

PART 3: SCOPE OF WORK

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CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**C3.1: EMPLOYER'S SERVICE INFORMATION****Contents**

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CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**Description of the service****1. Scope Objective**

The key objective of this outage scope is to assist the ESKOM business unit at Hendrina Power Station in achieving as well as sustaining 80% UCF, 10% PCLF and 10% UCLF to ensure the long-term availability and reliability of all its running Units.

1.1. scope summary

This scope is provided as a guideline for Hendrina Power Station to conduct high or low pressure water jetting as well as chemical cleaning on all wet cooled shell-and-tube main turbine condensers in order to improve condenser performance, reduce/eliminate any load-losses which are allocated to poor condenser vacuum as well as to ensure the ongoing operation of Units 2, 4, 5, 6, 7, & 10 for years to come.

1.2. AIM of scope

The aim of this scope is to provide specific requirements regarding methodology, quality assessment, equipment & safety preconditions, as well as testing and optimization criteria to be considered when planning for either high- or low-pressure water jetting and chemical cleaning on main turbine condensers at Hendrina Power Station.

1.3. main Requirement of contract

Based on condenser performance trends, Hendrina Power Station may at any point in time call on the tendered *Contractor* to perform either high- or low-pressure water jetting, or chemical cleaning at any one of its running Units to reduce/eliminate any load-losses caused by poor condenser performance. The work will be planned for either long-term outage periods or short-term opportunity outages, based on the directive of the business unit.

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PLANT	START	END	EXCLUSIONS	INCLUSIONS	P&ID DRAWINGS
Condenser System	As per P&ID	As per P&ID	Piping	Valves, Waterboxes & Tubing	25.15/24245 & 24185

3. general arrangement and location drawings

No	DRAWING NUMBER	TITLE
1	18.5100.0226	Main Turbine Condenser

3.1. applicable corporate/generation guidelines & standards

No	REFERENCE NUMBER	DOCUMENT TITLE
1	240-62196227	Eskom's Life Saving Rules
2	240-46243165	Procedure for Outage Management Plan for Execution & Finalisation Phases of an Outage
3	240-107677940	Specification Standard for High Pressure Water Jetting of Condenser and Heat Exchanger Tubes
4	240-56030499	Condenser Healthcare Guideline
5	240-56176026	Condenser Healthcare Standard
6	240-95112942	Condenser Process Design Guideline
7	240-56030508	Cooling Water System Healthcare Guideline

3.2. applicable HENDRINA power station procedures

No	REFERENCE NUMBER	DOCUMENT TITLE
1	HSPPM016	Outage Philosophy for Hendrina Power Station
2	HSIPMM580	Condenser and CW Side Water-box Inspection Procedure
3	HSPPO256	Condenser Flood Test Procedure
4	HSPPO216	Operating on CW System Procedure
5	HSPPO310	Minimum Requirements for Standard Isolations Units 1 to 5 Procedure – CW System (Includes Auxiliary Cooling)
6	HSPPO282	Minimum Requirements for Standard Isolations Units 6 to 10 Procedure – CW System (Includes Auxiliary Cooling)
7	HSPPM280	Chemical Cleaning of the Main Turbine Condensers Procedure

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1. Ensure permits to work are issued for all covered plant areas.
2. Production and/or safety risk assessments to be compiled and approved before commencing with the execution of this scope.
3. ITPs (inspection and test plans) or PQPs (Process Quality Plans) or QIPs (Quality inspections Plans) must be submitted to, and approved by, *Turbine Engineering* prior to executing the work.
4. All inspections, as required, must be captured via report documentation and must be made available to the appointed site *Engineer* as soon as possible.
5. Erect scaffolding as per the requirements of this SOW. Remove scaffolding upon completion of this SOW.
6. All plant component labels that are removed from the plant during disassembly of equipment are to be kept safe and free of damage. All damaged/missing plant labels are to be reported to Hendrina TSS (Technical Support Services) for new labels to be manufactured and installed.
7. Upon box-up of plant equipment, the responsible *Contractor* is to reinstate the equipment labels to their correct designated locations, ensure proper housekeeping, and lastly submit a "Box-up certificate" to the appointed site *Engineer* for clearance.

Interpretation and terminology

The following abbreviations are used in this Service Information:

Abbreviation	Meaning	Abbreviation	Meaning
SOW	Scope of Work	MSDS	Material Safety Data Sheet
NEC	New Engineering Contract	HECR	Heat Exchanger Cleaning Report
HPWJ	High Pressure Water Jetting	MPI	Magnetic Particle Inspection
LPWJ	Low Pressure Water Jetting	DPT	Dye Penetrant Testing
QCP	Quality Control Plan	FAC	Flow Accelerated Corrosion
PPE	Personal Protective Equipment	TED	Turbine Engineering Department
OD	Outer Diameter	PS	Power Station

5. 1st Detail Scope of work**5.1. HIGH & LOW PRESSURE WATER JETTING REQUIREMENTS FOR CONDENSER TUBING****5.1.1.ACCEPTANCE CRITERIA**

Note that for both HP and LP water jetting the acceptance criteria is that all foreign material must be removed from the inner walls of condenser tubing, i.e., in the case of HPWJ, the entire internal tube surface of every single condenser tube shall be completely cleaned to a uniform metallic colour with virtually no

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traces of hard scale & foreign deposits found on the inner surfaces of the tubes. And similarly, in the case of LPWJ, that all traces of mud and soft scale be completely removed from the entire internal tube surface of every single condenser tube.

This shall be validated by means of high-resolution endoscope inspections, which is to be provided by the *Contractor*. **Note that non-achievement of the aforementioned acceptance criteria shall be considered as non-performance with respect to the contract.**

5.1.2.CONTRACTOR EXPERIENCE

Only *Contractors* experienced and specialised in the high & low pressure water jetting of turbine plant industrial grade heat exchangers will be considered for tender technical evaluation; i.e., heat exchangers located on coal fired power plants with a Unit capacity of 150MW or greater. Furthermore, the *Contractor* shall provide a verifiable reference list of any HP & LP water jetting cleaning contracts of which they used a minimum of a 1000bar & 150 - 350bar working pressure, respectfully, on industrial grade heat exchangers in the last 5 years. Note that verifiable references of at least three (3) projects successfully conducted in the past 5 years are required.

5.1.3.HP & LP WATER JETTING MINIMUM SAFETY REQUIREMENTS

The safety of the *Contractor* personnel is of extreme importance. The following minimum safety requirements shall apply:

- ✓ *Contracted Operators shall wear CE (European Economic Area Conformity Marking) certified water jetting suits, and face shields rated for a working pressure of at least 1000bar.*
- ✓ *All foot and leg protection equipment to be appropriately rated for a working pressure of at least 1000bar.*
- ✓ *The Contractor shall work in accordance with a safety procedure/instruction aligned to industry recognised HP & LP water jetting practices & standards to protect all personnel using high pressure equipment.*
- ✓ *HP & LP water jetting Contracted Operators shall be trained and certified by an independent industry recognised authority affiliated to either WJA or WJTA. No operator will be allowed to use water jetting lances on site without the required certification.*
- ✓ *All water jetting hoses, pressure accessories (e.g., nozzles), and pressure equipment (e.g., pumps) to be used on site must be able to withstand a minimum working pressure of 1000bar (100MPa). The general safety standard is that all equipment be pressure tested to 1.25 times its design pressure. Note that pressure test certificates no older than 6 months will be required for all high-pressure equipment to be used on site.*
- ✓ *All hose-end connections must be fitted with the appropriate "hose-whip-checks" to prevent injury to operating personnel by restraining the hose in the event of nozzle failure or an accident.*
- ✓ *The water jetting pump discharge lines shall be fitted with a calibrated pressure gauge and safety relief valve or rupture diaphragm to further ensure safety of personnel when working on the plant.*

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- ✓ *Any manholes which are open for ventilation purposes shall be properly barricaded by the Contractor to eliminate unauthorised entry while cleaning is in progress.*
- ✓ *Barriers and Warning notices must be in place before any work commences.*
- ✓ *Compliance with Eskom's Life Saving Rules (240-62196227) is mandatory for all personnel involved with the cleaning activity.*
- ✓ *The Contracted Operators shall use a handheld pneumatic powered feeder which incorporates a sleeve into which the nozzle retracts as it exits the tube. The feeding speed and dwell-time shall be set during commissioning as defined in section 5.1.5. on page 5 of this document. The handheld pneumatic powered feeder shall be used at all times to ensure operators are not exposed to water jets when moving the lance from one tube to another.*

5.1.4. HP & LP WATER JETTING MINIMUM EQUIPMENT REQUIREMENTS

1. For tubes with an internal diameter of 20.5 up to 25 millimetres the minimum nozzle flow rate shall be 50 litres/min at 1000bar working pressure when performing HPWJ and 150 - 350bar working pressure when performing LPWJ. For tubes with an internal diameter between 15 and 20.5 millimetres the minimum nozzle flow rate shall be 33 litres/min.
2. Rotating tube cleaning nozzles with multiple radial water jets or polishing nozzles shall be used. The cleaning nozzles shall be obtained from a recognised HP & LP water jetting equipment supplier and must include technical datasheets for all types to be used on site. Those technical datasheets (in as much detail as possible) should indicate the maximum & minimum pressure rating of the HP & LP water jetting nozzles to be used on site, the outside diameter of the nozzles, and the tube inner diameter range the nozzle is intended for. The cleaning nozzle datasheets shall furthermore detail the design features of the cleaning nozzles for unblocking tubes and removing thick deposits of scale from inner tube walls when considering HPWJ. The maximum pressure rating of the nozzle shall be 1035bar or 15000 psi. **Nozzles with a higher-pressure rating are not acceptable.** The minimum number of nozzles available on site for the main turbine condenser is 6. Furthermore, the nozzles shall travel the full length of all the tubes, i.e., 9 meters.
3. Technical datasheets shall be provided for HP & LP water jetting pumps to be used on site and as a minimum should show evidence that the pumps are able to maintain a minimum continuous working pressure of 1000bar and 350bar, respectfully, at a flow rate of 50 litres/min. Note that this requirement assumes one pump will supply one cleaning nozzle. If a single pump is to supply more than one nozzle simultaneously the pump shall maintain a minimum volume flow of 50 litres/min per each of the cleaning nozzles attached to the pump while maintaining the specified discharge pressure.
4. The water jetting flexible hose from the foot-valve to the tube-cleaning-nozzle shall have a minimum internal diameter of 7 millimetres for tubes with an internal diameter of more than 20.5 millimetres. The maximum hose length is the condenser tube length (9 meters) plus an additional 7 meters, i.e., 16 meters in total. The foot-valve shall be positioned in the water-box at all times while water jetting is being performed. The minimum number of hoses available on site for the main turbine condenser is 4. Furthermore, the flexible hose from the pump outlet to the foot-valve shall have a minimum internal diameter of 10 millimetres / 1 centimetre.
5. The *Contractor* shall make provision to have an appropriate amount of spare equipment and tooling on-site during the outage, particularly nozzles, hoses, couplings, all wear and tear parts such as seals/gaskets/o-rings, etc. In the event of a pump breakdown then a suitable replacement shall be affected within 2 hours.

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6. **Under no circumstances is the tube-sheet or protruding tube-ends to be damaged during the HP & LP water jetting activities.** The *Contractor* shall establish a system or method to ensure impinging water jets from the nozzle are not directly focused on the tube-sheet or onto the outside diameter of the exposed tube-ends. Prior to any water jetting cleaning activities an inspection shall be performed by the *Contractor Supervisor* and the appointed site *Engineer* to photographically record the existing condition of the tube-sheet and protruding tube-ends. Thereafter the *Contractor* must compile and provide *Engineering* with a visual report containing the photographic evidence and the *Contractor's* signature, in acknowledgment of the existing condition.

NB! This activity shall be included in the QCP as a hold point. Note that once the water jetting cleaning activity has been completed, any discovered damages thereafter will be at the *Contractor's* expense to repair.

7. The *Contractor* shall make provision of adequate number of handheld pneumatic powered feeders as described on the previous page, at the end of section 5.1.3.
8. The *Contractor's* selection of all lances, nozzles, sleeves and hosing shall be suitable for the tubing diameters as defined in "Table 2: Main Turbine Condenser Technical Information" located on page 9.
9. The *Contractor* shall supply suitable endoscope/fiberscope equipment to facilitate pre- and post-cleanliness inspections of condenser tubes. The endoscope used for inspection of the tubes shall have a minimum length of 9 meters and digital display that includes image capture and recording capabilities with the minimum specifications as outlined in Table 1 on the next page.

Table 1: Specification for Minimum Requirements for Endoscope/Fiberscope Machine

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CAMERA MINIMUM REQUIREMENTS	
Camera Diameter	<i>< 23mm (condenser tube internal diameter)</i>
Camera Lens	<i>Dual (Front & Side)</i>
Video Resolution	<i>1080p HD (1920 x 1080 pixel) resolution</i>
Picture Resolution	<i>A4 page resolution: 2480 x 3508 pixels</i>
Megapixel (MP)	<i>2.1</i>
Image Format	<i>JPEG or TIF</i>
Video Format	<i>MP4</i>
Focal Length	<i>30 mm</i>
Magnification	<i>2x</i>
Waterproof	<i>IP67</i>
Bore hole minimum size	<i>10 m</i>
Long Range Semi-rigid Reinforced Cable Length	<i>9 m</i>

Table 2: Main Turbine Condenser Technical Information at Hendrina PS

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HEAT EXCHANGER SPECIFIC INFORMATION			
Tube Details:	Main Bundle "Condensing Zone"	Secondary Bundle "Air Extraction"	Impact Tubes "Peripheral tubes"
Tube Material:	<i>SoMs71F38</i>	<i>304L Stainless Steel</i>	<i>SoMs71F38</i>
Number of Tubes:	<i>6908</i>	<i>1512</i>	<i>8020</i>
Tube Length:	<i>9000mm</i>	<i>9000mm</i>	<i>9000mm</i>
Tube OD:	<i>25.4mm</i>	<i>25.4mm</i>	<i>25.4mm</i>
Tube Wall Thickness:	<i>1.219mm</i>	<i>1.0mm</i>	<i>1.219mm</i>
Tube Profile:	<i>Straight</i>	<i>Straight</i>	<i>Straight</i>
Anticipated Scale Thickness:	<i>2mm – 3mm</i>	<i>2mm - 3mm</i>	<i>2mm - 3mm</i>
Tube Protruding End Lengths	<i>3mm (Inlet & Outlet)</i>	<i>20mm (Inlet & Outlet)</i>	<i>3mm (Inlet & Outlet)</i>
Water-box Access:	<i>Water-boxes will not be removed from the condenser – access to the tube ends is from within the confined space of the water-box. Simultaneous access is available in 4 water-boxes; that being the North & South Inlets and the North & South Outlets.</i>		

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**5.1.5. COMMISSIONING TESTS AND OPTIMIZATION**

Before any work can take place, the *Contractor* shall demonstrate the following to the appointed site *Engineer*:

- Provide all required certificates (equipment pressure tests, pressure gauge calibration, personnel training) as stipulated in section 5.1.3 on page 5.
- The appointed site *Engineer* shall verify that the equipment on site complies in all respects to the technical data sheets provided with the tender as well as that the number of pumps, hoses, foot-valves, cleaning nozzles, etc. on site corresponds in all respects to the information provided in the tender technical evaluation strategy (Document Number: 380-136359).
- The *Contractor* shall demonstrate to the *Engineer* that the water jetting pump, hose, and cleaning nozzle combination can supply a volume flow rate of 50 litres/min by means of a container & stopwatch method for a pump outlet pressure of 1000bar when considering HPWJ and 150 - 350bar when considering LPWJ. This test assumes one pump will supply one cleaning nozzle. If a single pump is to supply more than one nozzle simultaneously the pump shall maintain a minimum volume flow of 50 litres/min per each of the cleaning nozzles attached to the pump while maintaining the specified discharge pressure.
- The *Contractor* shall demonstrate that the lance safety device (with a handheld pneumatic powered feeder) prevents the lance from withdrawing from the tube during a water jetting exercise to exhibit that it is safe for operators to use.
- Before starting with this production cleaning activity, the *Contractor* in consultation with the appointed site *Engineer* shall establish an acceptable nozzle resident/dwell-time, cleaning a minimum of 5 'pulled' condenser tubes during an on-site '*bucket test*', thereby demonstrating the *Contractor's* true capability of meeting the minimum acceptance criteria stipulated under section 5.1.1 of this document. *Engineering* will provide the 5 tubes for the exercise and as part of the test the *Contractor* must also demonstrate to the *Engineer* that the working pressure of the water jetting pump, hose and cleaning nozzle combination does not damage the tube internal surface.
- Dwell-times shall typically not exceed 40 seconds per tube, and the rate of lance travel should not be slower than 6 seconds per meter. After the '*bucket test*' has been conducted and during cleanliness visual inspections it may be found that cleaning with the pre-established nozzle resident/dwell-time is ineffective, i.e., the scale is not being entirely removed from the inner walls of the tubes as required. In such an event the nozzle resident/dwell-time may be further increased, and the '*bucket-test*' repeated. **This test must be performed in the presence of the appointed site *Engineer* and actual high-definition endoscopic inspections of all the cleaned tube sections will be required.** Thereafter, the *Contractor* shall capture all the video recorded inspection imagery (to be taken both before and after cleaning commences) within a visual report and both a physical and digital copy of said report is to be handed over to *Engineering* for cleanliness evaluation and record keeping purposes.

To clarify, the *Contractor* must demonstrate that these tube sections can be cleaned in a single nozzle pass to the point where no traces of products of corrosion or scale/debris deposits are visible, and no immediate damage to the internal surfaces of the tubes is evident once the test has been completed.

NB! This activity shall be included in the QCP as a hold point. Note that failure to pass the 'bucket-test' shall be considered as non-performance with respect to the contract.

5.2. HIGH & LOW PRESSURE WATER JETTING

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- As highlighted under point 4: "MAIN REQUIREMENT OF CONTRACT", on page 2 of this document, the Station reserves the right to any point in time call on the tendered *Contractor* to perform either high- or low-pressure water jetting, or chemical cleaning at any one of its running Units to **reduce/eliminate any load-losses caused by poor condenser performance. The scope below details the exact work orders to be followed to properly execute high- or low-pressure water jetting on main turbine condensers at Hendrina Power Station; the only difference being the required working pressure of the water jetting pumps. If** high pressure water jetting is required, then a working pressure of 1000bar must be used. If low pressure water jetting is required, then a working pressure of 150 - 350bar must be used.
- High pressure water jetting is required to remove layers of hard scale from condenser tubing, while low pressure water jetting is simply a flushing exercise to remove mud and soft scale from condenser tubing. At Hendrina Power Station, North side Units typically require HPWJ and the South side Units LPWJ due to differences in cooling water chemistry.

5.2.1. scope of work

SUBSYSTEM		MAIN TURBINE CONDENSER (CW SECTION)				
COMPONENT ACTIVITIES						
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	PROCEDURES	INTERVENTION POINTS (H/W/R)	TASK OWNERS
1	#0MAG10	Main Turbine Condenser	Isolate the condenser: Ensure back-up permit is enforced , condenser is drained, and that all 8 CW manhole covers are opened (i.e., those at the inlet, return, and outlet water-boxes). (Manhole cover ø = 500mm)	HSPPO216 HSPPO222	W	Operating MMD Turbines
2	#0MAG10	Main Turbine Condenser	Install blank flanges on the main CW inlet ducting to the condenser, i.e., blanks must be installed at the T1's. Refer to Figure 1 on page 17.	HSPPM280	S	MMD Turbines

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SUBSYSTEM		MAIN TURBINE CONDENSER (CW SECTION)				
COMPONENT ACTIVITIES						
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	PROCEDURES	INTERVENTION POINTS (H/W/R)	TASK OWNERS
3	#0MAG10	Main Turbine Condenser	TED to conduct initial ‘dirty’ inspection of the condenser inlet, return, and outlet water-boxes.	HSIHOS001 HSIPMM580	H	Turbine Eng. MMD Turbines Contractor.
4	#0MAG10	Main Turbine Condenser	Manually clean all foreign debris (i.e., splash-packing material, large fragments of scale, metal, wood, stones, etc.) out of the inlet and outlet condenser water-boxes. Also ensure that all the tube-plates are cleaned of foreign debris.	HSIPMM580	S	MMD Turbines Contractor
5	#0MAG10	Main Turbine Condenser	Rod all the condenser tubes to ensure these tubes are not completely or partially blocked prior to HP / LP water jetting. Unblocking is required to allow free movement of the waterjet hand lance across full length of the tubes.	240-56030530	S	MMD Turbines Contractor
6	#0MAG10	Main Turbine Condenser	Tubes that cannot be unblocked must be plugged with expandable rubber plugs which have brass-bolts. The tube-map diagram must be updated during this activity (copy will be provided by TED).	HSIPMM580	W	MMD Turbines Contractor Turbine Eng.
7	#0MAG10	Main Turbine Condenser	Install scaffolding inside the two-inlet water-boxes to completely cover the CW inlet ducts. Thereafter, lay a plastic sheet over the scaffolding to cover the entire floor of the inlet water-boxes.	HSIHOS001	S	MMD Turbines
8	#0MAG10	Main Turbine Condenser	TED to conduct preliminary endoscopic inspection of condenser tubes. Contractor to make sure that they provide an endoscopic machine, the camera of which must be able to travel the full-length of the tubes (9m). Endoscope must have video storage capability for record keeping and a copy of all recorded files must be handed over to TED.	HSIPMM580	H	Turbine Eng. MMD Turbines Contractor

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning

SUBSYSTEM		MAIN TURBINE CONDENSER (CW SECTION)				
COMPONENT ACTIVITIES						
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	PROCEDURES	INTERVENTION POINTS (H/W/R)	TASK OWNERS
9	#0MAG10	Main Turbine Condenser	Close the four (4x) return water-box manhole covers in preparation for HP / LP water jetting of all 16444 condenser tubes.		S	MMD Turbines
10	#0MAG10	Main Turbine Condenser	Commence HP / LP water jetting on all condenser tubes. Ensure that the specified pump discharge pressure is 1000bar / 150 - 350bar and that rotating nozzles are used. Note: The specified pressure must not be exceeded! Dwell-times shall typically not exceed 40 seconds per tube, and the rate of lance travel should not be slower than 6 seconds per meter.	240-56030530	S	Contractor Contractor
11	#0MAG10	Main Turbine Condenser	Post HP / LP water jetting, clean residual mud, fragments of scale, and all other debris out of the condenser's inlet and outlet water-boxes.		S	Contractor
12	#0MAG10	Main Turbine Condenser	TED to perform cleanliness inspection of all four condenser water-boxes as well as tube-sheets and conduct final endoscopic inspection of condenser tubes. Contractor to make sure that they provide an endoscopic machine, the camera of which must be able to travel the full-length of the tubes (9m). Endoscope must have video storage capability for record keeping and a copy of all recorded files must be handed over to TED.	HSIPMM580	H	Turbine Eng. MMD Turbines Contractor
13	#0MAG10	Main Turbine Condenser	Remove all scaffolding and plastic sheets from the two (2x) condenser inlet water-boxes.	HSIPMM580	S	MMD Turbines

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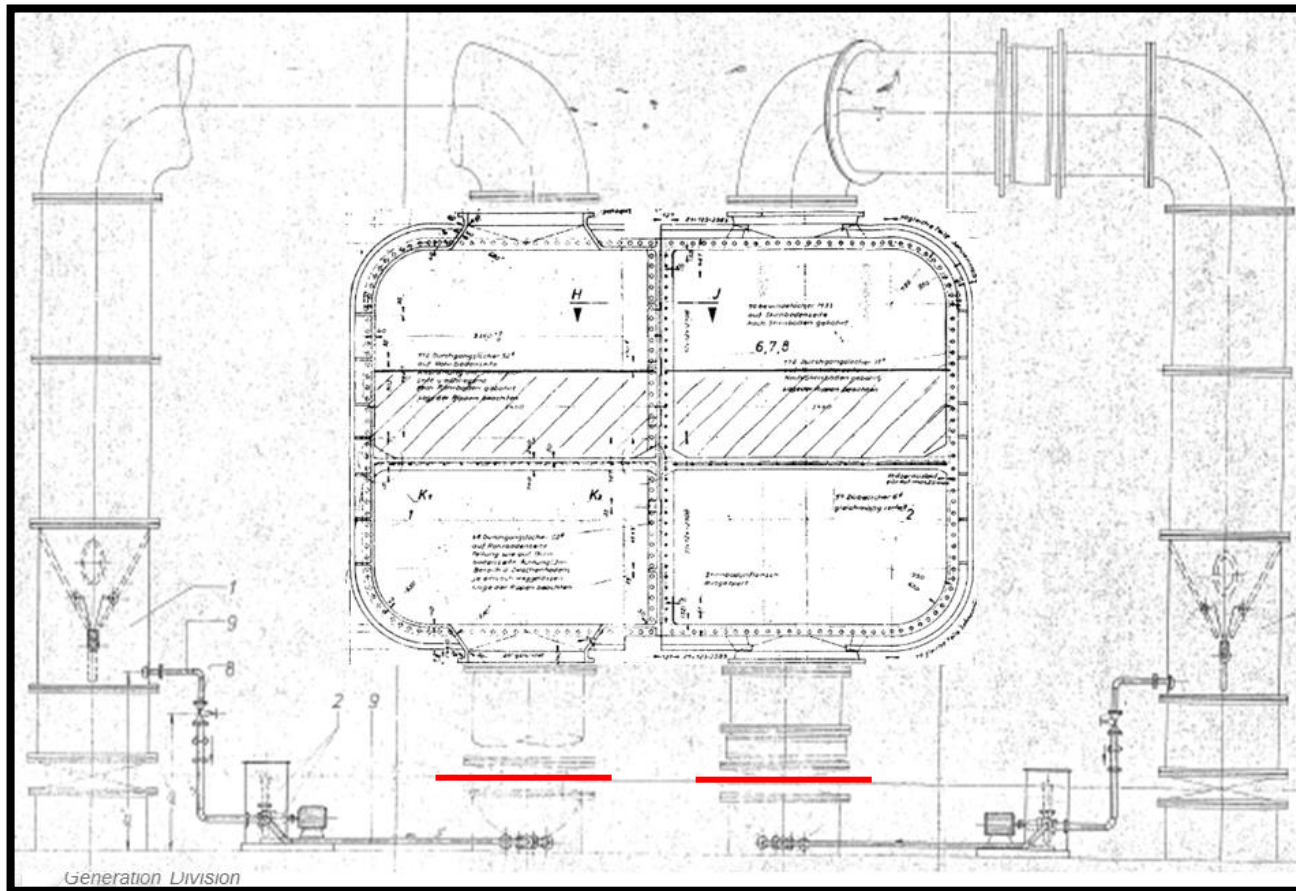
SUBSYSTEM		MAIN TURBINE CONDENSER (CW SECTION)				
COMPONENT ACTIVITIES						
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	PROCEDURES	INTERVENTION POINTS (H/W/R)	TASK OWNERS
14	#0MAG10	Main Turbine Condenser	Inspect all eight (8x) water-box manhole covers for damage / deteriorated seals. Repair / replace as required.	240-56030530	S	MMD Turbines
15	#0MAG10	Main Turbine Condenser	Perform a condenser high level flood test WITHOUT fluorescein. First ensure that the turbine shaft temperature is below 155°C, then fill the steam space up until the neck of the condenser (see Table 3 on page 18), inspect for defects according to check-sheet with document identifier HSIPO075, and list all visible defects/leaks which require repairing.	HSPPO256 HSIPO075	W	Operating MMD Turbines Turbine Eng.
16	#0MAG10	Main Turbine Condenser	After all uncovered defects have been accounted for, drain the water in the steam space to a level just above the condenser tubes. Now perform a condenser low level flood test WITH fluorescein. Allow an 8-hour soaking period before the tubes and tube-sheets are to be inspected for leaks.	HSPPO256 HSIPO075	S	Operating MMD Turbines
17	#0MAG10	Main Turbine Condenser	After the 8-hour soaking period, visually inspect the condenser tubes with a blacklight (UV-A light) and try to identify any noticeable tube leaks. If any leaking tubes are evident, plug those tubes using expanded rubber plugs which have brass-bolts. The tube-map diagram must be updated during this activity	HSPPO256 HSIPO075	S	MMD Turbines
18	#0MAG10	Main Turbine Condenser	After leaking tubes have been plugged contact TED to verify that there are no remaining leaking tubes and that the tube map has been updated correctly.	HSPPO256 HSIPO075	H	MMD Turbines Turbine Eng.
19	#0MAG10	Main Turbine Condenser	Drain the steam space of the main condenser and flush to remove residual fluorescein. Ensure sufficient capacity of the outside plant dams prior to draining.	HSPPO256 HSIPO075	W	Operating

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SUBSYSTEM		MAIN TURBINE CONDENSER (CW SECTION)				
COMPONENT ACTIVITIES						
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	PROCEDURES	INTERVENTION POINTS (H/W/R)	TASK OWNERS
20	#0MAG10	Main Turbine Condenser	Ensure proper housekeeping by making sure the inlet, return and outlet water-boxes have been sufficiently cleaned. Thereafter box-up the condenser for centre-line activities. A total of 8x manhole covers to be closed on the inlet, return and outlet water-boxes. Contact TED to sign the box-up certificate thereafter.	HSIPMM580	W	MMD Turbines Contractor
21	#0MAG10	Main Turbine Condenser	De-isolate the condenser by removing blank flanges on the main CW ducting (i.e., at the T1's) and charge the condenser with CW to service weight to allow for turbine centreline alignment.	HSPPO216 HSPPO222	S	MMD Turbines Operating

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CONDENSER CW SPADES



CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**Figure 1:** Blanks Positioning for Condenser CW Inlet Ducting (**Indicated in Red**)

<u>TABLE 3: VALVES TO BE IN PLACE TO ALLOW FOR CONDENSER STEAM SPACE FILLING</u>	
KKS:	Valve Description:
#0LAB02 AA504	RFT Outlet Isolating Valve
#0LAB02 AA505	Condensate Make-Up Isolating Valve
#0LAB02 AA506	Condensate Make-Up C/V Inlet Isolating Valve
#0LAB02 AA002	Condensate Make-Up Control Valve
#0LAB02 AA402	Condensate Make-Up Drain Valve
#0LAB02 AA507	Condensate Make-Up C/V Outlet Isolating Valve
#0LAB02 AA508	Condensate Make-Up C/V Bypass Valve
#0LAB02 AA101	Condenser Over-rider Control Valve
#0LAB02 AA509	Condenser Over-rider Isolating Valve
#0LAB02 AA502	Condensate Dumping C/V Outlet Isolating Valve
#0LAB02 AA401	Condensate Dumping Drain Valve
#0LAB02 AA001	Condensate Dumping Control Valve
#0LAB02 AA501	Condensate Dumping C/V Inlet Isolating Valve
#0LAB02 AA503	Condensate Dumping C/V Bypass Valve
#0LAB02 AA301	Condensate Dumping Vent Valve
#0LAB02 AA512	Condensate Dumping Vent Valve

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**6. 2nd Detail Scope of work****6.1. CHEMICAL CLEANING REQUIREMENTS FOR CONDENSER TUBING****6.1.1. ACCEPTANCE CRITERIA**

Note that the internal surfaces of all stainless-steel tubes contained within the condenser air-extraction zones shall be cleaned by means of HPWJ and LPWJ shall be performed on all remaining admiralty brass tubing to flush out the residual sludge that is left behind after chemical cleaning.

The acceptance criteria is that all foreign material must be removed from the inner walls of condenser tubing, i.e. the entire internal tube surface of every single tube shall be completely cleaned to a uniform metallic colour with no traces of corrosion product and/or scale deposits to be found on the tube inner surfaces after the chemical cleaning activity has been completed.

This shall be validated by means of high-resolution endoscope inspections which will take place at regularly occurring intervals during the cleaning activity as per QCP requirements. **Note that non-achievement of the stipulated acceptance criteria shall be considered as non-performance with respect to the NEC.**

6.1.2. CONTRACTOR EXPERIENCE

The *Contractor* shall provide a verifiable reference list of chemical cleaning contracts which includes HPWJ at minimum of 1000bar working pressure and LPWJ at minimum of 150 - 350bar working pressure of industrial grade heat exchangers in the last 5 years, i.e., heat exchangers located on coal fired power plants with a Unit capacity of 150MW or greater. Note that verifiable references of at least three (3) projects successfully conducted in the past 5 years are required.

Contractors who have been evaluated and pre-qualified to conduct chemical cleaning works by the *Employers* GT chemistry specialist in accordance with the requirements of the *Employers* guideline 240-107677940: "Specification Standard for High Pressure Water Jetting of Condenser and Heat Exchanger Tubes" shall submit the date, location and outcome of such an evaluation so that it may be properly reviewed and approved by the *Employer*.

6.1.3. CHEMICAL CLEANING MINIMUM SAFETY REQUIREMENTS

1. Access of personnel into condenser waterboxes shall only be authorised after the air oxygen levels inside each waterbox has been verified and determined to be suitable for safe access. The *Employer* will be responsible to conduct the air oxygen test.
2. The *Employer* ensures that suitable scaffolding is constructed to ensure safe access to the cleaning area.
3. The *Contractor* is required to familiarise all employees with the baseline health and safety risk assessment for the *works*.

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4. The *Contractor* ensures compliance to the Occupational Health and Safety Act, 1993 Hazardous Chemical Substances Regulations, 1995 and that the appropriate procedures are available for the handling and disposal of hazardous chemicals proposed for the chemical cleaning operation. Contingency plans shall be in place to cater for any unforeseen accident, or chemical spillage.
5. The *Contractor* employed to conduct the chemical cleaning is subject to Section 10(3) of the Occupational Health and Safety Act, 1993 Hazardous Chemical Substances Regulations of 1995. The *Contractor* shall, as far as is reasonably practicable, provide the *Employer* receiving such substance, free of charge, with a MSDS in the form of Annexure 1 of the Act.
6. The *Contractor* with the assistance of the *Employer* ensures that every possible precaution is taken to minimise the risk of accidental physical contact with the cleaning solutions / chemical solvent or concentrated chemicals. In such incident, the contingency planning shall fully provide for decontamination as well as adequate first aid and medical facilities.
7. The following additional mandatory safety requirements are prescribed for every chemical cleaning operation:
(Refer to the *Employer's* Specification 36-149 "Coal fired boilers – post operation chemical cleaning"):
 - The *Contractor* will supply a safety shower close to the chemical pump station. The supplied safety shower will be tested prior to the commencement of chemical cleaning activity.
 - The *Contractor* will erect a shark net barricade to restrict entry to the pump station and concentrated chemical storage area and a hazard tape barricade around the entire area dedicated to the clean.
 - All personnel within the barricaded operational area are required to wear the appropriate safety equipment/clothing at all times:
 - Chemical Resistant Overall
 - Face Shield / Safety Glasses
 - Rubber Gloves
 - Chemical Resistant Apron
 - Safety Boots
 - The *Contractor* ensures that all of their personnel involved in the operation are issued suitable protective clothing.
 - All personnel involved in the chemical cleaning operation will wear clearly visible identity tags.
 - The *Employer's Safety Officers* are required to control access to the operational area during acid injections.
 - The *Contractor* will ensure flanged temporary connections are fitted with plastic sleeves to prevent acid sprays in the event that leaks occur.
 - The *Contractor* will provide lime or soda ash to neutralize acid spills and leaks.

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- The *Contractor* will place warning signs at the appropriate locations as discussed with all stakeholders.
- The *Employer* ensures a first aider is present and medical staff is on stand-by during acid injections.
- The *Contractor* with the assistance of the *Employer* shall repair leaks that may occur during the clean.
- Solvent injection should preferably commence early in the morning, during normal office hours, to ensure the availability of resources should a solvent leak occur. Chemical injection is the most crucial step in the cleaning operation and the availability of adequate human resources is of great importance.
- A safety co-ordination meeting shall be held a week prior to the chemical clean: The following personnel or their representatives are required to attend:
 - *Employer's* System Engineer
 - *Employer's* Project Coordinator (Maintenance or Outage Coordinator)
 - *Employer's* Chemical Services Manager
 - *Employer's* Generation Group Specialist
 - *Employer's* Power Station Safety Officer
 - Chemical Cleaning *Contractor*
 - *Employer's* Industrial Nurse
 - *Employer's* Environmental Officer

6.1.4.CHEMICAL CLEANING MINIMUM EQUIPMENT REQUIREMENTS

1. The *Contractor* shall provide the technical information and calibration certificates on the chemical cleaning equipment and indicate in a method statement how circulation flow will be sufficient to flow through all the tubes of the condenser but not exceed 0.3 m/s through individual tubes.
2. The *Contractor* shall provide the *Employer* with details and proof of calibration for the electronic recorder to be used to record the water-box pressures.
3. The *Contractor* shall state how the chemical cleaning pump(s) to be used on site could potentially discharge at a pressure of 2.5 bar or greater at 0 m³/h flow during operation and shall specify the equipment that will be used to cut the power source to the pump(s) should the water-box pressure exceed 2.5 bar. The *Contractor* is expected to supply all calibration certificates for the equipment to be used.
4. The *Contractor* shall supply technical datasheets to the *Employer* for all the equipment that will be used to conduct chemical analysis for the dissolved species comprising of the primary alloying constituents of condenser tube material.
5. The *Contractor* shall also supply technical datasheets to the *Employer* for all the equipment that will be used to conduct analysis of the pH of the cleaning solution.
6. The *Contractor* shall provide the *Employer* with the Material Safety Data Sheet of the proposed solvent to be used for cleaning operations

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7. The *Contractor* shall provide demonstrable evidence that key personnel working for the *Contractor* or *Sub-contractor*, whom will be responsible for the application of the corrosion resistant epoxy coating to the ends of the stainless-steel condenser air-extraction-zone tubes which protrude out from the tube-sheets, have previously, successfully, applied a corrosion resistant epoxy in power plant condenser water-boxes of a similar size in the previous 6 years. Additionally, the contractor shall supply expandable rubber plugs which have brass-bolts (or that of a suitable alternative) so that all 1512- stainless-steel tubes may be temporarily plugged at both ends of the condenser, i.e., 3024 plugs will need to be installed in the inlet and return condenser water-boxes before the chemical solvent can be administered into the condenser in order to protect the sections of stainless steel in the inlet waterboxes from the chemical deterioration.

6.1.5.CHEMICAL CLEANING METHODOLOGY

A detailed description of the chemical cleaning *works* and constraints on how the *Contractor* conducts the cleaning *works* is provided below:

1. The *Employer* and *Contractor* conduct an initial inspection of the internals of the condenser to be cleaned. Using an endoscope/fiberscope, the *Employer* in consultation with the *Contractor* video-graphically documents the inner surface condition of the condenser tubes as well as photographically documents the amount of fouling and scaling on the tube-sheets and water-box walls. The *Contractor* includes the initial inspection findings and endoscope/fiberscope videos/photos in the Heat Exchanger Cleaning Report as discussed at the end of section 6.1.6 on page 25 of this document.
2. The *Contractor* removes all loose debris/foreign material from the water-boxes and tube-sheets to ensure all tubes are clearly visible prior to solvent injection. The *Contractor* ensures that water-boxes are free of debris as well as any additional objects that can hinder venting during the chemical cleaning operation.
3. The *Contractor* inspect vent and drain lines on the selected condenser to determine the risk of blockage and possible pressure build-up inside the condenser during a chemical cleaning operation. The *Employer* will, where necessary, remove strainers on the vent and drain lines prior to cleaning to mitigate the risk of blockage.
4. The *Contractor* unblocks all tubes of the condenser to be cleaned by means of rodding (using flexible tube rods). Tube unblocking is required to allow adequate circulation of the solvent and prevent possible tube leaks during the cleaning process.
5. The *Contractor* clearly marks all tubes which are identified as blocked, restricted, or obstructed during the rodding activity (using a permanent white marker) as well as on the tube-map diagram provided by the *Employer*.

Note: Marking of blocked tubes on the tube sheet by placing foreign debris (bolts, wires, etc.) in the tubes is regarded as unacceptable.

6. The *Contractor* assists the *Employer* in installing blank spades or flanges as required to allow for proper circulation of the solvent through all the condenser tubes. Blank-spades and isolating devices are required to prevent aggressive chemicals from contacting materials that are incompatible with the selected solvent.
- 7.1. Additional precautions are required when chemical cleaning is conducted on the main condensers because of different tube materials (i.e., 304H stainless-steel tubes in the air extraction zones and general admiralty brass tubes).

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- 7.2. After the *Contractor* has completed HPWJ of the 1512 stainless-steel tubes the *Contractor* shall ensure that all protruding tube faces of the 1512 stainless-steel tubes are coated with a protective epoxy coating prior to the commencement of the chemical cleaning operation.
- 7.3. The *Contractor* shall also ensure that the 1512 tubes of the extraction zone are plugged with suitable temporary rubber plugs prior to any chemical cleaning operation on the condensers, i.e., 3024 temporary plugs need to be installed in the inlet and return condenser water-boxes before the chemical solvent can be administered into the condenser.
- 7.4. **The *Contractor* does not proceed with chemical cleaning of a main condenser unless these precautionary measures have been taken.**
7. The *Contractor* fits the necessary temporary connections of the pumping station to the main turbine condenser.
8. In all cases the water-box pressures shall be recorded by means of an electronic recorder with a recording frequency of no more than 30 seconds.
9. The *Employer* ensures that the required supports ('condenser jacks' – 8 off) are correctly fitted to the condenser in order to conduct the chemical cleaning operation.
11. The *Contractor* verifies that the shell-side of the condenser is filled with demineralized water prior to chemical cleaning. The *Employer* is responsible for the shell-side filling activity in order to ensure that any solvent which escapes from the tubes into the shell-side of the condenser is diluted and the risk of damage is minimised.
12. The tube-side of the condenser is filled with potable/raw water using the chemical cleaning pump station supplied by the *Contractor* and circulation is established without exceeding the specified discharge pressures, noting that the maximum water-box pressure is 2.5 bar.
13. The *Contractor* inspects the closed-loop system for any leaks and addresses defects prior to chemical injection.
14. An amount of water equivalent to the amount of solvent to be added to achieve the desired concentration is drained from the tube-side of the condenser by the *Contractor*.
15. Solvent injection occurs according to the reviewed chemical cleaning procedure / method statement supplied by the *Contractor*.
16. The *Contractor* proceeds with the solvent circulation and ensures adequate gas release. The process is terminated on the basis of chemical analysis, which indicates stability of the residual solvent strength of the bulk solution and there is no further increase in the concentration of the scale/deposit species in the bulk solution. Chemical analysis is conducted by both the *Contractor* and *Employer* during the cleaning operation.
17. The *Contractor* stops circulation and drains the spent solvent to the area designated by the *Employer* (usually the ash sump of the appropriate unit). The *Contractor* ensures all mineral acids are neutralised with lime at the discharge point.

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18. The *Contractor* is required to fill and flush the condenser with potable/raw water until the residual conductivity is less than 100µS/cm above the potable/raw water quality.
19. The *Contractor* circulates the water and adds sufficient soda ash or tri-sodium phosphate to elevate the pH of this solution to 9.0 (±0.2). When the required pH is reached the *Contractor* circulates the solution for an additional 70 minutes to neutralise any residual acids and then drains the condenser.
20. The *Contractor* removes the temporary connections and temporary plugs from the condenser, and the *Employer* removes blank spades from the condenser.
21. The *Employer* drains the shell-side of the condenser. Should shell-side in-leakage have occurred during the cleaning operation, then the shell of the condenser will be flushed with demineralised water dosed with ammonia to elevate the pH to 9.1 (±0.2).
10. The *Contractor* flushes all tubes of the cleaned condenser to remove any remaining sludge, debris and scale fragments from the condenser.
11. The *Contractor* shall clean all water-boxes post chemical cleaning. All foreign materials and debris shall be removed from the water-boxes.
22. A condenser flood test is conducted by the *Employer* and tubes that have developed leaks are plugged with the appropriate plugs. The tube-map diagram shall be updated during this activity.
12. The *Employer* and *Contractor* conduct a post cleanliness inspection of the internals of the chemically cleaned condenser. Using an endoscope/fiberscope, the *Contractor* documents the condition and amount of fouling on the tube-sheets and tubes. The *Contractor* includes the final inspection findings and fiberscope/endoscope photos in the Heat Exchanger Cleaning Report.
13. The *Contractor* updates the tube-map diagram to include all plugs added post chemical cleaning and includes the final marked-up diagram in the Heat Exchanger Cleaning Report.

To ensure full comprehension of what is required, a more in-depth description of the chemical cleaning methodology has been included

6.1.6. ADDITIONAL REQUIREMENTS

in the Appendix

1. The Contractor shall supply suitable plastic sheeting and place it over the scaffolding which covers the main condenser cooling water inlet ducts to prevent any of the debris removed from the condenser tubes during HP-cleaning from falling down into the CW inlet duct.
2. The Contractor shall compile a final method statement, safety-works procedure and Quality Control Plan (QCP) and submit these documents to the Engineer for approval before chemical cleaning and HP-cleaning may commence. The Engineer shall have the opportunity to add witness or hold points on the QCP a week before the activity's scheduled start date.
3. All tubes which are blocked or obstructed, and which cannot be unblocked by HPWJ shall be marked on the tube-map diagram and shall be plugged using expanded rubber plugs which have brass-bolts (or that of an acceptable alternative).

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4. The Contractor ensures sufficient flow during a chemical cleaning activity. Circulation flow shall be sufficient to flow through all the tubes of the condenser but shall not exceed 0.3 m/s through individual tubes.
5. The chemical cleaning pump/s of the Contractor shall produce a maximum pressure of 2.5 bar at 0 m³/h flow OR the equipment will contain electrical protections that will cut the power source to the pump/s should the water-box pressure exceed 2.5 bar. The correct operation of the protection equipment shall be confirmed by the Employer prior to each chemical cleaning operation
6. The Contractor shall maintain a daily logbook where all the required information (chemical analysis, water-box pressures, etc.) are logged.
 7. *The Contractor shall clean all the water-boxes as well as the drainpipes connected to the inlet and return water-boxes after cleaning the tubes. Moreover, all foreign materials and debris shall be removed from the water-boxes.*
 8. *The Contractor will not be allowed to use compressed air in order to assist in draining of a condenser.*
 9. *The Contractor ensures the solvent concentration does not at any time exceed the prescribed concentration of 7.0% by mass and also ensures adequate reaction gas release during the cleaning operation.*
10. The Contractor ensures that the free residual acidity of the cleaning solution does not decrease to below 4.0 % by mass at any time.
11. The Contractor shall add phosphoric acid at a strength of 0.25 to 0.5% when hydrochloric acid is used as the primary solvent, as it has been found to function as an inhibitor of the brass dezincification corrosion process.
12. The Contractor assists in the chemical analysis appropriate to the constituents in the type of scale being dissolved, as well as residual acid strength, performed by the Employer at a frequency of not less than once every 30 minutes.
13. The Contractor assists the Employer with the chemical analysis for the dissolved species comprising the primary alloying constituents of condenser tube material which shall be performed at a frequency not less than once every 70 minutes to monitor corrosion protection by the selected inhibitor.
14. The Employer will conduct analysis of the pH and K25 of the demineralised water in the steam space every 70 minutes to check for acid in leakage and may choose to stop the cleaning operation should excessive leakage occur.
15. The Contractor ensures that all mineral acids is neutralised with lime at the discharge point. All spills shall also be neutralised with lime / soda ash.
16. The Contractor ensures that records of all chemical analysis are kept and made available in the heat exchanger cleaning report.
17. The Contractor shall supply suitable endoscope/fiberscope equipment to facilitate pre- and post- cleanliness inspections of condenser's stainless steel air extraction zone tubes before and after HPWJ, and of the condenser's admiralty brass tubes before and after chemical cleaning. After the inspections have been completed the Contractor shall capture all the video recorded inspection imagery within the Heat Exchanger Cleaning Report and both a physical (/hard copy) and digital copy of said report is to be handed over to the Employer for cleanliness evaluation and record keeping purposes.

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Therefore, as per the requirements of this document a total of six (6x) sections shall be included within the Heat Exchanger Cleaning Report:

- a) The first section capturing the video recorded inspection imagery of the original condition of the tube-sheet and protruding tube-ends, taken before HPWJ and chemical cleaning commences.*
- b) The second section capturing the video recorded inspection imagery of the 5 'pulled' condenser tubes both before and after they have been cleaned as part of the preliminary 'bucket test'.*
- c) The third section capturing the video recorded inspection imagery of the initial 'dirty' condition of the stainless-steel air-extraction zone condenser tubes in the inlet and return water-boxes, taken before HPWJ commences.*
- d) The fourth section capturing the video recorded inspection imagery of the final clean-condition of the stainless-steel air-extraction zone condenser tubes in the inlet and return water-boxes after HPWJ has been completed.*
- e) The fifth section capturing the video recorded inspection imagery of the initial 'dirty' condition of the admiralty brass condenser tubes in the inlet, return and outlet water-boxes, taken before chemical cleaning commences.*
- f) The sixth section capturing the video recorded inspection imagery of the final clean-condition of the admiralty brass condenser tubes in the inlet, return and outlet water-boxes, taken after chemical cleaning has been completed.*

Note that inspection findings are to be included at the end of each section and as a minimum should expertly detail the actual degree of cleanliness before and after the completion of the HPWJ and chemical cleaning production activities. As specified at the end of section 6.1.5., the final marked-up tube-map diagram shall also be included in the Heat Exchanger Cleaning Report.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**6.2. Chemical cleaning****6.2.1. detail scope of work**

SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
1	MAG10	Main Turbine Condenser	<p>Scaffolding will be required at the locations listed below in order to allow for chemical cleaning of the condenser:</p> <ol style="list-style-type: none"> 1. North & South CW outlet bellows (T2's) 2. North & South outlet water-box vents. 3. North & South return water-box vents. 4. North & South return water-box drain-lines. 5. North condenser air extraction pipework. 6. North CDT outlet to condenser connection. 7. Condenser level sight glasses. 		S	Outages
2	MAG10	Main Turbine Condenser	<p>Isolate the condenser: Ensure back-up permit is enforced, condenser is drained, and that all 8 CW manhole covers are opened (i.e., those at the inlet, return, and outlet water-boxes). (Manhole cover \varnothing = 500mm)</p>	HSPPO216 HSPPO222	H	Operating Outages
3	MAG10	Main Turbine Condenser	<p>Install blank flanges on the main CW inlet and outlet ducting of the condenser, i.e., blanks must be installed at the T1's & T2's. Refer to Figure 1 on page 43.</p>	HSPPM280	S	Outages

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
4	MAG10	Main Turbine Condenser	Turbine Engineering to conduct initial 'dirty' inspection of the condenser inlet, return, and outlet water-boxes.	HSIHOS001 HSIPMM580	H	Turbine Eng. Outages Contractor
5	MAG10	Main Turbine Condenser	Manually clean all foreign debris (i.e., splash-packing material, large fragments of scale, metal, wood, stones, etc.) out of the inlet and outlet condenser water-boxes. Also ensure that all the tube-plates are cleaned of foreign debris.	HSIPMM580	S	Outages Contractor
6	MAG10	Main Turbine Condenser	Rod all the condenser tubes to ensure these tubes are not completely or partially blocked prior to chemical cleaning. Unblocking is required to allow adequate solvent circulation.	240-56030530	S	Outages Contractor
7	MAG10	Main Turbine Condenser	Tubes that cannot be unblocked shall be plugged with expandable rubber plugs which have brass-bolts. The tube-map diagram shall be updated during this activity (will be provided by Turbine Engineering).	HSIPMM580	S	Outages Contractor Turbine Eng.
8	MAG10	Main Turbine Condenser	Turbine Engineering to conduct preliminary endoscopic inspection of condenser tubes. Contractor to make sure that they provide an endoscopic machine, the camera of which shall be able to travel the full-length of the tubes (i.e., 9 meters).	HSIPMM580	H	Turbine Eng. Outages Contractor

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
9	PAB10 AA401	North Return Water-box Drain	Remove the two return water-box drain-lines and ensure these drains are unrestricted.	HSPPPMM280	S	Outages
	PAB20 AA401	South Return Water-box Drain				
10	PAB15 AA503	North Inlet Water-box Drain	Remove the two inlet water-box drain-line strainers situated inside the inlet water-boxes, as well as the T-piece of the drain-lines located below the condenser and ensure pipework is unrestricted.	HSPPPMM280	S	Outages
	PAB15 AA504	South Inlet Water-box Drain				
11	MAG10	Main Turbine Condenser	Install scaffolding in the two inlet water-boxes to cover the cooling water ducts.	HSIHOS001	S	Outages
12	MAG10	Main Turbine Condenser	Ensure all safety requirements such as barricading, notices, safety shower, etc. are met prior to high pressure water jetting and chemical cleaning.	HSPPPMM280 36-149	H	Outages Contractor
13	MAG10	Main Turbine Condenser	Tubes that cannot be unblocked shall be plugged with expanded rubber plugs which have brass-bolts. Again, the tube-map diagram shall be updated during this activity.	HSIPMM580	S	Outages Contractor
14	MAG10	Main Turbine Condenser	Install blanks on the steam space section of the condenser, as specified in Table 3 on page 45. Disconnect lines for sampling as indicated in Table 4 on page 46.	HSPPPMM280	S	Outages
15	MAG10	Main Turbine Condenser	Close the 4x return water-box manhole covers in preparation for low- and high-pressure water jetting.		H	Contractor

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
16	MAG10	Main Turbine Condenser	Commence LPWJ on all 14928-condenser admiralty-brass tubes at a working pressure of 150 - 350bar. Forward facing nozzles are to be used. The purpose of LPWJ is not to remove scale from the tubes, but instead, to clear the tubes of any mud debris and/or blockages in preparation for chemical cleaning.	240-56030530	W	Contractor
17	MAG10	Main Turbine Condenser	Commence HPWJ on all 1512- stainless-steel tubes of the air extraction zones at 1000bar (see Figure 2, page 44). Rotating nozzles to be used. Dwell-times shall typically not exceed 40 seconds per tube, and the rate of lance travel should not be slower than 6 seconds per meter. Ensure that virtually all the scale is removed from these tubes as they will not form part of the acid cleaning. This to be confirmed by endoscope with Engineering representative present.	240-56030530	W	Contractor
18	MAG10	Main Turbine Condenser	Post HPWJ clean mud, fragments of scale, and any other anomalies out of the condenser's inlet and outlet water-boxes.	HSIPMM580	S	Outages Contractor
19	MAG10	Main Turbine Condenser	Contact Turbine Engineering to inspect stainless-steel tubes for cleanliness. Contractor to make sure that they provide an endoscopic machine, the camera of which shall be able to travel the full-length of the tubes (i.e., 9 meters).	HSIPMM580	H	Turbine Eng. Outages Contractor

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning

SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
20	MAG10	Main Turbine Condenser	Perform a condenser low level flood test WITHOUT fluorescein. Fill the condenser steam-space to a point just above the tubes (See Table 5 on page 47). As per procedure HSPPO256-R12, do not exceed the specified water level.	HSPPO256 HSIPO075	H	Operating
21	MAG10	Main Turbine Condenser	The plant shall be checked when filling the condenser steam space to identify any demineralized water leaks. If a leak is detected, filling shall be halted, and the leaks repaired.	HSPPO256 HSIPO075	W	Outages Turbine Eng.
NOTE: The condenser steam space should NOT be filled up to the v-beam, as this requires additional blanks to be installed on the pipework entering the condenser neck. The water level should only cover the tube bundles and fluorescence shall not be added as this will interfere with the steam space sampling.						
22	MAG10	Main Turbine Condenser	Conduct a visual inspection of all 1512-stainless-steel tubes of the air extraction zones to identify any obvious tube-leaks. All leaking tubes to be plugged prior to chemical cleaning. Only use expandable rubber plugs which have brass-bolts. Also plug any leaking brass tubes. Mark all permanent plugs installed on the air extraction zone tubes and ensure the tube map is updated.	HSIPMM580	H	Outages Contractor
23	MAG10	Main Turbine Condenser	After leaking tubes have been plugged contact Turbine Engineering to verify that there are no remaining leaking tubes and that the tube map has been updated correctly.	HSPPO256 HSIPO075	H	Turbine Eng. Outages Contractor
24	MAG10	Main Turbine Condenser	Leave the demin-water used to conduct the tube leak test in the steam space in preparation for chemical cleaning.	HSPPO256 HSIPO075	W	Operating

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning

SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
25	MAG10	Main Turbine Condenser	Install temporary tube plugs on both the inlets and outlets of all 1512- stainless-steel tubes of the air extraction zones. Note that 3024 temporary plugs shall be installed, and all plugs shall have brass bolts.	HSPPPMM280	H	Outages Contractor
26	MAG10	Main Turbine Condenser	Turbine Engineering to inspect that all temporary plugs have been fitted correctly to the stainless-steel tubes of the air extraction zone and will not dislodge during the chemical cleaning operation.	HSPPPMM280	H	Turbine Eng. Outages Contractor
27	MAG10	Main Turbine Condenser	Blow-dry the protruding ends of all 1512-stainless-steel tubes as well as their respective tube plates so that epoxy coating can be applied to the moisture-free exposed surfaces. Contractor to specify methodology for coating, including surface prep technique and type of coating to be used. Datasheets shall be included.	GSP36-1126	W	Contractor
28	MAG10	Main Turbine Condenser	Paint epoxy coating on the protruding ends of all 1512- stainless-steel tubes as well as their respective tube plates. Also coat any other exposed stainless-steel attachments which can be seen inside the condenser water-boxes (i.e., any stainless-steel supports or tube plugs with stainless-steel bolts, etc.)	GSP36-1126	W	Contractor
29	MAG10	Main Turbine Condenser	Ventilate the condenser to allow the epoxy coating to cure (contractor to specify required curing time).	GSP36-1126	W	Contractor

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
30	MAG10	Main Turbine Condenser	Contact Turbine Engineering to inspect that coating has been applied correctly and that any other exposed stainless-steel attachments have been coated.	HSIPMM580	H	Turbine Eng. Outages Contractor
NOTE: The material of the air extraction zone tubes, ducting expansion joints and water-box vent and drain strainers is Stainless Steel. This material is not compatible with chemical cleaning that uses hydrochloric acid as solvent. If these components are not protected from the solvent, chloride pitting damage will be the consequence.						
31	PAB10 BR030	North Return Water-box Vent	Disconnect all condenser water-box vents upstream of the valves to allow chemical cleaning contractor to connect temporary pipework. 4x vents are to be disconnected. Refer to Table 6 on page 48. All fasteners and gasket material shall be supplied to the contractor to connect temporary pipework.	HSPMM280	S	Outages
	PAB20 BR030	South Return Water-box Vent				
	PAB10 BR040	North Outlet Water-box Vent				
	PAB20 BR040	South Outlet Water-box Vent				
32	PAB10 AA401	North Return Water-box Drain	Connect / rig temporary pipework of the chemical pumping station to the vents and drains of the main condenser. 4x drains & 4x vents. Again, refer to Table 6 on page 48. Circulation shall be established with the Contractor's pump station, without exceeding the recommended operating pressure of the condenser water-boxes (i.e., 2.0 Bar).	HSPMM280	S	Contractor
	PAB20 AA401	South Return Water-box Drain				
	PAB15 AA503	North Inlet Water-box Drain				
	PAB15 AA504	South Inlet Water-box Drain				
	PAB10 BR030	North Return Water-box Vent				
	PAB20 BR030	South Return Water-box Vent				
	PAB10 BR040	North Outlet Water-box Vent				
	PAB20 BR040	South Outlet Water-box Vent				
33	MAG10	Main Turbine Condenser	Box-up the condenser for chemical cleaning. Remove all scaffolding from the two condenser inlet water-boxes.	HSPMM280	S	Contractor

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
34	MAG10	Main Turbine Condenser	A total of 8x manhole covers to be closed.		H	Contractor
35	MAG10	Main Turbine Condenser	Fill condenser cooling water side with potable / firewater and circulate. Turbine Engineering to witness the functionality of pump station 'over-pressure- protections', set at 2.5Bar.	HSPPPMM280	W	Contractor Turbine Eng.
36	MAG10	Main Turbine Condenser	Inspect all temporary pipework connected to the pump, mixing tank and condenser vents and drains for leaks and fix accordingly.	HSPPPMM280	I	Contractor Chemical Services
37	MAG10	Main Turbine Condenser	Commence solvent / acid injection. Chemical Services to be present during chemical injection.	HSPPPMM280	W	Contractor Chemical Services
38	MAG10	Main Turbine Condenser	Monitor the chemical reaction as per procedure. Chemical services to indicate when draining and flushing can commence.	HSPPPMM280	S	Contractor Chemical Services
39	MAG10	Main Turbine Condenser	Drain the cooling water side of the condenser and neutralise the waste according to procedure.	HSPPPMM280	S	Contractor Chemical Services
40	MAG10	Main Turbine Condenser	Re-fill / flush the main condenser with potable or fire water and prepare for passivation.	HSPPPMM280	S	Contractor Chemical Services
41	MAG10	Main Turbine Condenser	Inject passivation chemicals and commence final passivation of the condenser.	HSPPPMM280	S	Contractor Chemical Services

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
42	MAG10	Main Turbine Condenser	Drain the cooling water side of the main condenser once the required conductivity and pH has been reached.	HSPPPMM280	S	Contractor Chemical Services
43	PAB10 AA401	North Return Water-box Drain	Disconnect all temporary pipework attached to the condenser water-box vents and drains. 4x drains and 4x vents. Refer to Table 6 on page 48.	HSPPPMM280	S	Contractor
	PAB20 AA401	South Return Water-box Drain				
	PAB15 AA503	North Inlet Water-box Drain				
	PAB15 AA504	South Inlet Water-box Drain				
	PAB10 BR030	North Return Water-box Vent				
	PAB20 BR030	South Return Water-box Vent				
	PAB10 BR040	North Outlet Water-box Vent				
	PAB20 BR040	South Outlet Water-box Vent				
44	MAG10	Main Turbine Condenser	If the demin water inside the steam-space is still found to be within spec (i.e., isn't severely contaminated with acid) after chemical cleaning then leave the water within for final high-level flood test inspection. Otherwise, drain the steam space of the main condenser. Ensure sufficient capacity of the outside plant dams prior to draining.	HSPPO256 HSIPO075	S	Chemical Services Operating
45	MAG10	Main Turbine Condenser	Remove blank flanges / spades and reconnect sampling lines on the condenser steam space. Again, refer to Tables 3 & 4 on pages 45 & 46.	HSPPPMM280	S	Outages
46	MAG10	Main Turbine Condenser	Open a total of 8 manhole covers on the inlet, return and outlet water-boxes. Manhole cover $\varnothing = 500\text{mm}$	HSIHOS001	S	Outages
47	MAG10	Main Turbine Condenser	Install scaffolding in the two inlet water-boxes to cover the cooling water ducts.	HSIHOS001	S	Outages

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
48	MAG10	Main Turbine Condenser	Commence LPWJ on all 14928-condenser admiralty-brass tubes for the second time at a working pressure of 150 - 350bar. Forward facing nozzles are to be used. The purpose of LPWJ this time around is to clean residual sludge out of the inlet, outlet and return water-boxes of the condenser.	240-56030530	W	Contractor
49	MAG10	Main Turbine Condenser	Turbine Engineering to inspect main condenser water-boxes, tube-sheets, and to perform final endoscopic inspection of condenser tubes, post chemical cleaning. Contractor to make sure that they provide an endoscopic machine, the camera of which shall be able to travel the full-length of the tubes (9m). Endoscope shall have video storage capability for record keeping, Files to be given to TED	HSIPMM580	H	Turbine Eng. Outages Contractor
50	MAG10	Main Turbine Condenser	Remove the temporary plugs installed in the stainless-steel tubes of the air extraction zones.	HSPPM280	H	Outages Contractor
51	PAB10 AA401	North Return Water-box Drain	Re-install the two return water-box drain lines to ensure these drains are unrestricted.	HSPPM280	S	Outages
	PAB20 AA401	South Return Water-box Drain				
52	PAB15 AA503	North Inlet Water-box Drain	Re-install the two inlet water-box drain-line strainers situated inside the inlet water-boxes.	HSPPM280	S	Outages
	PAB15 AA504	South Inlet Water-box Drain				

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
53	MAG10	Main Turbine Condenser	Turbine Engineering to inspect all water-box manhole covers (8x) for damage / deteriorated seals. Turbine Engineering to provide repair recommendations based on inspection findings.		H	Turbine Eng.
54	MAG10	Main Turbine Condenser	Perform a condenser high-level flood test, this time WITH fluorescein. Fill the condenser steam-space up until the neck of the condenser. (See Table 5 on page 47). As per procedure HSPPO256-R12, do not exceed the specified water level. Allow a 24hours soaking period before the tubes are to be inspected for leaks.	HSPPO256 HSIPO075	H	Operating
55	MAG10	Main Turbine Condenser	Perform flood test inspects as per procedure. Defects to be addressed according to the inspection findings. (Prioritize condenser shell inspections)	HSPPO256 HSIPO075	W	Outages Turbine Eng.
56	MAG10	Main Turbine Condenser	After the 24-hour soaking period, visually inspect the condenser tubes with a blacklight (UV-A light) and try to identify any noticeable tube leaks. If any leaking tubes are evident, plug those tubes using expandable rubber plugs which have brass-bolts. The 'tube-map' shall be updated during this activity. Flushing of the condenser may be required to detect leaking tubes.	HSIPMM580	W	Outages Contractor
57	MAG10	Main Turbine Condenser	After leaking tubes have been plugged contact Turbine Engineering to verify that there are no remaining leaking tubes and that the tube map has been updated correctly.	HSPPO256 HSIPO075	H	Turbine Eng. Outages Contractor

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SUBSYSTEM		MAIN TURBINE CONDENSER				
COMPONENT ACTIVITIES				GOVERNING DOCUMENTS		
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATION	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
58	MAG10	Main Turbine Condenser	Drain the steam space of the main condenser and flush to remove residual fluorescein. Ensure sufficient capacity of the outside plant dams prior to draining.	HSPPO216 HSPPO222	H	Operating Chemical Services
59	MAG10	Main Turbine Condenser	Remove blank flanges / spades and reconnect sampling lines on the condenser steam space. Again, refer to Tables 3 & 4 on pages 45 & 46.	HSPPM280	S	Outages
70	MAG10	Main Turbine Condenser	Ensure proper housekeeping by making sure the inlet, return and outlet water-boxes have been sufficiently cleaned. Thereafter, box-up the condenser for centre-line activities. A total of 8x manhole covers to be closed on the inlet, return and outlet waterboxes. Contact TED to sign the box-up certificate thereafter.	HSIPMM580	W	Outages Contractor
61	MAG10	Main Turbine Condenser	De-isolate condenser and charge with CW to service weight to allow for centreline alignment.	HSPPO216 HSPPO222	S	Operating

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**A. CONDENSER PREPERATION FOR CHEMICAL CLEANING****CONDENSER COOLING WATER SIDE:**

1. Fix blank to the flange above the stainless-steel bellow of the left hand (LH) cooling water inlet pipework (LH T1 Line above Isolating Valve). Pipe OD = 1400mm.
2. Fix blank to the flange above the stainless-steel bellow of the right hand (RH) cooling water inlet pipework (RH T1 Line above Isolating Valve). Pipe OD = 1400mm.
3. Fix blank to the flange before the stainless-steel bellow (Condenser Side) of the LH cooling water outlet pipework (LH T2 line above the condenser water-box). Pipe OD = 1400mm.
4. Fix blank to the flange before the stainless-steel bellow (Condenser Side) of the RH cooling water outlet pipework (RH T2 line above the condenser water-box). Pipe OD = 1400mm.

NOTE: If chemical cleaning of the turbine coolers is required, then the cooler CW supply and return lines will also require blank spades.

CONDENSER STEAM SPACE:

1. North air suction Pipework on the condenser shell to be blanked at the condenser side inter-connecting flange. Pipe OD = 100mm.
2. South air suction Pipework on the condenser shell to be blanked at the condenser side inter-connecting flange. Pipe OD = 100mm.

NOTE: Some units, e.g., Unit 07, do not have flanges on the air ejector suction pipework from the condenser. In this case, blanks should be installed on the Suction Valves of the North, South and Quick Start Air Ejectors.

3. Drain-pipe from the clean drains tank on the North side of the condenser shell to be blanked at the shell interface (Condenser side). Pipe OD = 100mm.
4. The North condenser flash-box at basement level requires a blank at the bottom flange (Flash-box Condensate to Hot-well). Pipe OD = 300mm.

NOTE: The steam from the flash-box enters the condenser neck and is above the tube bundles at the same level as the condenser filling valve and blanking of the top section of the flash box is not necessary.

5. The condenser Filling Line that is situated on the North side of the condenser next to the North flash-box is utilised during the chemical cleaning and **SHOULD NOT BE BLANKED**. Pipe OD = 200mm. Ensure the filling line valve at the basement level is installed and the condenser can be filled with demineralized water.
6. The hot-well make up regulator situated on the hot-well on the Extraction Pump Side of the condenser is to be removed and blanked at top and bottom connection flanges with the condenser.
7. Both Extraction Pump A & B inlet isolating valves and bypasses are to be blanked off. The extraction inlet isolating v/v bypass valves are to be blanked on the condenser side.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning

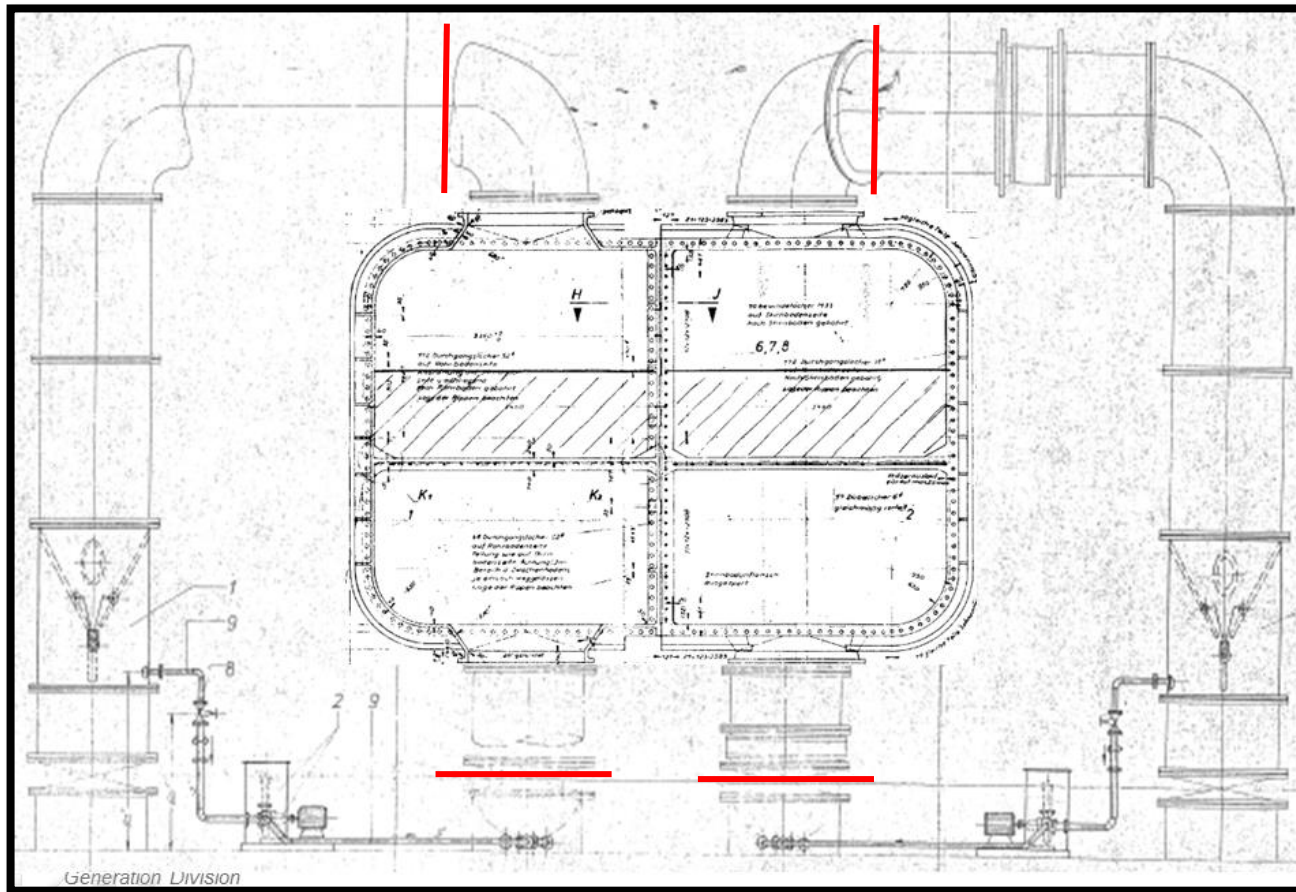
8. The steam space drain situated underneath the condenser hot-well is to be blanked off at the valve outlet. The other blank flange & gasket underneath the hot-well is to be inspected and re-sealed if necessary.
9. Mowbrey Alarmer (Low Level) situated on the South side of the condenser hot-well **REMAINS** in place.
10. Mowbrey Alarmer (High Level) situated on the South side of the condenser hot-well **REMAINS** in place.
11. Mowbrey Alarmer (Emergency Trip) situated on the South side of the condenser hot-well **REMAINS** in place.
12. The bottom water level indication glass on the South side of the condenser is to be blanked off at the top and bottom after the isolation valves. Pipe OD = 20mm
13. The top water level indication glass on the South side of the condenser to be blanked off at the top and bottom after the isolation valves. Pipe OD = 20mm
14. Blank the two gland steam piping drains at the orifice flanges leading to the South condenser blow down vessel.
15. Blank the three turbine drain orifices leading to the HP Turbine Blowdown Vessel on the South Side of the condenser.
16. Ensure all turbine chest-drain valves are fully functional and in the closed position.
17. Ensure all the spray-water valves to the HP Turbine Blowdown vessel is fully functional and in the closed position.
18. Ensure all the silt trap flanges on the chest drain lines have been opened.

SAMPLING POINTS FOR CHEMICAL SERVICES:

1. Split the two ammonia dosing lines underneath the hot-well located on condensate extraction lines A & B after their isolating valves.
2. The line protruding from the lower sight glass to the level transmitter is to be split after the isolation valve.
3. The line protruding from the upper sight glass to the level transmitter is to be split after the isolation valve.

PREPERATION OF TEMPORARY CONNECTION POINTS:

1. Disconnect the T-Piece connecting the two inlet water-box drain lines at the flanges below the isolating valves. Pipe OD = 150mm.
2. Remove the two return water-box drain lines from the condenser water-box. Pipe OD = 50mm.
3. Disconnect the two return water-box vent lines. These vents should be split at the water-box interface. Pipe OD = 50mm.
4. Disconnect the two vent lines from the CW return ducting. The vents are situated before the stainless-steel bellows on the T2 pipework.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**C. TECHNICAL PARTICULARS****CONDENSER CW SPADES****Figure 1: CW Ducting Blanks (Indicated in Red)**

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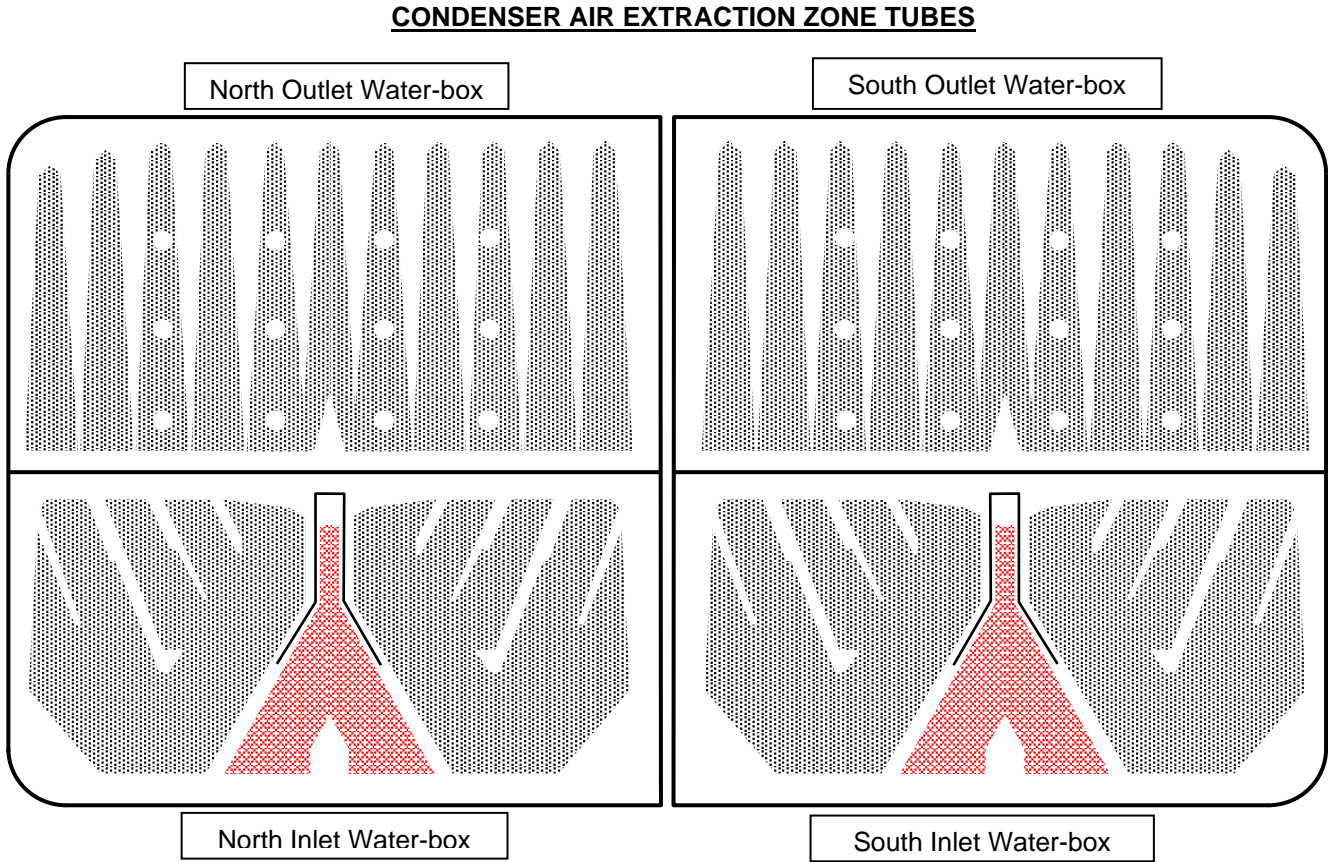


Figure 2: Stainless Steel Air Extraction Zone Tubes (Indicated in Red)

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Nr.	Flange Description:
1	North condenser air suction manifold at manifold connection
2	South condenser air suction manifold at manifold connection
3	CDT outlet pipe at condenser shell connection
4	North condenser flash-box at distillate outlet connection
5	Ensure the condenser make-up regulator is installed and secured.
6	Ensure blank flange below condenser make-up regulator is not leaking.
7	Extraction pump A at the condensate inlet isolating valve.
8	Extraction pump B at the condensate inlet isolating valve.
9	Extraction pump A condensate inlet isolating valve, bypass valve.
10	Extraction pump B condensate inlet isolating valve, bypass valve.
11	Ensure blank flange under condenser hot-well is not leaking.
12	Ensure blank flange is fitted to the outlet of the condenser hot-well drain valve.
13	Ensure the low level mowbrey alarmer is installed and secured.
14	Ensure the high level mowbrey alarmer is installed and secured.
15	Ensure the emergency trip mowbrey alarmer is installed and secured.
16	Remove the upper condenser sight glass – install 2x blanks at the top and bottom isolation valves.
17	Remove the lower condenser sight glass – install 2x blanks at the top and bottom isolation valves.
18	All steam chest-drain valves to be isolated / closed. Consult engineering should these valves have been removed during the outage.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**TABLE 4: CONDENSER CHEMICAL CLEANING ANALYSIS POINTS:****Flanges / Pipework to be split at the following location to allow chemical analysis:**

Nr.	Flange Description:
1	West condensate extraction ammonia dosing at isolation valve.
2	East condensate extraction ammonia dosing at isolation valve.
3	Lower condenser sight glass indication at isolation valve.
4	Upper condenser sight glass indication at isolation valve.

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<u>TABLE 5: VALVES TO BE IN PLACE TO ALLOW FOR CONDENSER STEAM SPACE FILLING</u>	
KKS:	Valve Description:
LAB02 AA504	RFT Outlet Isolating Valve
LAB02 AA505	Condensate Make-Up Isolating Valve
LAB02 AA506	Condensate Make-Up C/V Inlet Isolating Valve
LAB02 AA002	Condensate Make-Up Control Valve
LAB02 AA402	Condensate Make-Up Drain Valve
LAB02 AA507	Condensate Make-Up C/V Outlet Isolating Valve
LAB02 AA508	Condensate Make-Up C/V Bypass Valve
LAB02 AA101	Condenser Over-rider Control Valve
LAB02 AA509	Condenser Over-rider Isolating Valve
LAB02 AA502	Condensate Dumping C/V Outlet Isolating Valve
LAB02 AA401	Condensate Dumping Drain Valve
LAB02 AA001	Condensate Dumping Control Valve
LAB02 AA501	Condensate Dumping C/V Inlet Isolating Valve
LAB02 AA503	Condensate Dumping C/V Bypass Valve
LAB02 AA301	Condensate Dumping Vent Valve
LAB02 AA512	Condensate Dumping Vent Valve

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**TABLE 6: CONDENSER CW VENT AND DRAIN CONNECTION POINTS**

Component Description:	KKS Codification:
CONDENSER NORTH COOLING WATER BOX DRAIN VALVE	PAB10AA401
CONDENSER SOUTH COOLING WATER BOX DRAIN VALVE	PAB20AA401
CONDENSER NORTH COOLING WATER FILLING ISOLATING VALVE	PAB15AA503
CONDENSER SOUTH COOLING WATER FILLING ISOLATING VALVE	PAB15AA504
COOLING WATER RETURN NORTH VENT PIPE	PAB10BR030
CONDENSER WATER BOX NORTH VENT PIPE	PAB10BR040
COOLING WATER RETURN SOUTH VENT PIPE	PAB20BR030

g) DOCUMENTATION REQUIRED

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- The *Contractor* shall compile a final method statement, safety work procedure and QCP and submit these documents to the *Engineer* for approval before HP-cleaning & LP-cleaning may commence. The *Engineer* shall have the opportunity to add witness or hold points on the QCP.
- A statement from the Contractor that the minimum safety and equipment requirements (as defined in sections 5.1.3. (page 5), 5.1.4. (page 6), 6.1.3. (page 19) and 6.1.4.(page 21)) will be met without exception.
- Contractor to submit a detailed list of exclusions or deviations from the above specification (if any).
- All technical datasheets for the forward-facing and rotating tube cleaning nozzles to be used for cleaning of the condenser tubes as well as the nozzles to be used for testing purposes (if the same nozzle is not used for both). The minimum information to be shown on a datasheet is the following:
 - Names of supplier of nozzle,
 - Pressure rating of the nozzle.
 - Outside diameter of nozzle and tube inner diameter range the nozzle is intended for.

Note: The cleaning nozzle datasheets shall furthermore detail the design features of the cleaning nozzles for unplugging tubes and removing deposits from the inner tube walls. Note that only nozzles from recognized HP / LP water jetting equipment suppliers will be regarded as acceptable.

- Technical datasheets for all the HP / LP water jetting pumps to be used on site which must indicate as a minimum, the flow rate of the pumps at 1000bar working pressure and 150 - 350bar working pressure, respectfully.
- Technical datasheets for flexible hoses stating pressure rating and internal diameter as a minimum. The datasheets for both the flexible hose from pump outlet to foot-valve and the hose from foot-valve to rotating tube cleaning nozzle shall be supplied.
- The Contractor shall indicate in the tables shown on the next page what equipment will be available on site for the full duration of the HPWJ cleaning process to be executed on the condenser in the allocated outage time period. (Example: If only two pumps will be used then only the first two lines of the table are to be completed).

h) TECHNICAL TENDER RETURNABLES

Please refer to the attached document: “**Tender Technical Evaluation Strategy – Condenser High/Low Pressure Water Jetting and Chemical Cleaning**” (Document Number: **380-136359**; Rev 1) for information, written in full detail, regarding the technical returnables required at the tender stage as well as the tender evaluation criteria for high pressure water jetting, low pressure water jetting, and chemical cleaning at Hendrina Power Station. It is recommended that the *Contractor* read the document from beginning to end to make sure that there are no exclusions or deviations to sections 7.2 to 7.7 of this scope of work (pages 5 to 48) before they commit to any three of the aforementioned on-site cleaning activities.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**HP / LP Water Jetting Pumping Capacity/Resource**

Pump #	Pump Identification	Pump Flow Rate (litres/min) at 1000bar / 150 - 350bar Working Pressure	Number of Cleaning Sets (i.e., cleaning nozzles, hoses, foot-valves, etc.) which will be connected simultaneously to the pump
1			
2			
3			
4			
5			
6			

HP / LP Water Jetting Hose Inventory

Hose #	Hose Series or Part Number:	Hose Internal Diameter (mm):	Hose External Diameter (mm):	Maximum Working Pressure (bar):
1				
2				
3				
4				
5				
6				

HP / LP Water Jetting Nozzle Inventory

Nozzle #	Part Number:	Supplier Name:	Design (Unplugging / Polishing / Universal):	Pressure Rating (bar):	Flow Range (litres/min):
1					
2					
3					
4					
5					
6					

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**Interpretation and terminology**

The following abbreviations are used in this Service Information:

Abbreviation	Meaning given to the abbreviation
AIA	Authorised Inspection Authority
MT	Magnetic Particle Inspection
NDT	Non-destructive Testing
OEM	Original Equipment Manufacturer
PMI	Positive Material Identification
PPE	Personal Protective Equipment
PT	Penetrant Testing
QC	Quality Control Inspector
QCP	Quality Control Plan
RTS	Return to Service
BU	Business Unit
Ca	Calcium
Cu	Copper
GT	Group Technology
condenser	Heat Exchanger
HP	High Pressure
HCl	Hydrochloric acid
ID	Inner Diameter
ITP	Inspection and Test Plan
Mg	Magnesium
MSDS	Material Safety Data Sheet
m/s	Metres per second
mm	Millimetre
µS/cm	Micro-Siemens per centimetre
Ni	Nickel
NDE	Non-destructive examination
ppb	Parts per billion
QA	Quality Assurance
QC	Quality Control

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QCP	Quality Control Plan
RTD	Research, Testing and Development
SFP	Steam Feed Pump
Si	Silicon
Zn	Zinc

Definitions**1.4.1 Blocked Tube:**

Passage of air through the tube is not possible and the tube cannot be successfully cleared by rodding.

1.4.2 Fiberscope:

A device used to enable the visual inspection of the internal surfaces of condenser / heat exchanger tubes.

1.4.3 Fouling:

A term used to describe conditions in which the presence and accumulation of foreign materials interfere with or compromise the optimal functionality of a heat exchanger. The term includes the accumulation and growth of organisms on a submerged metal surface and the accumulation of organic and inorganic deposits on heat exchanger tubing.

1.4.4 Obstructed Tube:

External structures or the nature of the tube end limits physical access to the tube.

1.4.5 pH:

The negative logarithm of the hydrogen ion concentration measured at a defined temperature (Usually 25°C).

1.4.6 Heat Exchanger Cleaning Report:

A data book of collective documents containing all information on any cleaning activity conducted on a specific turbine plant heat exchanger.

1.4.7 Restricted Tube:

Passage of air through the tube is possible, but access to the entire length of the tube is not possible due to dents or solid debris.

1.4.8 Scaling:

The deposition of water-insoluble constituents on a metal surface.

1.4.9 Solution:

In chemistry, a solution is a homogeneous mixture composed of only one phase. In such a mixture, a solute is a substance dissolved in another substance, known as a solvent.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**1 Management strategy and start up.****2.1. The Service Provider's plan for the service**

2.1.1. The *Service Provider* submits a program for acceptance by *Service Manager* prior to commencing with the work. The program must be in line with the *Employer's* flexible (Consistent Project/Outage movement) Project/Outage programme. The program must be updated on a weekly basis.

2.1.2. The program is in MS Project and must include the following:

- The Number of Assigned resources as per Employer's Instruction
- The Servicing calendar (number of Service-hours per day, days per week),
- The leave days and relieve plan

The *Service Provider* to provide contingency plan in case each resource get deceased, resigns or get Sick. It remains the *Service Provider's responsibility* to replace such resource within 1 week with a resource of similar level of competency as prescribed in detailed job profile

2.1.3. The *Service Provider's* program must fit in with the interface activities of other Contractors, fit within the Project/Outage department programs. These interfaces are activities such as scaffolding, lagging etc.

2.1.4. Activities will only be recorded as complete when the quality inspection plan for the activity is returned to the *employer's representative* with all the relevant signatures, including that of the quality controller.

2.2. Management meetings

Regular meetings of a general nature may be convened and chaired by the *Service Manager* as follows:

Title and purpose	Approximate time & interval	Location	Attendance by:
Risk reduction and compensation event meeting	As and When required	Hendrina Power Station/ ms teams	<i>Service Provider's Rep Employer</i>
Overall contract progress and feedback	Every Tuesday at 15:00 or as agreed between the parties	Hendrina Power Station/ ms teams	<i>Employer & Service Provider</i>
Outage Meeting	Daily, 08h00 to 09h00 (If & when necessary <i>Service Provider</i> will be informed to attend)	Hendrina Power Station/ ms teams	<i>Service Provider's Rep</i>
<i>Service Provider</i> Safety Meeting	Weekly, Thursday's at 11h00	Hendrina Power Station (auditorium)	<i>Service Provider Safety Officer</i>
Site (Kick Off) meeting	First working day after official contract is placed at 10:00	Hendrina Power Station/ ms teams	<i>Employer's Team & Service Provider</i>

Meetings of a specialist nature may be convened as specified elsewhere in this Service Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the service. Records of these meetings must be submitted to the *Service Manager* by the person convening the meeting within five days of the meeting.

All meetings must be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register must not be used for the purpose of confirming actions or instructions under the contract as these must be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

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Before work starts on site, an inaugural or kick off meeting is held with the *Service Provider* and the Employer, to explain in detail all requirements of the Site Regulations including working hours access to site.

2.3. Service Provider's management, supervision and key people

The *Service Provider* to provide an organogram showing his people and their lines of authority/communication.

The *Service Provider* hires qualified personnel as per the prescribed qualification and related experience.

The *Service Provider* ensures that qualified personnel are used onsite and this will be applicable in their workshop as well. The personnel onsite reports and are supervised by the *Service Provider's* Site Supervisor who must report to the *Service Manager*.

The *Service Provider* attaches the personnel CV's for evaluation to the *Employer*. The *Employer* reserves the right to not accept the personnel not meeting the required expertise or competency level.

The *Service Provider* to give daily feed back to the *Service Manager* and he must compile a full report at the end of the outage. The *Service Provider* must be available during commissioning to assist with any quality inspection work that might be required.

2.4. Provision of bonds and guarantees

Not applicable to this contract.

2.5. Documentation control

All contractual communications will be in the form of properly compiled letters or forms attached to e mails and not as a message in the e-mail itself.

The routing of all written communications will be between the *Employer* and the *Service Provider* only, any agreements between the *Service Provider* and any other person representing the employer which has not been routed via the Service Manager is null and void.

Any written instruction(s) resulting in any changes to the duration, quality, and cost of the service will only be received from the Service Manager. Any verbal Instruction will also be considered null and void.

2.6. Invoicing and payment

Within one week of receiving an assessment from the *Service Manager* in terms of core clause 51.1, the *Service Provider* provides the *Employer* with a tax invoice showing the amount due for payment equal to that stated in the *Service Manager's* payment certificate.

The *Service Provider* must address the tax invoice to:

Eskom Holdings SOC Limited
Hendrina Power Station
Accounts Payable
PO Box X 1003
Pullenshope
1096

and include on each invoice the following information:

Name and address of the *Service Provider* and the *Service Manager*;
The contract number and title;
Service Provider's VAT registration number;
The Employer's VAT registration number 4740101508;
Description of service provided for each item invoiced based on the Price List;

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Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;

Payments are done within 14 to 28 working days after receipt of tax invoice.

2.7. Contract change management

For any changes on the contract standard, NEC forms must be used which includes but not limited to:

- Task order forms before the Service commencement.
- Assessment forms on completion of a task order.
- Early warning forms when either party warns the other about the foreseen situation.
- Compensation event notification when there is a possibility of additional Service.

2.8. Records of Defined Cost to be kept by the Service Provider

The *Service Provider* keeps records of all equipment and people employed on site which the Employer has access to at any time in order to access compensation events and audit purposes for the period of this contract.

2.9. Insurance provided by the Employer

Refer to the TSC3 Data by Employer Core Clause 83.1

2.10. Training workshops and technology transfer

Service provider must select candidate to go for AS and RP training course.

2.11. Design and supply of Equipment

Design of any component do not form part of this contract. Refer to section 5.7 for equipment that would be supplied by the Employer.

2.12. Things provided at the end of the service period for the Employer's use**2.12.1. Equipment**

Not Applicable to this Contract.

2.12.2. Information and other things

Certificate of completion will be submitted at the end of the contract or period of service and is to be signed by both the *Employer* and *Service Provider*. *Service Provider to provide a data pack file for all the work executed on each unit.*

Service provider to contribute CSI OF 0.5 %

2.13. Management of work done by Task Order

The *Employer* will issue a Task Order as an instruction to commence with the execution the work. No work will be permitted to commence without an issued task order signed by both *Employer* and *Service Provider*.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**3. Health and safety, the environment and quality assurance****3.1. Health and safety risk management**

The *Service Provider* is to ensure that all his personnel attend a Health and Safety Induction Course presented by *Employer* from 09:00 to 10:00, Monday- Friday prior to commencement of any *works*. This is a one (1) hour course and is valid for the duration of one (1) year at Hendrina Power Station.

- (a) The *Service Provider* works strictly to risk assessment associated to his plant specific hazards.
- (b) The *Service Provider* ensures supervised and authorised entry into the plant.
- (c) The *Service Provider* ensures at all times compliance with the safety regulations imposed by any act of parliament, or any regulation or by law of any statutory authority.
- (d) The *Service Provider* complies with the Occupational Health and Safety Act and Regulations, 1993 and all regulations made there under as well as the *Employer's* safety and operating procedures.
- (e) The *Service Provider* acknowledges that he is fully aware of the requirements of all the above and undertakes to employ people who have received sufficient training to do the work required by the scope that they can comply therewith.
- (f) The *Service Provider* undertakes not to do, or not to allow anything to be done which will contravene any provisions of the act, regulations or operating procedures.
- (g) All employees of the *Service Provider* must attend a safety induction course before they are allowed to work on site. It is the responsibility of the *Service Provider* to ensure that all employees have attended the safety induction.
- (h) The *Service Provider* holds a Toolbox Talk and inspects all PPE before any work commences and keep written proof of such actions.
- (i) The *Service Provider* complies with all of the applicable Quality, health, safety and plant procedures as stated on specifications point no 3.7.1
- (j) The *Service Provider* complies with all of the applicable procedures as required by the *Employer*, Procedures available from the *Employers* Documentation Centre on request.
- (k) The *Service Provider* complies with the health and safety requirements questionnaire.
- (l) The *Service Provider* familiarizes himself with all permit requirements for work to be done on all plant systems and ensures that permits are applied for accordingly. The *Service Provider* specifically addresses all risks related to work in any area by means of a written and approved risk assessment, which is compiled in liaison with the *Employer*
- (m) The following risks have been identified by the *Employer*, and the *Service Provider* must include these in his risk assessment:
 - Injury caused by hand tools
 - High noise level
 - Falling when working at heights
 - Movement of stairs while walking
 - Falling into open trenches while walking
- (n) Any tampering with the *Employer's* fire equipment is strictly forbidden
- (o) All exit doors, fire escape routes, walkways, stairways, stair landings and access to electrical distribution boards must be kept free of obstruction, and not be used for work or storage at any time. Firefighting equipment remains accessible at all times

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- (p) In case of a fire, report the location and extent of the fire to the Electrical Operating Desk at extension 5555
- (q) Take the necessary action to safeguard the area to prevent injury and spreading of the fire
- (r) *Employer* provides the *Service Provider* with the baseline risk assessment to use it as a minimum requirement to compile a risk assessment identifying all the risks before the implementation commences, the risk assessment compiled by the *Service Provider* will clearly show all the mitigating strategies in order to minimize all the possible risks.

3.2. Environmental constraints and management

The *Service Provider* is responsible to comply with any new environmental requirements, relevant to the Works Information or Scope that may come into effect as part of *Employer's* EMS during the duration of this contract

The *Service Provider* is responsible to ensure representation at Environmental meetings and *Service Provider* Partnerships Meeting that may require input for the updating of the EMS or presentation as well as training on an ad-hoc basis

The *Service Provider* adheres to the *Employer's* Environmental Management System that must meet the requirements for the Code of Practice for Environmental Management Systems (EMS), ISO 14001:2004

The EMS requirements are detailed in the latest revision of the following documents, which are available from the *Service Manager* on request, and include:

- ☐ The Hendrina Power Station Environmental Policy (HSPPPIN005)
- ☐ The Environmental Emergency Preparedness Procedure (HSPPIN032)
- ☐ The Prevention & Cleaning of Oil Spills Procedure (HSPPON003)
- ☐ The Waste Management Procedure (HSPPIN003)
- ☐ The Roles and Responsibilities Procedure (HSPPIN028)
- ☐ The EMS Non-Conformance, Corrective and Preventative Action (HSPPIN034)
- ☐ The relevant Environmental Management Programmes (EMP's) and Aspects on the Environmental Management System (EMS) database - this is continually changing and is available from the *Employer's* Representative
- ☐ Compliance to all relevant environmental legislation, as detailed in the latest version of the Hendrina Power Station Legal Register available from the *Employers* Representative
- ☐ All operational procedures that include environmental requirements, relevant to the Services Information or Scope of this contract

If there is uncertainty around any environmental issues, the *Employer's* Environmental Department may be contacted on (013) 296 3358 or (013) 296 3910 or (013) 296 3013

3.3. Quality assurance requirements

All Quality Control Documentation are submitted to the *Service Manager* within 7 days after contract date or before the work commence, the KPI's are used to evaluate the quality of service. The *Employer* reserves the right to terminate the Contract if the Service Quality is not satisfactory

The *Employer* carries out random Audit on the *Service Provider's* work ethics in ensuring that they render their service in line with the conditions of this Contract and as per the quality standard

The *Service Provider* complies with the *Employer's* Quality Requirements as specified in Eskom Generation Standard (GGS 0462) and the QM-58.

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NB: The *Employer* reserves the right to compel the *Service Provider* to replace the resource that is under-performing or involved in poor work ethics or Misconduct. Sample QCP's and QIP's have to be submitted with the tender.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**4. Procurement****4.1. People****4.1.1. Minimum requirements of people employed**

The *Service provider* will be required to have the following personnel in their service:

Resource	Minimum Qualification
Chemistry Specialists	B. Eng. or B. Tech.
Quality Control Inspectors	SAIW level II Certification
Qualified Operators with certified knowledge training on High Pressure Water Jetting	Water Jetting Training Certificates

4.1.2. BBBEE and preferencing scheme

SD& L TO ASSIST

4.1.3. Accelerated Shared Growth Initiative – South Africa (ASGI-SA)

Not Applicable to this Contract, Only SD&L requirements applies

4.2. Subcontracting**4.2.1. Preferred subcontractors**

Not Applicable to this Contract.

4.2.2. Subcontract documentation, and assessment of subcontract tenders

Not Applicable to this Contract.

4.2.3. Limitations on subcontracting

Not Applicable to this Contract

4.2.4. Attendance on subcontractors

Not applicable to this contract.

4.3. Plant and Materials**4.3.1. Specifications**

Blanks to be provided and installed by employer

4.3.2. Correction of defects

Not Applicable to this Contract

4.3.3. Service Provider's procurement of Plant and Materials

The *Employer* will provide blanks and install them. The Employer will also provide 5 'pulled' condenser tubes to allow for the 'bucket test' (refer to 5.11 on page 19 of this document for clarity).

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**4.3.4. Tests and inspections before delivery**

Not Applicable to this Contract

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

Refer to section 5.7 for equipment that would be provided by the Employer.

4.3.6. Cataloguing requirements by the *Service Provider*

Not Applicable to this Contract

5. Working on the Affected Property**5.1. *Employer's* site entry and security control, permits, and site regulations**

- Compulsory induction will be required before gaining access to Hendrina Power Station.
- Adherence to cardinal or lifesaving rules and other requirements will be explained during the induction process.
- No work will commence without an accredited Authorised Supervisor and accredited Responsible Person on site.

5.2. People restrictions, hours of work, conduct and records

- Contract maybe terminated due to the following conduct:
 - *Service Provider* may not divulge classified information about the Employer.
 - The *Service Provider* may not use any information about the Employer to the public.
 - All Tender and procurement information cannot be transferred outside Eskom.
 - Any conflict of interest will be prosecuted.
 - No documents can be reproduced or stolen for the Service Provider for self-establishment and enrichment.
 - Employer's Data and other Organisational process assets is treated as confidential.
 - Eskom Properties such as Laptops cannot be used for private use and no Private personal information can be stored on the Employer's computers.
 - The lost or damaged of Computers or other material and equipment will be at *Service Provider's* cost to replace.
 - The *Service Provider* resources may not lie or misrepresent themselves.
 - Frequent late arrival in meetings and at work may lead to termination of the contract or resource being replaced.
 - Poor work ethics may lead to resource being replaced e.g procrastination and delays in providing Service, negligence and elementary mistakes.
- Records:
 - No standing time claims will be entertained without proof of presence and activity in the form of a time sheet.
 - It is very important that the *Service Provider* keeps records of his people on Site, including those of his Subcontractors which the Project Manager or Supervisor have access to at any time. These records may be needed when assessing compensation events.

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning**5.3. Health and safety facilities on the Affected Property**

The *Service Provider* is provided with an on-site Medical Centre for 1st aid and minor injuries. Major injuries are referred to the hospitals outside Hendrina power station using the ambulance on site. The *Service Provider* is responsible for the medical treatment fees of his employees

5.4. Environmental controls, fauna & flora

As per the *Employer's* procedure: The Hendrina Power Station Environmental Policy (HSPPPIN005)

5.5. Cooperating with and obtaining acceptance of others

The *Service Provider* cooperates with all other relevant stakeholders. During the execution phase there will be interfacing with other contractors, this interfacing will be discussed in the outage meeting to specify the exact time and location of when it is needed.

5.6. Records of Service Provider's Equipment

The *Service Provider* keeps records of all their equipment on site which the *Employer* has access to at any time in order to access compensation events for the period of this contract. All containers brought to site by the *Service Provider* will be required to have COC's including independent DB Boards.

5.7. Equipment provided by the Employer

The Employer provides the following to the *Service Provider*:

Item	Date by which it will be provided
Potable water	Immediately
Power supply 220v to 380v	Upon 24hours advanced request
Compressed air up to 6 bar	Upon 24hours advanced request
Scaffolding	Upon 24hours advanced request

5.8. Site services and facilities**5.8.1. Provided by the Employer**

The Employer to provide electrical 220V and 380V power supply, portable water, waste bins in designated areas and ablution facilities.

Employer supplies, free of charge, reasonable quantities of potable water required for the purposes of this contract from the existing points. The *Service Provider* provides, at his own cost, all connection fittings, pipe work, temporary plumbing, and pumps necessary to lead the water from the *Employer's* points of supply to the various points where it is required.

Power is available at the existing points. The *Service Provider* provides his own portable 380V electrical distribution boards, and supply cables to and from the boards, for all his power supply requirements to execute the works. The *Service Providers'* Electrical Distribution Boards must comply with OHSAs as referred to in the Electrical Installation Regulations and the Electrical Machinery Regulations. Each board brought onto site has a Certificate of Compliance issued by an accredited person.

The *Service Providers'* electrical distribution boards are installed at the works on a time negotiated with the Supervisor, prior to the possession date. The Employer connects distribution boards to a 380V three-phase

CONTRACT TITLE: The Condenser High/Low Pressure Water Jetting and Chemical Cleaning

AC power supply, only after the *Service Provider* has submitted the valid Certificate of Compliance. All *Service Providers* electrical distribution boards are earthed to the steel structure of the plant.

The *Employer* provides the *Service Provider* access to identified existing ablution facilities.

The *Service Provider* maintains the site to meet the requirements of the health and safety requirements as per the requirements of the Service Manager. The *Service Provider* restores the site to its original state i.e., clean and no rubble. Inspection is held by the Service Manager and signed off.

5.8.2. Provided by the Service Provider

The *Service Provider* to bring whatever deemed necessary to complete the Services. The *Service Provider* to provide their own facilities in the form of Containers to be used as offices and including their own DB Boards in the case where the Employer's socket outlets are non-functional. Upon completion of the contract, the *Service Provider* to remove the containers from site as well as any other equipment which they brought to site.

5.9. Control of noise, dust, water and waste

As per Employer's Environmental requirements specified under section 3.2 **Environmental Constraints and Management**

5.10. Hook ups to existing works

Where hook ups to existing works is impractical, lanyards and retractable lifelines maybe used as per Employer's working at heights procedure

5.11. Tests and inspections**5.11.1. Description of tests and inspections**

Before starting with the production chemical-HPWJ cleaning operation, the *Contractor* in consultation with the *Employer* must establish an acceptable nozzle resident/dwell-time, cleaning a minimum of 5 'pulled' condenser tubes during an on-site '*bucket test*', thereby demonstrating the *Contractor's* true capability of meeting the minimum acceptance criteria stipulated under section 1.4.1.3. of this document. The *Employer* will provide the 5 tubes and as part of the test the *Contractor* must also demonstrate to the *Employer* that the working pressure of the HPWJ pump, hose and cleaning nozzle combination, does not damage the tubes.

Dwell-times must typically not exceed 40 seconds per tube, and the rate of lance travel should not be slower than 6 seconds per meter. After the '*bucket test*' has been conducted and during cleanliness visual inspections it may be found that cleaning with the pre-established nozzle resident/dwell-time is ineffective, i.e., scale deposits are not being entirely removed from the inner walls of the condenser tubes. In such an event the nozzle resident/dwell-time may be further increased, and the '*bucket-test*' repeated. This test must be performed in consultation with the *Employer* and actual high-definition endoscopic inspections of all the cleaned tube sections must be performed. Thereafter, the *Contractor* must capture all the video recorded inspection imagery (to be taken both before and after HPWJ commences) within a visual report and both a physical and digital copy of said report is to be handed over to the *Employer* for cleanliness evaluation and record keeping purposes.

To clarify once more, the *Contractor* must demonstrate that these tube sections can be cleaned in a single nozzle pass to the point where no traces of products of corrosion or scale deposits are visible, and no immediate damage to the internal surfaces of the tube(s) is evident once the test has been completed. In cases where excessive scale thickness prohibits the use of a nozzle capable of 50 litre/min at 1000 bar working pressure, then a nozzle with capability of no less than 33litre/min at 1000 bar working pressure must be used.

NB! This activity must be included in the QCP as a hold point. Note that failure to pass the 'bucket-test' will be considered as non-performance with respect to the contract.

With regards to inspections, several endoscope/fiberscope inspections will need take place throughout the chemical-HPWJ production cleaning operation. A preliminary endoscope inspection will take place before any

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cleaning activity commences so as to inspect the original condition of the condenser tubes. Separate to the aforementioned preliminary endoscope inspection, further inspections will be performed before and after the bucket test, before and after HPWJ of the stainless-steel air extraction zone condenser tubes as well as before and after the chemical cleaning of the admiralty brass condenser tubes. These inspections are required to evaluate the degree of cleanliness, achieved by both HPWJ and chemical cleaning. As stipulated in section 1.4.3. under point 15 on page 16 of this document, the *Contractor* must capture all the video recorded inspection imagery from each endoscope inspection within the Heat Exchanger Cleaning Report and both a physical (/hard copy) and digital copy of said report is to be handed over to the *Employer* for cleanliness evaluation and record keeping purposes.

5.11.2. Materials facilities and samples for tests and inspections

Not applicable to this contract.

6. List of drawings

Upon request from the *Service Provider*, the employer will issue general arrangement drawings and P&ID's to the *Service Provider*.