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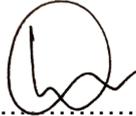
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## **1. INTRODUCTION**

Eskom utilizes filter bags manufactured from needle-felt fabric on its fabric filter plant (FFP) equipped operating units, to curb particulate emissions. The needle-felt is manufactured from various synthetic polymer fibres. Eskom has done extensive research in order to understand which fabric filter media would function best in which operating environment.

This Standard was developed based on the research done and extensive operational experience, to ensure that a minimum standard is applied when procuring filter bags for the respective power stations.

## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

This Standard stipulates the minimum requirements for filter media and bags used in FFP's.

It provides a consistent technical approach for the sourcing of raw material, manufacturing, supply and delivery of fabric filter bags to all applicable Eskom power stations.

Relevant information regarding Polyphenylene sulphide (PPS), Polyimide (PI) and Homopolymer Polyacrylonitrile (PAN) polymers are detailed.

The operating conditions and detailed bag specification for each power station are stipulated.

The suppliers and products that have gone through the applicable approval processes, and may be used for Eskom plants are listed.

The process for being approved as a fibre, needle-felt or bag supplier is described, as well as the expected timeframes for each approval process.

The fibre, needle-felt and bag, sampling and testing processes are contained herein.

The minimum quality requirements for the manufacturing of needle-felt and bags are listed.

#### **2.1.1 Purpose**

This Standard was developed to ensure that a minimum standard is applied when procuring filter bags for the respective power stations.

#### **2.1.2 Applicability**

This Standard applies to all filter bags utilised at the applicable power stations, be it spare bags used for plant maintenance, bags kept as stock items or "end of life" replacement sets of bags.

This Standard shall apply to the following FFP equipped Power Stations:

- Arnot Power Station
- Camden Power Station
- Duvha Power Station
- Grootvlei Power Station
- Hendrina Power Station
- Kusile Power Station
- Majuba Power Station
- Medupi Power Station

### **CONTROLLED DISCLOSURE**

## 2.2 NORMATIVE/INFORMATIVE REFERENCES

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

### 2.2.1 Normative

- [1] 240-56242363 – Eskom Standard for Emissions Monitoring and Reporting.
- [2] 240-56244749 – Fabric Filter Plant Operation Standard.
- [3] 240-48929482 – Tender Technical Evaluation Procedure
- [4] ISO 9001 – Quality Management System.
- [5] SABS ISO 14001, Framework of control to ensure that all SHE risks are considered along an auditable tract to ensure a successful outcome and continuous improvement.
- [6] 32-391 - Eskom Integrated Risk Management Procedure.
- [7] 240-119619889 - Determination of Fabric Mass, Ash Mass and Cleanability of Fabric Filter Bags
- [8] 240-119619621: Determination of the Permeability of Fabric Filter Bags to Air
- [9] 240-119618026 - Tensile Properties of Fabrics: Determination of the Maximum Force of Fabric Filter Bags using the Grab Method
- [10] 240-132338631 - Determination of Tearing Strength of Fabrics by the Tongue Method :
- [11] 240-119619058 - Determination of Dimensional Change in Fabric Filter Bags after Exposure to High Temperature
- [12] 240-119619621 - Determination of Permeability of fabric filter bags
- [13] 240-105658000 - Supplier Quality Management Specification
- [14] EN ISO 9073-2 – Methods of testing nonwovens: Determinations of thickness
- [15] 209-449 - Data Interpretation from the Textile Laboratory

### 2.2.2 Informative

- [16] EN 29073 – Methods of testing nonwovens: Determination of tensile strength and elongation
- [17] EN ISO 9237 – Textiles: Determination of air permeability
- [18] DIN 53887 – Frazier Differential Pressure air permeability tester
- [19] DIN 53861 – Testing of Textiles; Vaulting test and bursting test
- [20] UNI 8279/12 – Methods of testing nonwovens: Determination of dimensional change by heat
- [21] EN 12127 – Textiles and fabrics. Determination of Mass per unit area using small samples
- [22] Eskom Power Station Atmospheric Emissions Licences.

## 2.3 DEFINITIONS

Definition	Description
Warp	Machine direction (MD)
Weft	Cross-machine direction or cross-direction (CD)

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### 2.3.1 Classification

**Controlled Disclosure:** Controlled Disclosure to External Parties (either enforced by law, or discretionary).

### 2.4 ABBREVIATIONS

Abbreviation	Description
°C	Degrees Celsius
dtex	Decitex
FFP	Fabric Filter Plant
g/m <sup>2</sup>	Gram per square meter
g/Nm <sup>3</sup>	Gram per normal cubic meter (normalised to 10% O <sub>2</sub> on a dry basis at 101.325 kPa & 0 °C)
K	Kelvin
kPa	Kilo Pascal
m <sup>3</sup> /m <sup>2</sup> /minute	Cubic meter per square meter per minute
Max	Maximum
MCR	Maximum Continuous Rating
mg/Nm <sup>3</sup>	Milligram per normal cubic meter (normalised to 10% O <sub>2</sub> on a dry basis at 101.325 kPa & 0°C)
Min	Minimum
mm	Millimeter
N/cm	Newton per centimetre
Nm <sup>3</sup>	Normal cubic meter (normalised to 10% O <sub>2</sub> on a dry basis at 101.325 kPa & 0 °C)
O <sub>2</sub>	Oxygen
Pa	Pascal
PAN	Polyacrylonitrile
PI	Polyimide (P84 ®)
PPS	Polyphenylene sulphide
QA	Quality Assurance
QC	Quality Control

### 2.5 ROLES AND RESPONSIBILITIES

The Power Station General Manager is responsible for ensuring that this Standard is implemented at the power station.

The Station Engineering Manager is responsible for ensuring that the technical content and requirements of this Standard are complied with.

The Flue Gas Cleaning System Engineer is responsible to ensure that the requirements of this Standard is referenced and included in any process where bags are being purchased for the power station, be it spare bags for maintenance purposes, bags for stock keeping or full replacement sets of bags. The System Engineer will furthermore ensure that stock description of the bags, scopes of work for outages and Works Information for contracts, include the requirements of the latest revision of this Standard.

Project and Contract Managers that issue enquiries for bag replacements and manage bag replacement contracts will ensure that the requirement of this Standard is referenced and applied.

Subject Matter Experts are responsible for the periodic review of this document.

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## 2.6 PROCESS FOR MONITORING

Regular audits must be done to ensure compliance to this Standard.

Samples of all batches of fabric intended for use in the applicable FFP's shall be issued to the Eskom RT&D laboratory for analysis before the fabric is deemed fit for use, following the process below:

**Step 1:** Bag order placed, fabric manufactured and data sheet signed off

**Step 2:** Suppliers laboratory results completed and submitted to RT&D with fabric and scrim samples

**Step 3:** Fabric and scrim sample received by RT&D (with transmittal sheet)

**Step 4:** Samples analysed by RT&D

**Step 5:** RT&D analysis report issued

**Step 6:** Supplier given feedback on sample analysis. (If non-compliant, repeat process)

**Step 7:** Install bags and evaluate bag performance every 3 000 hours

## 2.7 RELATED/SUPPORTING DOCUMENTS

None

## 3. FABRIC FILTER PLANT BAG STANDARD

The objectives for this document include:

- Providing a consistent approach to the sourcing of raw material, manufacturing, supply and delivery of fabric filter bags to the various power stations.
- Ensuring that Eskom is supplied with the correct specification bags, manufactured according to rigorous quality requirements, which will ensure that they operate reliably and efficiently throughout their intended life.
- Sustaining and improving the power station's particulate emission performance.
- Ensuring the application, implementation and development of appropriate filter bag design, manufacturing and testing techniques.
- Developing performance standards which support the Eskom's reliability and optimised availability targets.
- Ensuring that suppliers shall provide adequate resources and engineering capability to support Eskom's objectives.

### 3.1 POWER STATION BAG QUANTITIES

Station	Unit No.	Installed No. of Bags	Recommended Min. No. of Bags to be Ordered (per full replacement set)
Arnot	1	13 584	13 700
	2	13 584	13 700
	3	13 584	13 700
	4	10 934	11 100
	5	10 934	11 100
	6	10 934	11 100

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<b>Camden</b>	1	9 616	9 800
	2	9 616	9 800
	3	9 616	9 800
	4	9 616	9 800
	5	9 600	9 800
	6	9 600	9 800
	7	9 616	9 800
	8	9 616	9 800
<b>Duvha *1</b>	1	26 928	27 100
	2	26 928	27 100
<b>Grootvlei</b>	1	8 832	9 000
	2	9 744	9 900
	3	9 744	9 900
<b>Hendrina</b>	2	8 832	9 000
	4	8 832	9 000
	5	8 832	9 000
	6	7 984	8 100
	7	7 984	8 100
	10	7 984	8 100
<b>Majuba</b>	1	30 976	31 100
	2	30 976	31 100
	3	30 976	31 100
	4	32 512	32 700
	5	32 512	32 700
	6	32 512	32 700
<b>Medupi</b>	1	18 480	18 600
	2	18 480	18 600
	3	18 480	18 600
	4	18 480	18 600
	5	18 480	18 600
	6	18 480	18 600
<b>Kusile</b>	1	18 480	18 600
	2	18 480	18 600
	3	18 480	18 600

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	4	18 480	18 600
	5	18 480	18 600
	6	18 480	18 600

Notes:

\*1 – As per the strategic report, Duvha will revert back to using the original number of bags to make sure that Duvha gets the maximum gas-to-cloth ratio. This is in-line with current best practise and also ensures sufficient margin against deteriorating coal and process conditions. It also assists in minimising the load losses incurred during on-load compartment outages.

**3.2 DOCUMENT CONTROL**

- The bag/needle-felt supplier shall have a documented ISO based management process that will describe and control the complete needle-felt fabric and bag manufacturing processes.
- The supplier shall complete and submit to Eskom upon request, the Filter Bag Information Summary on the prescribed form, for each bag type it intends to supply to Eskom.
- The supplier shall create controlled manufacturing drawings to be used during the manufacturing process that is based on the relevant Eskom drawings.
- The supplier shall carry out inspection at all stages of fabric and bag manufacture according to an Eskom approved QCP and ITP and records of such inspections shall be available for Eskom’s review.
- During manufacturing, the supplier shall submit QA data sheets, including test data of each batch of bags and needle-felt. The data sheets must include, as a minimum, the results for measurements of the following parameters:
  - Raw Materials: Certificates of compliance and source of material and periodic batch tests of all components and raw materials.
  - Fabric Manufacture: Weight, Thickness, Air permeability, Breaking Strength and % elongation at 50 N/cm and at break (warp and weft directions), PI (P84®) content and the Dimensional Stability (free shrinkage at 150 °C (PAN) or 180 °C (PPS) over 24 hrs, warp and weft).
  - Bag Manufacture: Length (under 5 kg tension), flat width and general compliance to Eskom Drawings.
- All applicable documentation are to reflect the Eskom order number and batch number.

**3.3 QUALITY ASSURANCE REQUIREMENTS**

- The Supplier shall comply with the requirements contained within the ISO 9001/9002 quality system and the Eskom Supplier Quality Management Specification (QM-58) requirements.
- The Supplier will allow and make provision for Eskom to carry out random inspections during the fabric and bag manufacturing process.
- The generic and complete Quality Plan as well as a proposed Inspection and Test Plan in strict compliance with the product standard are to be submitted with any tender submitted for the supply of filter bags.
- Once a contract has been awarded to a supplier, the proposed Quality Plan will be provided at least three (3) week before the needle-felt and/or bag manufacturing commences.
- The complete QA data packs for the bags will be provided with the bag delivery.

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- The data books must include the details of the tags and numbers with complete traceability to the fabric roll number and other relevant manufacturing information.
- All raw materials (i.e. fibre, thread, snap bands, seals, etc.) must have certificates of compliance and records of such shall be made available for Eskom's inspection.
- The supplier shall repair defects revealed during the routine quality control checks, provided the supplier demonstrates to Eskom's satisfaction that such repairs do not, in any way, lessen the service life and performance of the material.
- The supplier will allow and make provision for Eskom to carry out random inspections during the fabric and bag manufacturing process.
- During manufacture, as a minimum every 50<sup>th</sup> bag must be checked thoroughly using the approved bag inspection sheet. Records must be kept by the supplier and included in the data books.
- The quality of the fabric will be verified according to the following Eskom Research and Strategy testing methods:

METHOD	ESKOM NUMBER	EQUIVALENT STANDARD
Tearing Strength Determination of tearing strength of fabric by the tongue method	240-119618026	EN 29073-3
Air Permeability	240-119619621	
Bursting Strength		DIN 53861
Breaking Strength	240-119618026	
Thermal Stability		
P84® Content		
Area Weight, Mass & Cleanability	240-119619889	EN 12127
Thickness		EN ISO 9073-2
Micro Scanning Electron Microscope (SEM) analysis to determine the distinct cascaded layers of the cloth construction		
pH Determination of aqueous extract from fabric filter bags	240-119619455	
Determination of Fabric Mass, Ash mass and Cleanability of fabric filter bags	240-119619889	EN 12127
Determination of dimensional change in fabric filter bags after exposure to high temperature	240-119619058	UNI 8279/12
Solubility of Polyimide (P84®) in Polyacrylonitrile (PAN)	Still to be validated	
Determination of the maximum force of fabric filter bags using the grab method	240-119618026	EN 29073-3
Determination of Permeability of fabric filter bags to air	240-11961962162P4002	EN ISO 9237 / DIN 53887

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Solubility of Polyimide (P84®) in Polyphenylene Sulphide (PPS)	240-119618310	
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### 3.4 MANUFACTURING AND DELIVERY PROGRAM

The supplier shall provide as part of any tender, detailed manufacturing and delivery schedules. The supplier shall deliver all bags to site as per the required delivery schedule.

The supplier submits as part of any tender and on Eskom's request the following documentation:

- Generic Quality Plan
- Proposed Inspection and Test Plan
- QA/QC procedure for approval prior to manufacturing commencement
- QA data sheets for fabric manufacture for each batch one week before bag manufacturing starts
- QA data sheets for bags manufacture with bag delivery
- The supplier submits upon request, a delivery schedule, including detail lead times for the various products they intend supplying. The lead times will be broken up into the various phases of the bag and needle-felt manufacturing process and each phase will include the possible risks to that phase of the delivery lead time.
- The supplier submits upon request a production plan that indicates, from start to finish, how the products will be produced and what measures are put in place to execute the task successfully. The submission and subsequent revisions shall be hard copy, as well as a software copy. The software package is Microsoft compatible (e.g. MS Project etc.).

### 3.5 SUPPLIER'S MANAGEMENT, SUPERVISION AND PROCESS MANAGEMENT

- The supplier shall as part of any tender and on Eskom's request provide an organogram of the supplier and names of key people responsible for the project. The information shall include contact details of the key personnel.
- The supplier shall have a procedure in place to manage the selection and approval of sub-suppliers. The procedure will also describe how sub-supplier performance is managed. Credible proof of such a procedure or process shall be submitted with the tender.
- The supplier shall have a procedure in place to manage and ensure that a Dedicated Quarantine area is in effect, where faulty or defective products can be moved to once, removed from the manufacturing process. Credible proof of such a procedure or process shall be submitted with the tender.
- The supplier shall have a Material Storage and Identification Control procedure in place to manage material storage and identification and how it will manage externally sourced equipment/material and how it will be approved for use. Credible proof of such a procedure or process shall be submitted with the tender.
- The supplier shall have an Incoming Goods Inspection procedure in place to manage externally sourced equipment/material and how it will be approved for use. Credible proof of such a procedure or process shall be submitted with the tender.

### 3.6 PROVISION OF PERFORMANCE BONDS AND GUARANTEES

The supplier may be requested to provide a performance bond to ensure compliance to performance guarantees. The terms of the performance bond will be detailed in the Purchasing Contract. Below is an example of how a performance bond could be structured to ensure performance guarantee compliance.

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The amount of the performance bond is at least 5 (five) % of the Contract Value per Unit. The performance bond will be released as follows:

#### Routine Replacement Sets of Bags

- 50 % will be released 52 weeks after sectional completion of the whole of the works.
- The remaining 50 % will be released at the end of the defects guarantee period.

#### Spare Bags for Maintenance Purposes

- 50 % will be released 52 weeks after sectional completion of the whole of the works.
- The remaining 50 % will be released at the end of the defects guarantee period.

The supplier will as part of the tender returnables, provide a written assurance from the supplier's bank that the Performance Bond can and will be issued within 4 (four) weeks of Contract Award/Acceptance Letter Issued.

### **3.7 BAG LIFE GUARANTEE**

- The supplier shall be required to confirm acceptance and compliance to each portion of the required guarantees in any submitted tender.
- Any guarantee limitations are to be specifically stated in the specific tender submission. Eskom reserves the right to decline or accept these submissions.
- Eskom may factor any limitations of guarantee into the life cycle evaluation of each offer.

The required bag guarantee periods for the individual stations are as follows:

- Arnot PPS bags: minimum of 32 000 operating hours for Units 1 to 3 and 28 000 operating hours for Units 4 to 6.
- Duvha PPS bags: minimum of 32 000 operating hours.
- Camden PPS bags: minimum of 28 000 operating hours.
- Grootvlei PPS bags: minimum of 32 000 operating hours.
- Hendrina PPS bags: minimum of 32 000 operating hours.
- Majuba PAN bags: minimum of 20 000 operating hours.
- Medupi PPS bags: minimum of 15 000 operating hours.
- Kusile PAN bags: minimum of 17 500 operating hours.
- Kusile PPS bags: minimum of 15 000 operating hours.

Note: The PPS and PAN referred to is for the predominant base fibre used.

### **3.8 EMISSIONS GUARANTEE**

The supplier shall provide a guarantee that the Maximum Emission Limit stipulated in Section 4 shall not be exceeded.

### 3.9 DIFFERENTIAL PRESSURE DROP GUARANTEE

The supplier shall provide a guarantee that the Maximum Pressure Drop stipulated in Section 4 shall not be exceeded.

### 3.10 SUPPLIER DUTY AND LOCAL CONTENT

The supplier shall provide fabric filter bags in accordance with this Bag Standard, including the design, testing and manufacturing of the fabric and the filter bags to suit the process conditions and ensure the proper fitting of the bags onto the existing bag cages and tube plate. The supplier will ensure local production of the following components of the bags:

- Tubing and cutting to size of the fabric.
- Manufacturing of the top and bottom cuff and sock components.
- Cutting and assembling of the snap ring.
- Assembly of the completed bag including all stitching and thermo-welding activities
- Needle-felt manufacturing, unless a concession is obtained by the supplier from the Department of Trade, Industry and Competition (DTIC) and Eskom.

### 3.11 APPROVED SUPPLIERS

The following products, components and suppliers are approved by Eskom. No substitutes or alternatives shall be accepted for use in any of the applicable power stations.

#### 3.11.1 Fibre Suppliers

The following suppliers have been approved by Eskom for fibre production:

- Polyphenylene sulphide (PPS) – Trade Names: **Procon, Huvis, Torcon and Nexylene**,
- Polyimide (PI) – Trade Name: **P84®**
- Homopolymer Polyacrylonitrile (PAN) – Trade Names: **Dolanit and AKSA**

#### 3.11.2 Needle-felt Suppliers

The following suppliers have been approved by Eskom for Needle-felt production (including the sourcing of bag component materials such as cuffs and seal rings):

#### Local Suppliers

- Beier Envirotec's Pinetown Plant (South Africa)
- Industrial Filters and Fabrics' (IFF) Rosslyn Plant (South Africa)

#### International Suppliers

- Lydall (previously Andrew Webron) Lancs Plant (United Kingdom)
- BWF's Offingen Plant (Germany)
- Lydall's (previously Gutsche) Fulda Plant (Germany)
- Heimbach's Düren Plant (Germany)
- Testori's Milan Plant (Italy)
- Kayser's Einbeck Plant (Germany)
- Valmet's Ovar Plant (Portugal)

### CONTROLLED DISCLOSURE

### 3.11.3 Bag Manufacturers

Eskom only use local (South African) bag manufacturers. The following bag manufacturers have been approved by Eskom:

- Beier Envirotec's Pinetown Plant
- Industrial Filters and Fabrics' (IFF) Rosslyn Plant
- GI Filtration's Centurion Plant
- Clear Edge's Robertsham Plant
- BWF Envirotec's Nigel Plant
- Filter Pure's Kya Sand Plant
- Envirox Filtration Technologies' East Rand Plant

Products from the following suppliers have been approved by Eskom. If these suppliers are successful in any competitive tendering process and is considered to supply needle-felt or bags to any of the power stations, a factory assessment may need to be completed before the tender is awarded:

- WL Gore (Costa Rica and Poland factories)
- Arvind Ltd. (India)

FFP Original Equipment Manufacturers (OEMs) such as Howden Projects, Actom, Alstom/GE, DB Thermal/Balcke-Durr/SPX, Hamon, Bateman, Steinmuller, etc. will be allowed to participate in a competitive tender process as long as the requirements contained in this document are adhered to.

Furthermore, it must be noted that the Department of Trade, Industry and Competition (DTIC) has designated the textile industry. As such, permission needs to be obtained from the DTIC prior to the enquiry close date for the importation of any component related to the bag, i.e. fibers, yarns, threads, scrims, snap bands, seal rings, bags etc.

### 3.11.4 Selection of Suppliers

Eskom reserves the right to add and/or remove to the above list (3.11.1 to 3.11.3) solely at its discretion. No exception to Eskom's approved list will be accepted. Any additional/potential supplier to this list will be required to meet the requirements in this Standard and will only be considered after following the approval process detailed in 3.11.5.

### 3.11.5 Technical Approval Process

Through Eskom's Research Centre and Supplier Assessment Departments (QA), a comprehensive testing and evaluation program is followed (trial bag program) to ensure that the products used are fit for purpose. The level of detail varies depending on which aspect of the supply value chain is being evaluated. Suppliers intending to supply Eskom with new products will approach the Senior Consultant – Air Pollution Control and Senior Advisor – Polymers and Filtration, and the details of each proposed test program will be determined with the supplier. The typical periods of assessments are described below:

## CONTROLLED DISCLOSURE

Table: Typical Technical Approval Process Timeframes

Supply Value Chain Step	Assessment Description	Typical Assessment Durations
Resin manufacturing	Can the manufacturer produce resin that can be used for fiber extruded and withstand the required process conditions. This development is typically done between the resin and fiber suppliers.	18 to 24 months
Fibre extrusion	Can the resin be extruded for fiber and also spun into yarn. The fiber then undergoes extensive laboratory tests.	18 to 24 months
Yarn spinning	Same evaluation as fiber extrusion.	12 to 18 months
Non-woven needle-felt manufacturing / Coated fabrics	Tests fabric in simulated flue gas conditions in the laboratory. Tests the fabric in actual plant environment for fatal flaws Test the fabric in actual plant environment for life cycle assessment	2 to 3 months 6 to 12 months 18 to 30 months
Filter bag manufacturing	Assessment capability of bag producer to produce bags to the required quality, volumes and consistency. Test the final bag in actual plant environment for fatal flaws.	3 to 6 months 3 to 6 months

An updated list of approved suppliers can be obtained from Eskom. Consideration must be given by all stakeholders to the above timeframes in their project sourcing plans.

## 4. STATION SPECIFIC INFORMATION AND REQUIREMENTS

### 4.1.1 Camden Power Station

Continuous operating temperature range (FFP):	• 120 °C to 170 °C
Temperature control set point:	• None
Gas volume:	• Maximum 490 Am <sup>3</sup> / s
Gas volume:	• MCR 462 Am <sup>3</sup> / s
Flue gas oxygen content:	• 3% - 15%
Filtration velocity with one cell isolated:	• Maximum 0,022 m/s
Inlet dust concentration:	• 25 – 50 g/Nm <sup>3</sup>
Estimated number of starts per boiler:	• 50 per year
Mode of Operation:	• Load following and two shifting
Material Selection:	• PPS/PI
Exclusions from standard material standard:	• None
Bag drawing number	• 25.15/36898 (Hendrina bag drawing)
Bag length	• 8,110 meters (Detail dimensions as per bag drawing)
Bag diameter	• Oval bag, 127 mm equivalent (Howden Design)
Required operational hours (max number of bags failing during this period)	• 28 000 (3%)
Expected emission limits	• 30 mg/Nm <sup>3</sup>
Maximum emission limits	• 50 mg/Nm <sup>3</sup>
Maximum pressure drop	• 2.4 kPa (flange to flange @ MCR with one cell isolated)

### CONTROLLED DISCLOSURE

- The bag will conform to the requirements of bag drawing no. 25.15/36898 Revision latest.
- The snap band joint is to be riveted.
- The snap band seal will be a Rontex style endless felt ring.
- The longitudinal seam of the bag shall be triple stitched.
- The stitching thread will be 100 % PPS or PTFE.
- The cuff and base (foot/sock) material will be of 100% PPS conforming to the main filter media parameters. (Minimum weight 550 g/m<sup>2</sup> (+/- 5%))
- It is the Supplier's responsibility to ensure that the bags fit correctly into the tube plate and cages.
- Before bag manufacturing will commence the Supplier will provide a sample bag to the Purchaser Representative for evaluation and acceptance.
- No manufacturing of bags will commence prior to the Purchaser's representative receiving, analysing and releasing the fabric for manufacture, following fabric tests done by the Purchaser's RT&D department.

#### 4.1.2 Hendrina Power Station

Continuous operating temperature:	• 100 °C to 150 °C
Temperature control set point:	• None
Gas Volume at MCR:	• MCR 462 Am <sup>3</sup> / s
Filtration velocity (with all cells in services):	• Maximum 0,018 m/s
Filtration velocity (with one isolated):	• Maximum 0,021 m/s
Flue gas oxygen content:	• 3% - 8%
Inlet dust concentration:	• 25 – 50 g/Nm <sup>3</sup>
Estimate number of starts per boiler	• 30 per year
Mode of Operation	• Load following
Material Selection:	• PPS
Exclusions from standard material standard:	• No PI (First Surface layer – Dust Side): Material will not be blended with PI, PPS only.
Bag drawing number	• 25.15/36898
Bag length	• 8,110 meters (Detail dimensions as per bag drawing)
Bag diameter	• Oval bag, 127 mm equivalent (Howden Design)
Planned operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm <sup>3</sup>
Maximum emission limits	• 50 mg/Nm <sup>3</sup>
Maximum pressure drop	• 2.4 kPa (flange to flange @ MCR with one cell isolated)

- The Filter Bag Style is of the Howden type.
- The *Supplier* manufactures the bag according to the details shown on drawing no 25.15/36898.
- The snap band joint is to be riveted.
- The snap band seal will be a Rontex style endless felt ring.
- The longitudinal seam of the bag shall be triple stitched.

#### CONTROLLED DISCLOSURE

- The cuff and base (foot/sock) material will be of 100% PPS conforming to the main filter media parameters. (Minimum weight 550 g/m<sup>2</sup> (+/- 5%))
- The stitching thread will be 100 % PPS or PTFE
- It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
- Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
- No manufacturing of bags will commence prior to the Purchaser's representative receiving, analysing and releasing the fabric for manufacture following fabric tests done by the Purchaser's RT&D department.

#### 4.1.3 Majuba Power Station

- |  |   |
|--|---|
| Continuous operating temperature range (FFP):                              | • 100 °C to 150 °C  |
| Temperature control set point:   | • 125 °C  |
| Gas volume:  | • Maximum 1 553 Am <sup>3</sup> / s                       |
| Flue gas oxygen content:   | • 3% - 15%  |
| Filtration velocity with one cell isolated:                                | • Maximum 0,020 m/s                                       |
| Filtration velocity with all cells in-service:                             | • Maximum 0,018 m/s                                       |
| Inlet dust concentration:  | • 25 – 50 g/Nm <sup>3</sup>                               |
| Estimated number of starts per boiler                                      | • 150 per year  |
| Mode of Operation  | • Load following  |
| Material Selection:  | • PAN/PI  |
| Exclusions from standard material standard:                                | • None  |
| Bag drawing number   | • 0.66/95371 (latest revision)                            |
| Bag length   | • 7,130 meters (Detail dimensions as per bag drawing)     |
| Bag diameter   | • Oval bag, 127 mm equivalent (Howden Design)             |
| Required operational hours (max number of bags failing during this period) | • 20 000 (3%)   |
| Expected emission limits   | • 30 mg/Nm <sup>3</sup>                                   |
| Maximum emission limits  | • 50 mg/Nm <sup>3</sup>                                   |
| Maximum pressure drop  | • 2.3 kPa (flange to flange @ MCR with one cell isolated) |
- The Filter Bag Style is of the Bateman Howden type.
  - The *Supplier* manufactures the bag according to the details shown in drawing nr 0.66/95371 revision latest.
  - The snap band joint is to be riveted.
  - The snap band seal will be a Rontex style endless felt ring.
  - The longitudinal seam of the bag shall be triple stitched.
  - The cuff and base (foot/sock) material will be off 100% Homopolymer PAN conforming to the main filter media parameters. (Minimum weight 550 g/m<sup>2</sup> (+/- 5%))
  - The stitching thread will be PAN, or PTFE
  - It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.

#### CONTROLLED DISCLOSURE

- Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
- No manufacturing of bags will commence prior to the *Purchaser's* representative receiving, analysing and releasing the fabric manufacturing following fabric tests done by the *Purchaser's* RT&D department.

#### 4.1.4 Duvha Power Station

- |  |                                    |
|--|------------------------------------|
| Continuous operating temperature range (FFP):  | • 100 °C to 150 °C                 |
| Gas volume:                                    | • Maximum 1 553 Am <sup>3</sup> /s |
| Temperature control set point:                 | • None                             |
| Flue gas oxygen content:                       | • 3% - 15%                         |
| Filtration velocity with one cell isolated:    | • Maximum 0,020 m/s                |
| Filtration velocity with all cells in-service: | • Maximum 0,018 m/s                |
| Inlet dust concentration:                      | • 25 – 50 g/Nm <sup>3</sup>        |
| Estimated number of starts per boiler          | • 150 per year                     |
| Mode of Operation                              | • Base load                        |
| Material Selection:                            | • PPS/PI                           |
| Exclusions from standard material standard:    | • None                             |
- 
- |  |   |
|--|---|
| Bag drawing number   | • 0.57/48834 (latest revision)                            |
| Bag length   | • 8 meters (Detail dimensions as per bag drawing)         |
| Bag diameter   | • 135 mm  |
| Required operational hours (max number of bags failing during this period) | • 32 000 (3%)   |
| Expected emission limits   | • 30 mg/Nm <sup>3</sup>                                   |
| Maximum emission limits  | • 50 mg/Nm <sup>3</sup>                                   |
| Maximum pressure drop  | • 2.4 kPa (flange to flange @ MCR with one cell isolated) |
- 
- The *Contractor* manufactures the bag according to the details shown on drawing No 0.57/48834 Revision latest
  - The double circular base and the 100 mm wide reinforcing strip will be off 100% PPS.
  - The Filter Bag comprises of one end open with Stainless Steel snap band covered with an endless felt strips sewn into a 100% PPS non-woven false hem with 4 rows of stitching to fit cell plate. The other end is closed with double circular base with exterior base the filter fabric and the interior base 100% PPS) plus 100 mm wide reinforcing strip also from 100% PPS treated side outside.
  - The snap band joint is to be riveted.
  - The longitudinal seam of the bag shall be triple stitched.
  - The sewing thread will be 100% PPS or PTFE.
  - It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
  - Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
  - No manufacturing of bags will commence prior to the *Purchaser's* representative receiving, analysing and releasing the fabric manufacturing following fabric tests done by the *Purchaser's* RT&D department.

#### CONTROLLED DISCLOSURE

#### 4.1.5 Grootvlei Power Station

Continuous operating temperature range (FFP):	<ul style="list-style-type: none"> <li>• 100 °C to 160 °C</li> </ul>
Gas volume:	<ul style="list-style-type: none"> <li>• Maximum 550 Am<sup>3</sup>/s</li> </ul>
Temperature control set point:	<ul style="list-style-type: none"> <li>• None</li> </ul>
Flue gas oxygen content:	<ul style="list-style-type: none"> <li>• 3% - 15%</li> </ul>
Filtration velocity with one cell isolated:	<ul style="list-style-type: none"> <li>• Maximum 0.020 m/s</li> </ul>
Filtration velocity with all cells in-service:	<ul style="list-style-type: none"> <li>• Maximum 0.016 m/s</li> </ul>
Inlet dust concentration:	<ul style="list-style-type: none"> <li>• 25 – 50 g/Nm<sup>3</sup></li> </ul>
Estimated number of starts per boiler	<ul style="list-style-type: none"> <li>• 150 per year</li> </ul>
Mode of Operation	<ul style="list-style-type: none"> <li>• Load following</li> </ul>
Material Selection:	<ul style="list-style-type: none"> <li>• PPS/PI</li> </ul>
Exclusions from standard material standard:	<ul style="list-style-type: none"> <li>• None</li> </ul>
Bag drawing number	<ul style="list-style-type: none"> <li>• 0.19.46445 (latest revision)</li> </ul>
Bag length	<ul style="list-style-type: none"> <li>• 8,065meters (Detail dimensions as per bag drawing)</li> </ul>
Bag diameter	<ul style="list-style-type: none"> <li>• 150 mm equivalent</li> </ul>
Planned operational hours for Unit 1 (max number of bags failing during this period)	<ul style="list-style-type: none"> <li>• 28 000 (3%)</li> </ul>
Planned operational hours for Units 2 and 3 (max number of bags failing during this period)	<ul style="list-style-type: none"> <li>• 32 000 (3%)</li> </ul>
Expected emission limits	<ul style="list-style-type: none"> <li>• 30 mg/Nm<sup>3</sup></li> </ul>
Maximum emission limits	<ul style="list-style-type: none"> <li>• 50 mg/Nm<sup>3</sup></li> </ul>
Maximum pressure drop	<ul style="list-style-type: none"> <li>• 2.4 kPa (flange to flange @ MCR with one cell isolated)</li> </ul>

- The *Contractor* manufactures the bag according to the details shown on drawing No 0.19.46445 Revision Latest
- The double circular base and the 100 mm wide reinforcing strip will be off 100% PPS.
- The Filter Bag detail comprises of a bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a non-woven false hem with 4 rows of stitching to fit cell plate. The other end is closed with double circular base with exterior base the filter fabric and the interior base 100% PPS plus 100 mm wide reinforcing strip also from 100% PPS with the treated side on the outside.
- The snap band joint is to be riveted.
- The longitudinal seam of the bag shall be triple stitched.
- The stitching thread will be 100% PPS or PTFE
- It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
- Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
- No manufacturing of bags will commence prior to the *Purchaser's* representative receiving, analysing and releasing the fabric following fabric tests done by the *Purchaser's* RT&D department.

#### CONTROLLED DISCLOSURE

#### 4.1.6 Arnot Power Station

- |   |   |
|---|---|
| Continuous operating temperature range (FFP):   | • 110 °C to 175 °C  |
| Temperature control set point:  | • None  |
| Gas volume per unit:  | • Maximum 975 Am <sup>3</sup> /s                          |
| Flue gas oxygen content:  | • 3% - 15%  |
| Estimated number of starts per boiler   | • 150 per year  |
| Mode of Operation   | • Base load   |
| Inlet dust concentration:   | • 25 – 50 g/Nm <sup>3</sup>                               |
| Filtration velocity with one cell isolated:   | • Maximum 0,020 m/s                                       |
| Filtration velocity with all cells in-service:  | • Maximum 0,018 m/s                                       |
| Material Selection:   | • PPS/PI  |
| Exclusions from standard material standard:   | • None  |
| Bag drawing number  | • 26.41.38198 (latest revision)                           |
| Bag length  | • 8, 040 meters (Detail dimensions as per bag drawing)    |
| Bag diameter  | • 135 mm  |
| Planned operational hours, Units 1, 2 and 3 (max number of bags failing during this period) | • 32 000 (3%)   |
| Planned operational hours, Units 4, 5 and 6 (max number of bags failing during this period) | • 28 000 (3%)   |
| Expected emission limits  | • 30 mg/Nm <sup>3</sup>                                   |
| Maximum emission limits   | • 50 mg/Nm <sup>3</sup>                                   |
| Maximum pressure drop   | • 2.4 kPa (flange to flange @ MCR with one cell isolated) |
- The *Contractor* manufactures the bag according to the details shown on drawing No 26.41.38198 Revision latest.
  - The double circular base and the 100 mm wide reinforcing strip will be of 100% PPS.
  - The Filter Bag detail comprises of a bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a non-woven false hem with 4 rows of stitching to fit cell plate 155 mm diameter x 5 mm thick. The other end is closed with double circular base with exterior base the filter fabric and the interior base 100% PPS plus 100 mm wide reinforcing strip also from 100% PPS treated side outside.
  - The snap band joint is to be riveted.
  - The longitudinal seam of the bag shall be triple stitched.
  - The stitching thread will be 100% PPS or PTFE
  - It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
  - Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
  - No manufacturing of bags will commence prior to the Purchaser's representative receiving, analysing and releasing the fabric manufacturing following fabric tests done by the Purchaser's RT&D department.

#### CONTROLLED DISCLOSURE

#### 4.1.7 Kusile Power Station

- |  |  |
|--|--|
| Continuous operating temperature range (FFP):                              | <ul style="list-style-type: none"> <li>• 110 °C to 160 °C,</li> </ul>  |
| Gas volume per unit:   | <ul style="list-style-type: none"> <li>• Maximum 1 283 Am<sup>3</sup>/s</li> </ul>                                 |
| Flue gas oxygen content:   | <ul style="list-style-type: none"> <li>• 3% - 15%</li> </ul>   |
| Estimated number of starts per boiler                                      | <ul style="list-style-type: none"> <li>• 150 per year</li> </ul>   |
| Mode of Operation  | <ul style="list-style-type: none"> <li>• Base load</li> </ul>  |
| Inlet dust concentration:  | <ul style="list-style-type: none"> <li>• 25 – 70 g/Nm<sup>3</sup></li> </ul>                                       |
| Filtration velocity with one cell isolated:                                | <ul style="list-style-type: none"> <li>• Maximum 0,020 m/s</li> </ul>  |
| Filtration velocity with all cells in-service:                             | <ul style="list-style-type: none"> <li>• Maximum 0,017 m/s</li> </ul>  |
| Material Selection:  | <ul style="list-style-type: none"> <li>• Main specification - PPS/PI , Alternative specification PAN/PI</li> </ul> |
| Exclusions from standard material standard:                                | <ul style="list-style-type: none"> <li>• None</li> </ul>   |
| Bag drawing number   | <ul style="list-style-type: none"> <li>• 366-317227 Rev 1 (or later revision)</li> </ul>                           |
| Bag length   | <ul style="list-style-type: none"> <li>• 8.30 meters (Detail dimensions as per bag drawing)</li> </ul>             |
| Bag diameter   | <ul style="list-style-type: none"> <li>• 165 mm (flat width – 259 mm)</li> </ul>                                   |
| Required operational hours (max number of bags failing during this period) | <ul style="list-style-type: none"> <li>• 17 500 (3%)</li> </ul>  |
| Expected emission limits   | <ul style="list-style-type: none"> <li>• 30 mg/Nm<sup>3</sup></li> </ul>   |
| Maximum emission limits  | <ul style="list-style-type: none"> <li>• 50 mg/Nm<sup>3</sup></li> </ul>   |
| Maximum pressure drop  | <ul style="list-style-type: none"> <li>• 2.2 kPa (flange to flange @ MCR with one cell isolated)</li> </ul>        |
- The *Contractor* manufactures the bag according to the details shown on drawing No 366-317227 rev 1 or revision latest.
  - The double circular base and the 100 mm wide reinforcing strip will be manufactured from the same material as the rest of the bags and be as per the bag specification or 100% PPS.
  - The Filter Bag detail comprises of a bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a non-woven false hem with 4 rows of stitching to fit cell plate 167 mm diameter x 5 mm thick. The other end is closed with double circular base with exterior base the filter fabric and the interior base 100% PPS plus 100 mm wide reinforcing strip also from 100% PPS treated side outside.
  - The snap band joint is to be riveted or induction spot welded
  - The longitudinal seam of the bag shall be triple stitched.
  - The stitching thread will be PPS or PTFE.
  - It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
  - Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
  - No manufacturing of bags will commence prior to the *Purchaser's* representative receiving, analysing and releasing the fabric following fabric tests done by the *Purchaser's* RT&D department.

#### CONTROLLED DISCLOSURE

#### 4.1.8 Medupi Power Station

- |  |   |
|--|---|
| Continuous operating temperature range (FFP):                              | <ul style="list-style-type: none"> <li>• 110 °C to 160 °C,</li> </ul>                                       |
| Gas volume per unit:   | <ul style="list-style-type: none"> <li>• Maximum 1 283 Am<sup>3</sup>/s</li> </ul>                          |
| Flue gas oxygen content:   | <ul style="list-style-type: none"> <li>• 3% - 15%</li> </ul>  |
| Estimated number of starts per boiler                                      | <ul style="list-style-type: none"> <li>• 150 per year</li> </ul>  |
| Mode of Operation  | <ul style="list-style-type: none"> <li>• Base load</li> </ul>   |
| Inlet dust concentration:  | <ul style="list-style-type: none"> <li>• 25 – 70 g/Nm<sup>3</sup></li> </ul>                                |
| Filtration velocity with one cell isolated:                                | <ul style="list-style-type: none"> <li>• Maximum 0,020 m/s</li> </ul>                                       |
| Filtration velocity with all cells in-service:                             | <ul style="list-style-type: none"> <li>• Maximum 0,017 m/s</li> </ul>                                       |
| Material Selection:  | <ul style="list-style-type: none"> <li>• PPS/PI</li> </ul>  |
| Exclusions from standard material standard:                                | <ul style="list-style-type: none"> <li>• None</li> </ul>  |
| Bag drawing number   | <ul style="list-style-type: none"> <li>• 084/42161 Rev 2 (or later revision)</li> </ul>                     |
| Bag length   | <ul style="list-style-type: none"> <li>• 8.30 meters (Detail dimensions as per bag drawing)</li> </ul>      |
| Bag diameter   | <ul style="list-style-type: none"> <li>• 165 mm (flat width – 259 mm)</li> </ul>                            |
| Required operational hours (max number of bags failing during this period) | <ul style="list-style-type: none"> <li>• 15 000 (3%)</li> </ul>   |
| Expected emission limits   | <ul style="list-style-type: none"> <li>• 30 mg/Nm<sup>3</sup></li> </ul>                                    |
| Maximum emission limits  | <ul style="list-style-type: none"> <li>• 50 mg/Nm<sup>3</sup></li> </ul>                                    |
| Maximum pressure drop  | <ul style="list-style-type: none"> <li>• 2.2 kPa (flange to flange @ MCR with one cell isolated)</li> </ul> |
- The *Contractor* manufactures the bag according to the details shown on drawing No 084/42161 Rev 2 or Revision Latest.
  - The double circular base and the 100 mm wide reinforcing strip will be manufactured from the same material as the rest of the bags and be as per the bag specification or 100% PPS
  - The Filter Bag detail comprises of a bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a non-woven false hem with 4 rows of stitching to fit cell plate 167 mm diameter x 5 mm thick. The other end is closed with double circular base with exterior base the filter fabric and the interior base 100% PPS plus 100 mm wide reinforcing strip also from 100% PPS treated side outside.
  - The snap band joint is to be riveted or induction spot welded.
  - The longitudinal seam of the bag shall be triple stitched.
  - The stitching thread will be 100% PPS or PTFE
  - It is the *Supplier's* responsibility to ensure that the bags fit correctly into the tube plate and cages.
  - Before bag manufacturing will commence the *Supplier* will provide a sample bag to the *Purchaser* for his evaluation and acceptance.
  - No manufacturing of bags will commence prior to the *Purchaser's* representative receiving, analysing and releasing the fabric following fabric tests done by the *Purchaser's* RT&D department.

#### CONTROLLED DISCLOSURE

## 5. NEEDLEFELT SPECIFICATION

### 5.1 PPS/PI SPECIFICATION FOR CAMDEN, DUVHA, GROOTVLEI, MEDUPI AND KUSILE

#### 5.1.1 Needle-felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle-felt
Fibre chemical name:	Polyphenylene sulphide (PPS)
Weight:	580 – 620 g/m <sup>2</sup> range, 600 g/m <sup>2</sup> average
Fabric thickness:	Minimum 1.8 mm, Maximum 2.4 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulphide (PPS)
Snap band	As specified in Section 4 for the various power stations
Cuff Seal (if applicable)	Endless Rontex Ring (PPS)
Cuff Material	Polyphenylene sulphide (PPS)
Foot/Sock Material	Polyphenylene sulphide (PPS)

#### 5.1.2 Scrim

Construction:	The scrim will be woven from Polyphenylene sulphide (PPS) yarns.
Material:	Polyphenylene sulphide (PPS)
Yarn type:	Spun staple yarn and/or multifilament
Weight:	175 -185 g/m <sup>2</sup> before needling (Loom State)
Fibre Dimension:	2.2 dtex

#### 5.1.3 Batt – Cascade Construction

##### 5.1.4 Surface Layer (First Surface Layer – Dust Side)

*Construction: The surface layer will be a blend of the following fibre materials and to be needled as a distinct surface layer.*

Material 1:	Polyimide (P84)
Fibre dimension:	1.7 dtex Multilobal
Weight:	45 - 55 g/m <sup>2</sup> (Before Needling)
Material 2:	Polyphenylene sulphide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	55 - 45 g/m <sup>2</sup> (Before Needling)

##### 5.1.5 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m <sup>2</sup> (Before Needling)

##### 5.1.6 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m <sup>2</sup> (Before Needling)

#### 5.1.7 Cloth Construction

Fabric Construction:	Scrim supported needle-felt
Weight:	580 – 620 g/m <sup>2</sup> range, 600 g/m <sup>2</sup> average

### CONTROLLED DISCLOSURE

Number of sides needed: Both sides

### 5.1.8 Fabric Special Treatments

Coatings: None  
 Heat Set: Yes, as Required by Supplier  
 Singeing: Yes, as Required by Supplier  
 Calendaring: Yes, as Required by Supplier

### 5.1.9 Fabric Properties

Air permeability: 7.6 – 10 m<sup>3</sup>/m<sup>2</sup>/minute @ 125 Pa  
 Elongation: Warp: max. 6% @ 50 N/cm  
 Weft: max. 8 % @ 50 N/cm  
 Bursting strength: min. 2800 kPa  
 Dimensional stability: (Free shrinkage at 180 °C Dry heat for 24hrs) Warp: max. 1.5%  
 Weft: max. 1.5%  
 Tensile strength: Warp: min. 9 00 N/50mm  
 Weft: min. 1 200 N/50mm

## 5.2 PPS/PI SPECIFICATION FOR ARNOT (AND ALTERNATIVE FOR MEDUPI AND KUSILE)

### 5.2.1 Needle-felt Standard and Cloth Construction

Fabric construction: Scrim supported needle-felt  
 Fibre chemical name: Polyphenylene sulphide (PPS)  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Fabric thickness: Minimum 1.8 mm; Maximum 2.4 mm  
 Sides needed: Both  
 Sewing Thread: Polyphenylene sulphide (PPS)  
 Snap band: Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)  
 Cuff Seal (if applicable): As specified in Section 4 for the various power stations  
 Cuff Material: Polyphenylene sulphide (PPS)  
 Foot/Sock Material: Polyphenylene sulphide (PPS)

### 5.2.2 Scrim

Construction: The scrim will be woven from Polyphenylene sulphide (PPS) yarns.  
 Material: Polyphenylene sulphide (PPS)  
 Yarn type: Spun staple yarn and/or multifilament  
 Weight: 175 -185 g/m<sup>2</sup> before needling (Loom State)  
 Fibre Dimension: 2.2 dtex

### 5.2.3 Batt – Cascade Construction

### 5.2.4 Surface Layer (First Surface Layer – Dust Side)

*Construction: The surface layer will be a blend of the following fibre materials and to be needed as a distinct surface layer.*

Material 1: Polyimide (P84)  
 Fibre dimension: 1.7 dtex Multilobal

## CONTROLLED DISCLOSURE

Weight: 45 - 55 g/m<sup>2</sup> (Before Needling)  
 Material 2: Polyphenylene sulphide (PPS)  
 Fibre dimension: 1.7 dtex trilobal  
 Weight: 55 - 45 g/m<sup>2</sup> (Before Needling)

### 5.2.5 Support Layer (Second Inner Layer – Dust Side)

Material: Polyphenylene Sulphide (PPS)  
 Fibre dimensions: 2.2 dtex  
 Weight: 125 – 135 g/m<sup>2</sup> (Before Needling)

### 5.2.6 Support Batt (Inner Layer – Clean Side)

Material: Polyphenylene Sulphide (PPS)  
 Fibre dimension: 2.2 dtex  
 Weight: 190 - 200 g/m<sup>2</sup> (Before Needling)

### 5.2.7 Cloth Construction

Fabric Construction: Scrim supported needle-felt  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Number of sides needed: Both sides

### 5.2.8 Fabric Special Treatments

Coatings: None  
 Heat Set: Yes, as Required by Supplier  
 Singeing: Yes, as Required by Supplier  
 Calendaring: Yes, as Required by Supplier

### 5.2.9 Fabric Properties

Air permeability: 60 l/dm<sup>2</sup>/min (+/- 20%) at 200 Pa  
 Elongation: Warp: max. 6% @ 50 N/cm  
 Weft: max. 8 % @ 50 N/cm  
 Bursting strength: min. 2800 kPa  
 Dimensional stability: (Free shrinkage Warp: max. 1.5%  
 at 180 °C Dry heat for 24hrs) Weft: max. 1.5%  
 Tensile strength: Warp: min. 9 00 N/50mm  
 Weft: min. 1 200 N/50mm

## 5.3 PAN/PI STANDARD FOR MAJUBA AND ALTERNATIVE FOR KUSILE

### 5.3.1 Needle-felt Standard and Cloth Construction

Fabric construction: Scrim supported needle-felt  
 Fibre chemical name: Polyacrylonitrile (PAN)  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Fabric thickness: Minimum 1.8 mm; Maximum 2.6 mm  
 Sides needed: Both  
 Sewing Thread: Polyacrylonitrile (PAN)  
 Snap band: Riveted/Welded Stainless Spring Steel  
 (Diameter to fit tube plate)  
 Cuff Seal: As specified in Section 4 for the various power stations

### CONTROLLED DISCLOSURE

Cuff Material: Polyacrylonitrile (PAN)  
Foot/Sock Material: Polyacrylonitrile (PAN)

### 5.3.2 Scrim

Construction: The scrim will be woven from Polyacrylonitrile (PAN) yarns.  
Material: Polyacrylonitrile (PAN)  
Yarn type: Spun staple yarn and/or multifilament  
Weight: 175 -185 g/m<sup>2</sup> before needling (Loom State)  
Fibre Dimension: 2.2 dtex

### 5.3.3 Batt - Cascade Construction

#### 5.3.4 Surface Layer (First Surface layer – Dust Side)

*Construction: The surface layer will be a blend of the following fibre materials and to be needed as a distinct surface layer.*

Material 1: Polyimide (P84)  
Fibre dimension: 1.7 dtex Multilobal  
Weight: 45 - 55 g/m<sup>2</sup> (Before Needling)  
Material 2: Polyacrylonitrile (PAN)  
Fibre dimension: 1.7 dtex maximum  
Weight: 55 - 45 g/m<sup>2</sup> (Before Needling)

#### 5.3.5 Support Batt (Second Inner layer – Dust Side)

Material: Polyacrylonitrile (PAN)  
Fibre dimensions: 2.2 dtex  
Weight: 120 - 130 g/m<sup>2</sup> (Before Needling)

#### 5.3.6 Support Batt (Inner layer – Clean Side)

Material: Polyacrylonitrile (PAN)  
Fibre dimension: 2.2 dtex  
Weight: 190 - 200 g/m<sup>2</sup> (Before Needling)

### 5.3.7 Cloth Construction

Fabric Construction: Scrim supported needle-felt  
Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
Number of sides needed: Both sides

### 5.3.8 Fabric Special Treatments

Coatings: None  
Heat Set: Yes, as Required by Supplier  
Singeing: Yes, as Required by Supplier  
Calendaring: Yes, as Required by Supplier

### 5.3.9 Fabric Properties

Air permeability: 7.6 – 13 m<sup>3</sup>/m<sup>2</sup>/minute @ 125 Pa  
Elongation: Warp: max. 4% @ 50 N/cm  
Weft: max. 6% @ 50 N/cm

## CONTROLLED DISCLOSURE

Bursting strength:	min. 2800 kPa
Dimensional stability: (Free shrinkage at 150 °C dry heat for 24hrs)	Warp: max. 1.5% Weft: max. 1.5%
Tensile strength:	Warp: min. 8 00 N/50mm Weft: min. 8 00 N/50mm

## 5.4 PPS STANDARD FOR HENDRINA

### 5.4.1 Needle-felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle-felt
Fibre chemical name:	Polyphenylene sulphide (PPS)
Weight:	580 – 620 g/m <sup>2</sup> range, 600 g/m <sup>2</sup> average
Fabric thickness:	Minimum 1.8 mm; Maximum 2.4 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulphide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal	As specified in Section 4
Cuff Material	Polyphenylene sulphide (PPS)
Foot/Sock Material	Polyphenylene sulphide (PPS)

### 5.4.2 Scrim

Construction:	The scrim will be woven from Polyphenylene sulphide (PPS) yarns.
Material:	Polyphenylene sulphide (PPS)
Yarn type:	Spun staple yarn and/or multifilament
Weight:	175 -185 g/m <sup>2</sup> before needling (Loom State)
Fibre Dimension:	2.2 dtex

### 5.4.3 Batt

#### 5.4.4 Surface Layer (First Surface Layer – Dust Side)

*Construction: The surface layer will consist of PPS only*

Material 1:	Polyphenylene sulphide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	100 - 110 g/m <sup>2</sup> (Before Needling)

#### 5.4.5 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m <sup>2</sup> (Before Needling)

#### 5.4.6 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m <sup>2</sup> (Before Needling)

### 5.4.7 Cloth Construction

Fabric Construction:	Scrim supported needle-felt
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## CONTROLLED DISCLOSURE

Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Number of sides needed: Both sides

#### 5.4.8 Fabric Special Treatments

Coatings: None  
 Heat Set: Yes, as Required by Supplier  
 Singeing: Yes, as Required by Supplier  
 Calendaring: Yes, as Required by Supplier

#### 5.4.9 Fabric Properties

Air permeability: 7.6 – 10 m<sup>3</sup>/m<sup>2</sup>/minute @ 125 Pa  
 Elongation: Warp: max. 6% @ 50 N/cm  
 Weft: max. 8 % @ 50 N/cm  
 Bursting strength: min. 2800 kPa  
 Dimensional stability: (Free shrinkage at 180 °C Dry heat for 24hrs) Warp: max. 1.5%  
 Weft: max. 1.5%  
 Tensile strength: Warp: min. 9 00 N/50mm  
 Weft: min. 1 200 N/50mm

### 5.5 ALTERNATIVE PPS SPECIFICATION 1 IN THE EVENT OF PPS 1, 7 DTEX TRILOBAL FIBRE NOT BEING AVAILABLE

**Note:** This is an alternative specification for stations that utilise PPS or PPS/PI bags.

#### 5.5.1 Needle-felt Standard and Cloth Construction

Fabric construction: Scrim supported needle-felt  
 Fibre chemical name: Polyphenylene sulphide (PPS)  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Fabric thickness: Minimum 1.8 mm; Maximum 2.4 mm  
 Sides needed: Both  
 Sewing Thread: Polyphenylene sulphide (PPS)  
 Snap band: Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)  
 Cuff Seal: As specified in Section 4 for the various power stations  
 Cuff Material: Polyphenylene sulphide (PPS)  
 Foot/Sock Material: Polyphenylene sulphide (PPS)  
 Coating: Polytetrafluoroethylene (PTFE) bath treated

#### 5.5.2 Scrim

Construction: The scrim will be woven from Polyphenylene sulphide (PPS) yarns.  
 Material: Polyphenylene sulphide (PPS)  
 Yarn type: Spun staple yarn and/or multifilament  
 Weight: 175 -185 g/m<sup>2</sup> before needling (Loom State)  
 Fibre Dimension: 2.2 dtex

#### 5.5.3 Batt – Cascade Construction

#### 5.5.4 Surface Layer (First Surface Layer – Dust Side)

*Construction: The surface layer will be a blend of the following fibre materials and to be needed as a distinct surface layer.*

### CONTROLLED DISCLOSURE

Material 1: Polyphenylene sulphide (PPS)  
 Fibre dimension: 1.7 dtex round  
 Weight: 95 - 105 g/m<sup>2</sup> (Before Needling)

#### 5.5.5 Support Layer (Second Inner Layer – Dust Side)

Material: Polyphenylene Sulphide (PPS)  
 Fibre dimensions: 2.2 dtex  
 Weight: 125 – 135 g/m<sup>2</sup> (Before Needling)

#### 5.5.6 Support Batt (Inner Layer – Clean Side)

Material: Polyphenylene Sulphide (PPS)  
 Fibre dimension: 2.2 dtex  
 Weight: 190 - 200 g/m<sup>2</sup> (Before Needling)

#### 5.5.7 Cloth Construction

Fabric Construction: Scrim supported needle-felt  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Number of sides needed: Both sides

#### 5.5.8 Fabric Special Treatments

Coatings: Polytetrafluoroethylene (PTFE) bath treated  
 Heat Set: Yes, as Required by Supplier  
 Singeing: Yes, as Required by Supplier  
 Calendaring: Yes, as Required by Supplier

#### 5.5.9 Fabric Properties

Air permeability: 7.6 – 10 m<sup>3</sup>/m<sup>2</sup>/minute @ 125 Pa before PTFE bath treatment  
 Elongation: Warp: max. 6% @ 50 N/cm  
 Weft: max. 8 % @ 50 N/cm  
 Bursting strength: min. 2800 kPa  
 Dimensional stability: (Free shrinkage at 180 °C Dry heat for 24hrs) Warp: max. 1.5%  
 Weft: max. 1.5%  
 Tensile strength: Warp: min. 9 00 N/50mm  
 Weft: min. 1 200 N/50mm

### 5.6 ALTERNATIVE PPS SPECIFICATION 2 IN THE EVENT OF PPS 1, 7 DTEX TRILOBAL FIBRE NOT BEING AVAILABLE

**Note:** This is an alternative specification for stations that utilise PPS or PPS/PI bags.

#### 5.6.1 Needle-felt Standard and Cloth Construction

Fabric construction: Scrim supported needle-felt  
 Fibre chemical name: Polyphenylene sulphide (PPS)  
 Weight: 580 – 620 g/m<sup>2</sup> range, 600 g/m<sup>2</sup> average  
 Fabric thickness: Minimum 1.8 mm; Maximum 2.4 mm  
 Sides needed: Both

### CONTROLLED DISCLOSURE

Sewing Thread	Polyphenylene sulphide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal	As specified in Section 4 for the various power stations
Cuff Material	Polyphenylene sulphide (PPS)
Foot/Sock Material	Polyphenylene sulphide (PPS)
Coating	None

### 5.6.2 Scrim

Construction:	The scrim will be woven from Polyphenylene sulphide yarns.
Material:	Polyphenylene sulphide (PPS)
Yarn type:	Spun staple yarn and/or multifilament
Weight:	175 -185 g/m <sup>2</sup> before needling (Loom State)
Fibre Dimension:	2.2 dtex

### 5.6.3 Batt – Cascade Construction

#### 5.6.4 Surface Layer (First Surface Layer – Dust Side)

*Construction: The surface layer will be a blend of the following fibre materials and to be needed a distinct surface layer.*

Material 1:	Polyimide (P84)
Fibre dimension:	1.7 dtex Multilobal
Weight:	45 - 55 g/m <sup>2</sup> (Before Needling)
Material 2:	Polyphenylene sulphide (PPS)
Fibre dimension:	1.0 dtex round
Weight:	55 - 45 g/m <sup>2</sup> (Before Needling)

#### 5.6.5 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m <sup>2</sup> (Before Needling)

#### 5.6.6 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulphide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m <sup>2</sup> (Before Needling)

### 5.6.7 Cloth Construction

Fabric Construction:	Scrim supported needle-felt
Weight:	580 – 620 g/m <sup>2</sup> range, 600 g/m <sup>2</sup> average
Number of sides needed:	Both sides

### 5.6.8 Fabric Special Treatments

Coatings:	None
Heat Set:	Yes, as Required by Supplier
Singeing:	Yes, as Required by Supplier
Calendaring:	Yes, as Required by Supplier

## CONTROLLED DISCLOSURE

### 5.6.9 Fabric Properties

Air permeability:	7.6 – 10 m <sup>3</sup> /m <sup>2</sup> /minute @ 125 Pa
Elongation:	Warp: max. 6% @ 50 N/cm Weft: max. 8 % @ 50 N/cm
Bursting strength:	min. 2800 kPa
Dimensional stability: (Free shrinkage at 180 °C Dry heat for 24hrs)	Warp: max. 1.5% Weft: max. 1.5%
Tensile strength:	Warp: min. 9 00 N/50mm Weft: min. 1 200 N/50mm

## 6. SAMPLE, TESTING AND INSPECTION REQUIREMENTS

### 6.1 SAMPLE BAG MATERIAL

Eskom requires 1 (one) m<sup>2</sup> (minimum) of sample fabric for every 10 000 m<sup>2</sup> of fabric produced. The supplier shall do tests on the fabric and scrim to determine compliance with the Standard. The certificates detailing full test results shall be submitted with the sample fabric.

Furthermore, Eskom requires an additional 4 m<sup>2</sup> of fabric and 2 m<sup>2</sup> of the raw scrim per bag order or set of bags manufactured. This fabric and Scrim will be removed during the bag manufacturing process for compliance evaluation (at random and at discretion). The provision and cost of this additional fabric must be included in the scope of supply in any contract.

Where cascaded fabric construction is specified, the supplier will provide prove of the cascade effect by means of microscopic analysis of the completed fabric. This will be done for every 10 000 m<sup>2</sup> of fabric produced. The certificates detailing microscopic SEM analysis results shall be submitted with the sample fabric.

### 6.2 BAG TESTING REQUIREMENTS

#### 6.2.1 Raw Materials

Data packs consisting of certificates of compliance, source of material and periodic batch tests of all components and raw materials need to accompany material at all stages of production.

#### 6.2.2 Fabric Manufacture

The following aspects need to be verified and controlled according to the required limits in Section 4.2 for the applicable material specification. The verification data will form part of the data packs that accompany the material throughout the manufacturing process. .

- Weight
- Thickness
- Air permeability
- Breaking Strength
- Percentage elongation at 50 N/cm and at break (warp and weft directions)
- P84® content (if included in bag specification)

### CONTROLLED DISCLOSURE

- Dimensional Stability
- Microscopic analysis confirming cascade fabric construction.

### **6.2.3 Bag Manufacture**

The length of the bag, flat width and compliance to bag drawing needs to be verified under a 50N load.

The Employer reserves the right to randomly remove any bag filters from the production line for bag compliance analysis.

Fabric that does not conform to the standard will be rejected and new replacement fabric that conforms to the standard will be produced at the supplier's cost.

### **6.3 LABELLING OF BAGS**

Each individual bag shall be labelled. The labels shall identify each bag with a shape coded tag, showing the fabric batch and bag number. The label shall be sewn into the top cuff.

The label shall link all relevant manufacturing information, including the raw material information. No repeatability of tags and numbers will be allowed.

### **6.4 PACKAGING OF BAGS**

The packaging needs to be clearly marked with the manufacturers name, fabric type, destination power station and order number. Any other relevant information pertaining to the particular shipment should be included. Each package shall contain approximately 10 to 15 bags to facilitate manual handling by one person. It shall be stipulated on the packaging what polymer that bags were manufactured from, i.e. PPS, PAN, PPS/PI OR PAN/PI.

All bags in each package needs to be packed in sealed non-transparent plastic bags. The packaging must clearly differentiate between maintenance spare bags and complete sets of replacement bags.

### **6.5 QUALITY REQUIREMENTS**

A typical quality control plan (QCP) and Inspection and test plan (ITP) is shown below.

The bag/needle-felt manufacturer will develop their own QCP's and ITP's for each set of bags and/or order of maintenance spare bags.

The QCP's and ITP's will be submitted to Eskom for approval before bags/needle-felt are manufactured and the approved QCP's and ITP's will be used during the manufacturing of the relevant bags/needle-felt.

		<b>FILTER BAG TEST &amp; INSPECTION REPORT</b>			<b>Contract No</b> 4600022655	
<b>Title of the Contract</b>		The Manufacturing and Supply of Complete Set of Fabric Filter Bags for <u>Duvha Unit 3</u> .			<b>Filter Bag Drawing No.</b> 0.57/48834 Rev 2	
					BA Internal Product Code: 44181034-1 BA ORDER No. 4500906504	
<b>Control Codes</b>		(*) Y = Acceptance / X = Reject.			(**) Measure	

Ref. No.	Control Description	Control Code	Spec	Bag 1	Bag 2	Bag 3	Bag 4	Remarks
1	BAG IDENTIFICATIN TAG		Sketch					
2	RIVET POSITION (TO BE OPPOSITE CUFF SEAM)	(*)	✓					
3	TOP CUFF WIDTH	(**)	110mm +/- 2mm					
4	DISTANCE FROM EDGE TO 2nd ROW OF STITCHING (top cuff)	(**)	45 - 50 mm					
5	TOP CUFF FIT - SNAP BAND	(*)	✓					
6	TOP CUFF SEAM RUN OFF - VISUAL	(*)	✓					
7	SEAM RUN-OFF - ALONG LENGTH - VISUAL	(*)	✓					
8	DISTANCE FROM EDGE TO SEAM - ALONG LENGTH	(*)	min 2mm					
9	FLAT MEASURE	T	209 +/- 3mm					
		M						
		B						
10	LONGTITUDINAL SEAM OVERLAP	T	13-17mm					
		M						
		B						
11	BOTTOM REINFORCEMENT CUFF WIDTH	(**)	140 +/- 3mm					
12	BOTTOM CUFF - BOTTOM EDGE TO 2nd ROW OF STITCHING	(**)	min 10mm					
13	BOTTOM CUFF - 2nd ROW TO 3rd ROW OF STITCHING	(**)	8 -10mm					
14	BOTTOM CUFF - SNAPBAND	(**)	20mm +/- 2mm					
15	LENGTH AT 50 N (5kg)	(**)	8085 - 8115					
16	CAGE FITMENT - PENETRATION INTO BOTTOM CUFF	(**)	40 - 70mm (for info only)					

<b>Person conducting inspection:</b>		<b>Date of inspection:</b>	
<b>Suppliers Name:</b>		<b>Suppliers signature:</b>	
<b>Notes / Remarks:</b>			

**CONTROLLED DISCLOSURE**

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

				QUALITY PLAN												PROJECT : Duvha			
CLIENT : ESKOM DUVHA Unit 3		1 = Supplier						V = Verify				Quality Plan Reference : Duvha 2009		Rev # : 0					
CLIENT ORDER # :		2 = Eskom						H = Hold				Page # : Page 1		of 6					
ITEM DESCRIPTION : FABRIC FILTER BAGS		3 =						W = Witness				Drawing # : 0.57/48834 Rev. 2							
PRODUCT CODE :		4 =						S = Surveillance				CONTRACT # :							
SUPPLIER # :		5 =						R = Record											
				Hold or Witness				Inspection Required											
				by															
Op #	Operation Description	Reference Document	1	2	3	4	5	V	D	S	P	E	M	D	Accept Signature	Reject Signature	Date	Remarks	
								I <td>I <td>T <td>E <td>L <td>A <td>O <td></td> <td></td> <td></td> <td></td> </td></td></td></td></td></td>	I <td>T <td>E <td>L <td>A <td>O <td></td> <td></td> <td></td> <td></td> </td></td></td></td></td>	T <td>E <td>L <td>A <td>O <td></td> <td></td> <td></td> <td></td> </td></td></td></td>	E <td>L <td>A <td>O <td></td> <td></td> <td></td> <td></td> </td></td></td>	L <td>A <td>O <td></td> <td></td> <td></td> <td></td> </td></td>	A <td>O <td></td> <td></td> <td></td> <td></td> </td>	O <td></td> <td></td> <td></td> <td></td>					
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1	RECEIVING INSPECTION :	MCP																	
	RECEIPT OF MATERIAL :																		
	Delivery documents are compared with Purchase Documents for compatibility .							X						X					
	Raw Material is visually checked for :																		
	- Type							X											
	- Quantity							X											
	- Transit damage							X											
	Certificates of Conformance / Inspection and test reports are checked		W	V										X					
1.2	SCRIM																		
	Certificates of Conformance / Inspection and test reports are checked		W	V										X					
1.3	NEEDLEFELT																		
	Web pass : check grams per square metre every roll		W	V				X						X					
	Dry pass : check grams per square every roll		W	V				X						X					
	Calendaring		W	V				X						X					
	Singeing : visual inspection		W	V				X											
	Heatsetting		W	V				X						X					
SUPPLIER APPROVAL :		DATE												ESKOM APPROVAL		DATE			

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				QUALITY PLAN												PROJECT : Duvha			
CLIENT : ESKOM DUVHA Unit 3		1 = Supplier						V = Verify				Quality Plan Reference : Duvha 2009		Rev # : 0					
CLIENT ORDER # :		2 = Eskom						H = Hold				Page # : Page 2		of 6					
ITEM DESCRIPTION : FABRIC FILTER BAGS		3 =						W = Witness				Drawing # : 0.57/48834 Rev. 2							
PRODUCT CODE :		4 =						S = Surveillance				CONTRACT # :							
SUPPLIER # :		5 =						R = Record											
				Hold or Witness				Inspection Required											
				by															
Op #	Operation Description	Reference Document	1	2	3	4	5	V	D	S	P	E	M	D	Accept Signature	Reject Signature	Date	Remarks	
								I	I	T	E	L	A	O					
								S	M	R	R	O	S	C					
								N	E	M	N	S							
2	TESTING OF FINISHED FABRIC	MCP																	
	- Weight - grams per square metre	Eskom	H	V				X	X					X					
	- Mass	Spec	H	V				X	X					X	X				
	- Air Permeability		H	V				X	X		X			X					
	- Tensile strength / Elongation		H	V				X	X	X		X		X					
	- Mullen Burst		H	V				X	X					X					
	- Shrinkage		H	V				X	X					X					
3	SLITTING OF FABRIC																		
	Check Slit width		H	V				X	X					X					
SUPPLIER APPROVAL :		DATE												ESKOM APPROVAL		DATE			

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				QUALITY PLAN											PROJECT : Duvha				
CLIENT : ESKOM DUVHA Unit 3		1 = Beier Albany			V = Verify			Quality Plan Reference : Duvha 2009				Rev # : 0							
CLIENT ORDER # :		2 = Eskom			H = Hold			Page # : Page 3 of 6											
ITEM DESCRIPTION : FABRIC FILTER BAGS		3 =			W = Witness			Drawing # : 0.57/48834 Rev. 2											
PRODUCT CODE :		4 =			S = Surveillance			CONTRACT # :											
SUPPLIER # :		5 =			R = Record														
Op #	Operation Description	Reference Document	Hold or Witness by					Inspection Required					Accept Signature	Reject Signature	Date	Remarks			
			1	2	3	4	5	V	D	S	P	E					M	D	
4	RECEIVING INSPECTION :	MCP																	
	RECEIPT OF MATERIAL :																		
	Delivery documents are compared with Purchase Documents for compatibility .							X						X					
	Material is visually checked for :																		
	- Type								X										
	- Quantity								X										
	- Transit damage								X										
	Certificate of Conformance are required for :	Eskom																	
	- Pre-Slit Needlefelt	Spec	W	V										X					
	- Snapband Stainless Steel		W	V										X					
	- Thread		W	V										X					
	- Seals		W	V										X					
	- Rivets		W	V										X					
	- Assembled Snapbands		W	V										X					
SUPPLIER APPROVAL :		DATE														ESKOM APPROVAL		DATE	

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				QUALITY PLAN												PROJECT : Duvha			
CLIENT : ESKOM DUVHA Unit 3		1 = Supplier			V = Verify			Quality Plan Reference : Duvha 2009			Rev # : 0								
CLIENT ORDER # :		2 = Eskom			H = Hold			Page # : Page 4			of 6								
ITEM DESCRIPTION : FABRIC FILTER BAGS		3 =			W = Witness			Drawing # : 0.57/48834 Rev. 2											
PRODUCT CODE :		4 =			S = Surveillance			CONTRACT # :											
SUPPLIER # :		5 =			R = Record														
Op #	Operation Description	Reference Document	Hold or Witness by					Inspection Required					Accept Signature	Reject Signature	Date	Remarks			
			1	2	3	4	5	V	D	S	P	E					M	D	
5	CONTINUOUS TUBER	MCP																	
5.1	PILOT BAG																		
	The very first bag of production to be approved		H	H				X	X					X					
	At the start of every shift the first tube seamed is sent through the entire manufacturing process and is subjected to critical inspection at every manufacturing stage .		H	V				X	X					X					
	Should any problems be identified , immediate effective Corrective Action will be taken prior to manufacturing continuing .																		
	All foregoing details will be recorded in the CT Diary and the QA Diary .																		
5.2	IN PROCESS INSPECTION																		
	Every tube is inspected by the Operator for :																		
	- Flat width	Drawing	S	V				X						X					
	- Seam form and stitching	Drawing	S	V				X	X					X					
	- Length	Drawing	S	V				X						X					
	- Tube fabric appearance		S	V				X											
	Tubes that pass inspection are stamped with the roll identification # to so signify .	MCP	S	V															
5.3	TOP CUFF																		
	Every Top Cuff is inspected by the Operator for :																		
	- Fabric appearance		S	V				X											
	- Seam Form and Stitching		S	V				X	X										
	- Stitching Dimensions from the edge		S	V				X											
	- Stitching Identity Tag		S	V				X											
SUPPLIER APPROVAL :		DATE												ESKOM APPROVAL		DATE			

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				QUALITY PLAN													PROJECT : Duvha			
CLIENT : ESKOM DUVHA Unit 3		1 = Supplier			V = Verify								Quality Plan Reference : Duvha 2009		Rev # : 0					
CLIENT ORDER # :		2 = Eskom			H = Hold								Page # : Page 5		of 6					
ITEM DESCRIPTION : FABRIC FILTER BAGS		3 =			W = Witness								Drawing # : 0.57/48834 Rev. 2							
PRODUCT CODE :		4 =			S = Surveillance								CONTRACT # :							
SUPPLIER # :		5 =			R = Record															
Op #	Operation Description	Reference Document	Hold or Witness by					Inspection Required						Accept Signature	Reject Signature	Date	Remarks			
			1	2	3	4	5	V	D	S	P	E	M					D		
5.4	FIT OF SNAPBAND																			
	The first Top Cuff of each shift is checked for fit in the cell plate		S	V				X	X											
	thereafter 1 in 10 is checked for fit in the Cell Plate		S	V				X	X											
5.5	BOTTOM CUFF manufacture & assembly :																			
	Every Bottom Cuff is inspected by the Operator for :																			
	- Fabric appearance		S	V				X												
	- Seam form and stitching	Draw ing	S	V				X	X											
	- Stitching dimension from the edge	Draw ing	S	V				X												
5.6	BAG MANUFACTURE & assembly :																			
	Every Bag is inspected by the Operator for :																			
	- Fabric appearance		S	V				X												
	- Seam form and stitching		S	V				X	X											
SUPPLIER APPROVAL :		DATE															ESKOM APPROVAL		DATE	

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## **7. DEVIATIONS FROM THIS STANDARD**

Based on project specific requirements, the Project Engineer in consultation with the Senior Consultant – Air Pollution Control, and Senior Advisor – Polymers and Filtration, may make informed material selections which differ from those specified in this Standard. This may only be done if the fabric or bags considered as an alternative, have been approved for use by following the technical approval process described in 3.11.5 and guarantee requirements are still being met.

Eskom has over the years tested a number of fabric configurations which include coated material, self-supporting scrim-less material, finer denier surface blended fabric and alternate fibers etc. The results of these tests are documented in research reports. In a number of these instances, these alternate fabrics contain proprietary supplier information and as such cannot be included in this Standard. Should these fabrics be offered as alternates in any tender submission, the offer need to be evaluated on the merits of each submission in consultation with the Senior Consultant – Air Pollution Control and Senior Advisor – Polymers and Filtration.

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## 8. LIST OF TRIAL BAGS TESTED FOR USE IN ESKOM POWER PLANTS

Power Station	Bag Description	Purpose	Supplier	Installation Date	Hours	Status
Medupi Unit 5 Cell 21	PPS Coated with Resilles	Erosion Resistance in the high flow areas	Beier Envirotec	03/05/2024	1 000	Testing in Progress
Medupi Unit 5 Cell 31	PPS Coated with Novates	Erosion Resistance in the high flow areas	Beier Envirotec (Testori)	03/05/2024	1 000	Testing in Progress
Medupi Unit 5 Cell 11	PPS ParaAramid Blend	Erosion Resistance in the high flow areas	Beier Envirotec	03/05/2024	1 000	Testing in Progress
Duvha Unit 2 (Cell B)	PPS/P84 Cascading Layers	New Supplier Assessment	AOG India	19/05/2023	9 000	Testing in Progress
Medupi Unit 2 Cell 11	Meta Aramid Composite	Erosion Resistance in the high flow areas	Beier Envirotech	09/12/2020	6 000	Affected (Removed) During Plant Maintenance
Medupi Unit 3 cells 14 and 34	(30) Low Drag PTFE Coated PPS Bags	Chemical Resistance and Air Permeability Consistency	WL Gore	06/05/2019	12 000	Recommended for larger scale testing
Medupi Unit 3 cells 14 and 34	(27) PPS Fine Fibre Material	PPS Fine Fibre Material	Gutsche	06/05/2019	12 000	No significant improvement observed
Camden Unit 7	(99) Huvis PPS/PI Bags	Evaluation of New PPS Bagfilter Material	Testori	01/02/2016	20 000	Recommended
Camden Unit 2	0 (31) PTFE/PTFE	Evaluation of New Bagfilter Material for High Temperature Application	BWF	11/09/2013	21 351 (26 351)	Not Recommended
Camden Unit 2	0 (31) PFB/PTFE Bags	Evaluation of New Bagfilter Material for High Temperature Application	BWF	11/09/2013	21 351 (26 351)	Not Recommended
Camden Unit 2	0 (20) PPS/PI Bags	New Supplier Assessment	Filtafelt	11/09/2013	21 351 (26 351)	Recommended
Duvha Unit 1, Cell C	8 (16) Didom (Pink) Bags	New Fibre Assessment	Beier Envirotech	26/05/2013	18 000 (21 000)	Not Recommended
Duvha Unit 1, Cell C	14 (18) PPS Super Novates Coated Bags	Improved Coating Assessment	Testori	26/05/2013	18 000 (21 000)	(Cancelled)
Hendrina Unit 1	18 PPS & 18 PPS/PI Bags (36)	New Supplier Assessment	Tamfelt (Metsu)	10/07/2012	15 000	Recommended
Hendrina Unit 7	10 (26) China PPS Bags	China PPS Assessment	BWF	15/04/2012	14 000	Affected by Plant Risk
Hendrina Unit 5	0 (4) PAN Tectus Bags by How den	Shrinkage reduction	Andrew Webron	17/01/2011	18 000	Affected by Plant Risk
Hendrina Unit 5	30 (60) Tectus PAN Bags by Clear Edge	Shrinkage reduction	Andrew Webron	17/01/2011	18 000	Affected by Plant Risk
Hendrina Unit 5	10 (18) Red Bags by BWF	Shrinkage reduction	BWF	17/01/2011	18 000	Not Recommended
Hendrina Unit 8	14 (36) self-supporting PPS Bags	Improved filtration efficiency at reduced cost	Andrew Webron	25/04/2008	40 500	Recommended
Majuba Unit 5 Cell 1.2	0 (6) PAN Tectus/polyimide (PI) Bags	Shrinkage reduction	Andrew Webron	09/09/2010	18 000	Recommended
Majuba Unit 5 Cell 1.2	60 (70) PAN (Dralon)/PIAKSA Bags	Ricem alternative/shrinkage reduction	Gutsche/Clear Edge	09/09/2010	18 000	Recommended
Majuba Unit 5 Cell 1.2	0 (34) Gutsche PAN/PI Bags (AKSA)	Shrinkage/filtration efficiency	Gutsche/Clear Edge	09/09/2010	18 000	Recommended
Majuba Unit 5 Cell 1.2	0 (21) Gutsche PAN Bags (AKSA)	Shrinkage/filtration efficiency	Gutsche/Clear Edge	09/09/2010	18 000	Recommended
Duvha Unit 2	0 (21) PPS/PI Bags	New bag supplier evaluation	Stokto/Kayser	28/11/2008	35 000	Not Recommended
Majuba Unit 3 Cell 2.3	0 (16) PAN Ricem Bags	Shrinkage reduction	Testori	13/02/2009	25 000	N/A
Majuba Unit 3 Cell 2.3	0 (16) PAN Ricem Bags	Shrinkage reduction	Testori	13/02/2009	25 000	N/A
Majuba Unit 3 Cell 2.3	0 (19) iron oxide treated Dolanit Bags	Shrinkage reduction	BWF	13/02/2009	25 000	Not Recommended
Majuba Unit 4 Cell 2.4	0 (73) special heat treated Dolanit Bags	Shrinkage reduction	Andrew Webron	17/09/2009	25 000	Not Recommended
Duvha Unit 1, Cell A	0 (18) PPS Bags with Novates (PU) coating	Improved chemical resistance/filtration efficiency	Testori	18/01/2008	35 212	Recommended
Duvha Unit 1, Cell A	9 Light Scrim (130), 9 Heavy Scrim 170, 9 High Heat Set PAN (27)	Accelerated Test on PAN, Heat Set Test for Supplier	Beier Envirotech	24/05/2007	18 000	N/A, Supplier Test
Duvha Unit 2 Cell D	0 (1) Red Bag	Accelerated Test on Red Bag	Gutsche	9/02/2006	19 000	Not Recommended
Majuba Unit 6 Cell 1.2	0 (4) Red Bags	Shrinkage reduction	Gutsche	01/03/2006	26 000	Not Recommended
Majuba Unit 5 Cell 2.4	0 (62) Red Bags	Shrinkage reduction	Beier Envirotech	01/09/2006	25 000	Not Recommended
Majuba Unit 3 Cell 1.2	0 (3) Red Bags	Shrinkage reduction	Gutsche	15/06/2005	26 000	Not Recommended
Hendrina Unit 4 (LHC & RHC)	0 (4) Red Bags	Shrinkage reduction	Gutsche	31/12/2005	26 000	Not Recommended

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## 9. PRE-COATING OF BAGS

All bag cells/compartments or units that are fully re-bagged must be pre-coated with hydrated lime before the cells/compartments are put into service.

All bag cells/compartments or units that have been cleaned offline must be recoated with hydrated lime before the cells/compartments are put back into service.

The minimum amount of hydrated lime required is 1 kg of lime per 1 m<sup>2</sup> of fabric.

The effectiveness and proper distribution of the lime coating on the bags must be verified before the bag cells/compartments are put in service.

Hydrated Lime Specifications: Chemical Properties	Average (%)	Min. (%)	Max. (%)
Free Calcium Oxide (CaO)	0.16	-	1.00
Magnesium Oxide (MgO)	1.01	-	1.20
Silica	0.50	-	0.98
Ferric Oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.15	-	0.60
Alumina (Al <sub>2</sub> O <sub>3</sub> )	0.08	-	0.35
Calcium Hydroxide (CaOH <sub>2</sub> )	94.8	90.0	-
Carbon Dioxide (CO <sub>2</sub> )	0.60	-	1.5
Free Moisture (H <sub>2</sub> O)	0.64	0	2.00
Colour / Texture	Light Brown / Fine Powder		

### High Calcium Hydrated Lime Particle Size:

Size Parameter	Typical %
< 850 micron	100
< 300 micron	99.5
< 100 micron	99.0
< 75 micron	85

## 10. SPARE BAGS

Stations shall keep sufficient stock of spare bags to replace failed bags that occur during the course of plant operation. The recommended minimum stock level is 3% of the total installed number of bags per station.

The bag re-order point and the order quantity must take a six month lead time from order placement to delivery to site into consideration.

The bags, bag components and filter media must be of the same specification as the installed bags i.e. shall comply with the specification and standards detailed in this document.

The spare bags must be stored in compliance to the requirements stipulated in 240-56244749, Fabric Filter Plant Operation Standard.

### CONTROLLED DISCLOSURE

## 11. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
Ntebogeng Mogudi	Senior Manager (Acting) – Gx Engineering, Boilers
Hendre Grobbelaar	Senior Consultant – Air Pollution Control (Gx Engineering)
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Jeff Mchunu	Project Manager – FFP Bags,
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Felix Bosch	Generation Engineering Documentation Manager

## 12. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	E.M. Patel	Draft to Replace 474-274
August 2013	1	E.M. Patel	Final Document for Authorisation
December 2015	1.3	E.M. Patel	General Update
December 2015	1.4	E.M. Patel	Draft Document for Comments Review
February 2016	2	E.M. Patel	Final Rev 2 Document for Authorisation and Publication
July 2019	2.1	E.M. Patel	Document Revision
September 2019	2.2	E.M. Patel	Draft Document for Comments Review
October 2019	2.3	E.M. Patel	Updated Final Draft after Comments Review
October 2019	3	E.M. Patel	Final Rev 3 Document for Authorisation and Publication
July 2024	3.1	H Grobbelaar	Document Revision
August 2024	3.2	H Grobbelaar	Draft Document for Comments Review
August 2024	3.3	H Grobbelaar	Updated Final Draft after Comments Review
August 2024	4	H Grobbelaar	Final Rev 4 Document for Authorisation and Publication

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### **13. DEVELOPMENT TEAM**

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

- Ebrahim Patel
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- Luyanda Mvulane
- Nthabiseng Tsosane
- Irish Phiri
- Spinola Baloyi

### **14. ACKNOWLEDGEMENTS**

None

**APPENDIX 1 - FABRIC FILTER INFORMATION SUMMARY**

**ESKOM FABRIC FILTER PLANTS  
FABRIC FILTER INFORMATION SUMMARY**

<b>POWER STATION:</b>	
<b>UNIT:</b>	
<b>ENQUIRY/CONTRACT NUMBER:</b>	

**INFORMATION TO BE COMPLETED FOR EACH BAG OFFER**

Bag Supplier Details			
Company Name			
Company Address			
Contact Person			
Telephone Number		Fax Number	
Destination Company (if applicable)		Supplier Bag Code	

Bag Dimensions	
Length (m)	
Diameter (mm)	
Eskom Drawing Number	
Supplier Drawing Number	

Physical Characteristics		
Tensile strength	Warp (N/5cm)	
	Weft (N/5cm)	
Tearing strength	Warp (N)	
	Weft (N)	
Bursting strength (kPa)		
Air permeability (m <sup>3</sup> /dm <sup>2</sup> /s) at 125 Pa		
Fabric weight (g/m <sup>2</sup> )		
Fabric thickness (mm)		

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Elongation at 50N/cm (%) Warp and Weft	
--	--

Snap Band Construction	
Material	
Tensile Strength of snap band material	
Dimensions	
Joining of snap band (describe the fitting)	

Fabric Construction	
<i>Scrim</i>	
Type of fibre	
Weight (g/m <sup>2</sup> )	
Fibre size (denier)	
Yarn size (no. of fibres)	
Type of yarn (spun or multifilament)	
Number of yarns per cm (warp and weft)	
Type of weave	
<i>Batt</i>	
Number of layers	
<b>Surface Batt</b>	
Type of fibres	
Fibre sizes (denier)	
Weight of fibres in layer	
Other information to note	
<b>Second Layer (if applicable)</b>	
Type of fibres	
Fibre sizes (denier)	
Weight of fibres in layer	
Other information to note	
<b>Inside Batt</b>	
Type of fibres	
Fibre sizes (denier)	
Weight of fibres in layer	
Other information to note	
<i>Fabric Surface Finish</i>	
Heat setting	Yes
	No

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If yes, describe in detail (temperature, dwell time)			
Coatings	<b>Yes</b>		<b>No</b>
If yes, describe in detail (type)			
Singed	<b>Yes</b>		<b>No</b>
If yes, describe in detail (time and type of exposure)			
Calendared	<b>Yes</b>		<b>No</b>
If yes, describe in detail (temperature, pressure, speed)			
<b>Dimensional Stability</b>			
Shrinkage in both directions (%) 150°C (for PAN) or 180°C (for PPS) over 24 hours	Warp		
	Weft		
<b>Sewing Tread</b>			
Type			
Other information to note			
<b>Are the bags...</b>			
Thermowelded		Stitched	

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