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## **1. INTRODUCTION**

Medupi Power Station's pulse jet fabric filter plants (PJFF) do not function appropriately. Bag failures, high emissions and high differential pressure began to be experienced during the first year of operation and have not yet been suitably and sustainably corrected. Kusile Power Station, which is of a similar design by the same OEM, experiences similar problems.

Currently, Medupi operates with polyphenylene sulphide (PPS) based bags and Kusile with polyacrylonitrile (PAN) based bags. Both stations were originally designed for operation with the low temperature range PAN fabric, however operational constraints have necessitated the change at Medupi as an interim measure.

As a temporary measure to investigate possible improvement of plant performance while planning for major PJFF plant modifications, fabric filter bags that are not traditionally used within the Eskom fabric filter fleet are being considered for trials at Medupi. The objective is to establish whether alternative bag options may provide operational relief until such time that defects are sustainably corrected. Should the initial trials be successful at Medupi, further trials at Kusile may be considered.

## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

#### **2.1.1 Purpose**

The purpose of this document is to specify requirements for bags that may be considered for trials at Medupi and Kusile Power Stations.

#### **2.1.2 Applicability**

This document is applicable to Medupi and Kusile Power Stations.

### **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] 240-53113965: Fabric Filter Plant Bag Standard

#### **2.2.2 Informative**

- [3] 474-11896: Medupi/Kusile Power Station: Pulse Jet Fabric Filter Plant Defects Position Paper

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## 2.3 DEFINITIONS

Definition	Description
Air-to-Cloth Ratio	The ratio of the volume of the flue gas filtered to the area of filtration cloth available for filtration, otherwise known as the filtration velocity. This parameter influences pressure drop.

### 2.3.1 Disclosure Classification

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

## 2.4 ABBREVIATIONS

Abbreviation	Description
mm	millimetre
CFD	Computational Fluid Dynamics
OEM	Original Equipment Manufacturer
PAN	Polyacrylonitrile
PJFF / FFP	Pulse Jet Fabric Filter / Fabric Filter Plant
PPS	Polyphenylene Sulphide
RT&D	Research Testing and Development

## 2.5 ROLES AND RESPONSIBILITIES

Group Technology and RT&D to evaluate the performance of the trial bags.

The Power Station (Generation) is to facilitate the installation and sampling of the trial bags at the pre-defined test intervals.

## 2.6 PROCESS FOR MONITORING

As per relevant Engineering and RT&D procedures

## 2.7 RELATED/SUPPORTING DOCUMENTS

240-53113965: Fabric Filter Plant Bag Standard

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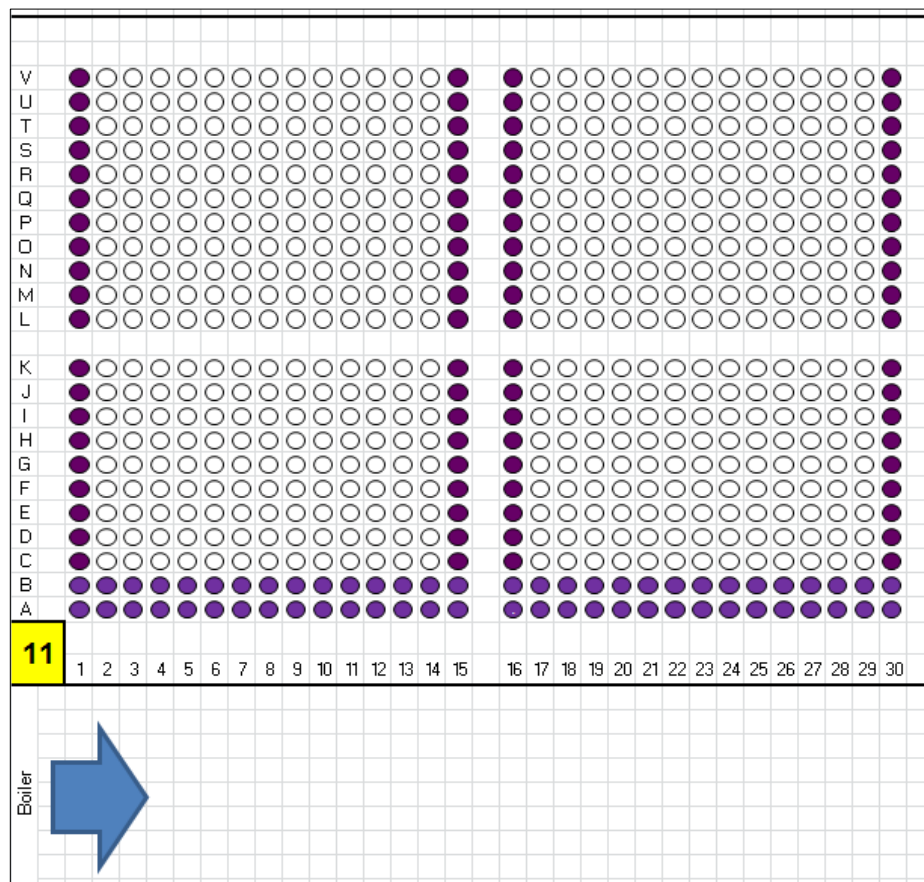
### 3. TRIAL DETAILS

#### 3.1 TRIAL BAG LOCATIONS AND QUANTITIES

Currently, Medupi and Kusile suffer significant bag failures within the first rows of bags from the cell inlets and at the areas near the cell walls as shown in Figure 1. Reasons for this are discussed in 474-11896: Medupi/Kusile Power Station: Pulse Jet Fabric Filter Plant Defects Position Paper [3].

The abrasion resistant materials discussed in this document are to be trialled in rows A and B positions 1 - 30 (indicated in pale purple in Figure 1). Although bag failure is also experienced in positions 1, 15, 16 and 30 in all rows, the trial bags are limited to the front two rows in order to assess performance in the highest wear zones and limit potential impact on the air-to-cloth ratio where filtration performance of the trial bags is not in accordance with typical operation.

The objective of these trials is to establish whether extended bag life can be obtained in order to temporarily provide operational relief until major modifications for sustainable performance improvement can be implemented. For this reason, filtration performance of the materials considered is of lesser importance than abrasion and chemical resistance.



**Figure 1: Typical Medupi/Kusile bag failure locations within a cell**

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Each alternative trial bag type is to be tested in one compartment at Medupi. Bags will be installed at the locations indicated and the remaining bags will be in accordance with the station's specific bag requirements for normal operation (refer to 240-53113965: Fabric Filter Plant Bag Standard [2]). All trial bags in a single compartment will therefore be of the same type.

The quantity of bags purchased is influenced by the Suppliers' manufacturing requirements. In cases where a full production run of a material is made specifically for this trial, this will dictate how many bags are purchased. The minimum quantity to be purchased is 60 bags in order to allow installation in the areas discussed above.

### 3.2 TRIAL DURATION

Bags are to be installed and plant data collected over a period of a minimum of one year, sampled every three months, or up to bag failure. Ideally, all trial bag types are to be installed in different cells during the same period in order to ensure that the same operational environment is experienced by all bag types.

### 3.3 PLANT OPERATION

Since the focus of the materials discussed in this document is not on filtration performance, the overall air-to-cloth ration (or filtration velocity) of the plants may be influenced. This could potentially result in increased differential pressure. However, since materials selected are for filtration applications, it is anticipated that the benefit of possible longer life will outweigh the potential marginal increase in differential pressure.

It is imperative that the plant is appropriately operated and maintained in accordance with the relevant procedures during the trial in order to provide reliable trial results.

## 4. MEDUPI TRIAL BAG SPECIFICATION

Where reference is made to PPS, specifications shall be in accordance with 240-53113965: Fabric Filter Plant Bag Standard, [2]. Needle-felt bag manufacture and dimensions are in accordance with the relevant drawings specified in [2].

Alternative wear resistant material proposals from all approved fabric manufactures in [2] will be considered.

### 4.1 PARA-ARAMID (KEVLAR® / TWARON® / HERACRON®) NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex Round PPS, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex Round PPS, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	1.7 dtex Trilobal PPS, 125 – 135 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	2.5 dtex Para-Aramid, 100 – 110 g/m <sup>2</sup>

### 4.2 NOVATES® FABRIC TREATMENT ON NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex Round PPS, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex Round PPS, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex Round PPS, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex Trilobal PPS, 100 – 110 g/m <sup>2</sup>
Surface treatment:	Novates®

### 4.3 RESILTES® FABRIC TREATMENT ON NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex Round PPS, 190 – 200 g/m <sup>2</sup>
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Scrim:	2.2 dtex Round PPS, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex Round PPS, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex Trilobal PPS, 100 – 110 g/m <sup>2</sup>
Surface treatment:	Resiltes®

#### 4.4 PYROGUARD® FABRIC TREATMENT ON NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex Round PPS, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex Round PPS, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex Round PPS, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex Trilobal PPS, 100 – 110 g/m <sup>2</sup>
Surface treatment:	Pyroguard®

#### 4.5 RIGID POROUS FILTER MEDIA

In order to allow installation within the clean gas compartments, rigid porous filters may not exceed 4 m in length. Shorter filters may be considered. Flow characteristics within the cell are to be confirmed via computational fluid dynamics (CFD) analysis prior to the trial to ensure that velocities within the cell are such that the non-trial bags will not be negatively affected.

Tube sheet connection is proposed by the Supplier and accepted by Eskom to fit tube sheet holes of 165 mm diameter. Tubesheet fit must be confirmed prior to manufacture.

Rigid porous filter type/material is as proposed by the Supplier.

### 5. KUSILE TRIAL BAG SPECIFICATION

If successful trial bags are identified at Medupi, these bags may be further trialled or installed at Kusile. Kusile specific PAN-based fabrics are described below; however the decision may be taken to install the identical materials trialled at Medupi.

Where reference is made to PAN, specifications shall be in accordance with 240-53113965: Fabric Filter Plant Bag Standard, [2]. Should alternative proposals mentioned in Section 4 be successful, these materials may be tailored for Kusile's application if required. Needle-felt bag manufacture and dimensions are in accordance with the relevant drawings specified in [2].

#### 5.1 PARA-ARAMID (KEVLAR® / TWARON® / HERACRON®) NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex PAN, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex PAN, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	1.7 dtex PAN, 125 – 135 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	2.5 dtex Para-Aramid, 100 – 110 g/m <sup>2</sup>

#### 5.2 NOVATES® FABRIC TREATMENT ON NEEDLE FELT FABRIC

Inner Batt (Clean Gas Side):	2.2 dtex PAN, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex PAN, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex PAN, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex PAN, 100 – 110 g/m <sup>2</sup>
Surface treatment:	Novates®

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**5.3 RESILTES® FABRIC TREATMENT ON NEEDLE FELT FABRIC**

Inner Batt (Clean Gas Side):	2.2 dtex PAN, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex PAN, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex PAN, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex PAN, 100 – 110 g/m <sup>2</sup>
Surface treatment:	Resiltes®

**5.4 PYROGUARD® FABRIC TREATMENT ON NEEDLE FELT FABRIC**

Inner Batt (Clean Gas Side):	2.2 dtex PAN, 190 – 200 g/m <sup>2</sup>
Scrim:	2.2 dtex PAN, 175 – 185 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Inner Layer):	2.2 dtex PAN, 120 – 130 g/m <sup>2</sup>
Outer Batt (Dirty Gas Side – Outer Layer):	1.7 dtex PAN, 100 – 110 g/m <sup>2</sup>
Surface treatment:	PyroGuard®

**5.5 RIGID POROUS FILTER MEDIA**

In order to allow installation within the clean gas compartments, rigid porous filters may not exceed 4 m in length. Shorter filters may be considered. Flow characteristics within the cell are to be confirmed via computational fluid dynamics (CFD) analysis prior to the trial to ensure that velocities within the cell are such that the non-trial bags will not be negatively affected.

Tube sheet connection is proposed by the Supplier and accepted by Eskom to fit tube sheet holes of 165 mm diameter. Tubesheet fit must be confirmed prior to manufacture.

Rigid porous filter type/material is as proposed by the Supplier.

**6. BAG TESTING REQUIREMENTS****6.1 MATERIAL TESTS TO BE PERFORMED BY THE SUPPLIERS**

Potential suppliers will perform the following tests and provide the results thereof to Eskom prior to bag materials being accepted.

Eskom will perform standard bag material tests in order to confirm the Suppliers' results, where applicable, prior to installation and will continue to perform standard bag material tests at predetermined intervals in order to monitor bag performance.

**6.1.1 MATERIAL TESTS FOR NEEDLE FELT FABRICS**

- Weight
- Thickness
- Air permeability
- Breaking Strength
- Percentage elongation at 50 N/cm and at break (warp and weft directions)
- Dimensional Stability
- Microscopic analysis confirming cascade fabric construction

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- VDI filtration performance tests (based on VDI/DIN guideline 3926 “Testing of Cleanable Filter Media”)
- Abrasion resistance (Supplier to advise method)

#### **6.1.2 MATERIAL TESTS FOR RIGID POROUS FILTER MEDIA**

- Weight
- Thickness
- Air permeability
- Abrasion resistance (Supplier to advise method)
- VDI filtration performance tests (based on VDI/DIN guideline 3926 “Testing of Cleanable Filter Media”), if applicable

Any further appropriate rigid porous filter media tests to be suggested by the Supplier.

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## 7. AUTHORISATION

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## 8. REVISIONS

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August 2019	0.2	J Fourie	Final draft after Review Process
October 2019	1	J Fourie	Final document for Authorisation and Publication

## 9. DEVELOPMENT TEAM

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

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## 10. ACKNOWLEDGEMENTS

N/A

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