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|  Eskom | Scope of Work | Boiler Plant Engineering |
|-----------------------------------------------------------------------------------------|---------------|--------------------------|

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### **CONTROLLED DISCLOSURE**

## **1. Introduction**

The air and flue gas ducts erode during operation. The flue gas ducts from the flue gas hoods to the precipitator inlet ducts are subject to erosion of the walls/casings, stays/bracings, turning vanes and dampers and the associated protecting channels/angle irons, cover plates and expansion joints sleeves/covers. There is very minor erosion, if any, in the precipitator flue gas outlet ducts to smokestack. The air duct walls erode around the control air dampers especially around the hot air recirculating and secondary air dampers. Metallic expansion joints are subject to cracking and corrosion (for one on the low temperature flue gas ducts) and erosion when the sleeves are eroded. The access doors also leak (those under pressure) or allow ingress of air (those under suction). The consequences of failure of ducts/ eroded ducts are:

- The eroded sealing surfaces of the control air dampers result in the dampers passing and duct walls result in secondary air leaks and these lead to FD fans and PA fans running out of capacity or the motors draw high currents and high motor currents or poor mill load losses incurred.
- Holes often develop on the flue gas ducts resulting in air ingress into the flue gas stream. The ID fans run out of capacity (RVC's open fully) or the ID fan motors draw high currents and positive furnace pressure or high motor currents load losses incurred.
- The eroded turning vanes fail to direct the flue gas causing high flue gas velocities at particular areas resulting in accelerated erosion in these areas.
- The eroded damper blades fail to stop flue gas flows when one draught group is out of service with the other draught group load. Although the dampers cannot be used as points of isolation, they do assist in minimizing exposure of the precipitators and ID fan impellers to high flue gas temperatures for the draught group that is out of service.
- The eroded stays/bracings fail to keep the ducts rigid and at times the eroded bracings or covers on the vertical and inclined ducts fall into the air heaters and cause them to get stuck. This results in the load losses being incurred as the affected unit will have to be shut down in order to remove the fallen bracing.

## **2. Supporting Clauses**

### **2.1 Scope**

The document outlines the scope of work for maintenance of boiler air and flue gas ducts covering casings/walls, turning vanes, dampers, bracings and associated protection channels/angle iron and covers and metallic compensators and metallic expansion joints during philosophy outages (IN, IR and GO outages) at Tutuka Power Station. The flue gas ducts start from the boiler flue gas hoods to the smokestacks and the air ducts from the FD fan suctions to the secondary air dampers and to the hot air mills for the primary air.

#### **2.1.1 Purpose**

The purpose of this scope of work is to define the maintenance work that is carried out on the air and flue gas ducts including metallic expansion joints during philosophy outages.

#### **2.1.2 Applicability**

This document shall apply throughout Tutuka Power Station unit 1-6 air and flue gas ducts.

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## **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] 15ENG STR 001: Draught Plant Maintenance Execution Strategy
- [2] 240-56241933: Standard for Welding Requirements on Eskom Plants

### **2.2.2 Informative**

- [3] ISO 9001 Quality Management Systems.

## **2.3 Definitions**

### **2.3.1 Classification**

- a) **Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## **2.4 Abbreviations**

| <b>Abbreviation</b> | <b>Description</b>        |
|---------------------|---------------------------|
| COC                 | Certificate of Completion |
| FD                  | Forced Draught            |
| GO                  | General Overhaul          |
| ID                  | Induced Draught           |
| IN                  | Inspection                |
| IR                  | Interim Repairs           |
| ITP                 | Inspection and Test Plan  |
| NDT                 | Non-Destructive Test      |
| PA                  | Primary Air               |
| QCP                 | Quality Control Plan      |
| RVC's               | Radial Vane Control       |
| SA                  | Secondary Air             |

## **2.5 Roles and Responsibilities**

- Boiler Plant Engineering shall compile the scope of work for the outages and shall issue repair instructions for repairs based on inspection reports during the outages.
- Outage coordinator shall issue scope of work to the service provider, put reservations for spares and shall issue picking tickets or order spares that are not stock items.

## **2.6 Process for Monitoring**

The inspection reports and the repair/cutting instructions shall be used for monitoring the repair of the ducts.

## **2.7 Related/Supporting Documents**

N/A

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### **3. Scope of Work or Maintenance**

#### **3.1 Plant description**

The fans are connected to the boiler and the air heaters through rectangular/circular ducts and air heaters. The flue gas is extracted from the boiler furnace to the chimneys through the flue gas ducts connected to the boiler outlets. The flue gas ducts and associated dampers connect the boiler, the air heaters, electrostatic precipitators, ID fans and the chimneys. The flue gas ducts are rectangular in shape with internal bracings. The flue gas ducts have both metallic and fabric compensators before and after the air heaters respectively.

The air is sucked from the top of the boiler where the ambient temperature is the highest and delivered to the boiler furnace (secondary air) and mills (primary air) through air ducts. The air ducts and associated dampers including bypass, tempering and re-circulating air ducts connect the boiler, air heaters and mills. The air ducts are mainly circular in shape with the secondary air ring main and the ducts to individual burners being rectangular in shape. The air ducts have air flow metering devices (venturi's and aerofoils). The air ducts also have fabric and metallic compensators before and after the air heaters respectively.

The air and flue gas ducts fabricated from 6mm mild steel are either circular (most air ducts) or rectangular (other air ducts and flue gas ducts) in shape and have internal bracings to maintain the shape or rigidity. The air ducts see little erosion except the erosion taking place around the control damper sealing surfaces.

The flue gas ducts consisting of the vertical, inclined/slopes and horizontal steel ducts are subjected to fly ash erosion affecting the casings/walls, turning vanes, damper blades and the bracings/stays including the bracing erosion protecting covers. The most affected sections of the flue gas ducts are between the economizer outlet and the electrostatic precipitators. The flue gas ducts downstream the precipitators see very little.

#### **The flue gas ducts broadly consist of:**

- 1) Vertical flue gas ducts including the air heater flue gas inlet duct (slope)
- 2) Horizontal flue gas ducts from air heaters to ID fan inlet reducing to 2 ducts and then 1 into the smokestack

#### **The air ducts consist of:**

- 1) FD fan suctions
- 2) Air heater secondary air inlet and outlet ducts
- 3) Secondary air common duct (ring main)
- 4) Secondary air ducts to PF burners including dampers and aerofoils
- 5) Core air ducts to oil burners including dampers tapping off from secondary air ducts
- 6) Hot air re-circulating ducts tapping off from air heater secondary air outlet ducts to the FD fan suction
- 7) Air heater by-pass ducts tapping off from the air heater secondary air inlet ducts to the secondary air outlet ducts
- 8) PA fan suction ducts
- 9) Air heater primary air inlet and outlet ducts
- 10) Tempering air ducts

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### **3.2 Philosophy**

The type of repair/maintenance on the air and flue gas ducts during IR and GO outages will be the same only differ in the areas covered. The difference is due to the duration of the two (2) outages. The scope of work during IN outage will be as and when required for specific areas. All the ducts are included even those that are not subject to erosion as per appendix B. The areas covered during the IR and GO outages include the following:

#### **3.2.1 Interim Repair (IR) outage**

The areas covered during IR outage:

- 1) From and including air heater flue gas inlet ducts (slopes) to the smokestack excluding the ID fans from the inlet ducts expansion joints to the discharge duct expansion joint. The following areas of the flue gas ducts are included:
  - i) LH and RH air heater flue gas inlet ducts (slopes)
  - ii) LH and RH air heater transition ducts on bottom and top of air heater stators
  - iii) LH and RH air heater LH and RH flue gas outlet ducts
  - iv) LH and RH precipitator LH and RH flue gas inlet ducts
  - v) LH and RH precipitator LH and RH flue gas outlet ducts
  - vi) LH and RH ID fan LH and RH inlet ducts
  - vii) LH and RH ID fan outlet ducts to common duct to the smokestack
- 2) From the FD fan suctions to the secondary air dampers excluding the FD fans from inlet ducts expansion joints to discharge duct expansion joint and air heater air hoods from bottom secondary air (SA) collar seals to the top secondary air collar seals. The following areas of the FD fan and SA ducts are included:
  - i) LH and RH FD fan suction ducts
  - ii) LH and RH FD fan discharge ducts
  - iii) LH and RH air heater SA inlet ducts
  - iv) LH and RH air heater SA outlet ducts
  - v) SA to PF burners including aerofoils and core air ducts
  - vi) SA ring main
  - vii) LH and RH SA bypass
  - viii) LH and RH hot air recirculating ducts and dampers
- 3) From Primary Air fan suction take off to the hot air to mill PA dampers excluding the PA fan from the inlet duct expansion joint to discharge duct expansion joint. The following areas of the PA ducts are included:
  - i) LH and RH PA fan suction ducts
  - ii) LH and RH air heater PA inlet ducts
  - iii) LH and RH air heater PA outlet ducts
  - iv) LH and RH tempering air ducts and dampers

#### **3.2.2 General overall (GO) outage**

The areas covered during GO outage include:

- 1) From flue gas hoods to the smokestack excluding the ID fans from the inlet ducts expansion joints to the discharge duct expansion joint. The following areas of the flue gas ducts are included:
  - i) LH and RH flue gas hoods

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- ii) LH and RH vertical flue gas ducts
  - iii) LH and RH air heater flue gas inlet ducts (slopes)
  - iv) LH and RH air heater transition ducts on bottom and top of air heater stators
  - v) LH and RH air heater LH and RH flue gas outlet ducts
  - vi) LH and RH precipitator LH and RH flue gas inlet ducts
  - vii) LH and RH precipitator LH and RH flue gas outlet ducts
  - viii) LH and RH ID fan LH and RH inlet ducts
  - ix) LH and RH ID fan outlet ducts to common duct to the smokestack
- 2) From the FD fan suctions to the secondary air dampers excluding the FD fans from inlet ducts expansion joints to discharge duct expansion joint and air heater air hoods from bottom secondary air (SA) collar seals to the top secondary air collar seals. The following areas of the FD fan and SA ducts are included:
- i) LH and RH FD fan suction ducts
  - ii) LH and RH FD fan discharge ducts
  - iii) LH and RH air heater SA inlet ducts
  - iv) LH and RH air heater SA outlet ducts
  - v) SA to PF burners including aerofoils and core air ducts
  - vi) SA ring main
  - vii) LH and RH SA bypass
  - viii) LH and RH hot air recirculating ducts and dampers
- 3) From Primary Air fan suction take off to the hot air to mill PA dampers excluding the PA fan from the inlet duct expansion joint to discharge duct expansion joint. The following areas of the PA ducts are included:
- i) LH and RH PA fan suction ducts
  - ii) LH and RH air heater PA inlet ducts
  - iii) LH and RH air heater PA outlet ducts
  - iv) LH and RH tempering air ducts and dampers

The welding around secondary air and core air dampers are excluded in this scope of work as this covered under the PF burners scope of work.

### **3.3 Scope of work during IN, IR & GO outages**

#### **3.3.1 Scope of Work**

The repair/maintenance of the air and flue gas ducts during IR and GO outage is similar but differ in the number of areas covered as outlined in paragraph 3.2. The maintenance of ducts is mainly cutting, weld preparations and welding. The scope of work including the approximate sizes will be determined by inspection and will entail:

- 1) Opening and closing of access doors for inspection/repairs and after inspection/repairs respectively.
- 2) Removing the bottom 3 turning vanes on the first set of turning vanes on each of the air heater flue gas outlet ducts to give access for erection of scaffolding.
- 3) Window patching of eroded duct walls, big turning vanes and baffle plates (cutting, weld preparations, installation and welding). The different sizes/dimensions of the patches are suggested in appendix A.
- 4) Weld build-up of some grooved areas of duct walls especially at the ends of the cover plates (cleaning/grinding and welding).

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- 5) Repair of air heater flue gas outlet damper blades, damper blades bottom support structures and pillars (cutting, weld preparations, installation and welding).
- 6) Replace the flue gas damper blade bottom guide stub shaft (cutting, weld preparations, installation and welding).
- 7) Install sleeves to protect the flue gas damper blade shaft between the damper blade and the wall and between the damper blade and the bottom support structure (cutting, weld preparations, installation and welding).
- 8) Fabrication of a new damper blade for the air heater flue gas outlet ducts. The condition of some of the flue gas damper blades will be such that fabrication of new doors will be cost effective than repairs.
- 9) Replacement of small turning vanes and repair of big turning vanes (cutting, bending of new turning vanes, weld preparations, installation and welding). The bottom half of the first turning vanes should be replaced and the replacement of the other half will be dependent on the condition during inspection.
- 10) Close the troughs outside the flue gas ducts above the turning vanes on the precipitator flue gas inlet ducts (cutting, weld preparations, installation and welding).
- 11) Repair of deflector/baffle plates in the precipitator inlet slopes (cutting, weld preparations, installation and welding)
- 12) Replacement of eroded stays or repair by installation of inserts including protecting channels/angle irons/flat bars (cutting from the gussets for complete replacement, weld preparations, installation and welding).
- 13) Replace of eroded stay protecting channels/angle irons/flat bars or repair by installation of inserts (cutting, weld preparations, installation and welding).
- 14) Fabricate stay pipes including the protecting channels (cutting, weld preparations, installation and welding).
- 15) Replacement of the gussets which includes the replacement of the stays and stay protecting channels (cutting, weld preparations, installation and welding)
- 16) Replacement of cover plates that protect the gussets (cutting, weld preparations, installation and welding).
- 17) Opening of the bottom part of the expansion joints sleeves or cover plates on the flue gas hood, air heater flue gas inlet ducts (slopes) and ID fan discharge ducts to smokestack for inspection (cutting, bending of cover plates where necessary, weld preparations, installation and welding)
- 18) Cleaning of the ash in the bottom part of the convolutions of the flue gas hoods, air heater flue gas inlet ducts (slopes) and ID fan discharge ducts to smokestack.
- 19) Repair of expansion joints by installation of inserts (cutting, weld preparations, installation and welding).
- 20) Repair of the expansion joint sleeve/cover by installation of inserts (cutting, bending of cover plates where necessary, weld preparations, installation and welding).
- 21) Replace and/or repair the oxygen probe support channel including the saddles (cutting, weld preparations, installation and welding).
- 22) Repair of access doors (cutting, weld preparations, installation and welding).
- 23) Replacement of access door seals
- 24) Fabricate new access doors as and when required.
- 25) Replacement of dog brackets on the expansion joints sleeves/covers (cutting, weld preparations, installation and welding).
- 26) Replace eroded cat ladder rungs and the protecting plates (cutting, bending of round bar, weld preparations, installation and welding).

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### **3.3.2 Brief Method Statement**

The scope of work/repair instruction shall be issued to repair partner based on inspection reports by inspection partner (initial scope of work) and this includes the scope of work identified during repairs. The repairs shall entail:

- 1) Cutting out of erosion/corrosion damaged areas as per recommendation from inspection reports and repair instructions.
- 2) Preparation for welding (grinding) of inserts and areas to which the components/inserts will be welded to 30°
- 3) Fit and tack weld the components/inserts into position and notify the inspector to check the fit up as per QCP's/ITP's.
- 4) Weld the components/inserts according to approved welding procedures as per QCP's.
- 5) Clean the new welds for NDT and inform the inspector of the welds to be tested

## **3.4 Welding**

### **3.4.1 Welding Requirements**

- 1) Company must be at least accredited to SANS 3834 Part 3.
- 2) All welding to be done according to the Standard for Welding Requirements on Eskom Plants, 240-56241933
- 3) All welding should be done according to approved EN BS ISO welding procedures. Submit welding procedures for approval by Eskom and the Third-Party Inspection Authority before starting with any welding.
- 4) All welders and welding supervisors should be ISO and/or IIW qualified. Submit welders and welding supervisor's CV's and qualifications for approval by Eskom and the Third-Party Inspection Authority before starting with any welding.
- 5) All welding to be done as per approved Inspection and test plans (ITP's).
- 6) A data book must be delivered to Eskom on completion of the project and should as a minimum contain the following:
  - i) Approved scope of work
  - ii) Approved repair instructions/recommendations
  - iii) Approved and signed off QCP's
  - iv) Welding procedures and welder qualification records
  - v) Material & electrodes certificates
  - vi) Updated drawing can be used as weld map.
  - vii) NDT reports
  - viii) Final release certificate/certificate of completion (COC)
  - ix) Any information deemed relevant

### **3.4.2 Quality Requirements**

- 1) The Contractor to submit the ITP's/QCP's before any work may commence.
- 2) All inspection and test plans (ITP's) / quality control plans (QCP's) to be approved by Eskom, Third Party Inspection Authority and
- 3) All work to be done according to an approved ITP's/QCP's. All hold points and witness points to be adhered to.
- 4) All new materials supplied by the contractor to be delivered with material certificates

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### **3.4.3 Non-Destructive Test (NDT)**

- 1) Eskom shall be responsible for all NDT.
- 2) The inspection and NDT will be carried out by Eskom partner
- 3) The contractor responsible for the repairs of the ducts shall request for all NDT as per the approved ITP at least 24 hours in advance in writing to Eskom.
- 4) Daily requests will be discussed at the daily feedback meeting and NDT requests should be handed over to Eskom in writing.

## **3.5 General**

### **3.5.1 Materials**

- 1) The material (plates of different sizes, channels, angle irons, flat bars) will be supplied free of charge for this scope of work.
- 2) In an effort not to waste materials (plates), the following standard sizes of 6mm plate that can be cut using a guillotine will be used unless it is not possible to use the standard sizes as given in appendix A.

### **3.5.2 Scaffolding**

- 1) Eskom will provide all scaffolding requirements.
- 2) The scaffolding requirements must be provided two weeks prior to the outage to the Contract Manager.
- 3) Daily requirements will be discussed at the daily feedback meeting and scaffolding requirements should be handed over to Eskom in writing.

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#### **4. Acknowledgements**

N/A

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## Appendix A: Scope of Work

| Number                         | Activity Description                                                                           | Estimated Quantity | Cost/Item | Total Cost |
|--------------------------------|------------------------------------------------------------------------------------------------|--------------------|-----------|------------|
| <b>Vertical Flue Gas Ducts</b> |                                                                                                |                    |           |            |
| 1                              | Open and close access doors (with locking mechanism – 52m level)                               | 2                  |           |            |
| 2                              | Open and close access doors (bolted) 57m & 76m levels                                          | 4                  |           |            |
| 3                              | Cut out and weld windows for access                                                            | 4                  |           |            |
| 4                              | Window patch 2 400mm x 1 200mm                                                                 | 24                 |           |            |
| 5                              | Window patch 2 400mm x 600mm                                                                   | 24                 |           |            |
| 6                              | Window patch 2 400mm x 300mm                                                                   | 18                 |           |            |
| 7                              | Window patch 1 200mm x 1 200mm                                                                 | 48                 |           |            |
| 8                              | Window patch 1 200mm x 600mm                                                                   | 120                |           |            |
| 9                              | Window patch 1 200mm x 300mm                                                                   | 80                 |           |            |
| 10                             | Window patch 600mm x 600mm                                                                     | 100                |           |            |
| 11                             | Window patch 600mm x 300mm                                                                     | 120                |           |            |
| 12                             | Window patch 600mm x 150mm                                                                     | 20                 |           |            |
| 13                             | Window patch 300mm x 300mm                                                                     | 160                |           |            |
| 14                             | Window patch 300mm x 150mm                                                                     | 20                 |           |            |
| 15                             | Window patch 150mm x 150mm                                                                     | 28                 |           |            |
| 16                             | Weld build-up 40mm x 80mm                                                                      | 28                 |           |            |
| 17                             | Replace protecting channel                                                                     | 210                |           |            |
| 18                             | Replace protecting channel insert                                                              | 60                 |           |            |
| 19                             | Replace stay pipe                                                                              | 210                |           |            |
| 20                             | Replace stay pipe insert                                                                       | 80                 |           |            |
| 21                             | Replace gusset/ connecting bracket                                                             | 120                |           |            |
| 22                             | Replace cover or protecting plates                                                             | 360                |           |            |
| 23                             | Open & re-weld expansion joint sleeve (bottom & about 1m on sides) about 2.5m inserts (44 off) | 44 inserts         |           |            |
| 24                             | Replace expansion joint sleeve insert per 2.5m (24 x 2.5m inserts)                             | 24 inserts         |           |            |
| 25                             | Clean ash accumulated in expansion joint convolutions bottom section (8 exp/joints)            | 8                  |           |            |
| 26                             | Repair metallic expansion joint by installing insert (2 convolutions) per 2.5m inserts         | 12 inserts         |           |            |
| 27                             | Repair metallic expansion joint by installing insert (3 convolutions) per 2.5m inserts         | 16 inserts         |           |            |

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| 28                                                                             | Repair metallic expansion joint by installing insert (4 convolutions) per 2.5m inserts | 32 inserts |  |  |
| 29                                                                             | Replace dog brackets                                                                   | 80         |  |  |
| 30                                                                             | Re-weld 3000mm x 40mm                                                                  | 8          |  |  |
| 31                                                                             | Re-weld 4300mm x 20mm                                                                  | 8          |  |  |
| 32                                                                             | Re-weld 1400mm x 40mm                                                                  | 16         |  |  |
| 33                                                                             | Re-weld 600mm x 40mm                                                                   | 20         |  |  |
| 34                                                                             | Re-weld 400mm x 20mm                                                                   | 14         |  |  |
| 35                                                                             | Re-weld 300mm x 20mm                                                                   | 10         |  |  |
| 36                                                                             | Replace access door seals                                                              | 6          |  |  |
| <b>Horizontal Flue Gas Ducts (Air heater outlet to ID fan discharge ducts)</b> |                                                                                        |            |  |  |
| 1                                                                              | Open and close access doors (with locking mechanism)                                   | 14         |  |  |
| 2                                                                              | Cut out and weld windows for access                                                    | 4          |  |  |
| 3                                                                              | Window patch 2 400mm x 1 200mm                                                         | 84         |  |  |
| 4                                                                              | Window patch 2 400mm x 600mm                                                           | 48         |  |  |
| 5                                                                              | Window patch 2 400mm x 300mm                                                           | 24         |  |  |
| 6                                                                              | Window patch 1 200mm x 1 200mm                                                         | 72         |  |  |
| 7                                                                              | Window patch 1 200mm x 600mm                                                           | 48         |  |  |
| 8                                                                              | Window patch 1 200mm x 300mm                                                           | 24         |  |  |
| 9                                                                              | Window patch 600mm x 600mm                                                             | 48         |  |  |
| 10                                                                             | Window patch 600mm x 300mm                                                             | 100        |  |  |
| 11                                                                             | Window patch 600mm x 150mm                                                             | 10         |  |  |
| 12                                                                             | Window patch 300mm x 300mm                                                             | 120        |  |  |
| 13                                                                             | Window patch 300mm x 150mm                                                             | 16         |  |  |
| 14                                                                             | Window patch 150mm x 150mm                                                             | 12         |  |  |
| 15                                                                             | Weld build-up 40mm x 80mm                                                              | 16         |  |  |
| 16                                                                             | Replace protecting channel                                                             | 220        |  |  |
| 17                                                                             | Replace protecting channel insert                                                      | 30         |  |  |
| 18                                                                             | Replace stay pipe                                                                      | 244        |  |  |
| 19                                                                             | Replace stay pipe insert                                                               | 30         |  |  |
| 20                                                                             | Replace gussets/ connecting brackets                                                   | 80         |  |  |
| 21                                                                             | Replace cover or protecting plates                                                     | 150        |  |  |
| 22                                                                             | Open & re-weld expansion joint sleeve (bottom & about 1m on sides) 2.5m inserts        | 10 inserts |  |  |
| 23                                                                             | Clean ash accumulated in expansion joint convolutions bottom section (3 exp/joints)    | 3          |  |  |

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|                     |                                                                                        |            |  |  |
|---------------------|----------------------------------------------------------------------------------------|------------|--|--|
| 24                  | Repair metallic expansion joint by installing insert (2 convolutions) per 2.5m inserts | 20 inserts |  |  |
| 25                  | Repair metallic expansion joint by installing insert (3 convolutions) per 2.5m inserts | 10 inserts |  |  |
| 26                  | Replace dog brackets                                                                   | 20         |  |  |
| 28                  | Replace turning vanes (2 sizes)                                                        | 448        |  |  |
| 29                  | Repair flue gas damper blades                                                          | 16         |  |  |
| 30                  | Repair flue gas damper pillars                                                         | 12         |  |  |
| 31                  | Repair the flue gas damper blade bottom support structure                              | 4          |  |  |
| 32                  | Replace the flue gas damper blade bottom guide stub shaft                              | 16         |  |  |
| 33                  | Replace the flue gas damper blade top shaft                                            | 16         |  |  |
| 34                  | Install protecting sleeve damper blade shaft                                           | 32         |  |  |
| 35                  | Repair the cat ladder rungs (per rung)                                                 | 32         |  |  |
| 36                  | Replace/ patch the cat ladder rungs protecting plate                                   | 4          |  |  |
| 37                  | Replace access door seals                                                              | 13         |  |  |
| <b>Air Ducts</b>    |                                                                                        |            |  |  |
| 1                   | Open inspection doors                                                                  | 20         |  |  |
| 2                   | Window patch 600mm x 300mm                                                             | 8          |  |  |
| 3                   | Window patch 600mm x 150mm                                                             | 8          |  |  |
| 4                   | Window patch 300mm x 300mm                                                             | 12         |  |  |
| 5                   | Window patch 300mm x 150mm                                                             | 6          |  |  |
| 6                   | Window patch 150mm x 150mm                                                             | 6          |  |  |
| 7                   | Replace access door seals                                                              | 20         |  |  |
| 8                   | Cut and re-weld windows (3 off x 150mm x 150mm per SA duct per aerofoil) for cleaning  | 24 ducts   |  |  |
| <b>Fabrications</b> |                                                                                        |            |  |  |
| 1                   | Fabricate turning vanes (2 sizes)                                                      | 440        |  |  |
| 2                   | Fabricate flue gas damper blade                                                        | 16         |  |  |
| 3                   | Fabricate access damper doors                                                          | 16         |  |  |
| 4                   | Fabricate stay pipes with the protecting channel                                       | 600        |  |  |

**NB:** Appendix A to be used in conjunction with the section 3.3.1 Scope of work

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## Appendix B: Air & Flue Gas Ducts

| No. | Description                                            | Functional Location<br>(AKZ No.) | Access Doors to<br>be Opened &<br>Closed |
|-----|--------------------------------------------------------|----------------------------------|------------------------------------------|
| 1   | LH flue gas hood                                       | NR12G001                         | ✓                                        |
| 2   | LH vertical flue gas duct                              | NR12G001                         | ✓                                        |
| 3   | LH air heater flue gas inlet duct (Slope)              | NR12G001                         |                                          |
| 4   | LH air heater transition ducts top                     | NR12G001                         |                                          |
| 5   | RH flue gas hood                                       | NR22G001                         | ✓                                        |
| 6   | RH vertical flue gas duct                              | NR22G001                         | ✓                                        |
| 7   | RH air heater flue gas inlet duct (Slope)              | NR22G001                         |                                          |
| 8   | RH air heater transition ducts top                     | NR22G001                         |                                          |
| 9   | LH air heater transition ducts bottom                  | NR14/15G001                      |                                          |
| 10  | RH air heater transition ducts bottom                  | NR24/25G001                      |                                          |
| 11  | LH air heater LH flue gas outlet duct & turning vanes  | NR14G001                         | ✓                                        |
| 12  | LH air heater RH flue gas outlet duct & turning vanes  | NR15G001                         | ✓                                        |
| 13  | RH air heater LH flue gas outlet duct & turning vanes  | NR24G001                         | ✓                                        |
| 14  | RH air heater RH flue gas outlet duct & turning vanes  | NR25G001                         | ✓                                        |
| 15  | LH precipitator LH flue gas inlet duct & turning vanes | NR14G001                         |                                          |
| 16  | LH precipitator RH flue gas inlet duct & turning vanes | NR15G001                         |                                          |
| 17  | RH precipitator LH flue gas inlet duct & turning vanes | NR24G001                         |                                          |
| 18  | RH precipitator RH flue gas inlet duct & turning vanes | NR25G001                         |                                          |
| 19  | LH precipitator LH flue gas outlet duct                | NR14G002                         | ✓                                        |
| 20  | LH precipitator RH flue gas outlet duct                | NR15G002                         | ✓                                        |
| 21  | RH precipitator LH flue gas outlet duct                | NR24G002                         | ✓                                        |
| 22  | RH precipitator RH flue gas outlet duct                | NR25G002                         | ✓                                        |
| 23  | LH ID fan LH flue gas inlet duct                       | NR14G002                         |                                          |
| 24  | LH ID fan RH flue gas inlet duct                       | NR15G002                         |                                          |
| 25  | RH ID fan LH flue gas inlet duct                       | NR24G002                         |                                          |
| 26  | RH ID fan RH flue gas inlet duct                       | NR25G002                         |                                          |
| 27  | LH ID fan discharge to smokestack flue gas duct        | NR16G002                         | ✓                                        |
| 28  | RH ID fan discharge to smokestack flue gas duct        | NR26G002                         | ✓                                        |
| 29  | LH FD fan suction duct                                 | NG11G001                         |                                          |

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|    |                              |             |   |
|----|------------------------------|-------------|---|
| 30 | RH FD fan suction duct       | NG21G001    |   |
| 31 | LH FD fan discharge duct     | NG12G001    |   |
| 32 | RH FD fan discharge duct     | NG22G001    |   |
| 33 | LH air heater SA inlet duct  | NG12G001    | ✓ |
| 34 | RH air heater SA inlet duct  | NG22G001    | ✓ |
| 35 | LH air heater SA outlet duct | NG12G001    |   |
| 36 | RH air heater SA outlet duct | NG22G001    |   |
| 37 | SA ring main                 | NG13/23G001 | ✓ |
| 38 | SA to A1 PF burner duct      |             |   |
| 39 | SA to A2 PF burner duct      |             |   |
| 40 | SA to A3 PF burner duct      |             |   |
| 41 | SA to A4 PF burner duct      |             |   |
| 42 | SA to B1 PF burner duct      |             |   |
| 43 | SA to B2 PF burner duct      |             |   |
| 44 | SA to B3 PF burner duct      |             |   |
| 45 | SA to B3 PF burner duct      |             |   |
| 46 | SA to C1 PF burner duct      |             |   |
| 47 | SA to C2 PF burner duct      |             |   |
| 48 | SA to C3 PF burner duct      |             |   |
| 49 | SA to C4 PF burner duct      |             |   |
| 50 | SA to D1 PF burner duct      |             |   |
| 51 | SA to D2 PF burner duct      |             |   |
| 52 | SA to D3 PF burner duct      |             |   |
| 53 | SA to D4 PF burner duct      |             |   |
| 54 | SA to E1 PF burner duct      |             |   |
| 55 | SA to E2 PF burner duct      |             |   |
| 56 | SA to E3 PF burner duct      |             |   |
| 57 | SA to E4 PF burner duct      |             |   |
| 58 | SA to F1 PF burner duct      |             |   |
| 59 | SA to F2 PF burner duct      |             |   |
| 60 | SA to F3 PF burner duct      |             |   |
| 61 | SA to F4 PF burner duct      |             |   |
| 62 | CA to A1 PF burner duct      |             |   |
| 63 | CA to A2 PF burner duct      |             |   |
| 64 | CA to A3 PF burner duct      |             |   |

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|    |                               |          |   |
|----|-------------------------------|----------|---|
| 65 | CA to A4 PF burner duct       |          |   |
| 66 | CA to B1 PF burner duct       |          |   |
| 67 | CA to B2 PF burner duct       |          |   |
| 68 | CA to B3 PF burner duct       |          |   |
| 69 | CA to B3 PF burner duct       |          |   |
| 70 | CA to C1 PF burner duct       |          |   |
| 71 | CA to C2 PF burner duct       |          |   |
| 72 | CA to C3 PF burner duct       |          |   |
| 73 | CA to C4 PF burner duct       |          |   |
| 74 | CA to D1 PF burner duct       |          |   |
| 75 | CA to D2 PF burner duct       |          |   |
| 76 | CA to D3 PF burner duct       |          |   |
| 77 | CA to D4 PF burner duct       |          |   |
| 78 | CA to E1 PF burner duct       |          |   |
| 79 | CA to E2 PF burner duct       |          |   |
| 80 | CA to E3 PF burner duct       |          |   |
| 81 | CA to E4 PF burner duct       |          |   |
| 82 | CA to F1 PF burner duct       |          |   |
| 83 | CA to F2 PF burner duct       |          |   |
| 84 | CA to F3 PF burner duct       |          |   |
| 85 | CA to F4 PF burner duct       |          |   |
| 86 | LH air heater bypass duct     | NG14G001 | ✓ |
| 87 | RH air heater bypass duct     | NG24G001 | ✓ |
| 88 | LH hot air recirculating duct | NG15G001 | ✓ |
| 89 | RH hot air recirculating duct | NG25G001 | ✓ |
| 90 | LH PA fan suction duct        | NG31G001 |   |
| 91 | RH PA fan suction duct        | NG41G001 |   |
| 92 | LH PA fan discharge duct      | NG32G001 |   |
| 93 | RH PA fan discharge duct      | NG42G001 |   |
| 94 | LH air heater PA inlet duct   | NG32G001 | ✓ |
| 95 | RH air heater PA inlet duct   | NG42G001 | ✓ |
| 96 | LH air heater PA outlet duct  | NG33G001 | ✓ |
| 97 | RH air heater PA outlet duct  | NG43G001 | ✓ |
| 98 | LH PA tempering air duct      | NG34G001 | ✓ |

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|     |                                      |          |   |
|-----|--------------------------------------|----------|---|
| 99  | RH PA tempering air duct             | NG44G001 | ✓ |
| 100 | PA interconnector duct               | NG53G001 |   |
| 101 | PA tempering air interconnector duct | NG54G001 |   |

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