Eskom	Standard	Technology

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1. INTRODUCTION

Eskom utilizes needle felt fabric on its fabric filter plant (FFP) equipped operating units to curb particulate emissions. There are various types of material available to manufacture these filter bags from. Eskom has completed extensive research in order to understand which fabric filter media would function best in which operating environment.

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

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the minimum standard requirements for the purchase of replacement fabric filter plant filter media and bags, and serves to provide a consistent technical approach to the supply and delivery of fabric filter bags to all applicable Eskom operating units. Information regarding Polyphenylene sulphide (PPS), Polyimide (PI) and Homopolymer Polyacrylonitrile (PAN) materials as well as sample material requirements and plant guarantee requirements are contained herein.

2.1.1 Purpose

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

2.1.2 Applicability

This document shall apply to the following Power Stations which have fabric filter plants installed:

- Arnot Power Station
- Camden Power Station
- Duvha Power Station (Units 1-3)
- Grootvlei Power Station
- Hendrina Power Station
- Majuba Power Station
- Medupi Power Station
- Kusile Power Station
- Tutuka Power Station (To be retrofitted with FFP's. Generic standards for Tutuka Power Station are included in this document. The specification could however change during the design of the fabric filter plant following finalisation of the process conditions and plant design.)

This document applies to all filter bags utilised at the above mention power stations, be it spare bags used for plant maintenance or routine replacement bags.

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 Operational Procedure.

[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] 39-7 - Reporting, Recording, Investigating, Costing and the Follow-up of SHE Incidents / Accidents.

[8] Determination of Fabric Mass, Ash Mass and Cleanability of Fabric Filter Bags : 240-119619889

[9] Determination of the Permeability of Fabric Filter Bags to Air : 240-119619621

[10] Tensile Properties of Fabrics: Determination of the Maximum Force of Fabric Filter Bags using the Grab Method : 240-119618026

[11] Determination of Tearing Strength of Fabrics by the Tongue Method : 240-132338631

[12] Determination of Dimensional Change in Fabric Filter Bags after Exposure to High Temperature : 240-119619058Tensile Properties of Fabrics Determination of the Maximum Force of Fabric Filter Bags Using the Grab Method

[13] 240-119619621 - Determination of Permeability of fabric filter bags

[14] 240-105658000 Supplier Quality Management Specification

[15] EN ISO 9073-2 – Methods of testing nonwovens: Determinations of thickness

[16] 209-449 - Data Interpretation from the Textile Laboratory

2.2.2 Informative

[17] EN 29073 – Methods of testing nonwovens: Determination of tensile strength and elongation

[18] EN ISO 9237 – Textiles: Determination of air permeability

[19] DIN 53887 – Frazier Differential Pressure air permeability tester

[20] DIN 53861 – Testing of Textiles; Vaulting test and bursting test

[21] UNI 8279/12 – Methods of testing nonwovens: Determination of dimensional change by heat

[22] EN 12127 – Textiles and fabrics. Determination of Mass per unit area using small samples

2.3 DEFINITIONS

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

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^2	Gram per square meter
g/Nm^3	Gram per normal cubic meter (normalised to 10% O_2 on a dry basis at 101.325 kPa & 0 ^oC)
K	Kelvin
kPa	Kilo Pascal
m^3/m^2/minute	Cubic meter per square meter per minute
Max	Maximum
MCR	Maximum Continuous Rating
mg/Nm^3	Milligram per normal cubic meter (normalised to 6% O_2 on a dry basis at 101.325 kPa & 0^oC)
Min	Minimum
mm	Millimeter
N/cm	Newton per centimetre
Nm^3	Normal cubic meter (normalised to 6% O_2 on a dry basis at 101.325 kPa & 0 ^oC)
O_2	Oxygen
Pa	Pascal
PAN	Polyacrylonitrile
PI	Polyimide (P84 ®)
PPS	Polyphenylene sulphide
QA	Quality Assurance
QC	Quality Control

2.5 ROLES AND RESPONSIBILITIES

It is the responsibility of the System Engineer to ensure that the Standard is included in any purchase for filter bags at their respective stations, be it spare bags for maintenance purposes or full replacement bag sets. The System Engineer also need to ensure that the stores description of the bags reflect the latest version of this standard.

2.6 PROCESS FOR MONITORING

It is the System Engineers responsibility to ensure that all fabric intended for use are sampled and issued to the Eskom RT&D laboratory for analysis, following the process below

Step 1: Bag Order Placed and data sheet signed off

Step 2: Suppliers Laboratory Results received

Step 3: Fabric and Scrim Sample received (with transmittal sheet)

Step 4: Sample analysed by RT&D

Step 5: RT&D analysis report issued

Step 6: Supplier given feedback on sample analysis.

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 technical approach to the supply and delivery of fabric filter bags to the stations in line with the terms and conditions of the applicable purchasing contract.
- Ensuring that Eskom accepts and receives the right quality filter bags which will 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 UNIT BAG NUMBERS

Station	Unit No.	Installed No. of Bags	Recommended Min. No. of Bags to be Ordered (per full replacement set)
Arnot	1	13 584	13 650
	2	13 584	13 650
	3	13 584	13 650
	4	10 934	11 000
	5	10 934	11 000
	6	10 934	11 000
Camden	1	9 616	9 650
	2	9 616	9 650
	3	9 616	9 650
	4	9 616	9 650
	5	9 616	9 650
	6	9 616	9 650
	7	9 616	9 650
	8	9 616	9 650

Duvha [*1]	1	26 928	26 980
	2	26 928	26 980
	3	26 928	26 980
Grootvlei	1	8 832	8 880
	2	9 744	9 800
	3	9 744	9 800
	4	9 744	9 800
	5	8 832	8 880
	6	8 832	8 880
Hendrina	1	8 074	8 100
	2	8 832	8 900
	3	8 832	8 900
	4	8 832	8 900
	5	8 832	8 900
	6	7 984	8 050
	7	7 984	8 050
	8	7 984	8 050
	9	7 984	8 050
	10	7 984	8 050
Majuba	1	30 976	31 000
	2	30 976	31 000
	3	30 976	31 000
	4	32 512	32 550
	5	32 512	32 550
	6	32 512	32 550
Medupi	6	18 480	18 525
	5	18 480	18 525
	4	18 480	18 525
	3	18 480	18 525
	2	18 480	18 525
	1	18 480	18 525
Kusile	1	18 480	18 525
	2	18 480	18 525
	3	18 480	18 525

	4	18 480	18 525
	5	18 480	18 525
	6	18 480	18 525
Tutuka *2	1	20 160	20 250
	2	20 160	20 250
	3	20 160	20 250
	4	20 160	20 250
	5	20 160	20 250
	6	20 160	20 250

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.

*2 – Tutuka FFP retrofits expected to be completed between 2021 and 2026

3.2 DOCUMENT CONTROL

The Supplier shall have a documented management process that will describe the complete fabric and bag manufacturing process and will as a minimum describe how the following requirements will be met:

The Supplier shall carry out inspection at all stages of fabric and bag manufacture.

The Supplier shall repair defects revealed during the routine quality control checks, provided the Supplier demonstrates to the Purchaser's Representative satisfaction that such repairs do not, in any way, lessen the service life and performance of the material.

The Supplier will make provision for Purchaser's Representative to carry out random inspections during the fabric and bag manufacturing process.

During manufacture, as a minimum every 50th 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 Supplier submits QA data sheets including test data. 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 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 certificates are to reflect the Eskom order number.

3.3 QUALITY ASSURANCE REQUIREMENTS

The Supplier assures that they comply with the requirements contained within the ISO 9001/9002 quality system and the Eskom Supplier Quality Management Specification (QM-58) requirements.

The generic Quality Plan as well as a proposed Inspection and Test Plan in strict compliance with the product standard are to be submitted with the Tender.

The Quality Assurance (QA) data sheets for fabric are provided at least three (3) week before the bag manufacturing commences.

The QA data sheets for bag manufacture will be provided with the bag delivery.

The Purchaser Representative will inspect the quality of the fabric 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 analysis to determine the distinct cascaded layers of the cloth construction	To be advised	
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) 2 (11 2013)	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 filer bags to air	240-11961962162P4002	EN ISO 9237 / DIN 53887
Solubility of Polyimide(P84) in Polyphenylene Sulphide (PPS)	240-119618310	

The Supplier can view and discuss these methods or other applicable testing methods prior to contract award in order to agree about their suitability with the Purchaser's Representative.

All raw materials (i.e. fibre, thread, snap bands, seals, etc.) must have certificates of compliance.

The data books must include the details of the tags and numbers with complete traceability to the fabric slit width roll number.

3.4 MANUFACTURING AND DELIVERY PROGRAM

The Supplier provides manufacturing and delivery schedules. The Supplier delivers all bags to site as per the required delivery schedule.

The Supplier submits to the Purchaser's Representative the following documentation:

- Generic Quality Plan Included in Tender
- Proposed Inspection and Test Plan Included in Tender
- 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 compiles a Delivery Schedule in liaison with the Purchaser's Representative.
- The Supplier submits to the Purchaser's Representative the Delivery Schedule, Accepted Programme and subsequent revisions on 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 KEY PEOPLE

The Supplier is to provide names of key people responsible for the project as requested by the project manager. The information should include contact details of the key personnel.

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.

<u>Performance Bonds (Minimum requirements)</u>

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

- 50 % will be released 104 weeks after sectional completion of the whole of the works.
- The remaining 50 % will be released at the end of the defects guarantee period.

Routine Spare Bags (if applicable):

- 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 Unit Bags (if applicable):

- 50 % will be released 104 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 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 for Units 4 to 6 operating hours after installation.
- Duvha PPS bags: minimum of 36 000 operating hours after installation.
- Camden PPS bags: minimum of 30 000 operating hours after installation.
- Grootvlei PPS bags: minimum of 32 000 operating hours after installation
- Hendrina PPS bags: minimum of 38 000 operating hours after installation.
- Hendrina PAN bags: minimum of 34 000 operating hours after installation.
- Majuba PAN bags: minimum of 25 000 two-shifting operating hours after installation and/or a minimum of 32 000 base-load/load-following operating hours.
- Medupi PPS bags: minimum of 10 000 operating hours after installation.
- Kusile PAN bags: minimum of 15 000 operating hours after installation.
- Tutuka PPS bags: minimum of 36 000 operating hours after installation.
- All guarantee limitations are to be specifically stated in the tender submission. If viewed as unreasonable by the Client, these submissions will not be considered.
- The Client will factor limitations of guarantee into the life cycle evaluation of each offer, if required.

Note that the PPS and PAN referred to above, is for the predominant base fibre used in the material which could or could not be blended with other fibre types, such as PTFE and/or P84®.

3.8 SUPPLIER DUTY AND LOCAL CONTENT

3.8.1.1 The Supplier provides fabric filter bags in accordance with the Product Information and this Standard, including the design, testing and manufacturing of the fabric and the filter bags to suit the process standards and ensure the proper fitting of the bags onto the existing bag cages and tube plate.

3.8.1.2 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
- Fabric manufacturing unless a concession is obtained by the Supplier from the Department of Trade and Industry (DTI) and the Client

3.9 APPROVED SUPPLIERS

3.9.1 Fibre suppliers

The following products, components and suppliers are approved by Eskom. No other substitutes will be accepted and Eskom requires written assurance as such.

Products:

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

3.9.2 Suppliers for Fabric Productions

The following suppliers have been approved by Eskom for fabric productions (including the sourcing of component materials):

- Solaft Gosford Plant (Australia)
- Andrew Webron's Lancs Plant (United Kingdom)
- Beier Envirotec's Pinetown Plant (South Africa)
- BWF's Offingen Plant (Germany)
- Gutsche's Fulda Plant (Germany)
- Heimbach's Duren Plant (Germany)
- Testori's Milan Plant (Italy)
- Kayser's Einbeck Plant (Germany)
- Filtafelt's Rosslyn Plant (South Africa)
- Valmet's Ovar Plant (Portugal)

3.9.3 Local Bag Manufacturers

The following suppliers have been approved by Eskom to manufacture bags within the borders of South Africa:

- Beier Envirotec's Pinetown Plant
- Filtafelt's Rosslyn Plant
- GI Filtration's Centurion Plant
- Clear Edge's Robertsham Plant
- Environmental Dynamic's Nigel Plant
- Filter Pure's Kya Sand Plant (limited production capability)
- Envirox Filtration Technologies' Eastrand Plant

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.

3.9.4 Selection of Suppliers

Eskom reserves the right to add and/or remove to the above list (3.9.1 to 3.9.3) solely at its discretion. No exception to Eskom's approved list will be accepted. Any additional/potential supplier to this list will require extensive testing to be undergone and after successful trial evaluation may be considered for inclusion.

3.9.5 Technical Approval Process

Through Eskom's Research Centre and Supplier Assessment Departments (QA), a comprehensive testing and evaluation program is followed 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. The typical periods of assessments are described below:

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	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 the Purchaser's representative prior to an enquiry being issued. Consideration must be given by all stakeholders to the above timeframes in their project sourcing plans.

Furthermore, it must be noted that the Department of Trade and Industry (DTI) has designated the textile industry. As such, permission needs to be obtained from the DTI 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.

4. STATION SPECIFIC 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^3 / s
Gas volume:	• MCR 462 Am^3 / 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^3
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
Bag length	• 8 meters
Bag diameter	• 127 mm equivalent (Howden Design)
Required operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
Maximum pressure drop	• 2.4 kPa (flange to flange @ MCR with one cell isolated)

- 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 an endless felt strip type.
- 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 off 100% PPS
- 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

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^3 / 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^3
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 meters
Bag diameter	• 127 mm equivalent (Howden Design)
Required operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 an endless felt strip type.
- The longitudinal seam of the bag shall be triple stitched.
- The cuff and base (foot/sock) material will be of 100% PPS
- 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.3 Majuba Power Station

Continuous operating temperature range (FFP):	• 100 °C to 150 °C
Temperature control set point:	• 125 ^{o}C
Gas volume:	• Maximum 1 553 Am^3 / 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^3
Estimated number of starts per boiler	• 150 per year
Mode of Operation	• Load following and two shifting
Material Selection:	• PAN/PI
Exclusions from standard material standard:	• None
Bag drawing number	• 0.66/95371 (latest revision)
Bag length	• 7 meters
Bag diameter	• 127 mm equivalent (Howden Design)
Required operational hours (max number of bags failing during this period)	• 32 000 (5%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 an endless felt strip type.
- The longitudinal seam of the bag shall be triple stitched.
- The cuff and base (foot/sock) material will be off 100% Homopolymer PAN
- The stitching thread will be PAN 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.4 Duvha Power Station

Continuous operating temperature range (FFP):	• 100 °C to 150 °C
Gas volume:	• Maximum 1 553 Am^3/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^3
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
Bag diameter	• 135 mm
Required operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.5 Grootvlei Power Station

Continuous operating temperature range (FFP):	• 100 °C to 150 °C
Gas volume:	• Maximum 550 Am^3/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 0.015 m/s
Inlet dust concentration:	• 25 – 50 g/Nm^3
Estimated number of starts per boiler	• 150 per year
Mode of Operation	• Load following and two shifting
Material Selection:	• PPS/PI
Exclusions from standard material standard:	• None
Bag drawing number	• 0.19.46445 (latest revision)
Bag length	• 8 meters
Bag diameter	• 150 mm equivalent
Required operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 0.19.46445 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 8040 mm x 146 mm diameter bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a 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 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.6 Arnot Power Station

Process standards

Continuous operating temperature range (FFP):	• 110 °C to 175 °C
Temperature control set point:	• None
Gas volume per unit:	• Maximum 975 Am^3/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^3

Performance requirements

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 meters
Bag diameter	• 135 mm
Required operational hours (max number of bags failing during this period)	• 32 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 off 100% PPS.
- The Filter Bag detail comprises of a 8040 mm x 146 mm diameter bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.7 Kusile Power Station

Process standards

Continuous operating temperature range (FFP):	• 110 °C to 150 °C, controlled at 125 ^{o}C
Gas volume per unit:	• Maximum 1 250 Am^3/s (excl. Attemperation air)
Flue gas oxygen content:	• 3% - 15%
Estimated number of starts per boiler	• 150 per year
Mode of Operation	• Base load
Inlet dust concentration:	• 25 – 70 g/Nm^3

Performance requirements

Filtration velocity with one cell isolated:	• Maximum 0,020 m/s
Filtration velocity with all cells in-service:	• Maximum 0,016 m/s
Material Selection:	• PAN/PI •
Exclusions from standard material standard:	• None
Bag drawing number	• Z0088504 (latest revision)
Bag length	• 8.24 meters
Bag diameter	• 160 mm
Required operational hours (max number of bags failing during this period)	• 30 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
Maximum pressure drop	• 2.2 kPa (flange to flange @ MCR with one cell isolated)

- The *Contractor* manufactures the bag according to the details shown on drawing No Z0088504 Revision Latest and the cage drawing no. Z0101050 Revision Latest
- The double circular base and the 100 mm wide reinforcing strip will be off 100% Homopolymer PAN.
- The Filter Bag detail comprises of a 8240 mm x 160 mm diameter bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a 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% Homopolymer PAN plus 100 mm wide reinforcing strip also from 100% Homopolymer PAN 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 PAN 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.8 Medupi Power Station

Process standards

Continuous operating temperature range (FFP):	• 110 °C to 150 °C,
Gas volume per unit:	• Maximum 1 250 Am^3/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 – 70 g/Nm^3

Performance requirements

Filtration velocity with one cell isolated:	• Maximum 0,020 m/s
Filtration velocity with all cells in-service:	• Maximum 0,016 m/s
Material Selection:	• PPS/PI
Exclusions from standard material standard:	• None
Bag drawing number	• Z0088504 (latest revision)
Bag length	• 8.24 meters
Bag diameter	• 160 mm
Required operational hours (max number of bags failing during this period)	• 10 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
Maximum pressure drop	• 2.2 kPa (flange to flange @ MCR with one cell isolated)

- The *Contractor* manufactures the bag according to the details shown on drawing No Z0088504 Revision Latest and the cage drawing no. Z0101050 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 8240 mm x 160 mm diameter bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a 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.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.1.9 Tutuka Power Station

Process standards

Continuous operating temperature range (FFP):	• 110 °C to 175 °C
Gas volume per unit:	• Maximum 1 359 Am^3/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^3
Performance requirements	•
Filtration velocity with one cell isolated:	• Maximum 0,016 m/s
Filtration velocity with all cells in-service:	• Maximum 0,015 m/s
Material Selection:	• PPS/PI
Exclusions from standard material standard:	• None
	•
Bag drawing number	• To be confirmed (latest revision)
Bag length	• 10 meters
Bag diameter	• 150 mm
Required operational hours (max number of bags failing during this period)	• 36 000 (3%)
Expected emission limits	• 30 mg/Nm^3
Maximum emission limits	• 50 mg/Nm^3
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 (to be confirmed) Rev (latest).
- The top collar is constructed of material similar to that of the filter bag. The term “similar” means a material that has equal or greater strength and emission control capability of that of the bag material. A dual bead band is provided within the top collar for sealing the bag to the tubesheet.
- The snap band is stainless steel material joined by spot weld or stainless steel rivets.
- Each bag has dual bottom disks constructed of like material as that of the bag.
- The inside surface of the bags are singed to facilitate cage removal from the bag.
- The double circular base and the 100 mm wide reinforcing strip will be off 100% PPS.
- The Filter Bag detail comprises of a 10 000 mm x 150 mm diameter bag with one end open with Stainless Steel snap band covered with a felt strip sewn into a 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 or induction spot welded.
- The longitudinal seam of the bag shall be triple stitched.
- The stitching thread will be 100% PPS or PTFE. The vertical seams should be triple needle type 401. The horizontal seams should be double needle type 301.
- 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.
- Should welded seams be considered, the following will apply. Welded seams includes a tensile pull test per DIN or ASTM demonstrating a failure of no less than the acceptance value of the non-welded seem area. A minimum of one sample is tested for each contract. This test is conducted prior to seaming any material on the project. Use of welded seam is not permitted without prior written acceptance from the Employer of the results of the tests.
- The Employer reserves the right to randomly remove the bag filter on the floor for bag compliance analysis.

4.2 FILTER BAG FABRICATION

4.2.1 PPS/PI SPECIFICATION FOR CAMDEN, DUVHA, GROOTVLEI, MEDUPI and (TUTUKA-tentative)

4.2.1.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyphenylene sulfide (PPS)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulfide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal (if applicable)	Endless Rontex Ring (PPS)
Cuff Material	Polyphenylene sulfide (PPS)
Foot/Sock Material	Polyphenylene sulfide (PPS)

4.2.1.2 Scrim

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

4.2.1.3 Batt – Cascade Construction

4.2.1.3.1 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^2 (Before Needling)
Material 2:	Polyphenylene sulfide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	55 - 45 g/m^2 (Before Needling)

4.2.1.3.2 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m^2 (Before Needling)

4.2.1.3.3 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m^2 (Before Needling)

4.2.1.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.1.5 Fabric Special Treatments

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

4.2.1.6 Fabric Properties

Air permeability**:**	7.6 – 10 m^3/m^2/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

4.2.2 PPS/PI SPECIFICATION FOR ARNOT

4.2.2.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyphenylene sulfide (PPS)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulfide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal (if applicable)	Endless Rontex Ring (PPS)
Cuff Material	Polyphenylene sulfide (PPS)
Foot/Sock Material	Polyphenylene sulfide (PPS)

4.2.2.2 Scrim

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

4.2.2.3 Batt – Cascade Construction

4.2.2.3.1 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^2 (Before Needling)
Material 2:	Polyphenylene sulfide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	55 - 45 g/m^2 (Before Needling)

4.2.2.3.2 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m^2 (Before Needling)

4.2.2.3.3 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m^2 (Before Needling)

4.2.2.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.2.5 Fabric Special Treatments

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

4.2.2.6 Fabric Properties

Air permeability**:**	60 l/dm^2/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 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

4.2.3 PAN/PI STANDARD FOR MAJUBA AND KUSILE

4.2.3.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyacrylonitrile (PAN)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled:	Both
Sewing Thread:	Polyacrylonitrile (PAN)
Snap band:	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal:	Endless Rontex Ring (PAN)
Cuff Material:	Polyacrylonitrile (PAN)
Foot/Sock Material	Polyacrylonitrile (PAN)

4.2.3.2 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^2 before needling (Loom State)
Fibre Dimension:	2.2 dtex

4.2.3.3 Batt - Cascade Construction

4.2.3.3.1 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^2 (Before Needling)
Material 2:	Polyacrylonitrile (PAN)
Fibre dimension:	1.7 dtex maximum
Weight:	55 - 45 g/m^2 (Before Needling)

4.2.3.3.2 Support Batt (Second Inner layer – Dust Side)

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

4.2.3.3.3 Support Batt (Inner layer – Clean Side)

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

4.2.3.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.3.5 Fabric Special Treatments

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

4.2.3.6 Fabric Properties

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

4.2.4 PPS STANDARD FOR HENDRINA

4.2.4.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyphenylene sulfide (PPS)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulfide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal	Endless Rontex Ring (PPS)
Cuff Material	Polyphenylene sulfide (PPS)
Foot/Sock Material	Polyphenylene sulfide (PPS)

4.2.4.2 Scrim

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

4.2.4.3 Batt

4.2.4.3.1 Surface Layer (First Surface Layer – Dust Side)

Construction: The surface layer will consist of PPS only

Material 1:	Polyphenylene sulfide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	100 - 110 g/m^2 (Before Needling)

4.2.4.3.2 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m^2 (Before Needling)

4.2.4.3.3 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m^2 (Before Needling)

4.2.4.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.4.5 Fabric Special Treatments

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

4.2.4.6 Fabric Properties

Air permeability**:**	7.6 – 10 m^3/m^2/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

4.2.5 GENERIC PAN/PI STANDARD FOR STATIONS TO BE RETROFITTED

Note: This is the generic standard for stations to be retrofitted with FFP's where the flue gas temperature entering the FFP can be controlled to below 125^{o} C.

4.2.5.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyacrylonitrile (PAN)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled:	Both
Sewing Thread:	Polyacrylonitrile (PAN)
Snap band:	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal:	Endless Rontex Ring (PAN)
Cuff Material:	Polyacrylonitrile (PAN)
Foot/Sock Material	Polyacrylonitrile (PAN)

4.2.5.2 Scrim

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

4.2.5.3 Batt - Cascade Construction

4.2.5.3.1 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^2 (Before Needling)
Material 2:	Polyacrylonitrile (PAN)
Fibre dimension:	1.7 dtex maximum
Weight:	55 - 45 g/m^2 (Before Needling)

4.2.5.3.2 Support Batt (Second Inner layer – Dust Side)

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

4.2.5.3.3 Support Batt (Inner layer – Clean Side)

Material:	Polyacrylonitrile (PAN)
Fibre dimension:	2.2 dtex

Weight:	190 - 200 g/m^2 (Before Needling)

4.2.5.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.5.5 Fabric Special Treatments

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

4.2.5.6 Fabric Properties

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

4.2.6 GENERIC PPS/PI SPECIFICATION FOR STATIONS TO BE RETROFITTED

Note: This is the generic standard for stations to be retrofitted with FFP's where the flue gas temperature entering the FFP cannot be controlled to below 125^o C.

4.2.6.1 Needle Felt Standard and Cloth Construction

Fabric construction:	Scrim supported needle felt
Fibre chemical name:	Polyphenylene sulfide (PPS)
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Fabric thickness:	Minimum 1.8 mm
Sides needled	Both
Sewing Thread	Polyphenylene sulfide (PPS)
Snap band	Riveted/Welded Stainless Spring Steel (Diameter to fit tube plate)
Cuff Seal	Endless Rontex Ring (PPS)
Cuff Material	Polyphenylene sulfide (PPS)
Foot/Sock Material	Polyphenylene sulfide (PPS)

4.2.6.2 Scrim

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

4.2.6.3 Batt – Cascade Construction

4.2.6.3.1 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^2 (Before Needling)
Material 2:	Polyphenylene sulfide (PPS)
Fibre dimension:	1.7 dtex trilobal
Weight:	55 - 45 g/m^2 (Before Needling)

4.2.6.3.2 Support Layer (Second Inner Layer – Dust Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimensions:	2.2 dtex
Weight:	125 – 135 g/m^2 (Before Needling)

4.2.6.3.3 Support Batt (Inner Layer – Clean Side)

Material:	Polyphenylene Sulfide (PPS)
Fibre dimension:	2.2 dtex
Weight:	190 - 200 g/m^2 (Before Needling)

4.2.6.4 Cloth Construction

Fabric Construction:	Scrim supported needle felt
Weight:	580 – 620 g/m^2 range, 600 g/m^2 average
Number of sides needled:	Both sides

4.2.6.5 Fabric Special Treatments

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

4.2.6.6 Fabric Properties

Air permeability**:**	7.6 – 10 m^3/m^2/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

4.3 TESTING AND INSPECTION REQUIREMENTS AND SAMPLE BAG MATERIALS

4.3.1 Sample bag material

Eskom requires 1 (one) square meter (minimum) of sample fabric for every 10 000 m^2 of fabric produced. The certificates detailing full test results carried out by the supplier on the fabric and scrim to determine compliance with the standard should be included with the fabric sample.

Furthermore, Eskom requires an additional 4 square meters of fabric plus 2 square meters of the raw scrim per unit that 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.

The Employer reserves the right to randomly remove 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 need to be produced.

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^2 of fabric produced

4.3.2 Bag Testing Requirements

4.3.2.1 Raw Materials

Certificates of compliance, source of material and periodic batch tests of all components and raw materials will need to accompany material at all stages of production.

4.3.2.2 Fabric Manufacture

The following items will need to be verified according to the required limits as per section 3.1 and 3.2 depending on the bag material standard.

- 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)
- Dimensional Stability
- Microscopic analysis confirming cascade fabric construction.

4.3.2.3 Bag Manufacture

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

4.3.3 Labelling and Packaging of bags

Labels that identifies each bag with a colour and/or shape coded tag showing the batch and bag number sewn into the top outer cuff such that it may be linked to all relevant information including the name of any manufacturing supplier needs to be attached to newly manufactured bags. No repeatability of tags and numbers will be allowed.

The packaging needs to be clearly marked with the fabric type and order number. Any other relevant information pertaining to the particular shipment should also be marked. Each package contains approximately 10 to 15 bags to facilitate manual handling by one person.

All bags in each package needs to be packed in sealed non-transparent plastic bags. The packaging must clearly differentiate between routine spares bags and the complete spare unit bags.

4.3.4 Typical QCPs/ITPs

Eskom Generation	**FILTER BAG TEST & INSPECTION REPORT**	**Contract No** 4600022655
Title of the Contract	The Manufacturing and Supply of Complete Set of Fabric Filter Bags for Duvha Unit 3.	**Filter Bag Drawing No.** 0.57/48834 Rev 2
		BA Internal Product Code: 44181034-1
		BA ORDER No. 4500906504
Control Codes	(*) ✔ = 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)					

Person conducting inspection:	**Date of inspection:**
Suppliers Name:	**Suppliers signature:**
Notes / Remarks:	

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		

Op #	Operation Description	Reference Document	Hold or Witness by 1	2	3	4	5	Inspection Required VIS	DIMN	STRE	PERM	ELON	MASS	DOC	Accept Signature	Reject Signature	Date	Remarks
1	RECEIVING INSPECTION :	MCP																
	RECEIPT OF MATERIAL :																	
	Delivery documents are compared with Purchase Documents for							X						X				
	compatibility .																	
	Raw Material is visually checked for :																	
	~ Type							X										
	~ Quantity							X										
	~ Transit damage							X										
	Certificates of Conformance / Inspection and test reports are		W	V										X				
	checked																	
1.2	SCRIM																	
	Certificates of Conformance / Inspection and test reports are		W	V										X				
	checked																	
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

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 by					Inspection Required									
Op #	Operation Description	Reference Document	1	2	3	4	5	VIS	DIMN	STRE	PERM	ELON	MASS	DOC	Accept Signature	Reject Signature	Date	Remarks
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

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 1	2	3	4	5	Inspection Required: VIS	DIMN	STRE	PERM	ELON	MASS	DOC	Accept Signature	Reject Signature	Date	Remarks
4	RECEIVING INSPECTION :	MCP																
	RECEIPT OF MATERIAL :																	
	Delivery documents are compared with Purchase Documents for							X						X				
	compatibility .																	
	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

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 1	2	3	4	5	Inspection Required: VISUAL	DIMENSIONAL	STRENGTH	PERFORMANCE	ELONGATION	MASS	DOCUMENTATION	Accept Signature	Reject Signature	Date	Remarks
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		H	V				X	X					X				
	the entire manufacturing process and is subjected to critical																	
	inspection at every manufacturing stage .																	
	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	MCP	S	V														
	identification # to so signify .																	
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

	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	Draw ing # : 0.57/48834 Rev. 2
PRODUCT CODE :	4 =	S = Surveillance	CONTRACT # :
SUPPLIER # :	5 =	R = Record	

Op #	Operation Description	Reference Document	Hold or Witness by 1	2	3	4	5	Inspection Required VISIS	DIMN	STRE	PERM	ELON	MASS	DOC	Accept Signature	Reject Signature	Date	Remarks
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

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 6 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 1	2	3	4	5	Inspection Required: VISUAL	DIMENSION	STRENGTH	PERFORM	ELONG	MASS	DOC	Accept Signature	Reject Signature	Date	Remarks
5.7	INSPECTION :	MCP																
	Every bag is checked for top and bottom cuff dimension and		S	V				X	X									
	appearance .																	
	Every 100th bag is checked for length under 5 kg tension and fit		S	V				X	X					X				
	of Snapband in the cell plate .																	
	Each bag is stamped with the BA Order # inside the top cuff to		S	V														
	signify satisfactory inspection .																	
			S	V										X				
5.8	PACKING																	
	Bags are packed 10 per bale in a polypropylene bale.		S	V														
5.9	Release & Delivery		H	H										X				
	Delivery to customer																	

SUPPIER APPROVAL :	DATE		ESKOM APPROVAL	DATE

4.4 DEVIATIONS FROM BAG MATERIAL 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 in sections 3.1 and 3.2. This may only be done if guarantee requirements are still met and thorough testing of the fabric has been completed.

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 indicating if they are suitable or not. In a number of these instances, these alternate fabrics contain proprietary supplier information and as such cannot be included in the 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.

LIST OF TRIAL BAGS TESTED FOR USE IN ESKOM POWER PLANTS

Power Station	Bag Description	Purpose	Supplier	Installation Date	Hours	Status
Medupi Unit 3	(30) Low Drag PTFE Coated PPS Bags	Chemical Resistance and Air Permeability Consistency	WL Gore	06/05/2019	100	In Progress
Medupi Unit 3	(27) PPS Fine Fibre Material	PPS Fine Fibre Material	Gutsche	06/05/2019	100	In Progress
Camden Unit 7	(99) Huvis PPS/PI Bags	Evaluation of New PPS Bagfilter Material	Testori	01/02/2016	20 000	In Progress (Recommended)
Camden Unit 2	0 (31) PTFE/PTFE	Evaluation of New Bagfilter Material for High Temperature Application	BWF	11/09/2013	21 351	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	Not Recommended
Camden Unit 2	0 (20) PPS/PI Bags	New Supplier Assessment	Filtafelt	11/09/2013	21 351	Recommended
Duvha Unit 1, Cell C	8 (16) Didom (Pink) Bags	New Fibre Assessment	Beier Envirotech	26/05/2013	18 000	Not Recommended
Duvha Unit 1, Cell C	14 (18) PPS Super Novates Coated Bags	Improved Coating Assessment	Testori	26/05/2013	18 000	In Progress (Cancelled)
Hendrina Unit 1	18 PPS & 18 PPS/PI Bags (36)	New Supplier Assessment	Tamfelt (Metso)	10/07/2012	15 000	In Progress (Recommended)
Hendrina Unit 7	10 (26) China PPS Bags	China PPS Assessment	BWF	15/04/2012	14 000	In Progress (Plant Risk)
Hendrina Unit 5	0 (4) PAN Tectus Bags by Howden	Shrinkage reduction	Andrew Webron	17/01/2011	18 000	In Progress (Plant Risk)
Hendrina Unit 5	30 (60) Tectus PAN Bags by Clear Edge	Shrinkage reduction	Andrew Webron	17/01/2011	18 000	In Progress (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)/PI/AKSA 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

4.5 PRE-COATING OF BAGS

All complete cells/compartments or units that are fully rebagged must be coated with hydrated lime before the cells/compartments are put into service.

The minimum amount of hydrated lime required is based on 1 kg per 1 m^2 of fabric.

High Calcium 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_2O_3)	0.15	-	0.60
Alumina (Al_2O_3)	0.08	-	0.35
Calcium Hydroxide ($CaOH_2$)	94.8	90.0	-
Carbon Dioxide (CO_2)	0.60	-	1.5
Free Moisture (H_20)	0.64	0	2.00
Colour / Texture	Light Brown / Fine Powder		

High Calcium Hydrated Lime Particle Size:

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

4.6 SPARE BAGS

Stations are advised to keep sufficient stock of spare bags to replace failed bags that occur during the course of operation. The recommended minimum stock level is 3% of the total installed number of bags per station and the material should comply with the standards detailed in this document.

5. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
KB Naicker	Senior Manager (Acting) – Production Engineering Integration (Group Technology)
H Grobbelaar	Senior Consultant – Air Pollution Control (Group Technology)
RA Van Rensburg	Corporate Consultant – Air Pollution Control (Group Technology)
N Haripersad	Resources & Integrity Manager – CCECT, ERID (Sustainability)
I Phiri	Senior Advisor – Polymers & Filtration, ERID (Sustainability)
F Makananise	Manager – Condition Monitoring, Polymers & Filtration, ERID (Sustainability)
T Mokgatle	Engineering Manager – Arnot (Generation)
M Mathabatha	Engineering Manager – Camden (Generation)
N Toerien	Engineering Manager – Duvha (Generation)
T Montja	Engineering Manager – Grootvlei (Generation)
M Raphasha	Engineering Manager – Hendrina (Generation)
V Boya	Engineering Manager – Majuba (Generation)
J Mkhatshwa	Engineering Manager – Medupi (Generation)
N Mhlungu	Engineering Manager – Kusile (Generation)
P Mhlongu	Supplier Assessment Advisor – Quality Management (Group Technology)
J Mchunu	Project Manager – FFP Bags,
S Peta	Boiler Auxiliary Manager – Boiler Auxiliary Group (Group Technology)
EM Patel	SCOT: Particulate Care Group Chairperson
Y Singh	SCOT: AQC SC Chairperson
S Govender	General Manager Plant Engineering (Acting)

6. 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 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 Document for Authorisation and Publication

7. DEVELOPMENT TEAM

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

- Ebrahim Patel

- Hendre Grobbelaar
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- Nthabiseng Tsosane
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- Pieter Swart
- Jeanne Fourie
- Riana Nieuwoudt
- Hendrik Van Riel
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- Spinola Baloyi

8. ACKNOWLEDGEMENTS

None