects and/or damages, repair and/or replace components where necessary.

(iv) Inspect, service, lubricate and where necessary repair gear boxes and drives.

(v) Test conveying equipment motor windings for balance phases, insulation and check wiring. Where necessary motors shall be reconditioned.

(vi) Inspect, test, service, adjust and where necessary repair and/or replace hopper coal level equipment.

(vii) Inspect, test, service and repair coal conveying electrical control panel ensuring that all controls function properly in accordance with the design.

FA 12.03.05 Ash and grit removal equipment

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Grit collectors

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

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

(i) Inspect grit collector supports and mountings for sturdiness, and repair and/or replace where necessary.

(ii) Clear out grit collector of all grit, dust and foreign matter.

(iii) Inspect all discharge port and other access opening seals and replace with new ones, ensure that grit trolley seals seat tightly onto grit trolley. Check flap operation.

(iv) Prepare and repaint grit collector casing and supports.

(b) Ash conveying equipment

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

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

(i) Test all equipment for correct functioning.

(ii) For submerged belt ash conveyors drain sump, clean out, inspect belt, roller bearings, frame, etc, any defects and/or damages, repair and/or replace components where necessary.

(iii) For screw ash elevators inspect bushes, screw, casing, etc, for any defects and/or damages, repair and/or replace components where necessary.

(iv) Inspect, service, lubricate and where necessary repair gear boxes and drives.

(v) Test ash conveying equipment motor windings for balance phases, insulation test and check wiring. Where necessary motors shall be reconditioned.

(vi) Inspect, test, service, adjust and where necessary repair and/or replace control equipment.

(vii) Inspect, test, service and repair ash conveying electrical control panel ensuring that all controls function properly in accordance with the design.

(c) Ash and grit trolleys

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

FA 12.03.06 Electrical installation, wiring and control panels

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Instrumentation and controls

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

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

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

(b) General electrical power and lighting installation

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

(c) Electrical control panels

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

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

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

FA 12.03.07 Water treatment equipment

The Departmental representative/engineer reserves the right to check if all preparations required by the contractor are done before the inspection can be done.

If there are deviations from the below outlined preparations required by the contractor, the contractor will be liable for any costs suffered by the Department.

The contractor must furnish a checklist to the departmental representative/engineer of all the preparations outlined below completed.

(a) Water softener

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

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

(i) Test all equipment for correct operation.

(ii) Sample of feed-water shall be taken and analyzed to ensure that water softener is adjusted to the correct percentage. The hardness of the water shall be within the boiler manufacturer's specification.

(iii) Check control and mixing equipment and salt container.

(b) Chemical dosing equipment

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

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

(i) Test all equipment for correct operation.

(ii) Sample of feed-water shall be taken and analysed to ensure that the chemical dosing rate and chemicals conform to the requirements of the boiler manufacturer.

(iii) Check, inspect, service and repair control and dosing pump equipment.

(iv) The above work shall be done in collaboration with the water treatment supplier company.

FA 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 36-month contract period.
This part of the Contract shall include:

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

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

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

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

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

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

The maintenance work and items are to be 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;

- 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 COMMISSIONING AND RE-COMMISSIONING OF PLANT AND INSTALLATION

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 36-month contract period.

This part of the Contract shall include:

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

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

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

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

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in General Maintenance.
All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorized by the Contractor for each

maintenance activity under the following headings:

(a) Steam piping installation
(b) Condensate piping installation
(c) Supports and bracketing
(d) Lagging and cladding
(e) Steam ancillary equipment
(f) Condensate ancillary equipment
(g) Condensate pumping systems
(h) Electrical controls, panels and wiring.

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

FB 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

[redacted] - Specification of materials and methods to be used

[redacted] - 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 24-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.

FC 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.

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 36 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.