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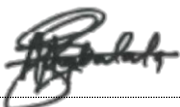
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1. Introduction

This document provides the technical specifications for the Arnot PS main air ejector condenser refurbishment inclusive of full retube. Safely replace the tube bundle tubes (re-tube) to restore design heat transfer and integrity, eliminate leaks, and ensure code-compliant re-commissioning.

Outcomes:

- New tubes installed to design spec and code.
- All NDT, pressure tests, and performance checks passed.
- Updated MDR (Manufacturer's/Data Record) & nameplate/stamping as required by PER and SANS 347 category).
- Successful return to service with baseline condition data captured.

2. Supporting Clauses

2.1 Scope

This document covers the applicable work to be done, as well as the requirements and specifications regarding the work.

2.1.1 Purpose

The purpose of this document is to provide the Contractor with all the relevant details required to perform the work as defined in the scope.

2.1.2 Applicability

This document applies to the refurbishment of main ejector condensers at Arnot Power Station.

2.1.3 Effective date

This document is effective from the date of authorisation until its withdrawn.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems
- [2] Pressure Equipment Regulations as defined in OHS Act (PER)
- [3] SANS 347 Categorization and conformity assessment criteria for all pressure
- [4] TEMA – Standards of the tubular exchanger manufacturers association

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- [5] PD 5500 Specification for Unfired Fusion Welded Pressure Vessels
- [6] ASME II part A, B & D. Standard for ferrous and non-ferrous material specifications.
- [7] ISO 3834 Quality Requirements for Fusion Welding of Metallic Material
- [8] 0.41/5189 Arnot Main Air Ejector Condenser arrangement drawing
- [9] ISO 3834 – Quality requirements for fusion welding of metallic materials

2.2.2 Informative

- [10] 240-106628253 Standard for welding Requirements on Eskom Plant
- [11] 240-83539994 Standard for Non-Destructive Testing (NDT) on Eskom Plant
- [12] 240-86973501 Engineering Drawing Standard
- [13] 240-145581571 Standard for the identification of contents of pipes and vessels
- [14] 240-76648318 Specification for the Procurement of UNS S44660 Stainless Steel Condenser Tubes

3. SCOPE OF WORK

3.1 GENERAL REQUIREMENTS

1. This specification is for the refurbishment of main ejector condensers for Arnot Power station. The exact quantity required will be provided by the commercial department.
2. The *Contractor* is responsible for the supply, manufacture and transport, delivery and offloading to Arnot Power Station of all items in the following sections of this document (hereafter referred to as “the works”) according to the applicable codes and standards and the requirements in this document.
3. The main ejector condensers shall be refurbished using the following steps:
 - Water boxes shall be re-used.
 - Shells shall be cleaned, inspected, tested, and repainted (refer to section 3.4).
 - Shell bellows to MPI tested, if damaged this might impact on re-use of the shell.
 - Tubes to be pulled and shell be inspected internally via the shell steam side and vacuum connections. Inspections will be done visually via colour endoscope, and as far as possible with an camera that can be entered into the shell via the vacuum nozzle. The course of action will be determined through agreement between Eskom Engineering and the *Contractor*. There are two possible outcomes: the tube bundle will be refurbished or replaced (refer to section 3.6 and 3.7).
 - The main ejector condensers shall be assembled and preserved.
 - The main ejector condensers shall be delivered and offloaded on site.
4. Employer will free issue the air ejectors in turn for refurbishment, on basis of two ejectors to be refurbished, and when those are installed the next two will be made available until all 12 has been refurbished..

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5. All new components shall be manufactured and the complete assembly shall be carried out in South Africa. Replacement tubes maybe imported but must be declared in the tender. The percentage value of the imported items must be stated in the tender.

3.2 DESIGN CONDITIONS AND REQUIREMENTS

1. The main ejector condensers are of a two-stage ejector with inter and after-coolers, two-pass design on water side (condensate/water inside the tubes) while steam flow is directed over the external surfaces of the tubes.
2. One side has a fixed tubesheet and the other a bellow/compensator on the shell side.
3. See table below for main ejector condensers mechanical design data:

Table 1: Main Ejector Condensers design

	Tube Side	Shell Side
Medium	Water	Steam
Design Pressure (Max)	1.35 MPa(g)	0.35 MPa(g)
Design Temperature (Max)	80°C	80°C
Test Pressure	2.7 bar(g)	0.53 bar(g)
Capacity	0.07 m ³	0.345 m ³
SANS 347 Hazard Category	SEP	III
Vessel SANS 347 Categorisation	CAT III	

4. The vessel is classified as CAT III in accordance with SANS 347 edition 3.1.
5. Any new components are to be designed and manufactured generally in accordance with PD 5500.
6. All NDE acceptance criteria are to be in accordance with PD 5500.
7. General arrangement drawings, including the bill of materials, are required for the main ejector condensers, clearly indicating existing/re-used components as well as new components.
8. Arnot Main Ejector Condensers drawing provides the layout and tube bundle details of the cooler. The drawing can be used for tender purposes, but the exact dimensions must be verified on the main ejector condensers before refurbishment.
9. Details regarding the tubesheets and the tubesheet-to-shell connection shall be determined by the *Contractor*, only if tubesheet or shell is replaced - if just retube these don't need to be cut, perhaps conduct all necessary NDT's as agreed with the employer.

3.3 WATER BOX REFURBISHMENT

1. Existing water boxes shall be re-used.
2. Water boxes are to be cleaned.
3. All welds are to be surface tested.
4. Any indications found on the welds must be repaired. The exact repair methodology shall be discussed and agreed upon with Eskom engineering. All Welding in accordance with ISO 3834 part 2.

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5. Flange faces are to be inspected. If required, the sealing faces will be resurfaced with a gramophone finish. If flanges need to be machined, this must be discussed with Eskom engineering first. The *contractor* will have to prove that the flange is still fit for use after machining through calculations. If the flange is not fit for use, it must be replaced.
6. All tapped holes are to be inspected and re-tapped if required.
7. Existing water box is to be pressure tested as per section **3.14**.

3.4 SHELL

1. Shells shall be re-used. Shell bellow might require replacement if defect found during NDT, Bellows will not be weld repaired.
2. Shells externals shall be cleaned and sandblasted. The nameplate and tubesheets shall be covered during sandblasting activities.
3. All welds shall be surface tested.
4. Wall thickness to be taken using Ultrasonic wall thickness examination intercooler and aftercooler (main air ejector condenser), and compared to the drawing thickness (0.41/5189 Arnot Main Air Ejector Condenser arrangement drawing), should more than 1mm wall loss be noted, repair action to be agreed with Employer.
5. Any indications found on the welds shall be repaired. The exact repair methodology shall be discussed and agreed upon with Eskom engineering.
6. Conduct shell bellow inspections after cleaning and sandblasting. Wall thickness to be taken using Ultrasonic wall thickness examination. Replace or repair bellows if damaged. Repair method to be review and approved by client engineering, as bellow replacement will require the shell to be cut in half, Care to be taken that shell sections are perfectly aligned before rewelding the shell, as any misalignment will cause tube next retubing to be hampered or not be possible..
7. Flange faces shall be inspected. If required, the sealing faces will be resurfaced with a gramophone finish. If flanges need to be machined, this must first be discussed with Eskom engineering. The *contractor* will have to prove that the flange is still fit for use after machining through calculation. If the flange is not fit for use, it shall be replaced.
8. All tapped holes shall be inspected and re-tapped if required.
9. The shell shall be sandblasted to SA 2½, painted externally with a suitable primer, and then painted. (See Eskom document 240-106365693).
10. The shell shall be pressure tested as per section **3.14**.

3.5 TUBE BUNDLE INSPECTION

1. The existing tube bundle shall be inspected, and the tube material shall be verified by means of PMI. MPI on tubesheet, visual for grooving, pitting, erosion; UT for thickness where needed.
2. Re-tube all tubes, as re-expanding on more than 1 or max two occasions can render tube sheets not to be fit for re-use.
3. Extraction: Push/pull tubes using dedicated pullers; protect tubesheet ligaments and holes.
4. Hole Reconditioning: Ream/brush tube holes, remove deposits; inspect and gauge holes per tolerance.

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5. If the tube bundle does not require replacement, the tube bundle will be refurbished as detailed in section 3.6 below.

3.6 TUBE BUNDLE REFURBISHMENT

1. The tubesheet bundle shall be chemically. A method statement outlining the cleaning methodology and chemicals to be used shall be submitted to Eskom engineering for acceptance before cleaning begins.
2. Replace all consumables such as seals and gaskets.
3. Pressure test as per section 3.14.

3.7 TUBE BUNDLE REPLACEMENT

The section below specifies the requirements for manufacturing and testing of retubing the bundles

3.7.1 Tube plates

1. The tube plate shall be cleaned and tube holes as well. All scale deposits / Loctite (if used on tube plates during tube expansion will be removed).
2. The nominal tube plate hole diameter shall adhere to TEMA requirements for a nominal tube after removal of a tube for measurements of a tube and tube hole so we can specify the tubes correctly with tolerance. If required, the relevant tables shall be interpolated.
3. The tube plate hole diameter vs Tube OD tolerance shall comply with TEMA Standard Fit Tolerances.
4. Tube plate hole inside edges shall be free of burrs. Internal hole finishes shall be given a smooth workmanlike finish. A practical test for smoothness is that cotton wool shall not attach to the surface when wiped over it.

3.7.2 Tubes

1. The tube material shall be stainless steel. Material grade will be determined after a tube has been pulled out and analysed.
2. The Main Ejector condenser tubes shall be procured in accordance with 240 76648318 *Specification for the Procurement of UNS S44660 Stainless Steel Condenser Tubes*.
3. The number of tubes and tube sizes shall match those of the original cooler. Information is provided in drawing [8]. Wall thickness to be confirmed by the contractor. The contractor is responsible for confirming the actual tube OD as well.
4. The minimum number of spare tubes to be procured per cooler is 2% additional tubes.
5. The length of tubes to be ordered shall be determined by the *Contractor*., but will be ordered in correct length per stage, tube cutting from a longer length will not be permitted as this cause the tube ends to become oval during such cutting process. A stick out of 2mm will be provided for, this stick out will be on the waterbox side, on the interface where stage 1 and stage two meet the tube ends will be flush with tubesheet.

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6. Tolerances on outside diameter and wall thickness are in accordance with 240-76648318
*Specification for the Procurement of UNS S44660 Stainless Steel Condenser
Tubes*

The Contractor is responsible for ensuring the tubes are manufactured with acceptable tolerances on the OD, considering the tube plate tolerances as per standard fit criteria.

3.7.3 Tube Expansion

3.7.3.1 Tube Expansion Requirements

1. The tubes shall be attached to the tube plates by mechanical roller expansion using 3-pin rollers.
2. The Contractor shall provide a marked-up tube plate drawing indicating the tubes designated as calibration holes to verify and test wall thinning during the expansion process. These tubes should account for no less than 2% of the total tube plate holes. Under no circumstances should more than 50 tubes be expanded without a reference tube. These designated holes must be clearly marked on the tube plate, documented on a tube plate drawing, and measured using a 3-pin bore gauge before the tubes are loaded into the tube.
3. In addition to the tube hole measurement requirements, the Contractor shall test 100% of tube holes on each tube plate using a no-go gauge. No holes shall be larger than the maximum hole tolerance specified in the TEMA standard. Should such holes exist the contractor to provide a method for sleeving that particular tube hole to bring it back to standard fit. Before sleeving a method statement will be provided to the Employer.
4. All joints at the interface tube plate between stage 1 and stage 2 end tube plate shall be made before any joints expansions will be done on the waterbox side tubeplate. The expanding procedure at the fixed end tube plate shall be as follows:
 - The tube will be positioned with a 2-3 mm stick-out tubesheet face on the waterbox side, the opposite tubeplate tubes will be flush.
 - The Contractor shall propose an expansion map or sequence to minimise any distortion of tube plate.
 - The tube will then be expanded according to the requirements of this Works Information and values achieved in the mock-up tests.
 - Full expansion shall terminate 3 - 5 mm from steam side (shell side) of tube plate.
5. When all expanded joints at the waterbox end tube plate have been completed, the joints at the waterbox side tube plate can be made. The expanding procedure at the expansion end tube plate shall be as follows:
 - The initial expansions shall be in approximately 5 clusters of around 10 tubes each, with the clusters spread out uniformly across the tube plate. This initial set of expansions aims to prevent distortion of the tube plate, which can otherwise occur due to forces imposed by the expansion process.
 - Once the clusters are complete, the remaining tubes can be expanded.
 - After expansion, all tube ends shall be trimmed back so that the maximum protrusion from the tube plate face is 2-3 mm on waterbox side where as the opposite tube plate tubes will be flush with tubesheet face.

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6. The Contractor shall continuously monitor and control the expanding process to ensure satisfactory tube-to-tube plate joints for every tube. As a minimum, the following checks and controls shall be implemented:
- Roller expanders shall be cleaned at least after every 15 tubes and lubricated before each tube.
 - During each expansion of a hole identified for calibration as defined above, the following shall be done:
 - Clean expander.
 - Rotate manually and inspect rollers, verifying free movement, and inspect mandrill shaft for defects (score, abrasion, and pitting).
 - Verify that the torque setting on the expander torque scale is correct and ensure that the locking mechanism is securely tightened.
 - Inspections shall also be conducted in the event of torque fluctuations or evidence of damage to the tube inside surface.
 - For each tube that enters the tube plate on the calibration holes, the average tube OD shall be recorded (value "D" as detailed below). Additionally, the Contractor shall measure the average tube ID before the tube is expanded (Value "d" as detailed below). Alternatively, the average tube wall formula can be used provided at least 3 measurements are taken.
7. The Contractor shall avoid re-expansion of joints whenever possible and should employ a system for marking, recording, and controlling the expansion process to prevent accidental re-expansion.
- Leaking tubes that need re-expansion must be clearly marked on a drawing included in the databook.

3.7.3.2 Tube Expansion Measurements

1. At least 30 percent of all tubes, selected in a "Z" with reference to the tube sheet, shall have a backup documentation stating the expansion levels achieved. The following measurements that will be recorded:
- Tube sheet hole ID before tube is inserted.
 - Tube OD before tube is inserted.
 - Wall thickness of tube before tube is inserted, measured at the midpoint of the expansion depth/length. If average wall thickness is used, a cross comparison between wall thickness/ID and OD will be provide.
 - Tube ID after expansion measured at the depth/length of expansion.
 - Results shall be in spreadsheet format and supported by a fully traceable tube sheet map indicating all measured tubes precisely.
2. The expansion records must be based on actual wall thickness, not average wall thickness. Wall thickness shall be determined from $(OD-ID)/2$.
3. The following formula shall be used for wall thinning and mock-up testing:

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$$T_w = \frac{(T - t) - (D - d)}{(d - t) * 100}$$

D = Diameter of tubesheet hole, mm

d = Outside diameter of tube, mm

T = Tube inside diameter after expansion, mm

t = Tube inside diameter before expansion, mm

T_w = % wall thinning

4. Example recording: The following is provided to the Contractor as an example of recording the tube expansion data.

Description	Symbol	Result
Tubesheet hole size	D	
Tube outside diameter	d	
Tube inside diameter before expansion	t	
Tube inside diameter after rolling	T	
% Expansion	T _w	

3.7.3.3 Requirements for Tube-to-tubesheet Mock-up Test

- Mock-up tests and pull-out tests shall be completed before expanding any tubes in the cooler. Only one set of mock-up tests is required in case of multiple coolers if the following conditions are met:
 - The same tube expander drives are used on the different units.
 - The tubes are of the same heat number
 - The tubesheets hole ID is to standard fit tolerance.
- The torque value on the expander shall be adjusted until a for a wall thinning of between 4-6% is achieved. AS existing tubesheet will be re-used tubes will be expanded into one of the tubesheets to determine the required torque to achieve a wall thinning of 4-6%. The tube will then be subjected to a push out test to prove integrity of tube joint. This will be witnessed by the Employer, tests will be performed until the required thinning is achieved and an adequate joint strength is mutually agreed upon by all parties.
- Before the pull-out test, measurements for wall thinning shall be taken, and wall thinning shall be calculated using the formular provided above.
- The Employer's representative shall witness the expansion tests on the push out tests.

3.7.3.4 Requirements for pull-out test

- The Contractor is responsible for concluding the datum point pull-out and push-test.
- The following shall be determined from pull-out tests and the following conclusions should be derived:
 - The corresponding force (torque value used for the mechanical expansion) for the greatest load-bearing joint

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- Documentation of the test results for future reference on the tubesheets.
- Tube or pull-out tests for various tube hole diameters: The Contractor is responsible to ensuring that all specified pull-out tests are conducted to assess the load-bearing capabilities of the expanded joints at various tube hole diameters.

3.8 FLANGES

1. All flanges shall be inspected, if replacement is deemed required it will be to same flange table and pressure rating as the installed flanges. Orientation when refitting the flanges is of utmost importance to ensure alignment on site. Any misalignment correction during installation will be a negative compensation event on the contractor, not ejector will be installed by others.
2. Blanks shall be fitted on all flanges before delivery to site.
3. All tapped holes to be blanked off with suitable plugs.

3.9 MATERIAL REQUIREMENTS

1. The Contractor is responsible for the supply of all materials, including but is not limited to tubes, , bellows/compensators if required. Any other pressure containment part replacement will be handled on a compensation event basis, after mutual agreement with the Employers representative. Additionally, any consumables required, such as gaskets, bolts, and nuts shall be supplied by the contractor.
2. All material forming part of the pressure envelope, including tubes, tubesheets, bellows/compensators and shell shall be provided with 3.1 material certification in accordance with BS EN 10204:2004.
3. The Stainless Steel Condenser Tubes shall be procured following 240-76648318, amended as follows:
 - Section 3.2 is not applicable.
 - Section 11: 3.1 certification for the tubes in accordance with BS EN 10204 is required only; therefore, no AIA needs to be appointed.

3.10 WELDING AND REQUIREMENTS

3.10.1 Welding Requirements

1. The contractor responsible for welding that may be required shall be ISO 3834-2 certified. The provided ISO 3834-2 certificate shall include the scope of accreditation, specifying the design code to be used.
2. All welders for manual welding shall be coded to BS EN ISO 9606.
3. All welding procedures shall be qualified to the latest version of BS EN 15614-1.
4. Geometry-specific Weld Procedure Specifications (WPS) are required, supported by the relevant PQR.
5. All welding documentation, including weld maps, will be subject to approval by an Eskom welding Engineer, in accordance with current Eskom standards.

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6. The following Eskom standard is applicable and shall be complied with for all welding activities:
240-106628253 Standard for Welding Requirements on Eskom Plant.

3.10.2 NDE Requirements

1. All required NDE shall be provide by the Contractor. Contractor to state during tender who the NDT subcontractor will be and for which process they are approved / certified.
2. All NDE done shall comply with the following Eskom standards: *240-83539994 Standard for Non-Destructive Testing (NDT) on Eskom Plant.*

3.11 QUALITY REQUIREMENTS

1. No work shall commence without an approved QCP from the Employer.
2. A QCP and dimensional drawings shall be submitted to the Employer 7 days prior to the commencement of the specific work.
3. QCPs and related documentation shall be subject to review and approval by the Employer's Quality Control personnel as well as Engineering. QCPs shall make provision for signatures indicating interventions by the Contractor's QC Representative, the Employers QC Representative, and the employer's engineer.
4. Each QCP shall incorporate a designated page for proof signatures, allowing for the traceability of any signature to the specific individual who endorsed any activity within the QCP.
5. Intervention points will be signed as the work progresses, and no backdating will be allowed.
6. Notification for hold and witness points shall be provide in writing and at least 72 hours in advance.
7. The following minimum hold points shall be included for the Employer's Quality Control Department:
 - Approval of QCP
 - Review of expansion tests results before the commencement of actual expansion on the main air ejector condenser unit
 - Review material certificates
 - Final Visual Inspection
 - Witness of Pressure Test
 - Final Sign-off and Acceptance
 - Final Data Book Review

3.12 DRAWING REQUIREMENTS

1. The Contractor shall provide a drawing of the complete main air ejector condenser with all relevant dimensions and full material list. Additionally, detailed information regarding the tube bundle shall be included. These drawing will be supplied to the Employer in CAD format and also readable PDF.

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2. All Drawings to be provided shall adhere to the Engineering Drawing Standard – Common Requirement (240-86973501).
3. Drawings submitted to Eskom may not be “Right Protected” or encrypted.

3.13 DOCUMENTATION REQUIREMENTS

1. All documents provided by the Contractor, including QCPs, Method Statements, and other documents impacting the work, are subject to Eskom’s approval. These documents must be approved by the Employer at least 7 working days before the commencement of the Works.
2. Each document or drawing revision shall be accompanied by a list of the comments from the Employer on the previous revision, if applicable, along with the Contractor’s response and corrective actions taken. Changes will be documented in a revision table within each drawing or document. Upon approval of the new revision, all prior revisions will be removed from the production floor.
3. Documents and drawings shall indicate the Employer’s assigned drawing number. The Contractor may have his own document or drawing number on the document or drawing, but where reference is made among documents or drawings, the Employer’s number shall be used.
4. The Contractor shall compile a complete data book for all work completed, containing the following at a minimum, if applicable:
 - Scope of work.
 - Approved QCP / ITP.
 - Inspection reports and Procedures.
 - As-built drawings, including tube maps.
 - Mechanical design calculations.
 - Full traceable material certificates in accordance with EN 10204 3.1, traceable to the actual bill of materials, drawings, and designs (applicable only to materials requiring 3.1 certification).
 - Pressure test certificates, a photocopy of the nameplate, including calibration certificates of pressure gauges.
 - Pressure test reports.
 - All NCR/CARs and associated corrective actions.

3.14 PRESSURE TEST REQUIREMENTS

1. The pressure test shall be conducted according to the pressure required by the design code, based on design pressure. The test pressure shall be as specified in Table 1.
2. The shell side pressure test shall be conducted first, with the waterbox blank flanges removed to inspect for leaking tubes. After that, the waterbox pressure test shall be carried out.
3. The pressure test shall be executed using normal tap water as the test medium at ambient temperature.

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4. Any leaking tube-tube plate joints found during the test will be re-expanded once. This information will be indicated on a tube plate map. If the tube still leaks after a second expansion, consultation with the Employer will be necessary. In this case, the leaking tubes shall be replaced.
5. For the vessel to pass the pressure test, the pressure must be sustained for at least 30 minutes. No cyclic testing is required.

3.15 CONFIGURATION MANAGEMENT AND DOCUMENT MANAGEMENT

1. Transmittal letters shall be provided with each document submittal. The transmittal letter shall include the Contractor's drawing/document number, revision number, and title for each drawing or document attached.
2. Each drawing title shall be unique and shall be descriptive of the specific drawing content.

3.16 COATING REQUIREMENTS

1. Main air ejector condenser to be painted Strong blue waterboxes and shell White as per typical Pipelines and Vessels and Eskom standard 240-145581571 Standard for the identification of contents of pipes and vessels.

3.17 DRY AND PRESERVATION

1. The Contractor shall submit the complete drying out and preservation procedures for the coolers. These procedures shall be approved by the Employer and the Employer's quality representative prior to pressure testing.
2. After completion of all hydrostatic testing, the main air ejector condensers shall be drained and dried out. The contractor shall demonstrate that the main air ejector condenser is completely dry on both the shell side and the tube side.
3. The drying out of the main air ejector condensers will be monitored by the Employer, and final blanking off shall not be carried out without the approval of the Employer and the Inspection Agency.
4. For storage periods longer than a week, the main air ejector condensers shall be stored indoors or under a fixed roof to avoid exposure to direct sunlight and high ambient temperatures.

3.18 DRY AND PRESERVATION

The Contractor shall supply per cooler a set of 10 tube plugs to be kept by the Employer. Contractor will also provide a tube plugging procedure.

4. TENDER RETURNABLES

The submission of the returnables stated in section 4.1 is mandatory. Failure to submit any of these returnables will result in disqualification of the tender.

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4.1 MANDATORY TENDER RETURNABLES

1. Contractor shall provide proof of ISO 3834-2 certification (all pages) for the company/manufacture that owns and operates the workshop where the heaters will be refurbished. The scope of accreditation of the ISO 3834-2 certificate shall include the design code to be used for this project.
2. A verifiable reference list of shell and tube heat exchangers re-tubed by the manufacturer during the last 5 years is required. A minimum of 5 references is required.

4.2 QUALITATIVE TENDER RETURNABLES FOR EVALUATION PURPOSES

1. A completed Quality Control Plan or Inspection and Test Plan of a similar heat exchanger refurbished or built by the Contractor in the past is required.
2. Exclusions or qualifications to the above Works Information must be clearly stated. If there are no exclusions or qualifications, a specific statement to that effect is required.
3. An example of a method statement from the Manufacturer for tube expansion used for a similar vessel manufactured previously, meeting the requirements of the works information, is required.
4. A Tools List (Table 2) shall be included in the tender, with columns 2 and 4 completed.

Table 2: Tool List to be completed

Minimum required quantity	Quantity available at Contractors workshop	Tool / Equipment Description	Description, Type or Make where applicable
2		Tube expander drive	
4		3 Pin roller expanders	
N/A		Lubricant for expansion	
2		Tube facing tools	
5 sets		Tube facing tool replacement blades	
1		Calibrated 3-Prong internal micrometer, min accuracy 0.01 mm	
1		Calibrated external tube vernier, min accuracy 0.01 mm	
1		Calibrated Torque analyser	

5. Acceptance

This document has been seen and accepted by:

Name	Designation
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CONTROLLED DISCLOSURE

6. Revisions

Date	Rev.	Compiler	Remarks
March 2026	1	A.K. Tshabalala	First issue and Unique Identifier Number
January 2026	1.1	A.K. Tshabalala	First Issue
January 2026	0.1	A.K. Tshabalala	Updating as per recommendations
November 2025	0	A.K. Tshabalala	First Issue for review

7. Development Team

The following people were involved in the development of this document:

- Khehla Tshabalala
- Herman van Niekerk

8. Acknowledgements

- None

CONTROLLED DISCLOSURE