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|---|---|---|

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# 1. INTRODUCTION

Valves form an integral part in the footprint and operations of fossil fired power plants. Fluid flow conveyance is primarily achieved via piping and valves. It is thus important to ensure that each and every valve on any of the Eskom Power plants have been manufactured to the highest standards. Due to the complexities associated with manufacturing of - and the relatively high safety risks associated with high pressure (HP) and high temperature (HT) valves, it is important to ensure that appropriate technical gatekeepers are in place for the procurement of valves, to ensure that all valves procured are safe for use on all Eskom power plants.

# 2. SUPPORTING CLAUSES

## 2.1 SCOPE

This standard covers the technical requirements for the procurement of HP/HT valves. This includes valves manufactured from forgings and castings in accordance to the applicable valve design standard. However this standard excludes the mains steam admission valves associated with the turbine centre line. The standard is applicable to valves that convey steam, water and other fluids with a design pressure that equals or exceeds 4.0 MPa or with a design temperature that equals or exceeds 250 °C. The requirements of this document also apply to valves that are ordered or released through the Materials Management (include MRP) process.

### 2.1.1 Purpose

The purpose of this standard is to provide the minimum technical requirements for the procurement of HP/HT valves and to ensure that all valves purchased by Eskom coal fired plants are of the highest quality and standard. This standard is to assist technical and procurement personnel with setting up quality gatekeepers for the procurement of high pressure, high temperature valves. Classification of valves is essentially based on their application such as fluid control (control valves), fluid isolation (isolation valves) and reflux or reverse flow protection (non-return or check valves).

### 2.1.2 Applicability

This document shall apply to the Eskom Coal Power Plant, Eskom Technology and Procurement Divisions.

## 2.2 NORMATIVE/INFORMATIVE REFERENCES

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

### 2.2.1 Normative

| | | |
|---|---|---|
| [1] | ISO 9001 | Quality Management System. |
| [2] | ASME B16.34 | Valve – Flanged, Threaded and Welded ends |
| [3] | ASME B16.5 | Pipe Flanges and Flanged Fittings. |
| [4] | ASME B16.10 | Face to Face and End to End dimensions of Valves |
| [5] | ASME B16.25 | Butt Welding Fittings |
| [6] | BS EN 12516 | Industrial valves (Part 1 to 4). |
| [7] | BS EN 12627 | Industrial valves – Butt Welding Ends of Steel Valves |
| [8] | BS EN 12892 | Industrial Valves – End to End and Centre to End Dimensions for Butt Welding End Valves. |

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[9] BS EN 558 Industrial valves – Face to Face and Centre to Face of Metal Valves for Use In Flanged Pipe Systems – PN and Class Designated.

[10] EN 1349 Industrial Process Control Valves

[11] BS EN 10250 Open die steel forgings for general engineering purposes(Part 2)

[12] BS EN 19 Industrial valves (Marking of metallic valves)

[13] BS EN 10213 Technical delivery conditions for steel castings for pressure purposes (Part 2)

[14] BS EN 12266 Industrial valves. Testing of metallic valves. (Part 1&2)

[15] ANSI/FCI 70-2 American National Standard - Control valve seat leakage

[16] ISO 5208 Industrial valves pressure testing of metallic valves

[17] BS EN 10222 Steel forgings for pressure purposes (Part 1 to 5)

[18] BS EN 10273 Hot rolled weld-able steel bars for pressure purposes with specified elevated temperature properties

[19] BS EN 10216 Seamless steel tubes for pressure purposes, technical delivery conditions (Part 1 to 5).

[20] BS EN 10272 Stainless steel bars for pressure purposes

[21] BS EN 1759 Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated. (Part 1, 3 & 4)

[22] BS EN 1092 Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated. (Part 1 to 4)

[23] 240-84513751 Material Specification and Certification Guideline for Power Generating Plant.

[24] 240-106628253 Standard for Welding Requirements on Eskom Plant

[25] 240-83539994 Standards for Non-Destructive Testing on Eskom Plant.

[26] Pressure Equipment Regulations (PER)

[27] Pressure Equipment Directive (PED).

### 2.2.2 Informative

[28] Australian pipeline valve Valve body materials (www.australianpipelinevalve.com.au)

[29] 240-84979413 Maintenance and Repair of High Temperature and High Pressure Valves and Fittings

[30] 240-87733094 Procurement of High Pressure Pipework Material Standard in the Generation Division

[31] API 598 Valve inspection and testing

[32] BS EN 10028 Flat products made of steels for pressure purposes: Non-Alloy and alloy steels with specified elevated temperature properties. Part 2.

[33] ASME II part D Materials.

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## 2.3 DEFINITIONS

| Definition | Description |
|---|---|
| Approved Inspection Authority | Authorised inspection authority as per SANS 10227/SANS 347 or a person accredited internationally according to IAF or ILAC |
| Foundry/Mill | The Foundry can be the same entity as the manufacturer, if the billet, i.e. base material was produced and final machined or reworked to standard of the shelf items.<br>In the event that a billet is supplied by this entity to another entity for processes such as forging, then the Foundry is not the manufacturer |
| Manufacturer | The entity where the final product is manufactured, or forged etc. |
| Supplier | The Entity which submits a tender to Eskom for valves, and/or fittings as listed in pipe schedule tables, from his own stock. The supplier can be the same as Manufacturer if the manufacturer tenders directly |
| Forging | Manufacturing process involving the shaping of metal using localized compressive forces. The blows are delivered with a hammer (often a power hammer) or a die. Forging is often classified according to the temperature at which it is performed: cold forging (a type of cold working), warm forging, or hot forging (a type of hot working). |
| Casting | Manufacturing process in which a liquid material is usually poured into a mould, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solidified part is also known as a casting, which is ejected or broken out of the mould to complete the process. Casting materials are usually metals or various cold setting materials that cure after mixing two or more components together; examples are epoxy, concrete, plaster and clay. |
| DN, NB or NPS | Alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters DN or NPS followed by a dimensionless number<br>indirectly related to the physical size of the bore or outside diameter of the end connections |
| PN or Class | Alphanumeric designation for pressure-temperature rating that is common for components used in a piping<br>system, used for reference purposes, comprising the letters “PN or Class” followed by a dimensionless<br>number indirectly related to the pressure retaining capability as a function of temperature of the component |
| Certificate of Manufacture | An authenticated or authorized document certifying that the goods ordered have been produced by the manufacture, and are being held for the account and risk of the buyer. |
| Notified body | Is an organisation designated by an EU country to assess the conformity of certain products before being placed in the market. |

### 2.3.1 Disclosure Classification

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

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## 2.4 ABBREVIATIONS

| Abbreviation | Explanation |
|---|---|
| AIA | Approved Inspection Authority |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| BS | British Standard |
| Cr | Chromium |
| DN | Diameter nominal |
| EN | Euro Norm |
| EU | European Union |
| HP | High Pressure |
| HT | High Temperature |
| MPa | Mega Pascal |
| MRP | Material Resources Planning |
| NRV | Non return valve |
| PED | Pressure Equipment Directive |
| PER | Pressure Equipment Regulations |
| PN | Nominal Pressure |
| SANS | South African National Standard |
| WCA/B/C | Fusion Weld Cast Steel grade A/B/C |

## 2.5 ROLES AND RESPONSIBILITIES

a) The Power Station Manager is accountable for the implementation of this standard.

b) The Engineering Manager is responsible for ensuring that the relevant system engineers include the provisions of this standard in all procurement specifications for valves. This includes re-ordering of valves and valve spares via MRP process.

c) The Procurement Manager is responsible for ensuring that the provisions of this standard are adhered to when an order for valves is placed.

d) The Materials Management Manager shall be responsible for ensuring that all delivery conditions are met.

e) The System Engineer shall ensure that all re-order specifications are in accordance to the requirements of this document

## 2.6 PROCESS FOR MONITORING

Not applicable

## 2.7 RELATED/SUPPORTING DOCUMENTS

Not applicable

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# 3. TECHNICAL REQUIREMENTS

## 3.1 MANDATORY REQUIREMENTS APPLICABLE TO THE ESKOM SYSTEM/ PLANT ENGINEER.

As a minimum, the orders for all valves shall include the following details in the technical specification:

1. Manufacturer, but only when the purpose of the order is to replenish stock quantities or for equivalent replacement of existing valves/ valve spares via MRP process.
2. Brand name, but only when the purpose of the order is to replenish stock quantities or for equivalent replacement of existing valves via the Materials Management through MRP processes.
3. Type of valve (e.g. Globe, Gate, etc.)
4. Manufacturers reference/part, figure number but only when the purpose of the order is to replenish stock quantities of existing valves. This is only included when the purpose of the order is to replenish stock quantities or for equivalent replacement of existing valves/ valve spares via the Materials Management through MRP processes.
5. Nominal size (DN, NB or NPS)
6. Face to face length
7. Material of construction for the valve body, valve bonnet and any bolting (Principal pressure containing components)
8. Valve trim materials (sealing arrangement materials).
9. Fluid or medium
10. For replacement control valves the table in appendix A is to be populated.
11. For replacement safety valves, as a minimum, the following information shall be supplied.
    - The set, calibration or lift pressure
    - Design pressure and temperature
    - Material for butt welded safety valves
    - Flow rate
12. Pressure designation/rating shall be defined as the design pressure (MPa) and design temperature (°C) for the specific valve.
13. Body end connection requirements, e.g. (Butt-welded, Threaded end, and Flanged ends). The Butt Weld end connections shall be consistent with the design code requirements in terms of the joint weld preparation angles e.g. BS EN 12516 or BS EN 12627 or BS EN 9692. Valve end connections prepared with burr tool shall not be allowed.
14. Flange drilling details/specification e.g. PCD/number of bolts etc. or the associated flange rating details in accordance to the applicable standard.
15. Dimensions of butt-weld end connections e.g. ID & OD.
16. Auxiliary connections e.g. anti-pressure lock devices, transition pieces, equalizing/bypass hardware details etc.
17. Actuator mounting requirements in accordance to ISO 5210 or ISO 5211.
18. Valve design and manufacturing standard (health and safety standard)
19. Material certification requirements (BS EN 10204: 3.1 or 3.2 Certificate).

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20. The system engineer approves the GA drawing and data sheet of the valve as approval for manufacturing and or shipping from overseas.

The Requestor shall ensure that the above mentioned information accompanies all valves/ valve spares Purchase Requests.

The Procurement Manager shall ensure that the above mentioned information accompanies all valve orders. The Engineering Manager ensures that the information in the Master Electronic Data Capture Forms (DCF) reflects the requirements of the above section.

The System Engineer shall ensure, full compatibility of the ordered valve, with respect to the valve material and piping end connections, to eliminate the requirement of Post Weld Heat Treatment in order to save costs and time to install the valves.

## 3.2 MANDATORY REQUIREMENTS APPLICABLE TO THE SUPPLIER/MANUFACTURER

### 3.2.1 Requirements applicable to documentation

Requirements applicable to document that shall be supplied by the valve supplier/manufacturer – This is applicable to completely assembled valves.

The following documents and data are mandatory deliverables for every order, and must accompany the valve on delivery:

- A GA drawing of each valve.
- Quality documentation such as material certificates, approved quality control plans, heat treatment charts and NDT reports.
- Bolting specification and torque values for all fasteners to be indicated on the GA drawing.
- Basic dimensions and material specification of all bolts and fasteners
- For linear valves, the stroke length of the valve shall be indicated on the GA drawing and data sheet.
- Valve selection and flow characteristic data sheets (Cv vs Stroke) shall be supplied for all control valves.
- Stem, plug/disc, dimensions and stem thread details indicated on the GA drawing.
- Maximum opening, and closing stem thrust load specified on the GA drawing and valve datasheet for power driven valves, and maximum hand wheel rim pull for hand operated valves.
- Maximum opening and closing stem/spindle torque specified on the GA drawing and valve datasheet.
- For quarter turn valves, maximum breakout/seating and dynamic drive torque data specified on the GA drawing and data sheet.
- Torque calculation data sheets for power driven multi-turn valves.
- For power driven valves the actuator mounting attachment shall be compliant to BS EN ISO 5210 or ISO 5211 (Specified on the GA drawing and valve datasheet). This includes valves that are manually driven via a gearbox.
- Allowable Total Indicated Run out (TIR) (mm/metre) of valve stems/spindles longer than 300 mm. (Specified on the GA drawing and valve datasheet).
- Clearance specification between moving and stationary components. (Specified on the valve datasheet).
- Packing type and number of packing rings specified on the GA drawing.

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- Gland packing and Gaskets specifications (Materials of constructions and dimensions). This includes packing and gasket data sheets.
- Maximum packing pre-load stress.
- End connection or flange specification details.
- For flanged valves, the flange specification rating shall be stamped on the flange rim.
- Face to face dimensions and total weight of the valve.
- Critical spares list
- Valve operating and maintenance manual
- Sample refurbishment QCP for completely assembled valves
- Where applicable, safety valve calibration certificates
- Pressure test and leakage rate test certificate.
- PED conformity assessment and declaration by the overseas manufacturer
- Conformity assessment by the South African supplier (importer) in accordance to the PER.

All of the above shall form part of the data book. The data book will be supplied in hard copy and electronic copy format.

### 3.2.2 Order validation and approval

The supplier/manufacturer issues the GA drawing and data sheet of the valve to the Eskom system engineer for validation against the specification and technical requirements before the start of manufacturing and or shipment from overseas.

### 3.2.3 Requirements applicable to documentation

Requirements applicable to documentation that shall be supplied by the valve supplier/ manufacturer – This is applicable to valve spare parts.

The information listed below shall be included in the tender submission for each valve. Failure to supply the information will result in automatic disqualification of the tender.

- Valves spares shall be procured from the original equipment manufacturer, with demonstrable documentary proof.
- Individually supplied valve spares such as valve bodies, bonnets, spindles and trim components shall be supplied with the required material certification as stipulated in section 3.2.3.
- Valve spare parts shall be supplied with a general arrangement drawing
- Where applicable, quality documentation such as material certificates, approved quality control plans, and NDT reports shall be supplied with the spare part.
- Allowable Total Indicated Run out (TIR) (mm/metre) of valve stems/spindles longer than 300 mm, shall be specified on the GA drawing and valve stem.

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### 3.2.4 Requirements applicable to material certification

Material certification shall be in accordance with the latest version of EN 10204: “Types of Inspection Documents” for both EN and ASME materials.

Impact testing of the pressure boundary components (valve body and bonnet) is a standard requirement for all valves supplied in accordance to this specification.

For valves with a (DN/NPS < 100 mm), an EN 10204 3.1 certificate shall be acceptable in all cases.

In the case of valves with a (DN/NPS > 100 mm), the following materials require EN 10204 3.2 certificates:

(a) A182-F22/A217-WC9 / 11CrMo 9-10

(b) A182-F5a/A212-C5 / 12CrMo195

(c) A182-F9/A217-C12 / X12CrMo91

(d) A182-F91/A217-C12A / X10CrMoVnb91

(e) X20CrMoV121

(f) WB36 / 15NiCuMoNb5-6-4

EN 10204 3.1 certification is the minimum requirement for all other grades of steels. For trim materials, EN 10204 3.1 certification shall be acceptable.

### 3.2.5 Requirements applicable to the pressure and seat leakage test

All valves supplied shall undergo a pressure test and seat leakage test. Both these tests shall be in accordance with the applicable international design and construction standard. Safety valves shall be subjected to a calibration test confirming the lifting of the valve seat at the maximum allowable safe working pressure. A pressure test report detailing the following shall be submitted with the handover documentation:

- Person(s) witnessing the test.
- Fluid used for the tests
- Fluid temperature before testing
- Test pressure and the duration at the test
- In the case of safety valves, a calibration certificate clearly showing the lift pressure shall be included

Where a 3.2 certificate is required, an independent AIA/Notified Body shall witness the foregoing tests.

### 3.2.6 Requirements associated with the physical marking of valves

#### a) Valve name plate markings

As a minimum, all valves shall have a name plate, permanently affixed, that indicates the following information:

- Name of manufacturer
- Country of origin
- Year of manufacture
- Manufacturer’s reference number (Figure Number)

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- Serial number
- Design pressure (MPa) as specified by the end user
- Design temperature (°C) as specified by end user
- Design standard (code of construction)
- Maximum pressure rating
- End connection or flange details
- Valve bore size

**b) Valve body markings**

For valve body marking, the requirements of the following standards including any additional requirements as stated in this document shall be followed:

- BS EN19 : Industrial valves – Marking of Metallic Valves
- MSS-SP-25 : Standard Marking system for valves, fittings, flanges and unions
- ASME VIII Division 1, Section UG 129

## 4. CONDITIONS FOR REJECTION OF VALVES AT DELIVERY

Any of the following shall result in the rejection of the supplied item:

a) Certificates that do not meet the requirements of Section 3.2.4 of this document.

b) Inconsistency of the heat/cast number of the supplied component versus that stipulated on the material certificate

c) Any correction made in hand writing on any certificate, either by pen or any other means.

d) Illegible heat or cast number on the supplied components and material certificates.

e) Non permanently marked heat or cast number on the valve body or bonnet

f) Insufficient dimensions on the GA drawings and not conforming to the requirements of section 3.2.1 and 3.2.3 of this document.

g) Any item that is visually damaged.

h) Valves delivered with uncovered ends.

i) Valves where the flange specification is not stamped on the flange rim.

j) Valves delivered without PED conformity assessment and manufacturing declaration.

k) Valves delivered without protection against moisture formation due to high humidity conditions

l) Valves delivered without manufacturing data book

m) Valves delivered without GA drawings indicating all parts associated with the valves and their materials of construction.

n) Valves delivered without maintenance and operating manuals.

o) Valves delivered without sample refurbishment QCP's applicable to completely assembled valves

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## 5. TENDER RETURNABLES FOR THE NATIONAL CONTRACT FOR HP * HT VALVES

The following details on the tender returnables for the national HP & HT valve contract:

(a) Demonstrable proof that the manufacturer and supplier are operating a quality management system entrench with the requirements of EN 764-5 Clause 4.

(b) Population and submission of Tables 1 & 2 Appendix A by Eskom System Engineer, and Tables 3, 4 & 5 Appendix B by the Valve Manufacturer.

(c) A declaration of conformity with respect to the requirements in section 3.2 of this standard

(d) A declaration of conformity to the design and manufacturing requirements of the international standards listed below, based on applicability and range of manufacturing capability:

- EN 12516
- ASME B16.34
- EN ISO 4126
- API 520

## 6. AUTHORISATION

This document has been seen and accepted by:

| Name & Surname | Designation |
|---|---|
| Morris Maroga | Materials, NDT & Welding Study Committee Chairperson |
| Alton Naidoo | Boiler Pressure Parts CoE Principal |
| Nicolaas Hallatt | Turbine Plant Study Committee Chairperson |
| Kisten Gounden | Commodity Sourcing Middle Manager |

## 7. REVISIONS

| Date | Rev. | Compiler | Remarks |
|---|---|---|---|
| 09 November 2016 | 00 | T.S Khumalo | Document due for review |
| 29 November 2016 | 00 | T.K Bolokang | Fourth review |
| 05 December 2016 | 00 | T.S Khumalo | Firth review |
| 05 June 2017 | 0.1 | T.S Khumalo | Sixth review |
| 14 June 2017 | 0.2 | T.S Khumalo | Final Draft Document for Comments Review |
| 09 November 2016 | 00 | T.S Khumalo | Document due for review |
| 07 July 2017 | 1 | T.S Khumalo | Final Document for Authorisation and Publication |
| 08 August 2017 | 1.2 | T.S Khumalo | Final Draft Document for Comments Review |
| 21 September 2017 | 2 | T.S Khumalo | Final Document for Authorisation and Publication Rev 2 |

## 8. DEVELOPMENT TEAM

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

- Kennedy Bolokang : High Pressure piping Engineer (Matla Power Station)
- Sipho Masondo : Valves System Engineer (Majuba Power Station)
- Sibonokuhle Tapala : Senior Metallurgist – RT&D

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- Michael Amir : Senior Consultant - Feed heating and Condensate Plant
- Herman Van Niekerk : Senior Consultant - Feed heating and Condensate Plant
- Devilliers Moll : Senior Welding Engineer – Hendrina, Komati & Arnot.
- Zakhele Bhayi : Senior Metallurgist

## 9. ACKNOWLEDGEMENTS

- Werner Smit
- Teboho Molokwane
- Erick Van Zyl
- Rajendran Padayachee

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# APPENDIX A

## Table 1: Control Valve Specification Sheet

The minimum required data for the procurement of control valves shall be populated by the Eskom system engineer in the table below:

| **Valve description** | | | | |
|---|---|---|---|---|
| **KKS Code** | | | | |
| **Operating point** | **1** | **2** | **3** | **4** |
| **Fluid (medium)** | | | | |
| **Inlet pressure** | | | | |
| **Outlet pressure** | | | | |
| **Differential pressure** | | | | |
| **Inlet temperature** | | | | |
| **Flow rate** | | | | |

## Table 2: Safety Valve Specification Sheet

The minimum required data for the procurement of safety and relief valves shall be populated by the Eskom system engineer in the table below:

| | |
|---|---|
| **Type of safety valve e.g. conventional, pilot operated, controlled, pressure assisted etc.** | |
| **Set, calibration or lift pressure** | |
| **Body design temperature** | |
| **Body design pressure** | |
| **Body material (if known)** | |
| **Discharge flow rate** | |

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# APPENDIX B

## Table 3: Foundry Details

**(This table shall be populated by the valve manufacturer)**

| | Name of Foundry | Country of location | Postal and Street Address | Contact person | Email address | Telephone numbers |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |

## Table 4: Forging Manufacturer's Details

**(This table shall be populated by the valve manufacturer)**

| | Name of Forging manufacturer | Country of location | Postal and Street Address | Contact person | Email address | Telephone numbers |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |

## Table 5: Valve Manufacturer's Details

**(This table shall be populated by the valve manufacturer)**

| | Manufacturer | Sub manufacturer | Country of location | Postal and Street Address | Contact person | Email address | Telephone numbers |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |

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