Eskom	Standard	Technology

Title: **SmartPlant Data Take-On Standard**

Unique Identifier:	**240-107305502**
Alternative Reference Number:	**N/A**
Area of Applicability:	**Plant Engineering**
Documentation Type:	**Standard**
Revision:	**1**
Total Pages:	**14**
Next Review Date:	**March 2017**
Disclosure Classification:	**CONTROLLED DISCLOSURE**

APPROVED FOR AUTHORISATION
☑ TECHNOLOGY ENGINEERING
DOCUMENT CENTRE ☎ X4962

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Date: 04/03/2016	Date: 04/03/2016	Date: 2016/03/04

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Date: 04/03/2016

PCM Reference: **240-46977703 - Manage Technical Data**

SCOT Study Committee Number: **SC09a – Data and Configuration Management**

CONTENTS

TABLES

1. INTRODUCTION

This document has been developed in order to strengthen the management of configuration management components, in preparation for use in an integrated data-centric engineering information management system. The intent of this Standard is to provide clear and specific requirements regarding the data take on for the Plant Design Base into SmartPlant. The Standard thus deals with:

- Documents,
- Drawings,
- Plant Codification,
- 3D models, and
- Data.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 PURPOSE

This document details the requirements for the data capture and delivery of documents, tags, drawings, models and relationship information by contractors for loading into SmartPlant. This will enable Eskom engineers to write project specific Data Take On specification using the information provided herein.

2.1.2 APPLICABILITY

This document shall apply throughout Eskom Group Technology Engineering.

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] 240-86973501 - Engineering Drawing Standard Common Requirements

[2] 240-53113685 - Design Review Procedure

[3] 240-53114026 - Project Engineering Change Management Procedure

[4] 240-58552870 - SmartPlant for Owner Operators (SPO) Documentation Metadata Standard

[5] 240-100457704 - Electronic Storage and Archiving of Technical Documents and Records Standard

[6] 240-54179170 Technical Documentation Classification and Designation Standard

[7] 474-1328 - SPEL Data Take on Procedure

[8] 474-1329 - SPEL Data Exchange Strategy

[9] 240-68604731 - Design Base Standard

[10] 474-10631 - Design Base Specification for Eskom Coal Fired Power Stations

[11] 240-53114186 - Project/Plant Specific Technical Document and Records Management Procedure

2.2.2 INFORMATIVE

[12] IEC 61355 Standard for Technical Document Classification

2.3 DEFINITIONS

Data Take On	The Process of Receiving Data/Models/information from contractors into Eskom Software system
Reference data	Engineering design reference data is standardised data describing the physical attributes of a design elements and components. This data is captured and configured prior to the initiation of engineering design and then referenced during the engineering design process.
Seed file	A **seed file** is essentially a design **file** with the appropriate settings; symbols and standards including appropriate dimensions, units, and origin.
SmartPlant 2D Design Tools	The intelligent design software offering of the SmartPlant Enterprise used for the development of two dimensional designs, specifically SmartPlant Process and Instrumentation Diagrams, SmartPlant Instrumentation and SmartPlant Electrical
SmartPlant design tools	The intelligent design software offering of the SmartPlant Enterprise suite, comprising of software packages such as SmartPlant P&ID, SmartPlant 3D and SmartPlant Instrumentation.
SmartPlant Enterprise	A comprehensive software suite comprising of engineering software solutions specifically targeted at the power generation and petro-chemical industries.
The System	The preferred software solution as identified by this Standard

2.3.1 DISCLOSURE CLASSIFICATION

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

2.4 ABBREVIATIONS

Abbreviation	Description
3D	Three Dimensional
C&I	Control and Instrumentation
CADD	Computer Aided Design and Drawing
EPC	Engineering Procurement and Construction
ILD	Instrument Loop Diagrams
OPC	Off Page Connectors
P&ID	Piping and Instrumentation Diagram
PBS	Plant Breakdown Structure
PDMS	Plant Design Model System
PDS	Plant Design System
PFD	Process Flow Diagrams
S3D	Smart 3D
SPEL	SmartPlant Electrical
SPF	SmartPlant Foundation
SPI	SmartPlant Instrumentation
SPO	SmartPlant Owner Operator

SPP&ID	SmartPlant Piping and Instrumentation Diagram
SPRD	SmartPlant Reference Data

2.5 PROCESS FOR MONITORING

This document will be reviewed and updated annually until the process has been streamlined.

2.6 RELATED/SUPPORTING DOCUMENTS

[1] 240-54179170 - Technical Documentation Classification and Designation Standard

[2] 240-58552870 -SmartPlant for Owner Operators (SPO) Documentation Metadata Standard

[3] 240-71448396 - Project Plant Specific Technical Documentation Registration and Revision Form (DCNPP)

[4] 240-61227631 - Piping and Instrumentation Diagram (P&ID) Standard

[5] 240-60546629 - SmartPlant 3D User Requirement Specification

3. SPO DESIGN INTEGRATION TECHNICAL SPECIFICATION

System integration of data and designs developed in the 2D Design Tools (SmartPlant P&ID, SmartPlant Instrumentation and SmartPlant Electrical) to the plant model is through SPO. Where a system or component represented on a 2D design relates to the same system or component represented in the plant model, the System shall ensure the referential integrity between the two representations and all their attributes.

3.1 CHANGE MANAGEMENT

Any changes and/or additional requirements from the contractor shall be submitted to the Eskom Engineer in the form of a deviation request. A deviation request shall be done using the formal change control process agreed between Eskom and the contractor for the project.

3.2 PLANT KEY PARTS LIST

1) Eskom shall provide the high level Plant Breakdown Structure for projects within existing power plants.
2) The contractor shall ensure that the correct PBS is utilised, including the third level components with its unique codes and description of the P&ID's drawings e.g. motor, component level Plant Tag Code and Descriptions to codify drawings like P&ID's, as well as populating the PBS down to third level components.

Minimum typical tag categories for the project information Handover includes:

1. Equipment and Components (Process and Non Process)
2. Instruments (Process and Non Process)
3. Piping (Process and Non Process) and Piping Components
4. Electrical equipment's
5. Cables
6. Communication equipment's
7. Civil
8. Structural
9. Building/Location/layout

Minimum typical relationships required to be captured for the project information Handover includes:

1. All Document types to Tags
2. Relevant Tags to Buildings
3. Relevant Tags to Purchase Orders
4. Relevant Document types to Vendors
5. Relevant Documents to Purchase Orders
6. Relevant Document to Buildings
7. Relevant Tags to Tags

3.3 TECHNICAL/DESIGN DOCUMENT SUBMISSIONS

In the handover stage the information, which consists of the documents, tags and relationships between document to Tags and documents to Vendor etc. will be submitted along with the original/native electronic format and hard copy documents, the contractor must submit full minimum/mandatory Meta-data describing such documents as specified by Eskom. The control process for submission will be communicated to the contractor.

Eskom will provide the contractor with document/drawing meta-data submission templates on which all meta-data regarding the document or drawing must be completed.

Eskom will discuss requirements and columns to be completed with the contractor upon contract conclusion

Tag upload templates will be provided to contractors electronically to complete and submit to Eskom together with related documents/drawings and must be done in MS-Excel format (NOT PDF). These upload lists provide minimum requirements. Should there be any updates to the Templates; the contractor will be provided with updated templates.

3.3.1 DOCUMENTS

The list of documents referred in [9] and [10] above will be submitted to Eskom. Documents and drawings required at handover to Eskom will be defined on a "per project" basis. As a minimum Standard, a typical document for the project information Handover include (but is not limited to):

1. Drawings (Architectural, Structural, Civil, Mechanical, Electrical, Plot Plans, HVAC, PFD, etc.)
2. P&ID (Piping & Instrumentation Diagrams)
3. PFD (Process Flow Diagrams)
4. Drive & Actuator schedules, Instrument Schedules, Panel Interface Schedules, Alarm Schedules, Cable schedules, Termination Schedules and SPI Bulk Upload Schedules”
5. ILD (Instrument Loop Diagrams)
6. Instrument Specification sheets
7. Calculation Sheets
8. Process Data Sheets
9. Dimensional Data Sheets
10. Equipment Datasheet
11. OEM/Supplier specific Procedures for Operation and Maintenance of plant equipment, systems and components.
12. Isometric drawings
13. Guarantee & Warrantee documents
14. Test Records and Certificates of Compliance (Material, Performance, etc.)

15. Safety Documentation (safety case, safety manual and statutory documents)
16. Operating Procedures/Instructions
17. Maintenance Procedures/Instructions
18. Work Instructions
19. Check Lists
20. Engineering Deliverables (design data not updated to reflect as-built condition)
21. As-Built Deliverables (representing accurate record of the plant)
22. Construction Records
23. Commissioning Records

3.3.2 ESKOM DOCUMENT CLASS STANDARD

1) With implementation of the SPO platform, Eskom has standardised on the use of the Technical Documentation Classification and Designation Standard [6] of which the contractor shall adhere to.
2) All technical and design documents submitted on the project should be classified according to this IEC standard.

3.3.3 GENERAL PLANT DRAWINGS

1) Drawings generated shall confirm to Eskom drawing standard [240-86973501], if not generated from a S3D Model or 2D intelligent design tools (SPP&ID, SPEL and SPI), shall be done in Bentley MicroStation format, using the correct seed files
2) The correct border sheet shall be placed as a cell into the relevant seed file. It is preferred that general drawings (non-intelligent) are not generated in A3 and A4 sizes due to the size of the standard title block. For C&I and Electrical Drawings where this size is regularly used, the alternative "mini" title block shall be used.

3.3.4 QUALITY CONTROL OF DOCUMENT/DRAWING SUBMISSIONS

1) Drawings submitted by the contractor shall be checked for general adherence and conformance to Engineering Drawing Standard Common Requirements [1]
2) To this extent, the Drawing Checklist shall be used.

3.3.5 CORRECT COMPLETION OF THE ESKOM DRAWING TITLE BLOCK

1) The contractor shall not in any way change the standard title blocks designed and configured in the SmartPlant 2D tools (SPP&ID, SPEL and SPI).

4. SMARTPLANT 2D DESIGN INTEGRATION TECHNICAL SPECIFICATIONS

2D Design integration shall allow users to select systems or components defined in the 2D Design Tools and then place them in the plant model, without having to recapture the attributes which may already have been captured in the 2D Design Tools. The System shall allow validation of the plant model against the designs created in the 2D design tools, and shall flag systems or components that are absent from either designs. To assist in the integration of the SmartPlant 2D, the following general requirements will be discussed:

4.1 GENERAL REQUIREMENTS: P&ID DRAWINGS

1) The following, according to IEC 61355 is the minimum MANDATORY content that shall be captured and displayed on P&ID's provided to Eskom:
   a) Function or type of equipment, including drives, conveyors, as well as installed spares
   b) Identification number of equipment including drives, conveyors as well as installed spares (if an item is displayed on the P&ID, it shall have a unique tag number assigned to it)
   c) Characteristic data of equipment
   d) Indication of nominal diameter, pressure rating, material and type of piping
   e) Details of equipment, piping, valves and fittings, thermal insulation
   f) Process measurement and control functions with identification number
   g) Characteristic data of drives
   h) Denomination of flow rates and amounts of energy or energy carriers
   i) Route and direction of flow of energy or energy carriers
   j) Type of essential primary elements and sensors
   k) Essential construction materials for equipment (as an attached spreadsheet)
   l) Elevation of platforms and approximate relative vertical position of equipment (as attached spreadsheet, related to X, Y, Z co-ordinates on the plant 3D Model)
   m) Reference designation for valves and fittings
   n) Denomination of equipment
2) The layout of the P&ID drawing shall be according to the Piping and Instrumentation Diagram (P&ID) Standard 240-61227631.
3) Other General Requirements
   a) Actuator motors, electrical drives, etc. shall be indicated on the P&ID with its third level TAG code indicated on the P&ID. The same applies to Instrumentation.
   b) Instrumentation shall clearly specify the instrument type required in the functional position, e.g. LAHH (Level Alarm indication required, High-High trigger). Instrument type bubbles shall be indicated as contained in the ANSI/ISA-5.1-2009 standard and shall thus implicitly include the prescribed indication for protection and safety instrumentation used in the plant.
   c) Valve Classification shall be as per Tags Identification for Power Plants.
4) Pipe (pipeline) classifications shall be done according to the fluid code requirements (configured in SPP&ID). The piping schedule produced from the P&ID shall contain the allocated fluid code allocation in the spreadsheet that is submitted.
5) Impulse piping and components in the pipeline shall also be shown on P&ID's and shall be coded according to the Tag rule-set.
6) Delimiters shall be applied as described in the VGB TAG Standard, where specific inclusions and exclusions are specified.
7) Control and Instrumentation and Electrical Supply/Control/Protection loops should by default not be shown on the P&ID – only the triggering instrument in the process. The drawing must include the basic instruments indicating the control logic. The contractor might also be required to show some of the more complex cascade control loops on the P&ID, but the details related to cable numbers, junction boxes and terminal strips will be indicated in software applications like SmartPlant Instrumentation (SPI) or SmartPlant Electrical (SPEL).
8) All P&ID items shall be codified and no implied components will be allowed. In cases where item codification is not indicated in order to reduce P&ID clutter, a separate sheet with the respective item codification must be supplied. A sample PDF of a plant P&ID will be provided. This will

provide a good example of how the title of a Drawing should be made up and displayed in the Eskom title blocks.

9) "Typical" P&ID's (I.e. P&ID's stating "For Units 1 – 6) is not allowed. P&ID drawing submissions shall thus be done for each Unit, System and Sub-system uniquely. Detail Design P&ID's shall have the FULL tag number (thus including the unit number) indicated on the P&ID for each component or plant item depicted on the P&ID.
10) Primary flow must be shown from left to right on all P&ID drawings wherever possible and practical.
11) Drains must be routed to the bottom of the drawings and grouped together wherever possible. Alternatively the drains must be routed to the horizontal midline of the drawing for items on the top half of the drawing and to the bottom of the drawing for items in the bottom half of the drawing.
12) All items must have a tag label assigned and the label must be placed in close proximity of the item on the P&ID.
13) An item must be indicated on the P&ID only once. Representation of the same item on other/multiple P&ID drawings is not allowed.
14) Off Page Connectors (OPC).
    a) The user must indicate and have the correct drawing number of the connecting drawing prior to placing the OPC's, specifically if SPP&ID is used.
    b) OPC's for all process, utility, ducting and instrumentation lines must be shown entering the P&ID horizontally starting 5mm from left inside borderline and exiting 5mm horizontally from the right side borderlines
    c) OPC's shall not be placed in the body of the drawing.
    d) OPC's shall enter or leave the drawing in a vertical plain.
    e) All OPC's must be routed to the left or right edge of the title block.

4.1.1 P&ID DRAWINGS USING SMARTPLANT P&ID

15) P&ID drawings shall be generated on A0 format only, using the correct A0 Border template (cell) as specified in Piping and Instrumentation Diagram (P&ID) Standard 240-61227631.
16) The seed file of SmartPlant P&ID module (SPP&ID) has also been configured with this A0 border. The SPP&ID Seedfile will be provided. The contractor may not make any changes to this seedfile without approval by the Eskom.
17) Only the approved Eskom P&ID symbols may be used on the P&ID's.
18) Should the contractor identify P&ID symbols that are required, but not contained in Eskom Symbol library, the relevant change Request shall be submitted to the Engineer, with a clear description (pictorial as well as functional) of the symbol required, process function it is required for. It is strongly preferred that the contractor utilise SmartPlant SPP&ID to create intelligent P&ID's, using the Eskom SPP&ID seedfile.
19) Where SPP&ID is used to generate the P&ID's, the relevant key process design information shall be captured in the relevant attribute fields in the SPP&ID package and published into SPF once the drawing is approved.
20) The "GRID", "ID" and "DRAWING NO" is populated from the SPP&ID system for OPCs

4.1.2 P&ID DRAWINGS USING OTHER SOFTWARE

1) If the contractor does not use SPP&ID, the P&IDs shall be generated in (.dgn) format, using the provided seed files as well as the Eskom P&ID Symbol Library. In such cases, the contractor shall be required to capture all the specified minimum content (as specified by the IEC 61355 standard) on the P&ID drawing. In addition to this, the contractor shall provide fully detailed spreadsheets with attributes as defined in

a) Equipment Schedules/Lists
b) Valve Schedules/Lists
c) Piping Schedules/Lists
d) Instrument Schedules/Lists
e) Load Schedules/Lists (e.g. Electrical Motors)
f) These spreadsheets shall contain full details of the design information (as required as minimum MANDATORY content in IEC 61355). All the items listed shall also have their "TO" and "FROM" relationships indicated on the spreadsheet. (e.g. Pipe A comes from Pump A and feeds to Heater B, indicated by the relevant codification number allocated).

2) Details represented by other design applications should not be duplicated on P&ID's. The Instrumentation loop diagram details or equipment data sheet information shall not be reproduced onto the P&ID. The contractor must however include enough information to provide clear plant process intent.
3) If SPP&ID is not used, the Grid reference shall refer to the *OPC entry point location on the connecting drawing* using the border grids (A-R vertical drawing plane and 1-23 horizontal drawing plane) on the referenced drawing. Similarly, if SPP&ID is not used, the "Drawing No" shall refer to the Eskom allocated drawing number of the referenced drawing number.

4.2 GENERAL REQUIREMENTS - CONTROL & INSTRUMENTATION DRAWINGS

4.2.1 CONTROL & INSTRUMENTATION DRAWINGS USING SPI

1) Drawings generated in SPI (SmartPlant Instrumentation) shall use the seedfile provided by Eskom for this purpose
2) Drawings generated from SPI shall be done in either A3 or A4 format. The relevant correct border template for SPI shall be applied when generating/creating the drawings.
3) The A4 template and A3 template will be made available to the contractor. The contractor works on the same version of SPI as Eskom when generating the outputs.
4) The contractor may not make any changes to the Eskom SPI seedfile without approval by the Engineer.

4.2.2 CONTROL & INSTRUMENTATION DRAWINGS USING OTHER SOFTWARE

1) If the contractor does not use SPI, the Control & Instrumentation deliverables shall be generated in Bentley MicroStation (.dgn) format, using the MicroStation provided seed files as well as the Eskom Standard Symbol Library for MicroStation. . In such cases, the contractor shall be required to capture all the specified minimum content.
2) In addition to this, the contractor shall provide fully detailed spreadsheets as per 3.3 as minimum (in MSExcel 2007 or later version) in adherence to the Eskom requirements.

4.3 GENERAL REQUIREMENTS - ELECTRICAL DRAWINGS

1) The contractor shall provide electrical information as specified in the latest revision of the SPEL Data Take on Procedure (474-1328).
2) Electrical information exchange shall be done according to the SPEL Data Exchange Strategy (474-1329)

4.3.1 ELECTRICAL DRAWINGS USING SPEL

1) Drawings generated in SPEL (SmartPlant Electrical) shall use the seedfile provided by Eskom for this purpose

2) Drawings generated from SPEL shall be done in either A3 or A4 format. The relevant correct border template for SPEL shall be applied when generating/creating the drawings. These border templates shall be provided by Eskom.

3) The A4 template and the A3 template can be made available on request. It is preferred that the contractor work on the same version as Eskom SPEL when generating the outputs.

4) If the contractor utilised SPEL, Electrical information exchange shall be done according to the SPEL Data Exchange Strategy (474-1329)

4.3.2 ELECTRICAL DRAWINGS USING OTHER SOFTWARE

1) If the contractor does not use SPEL, the electrical deliverables shall be generated in Bentley MicroStation (.dgn) format, using the MicroStation provided seed files as well as the Eskom Electrical Symbol Library for MicroStation. In such cases, the contractor shall be required to capture all the specified minimum content. In addition to this, the contractor shall provide fully detailed spreadsheets (in MSExcel 2007 or later version) in adherence to the Eskom Standard. All the items listed shall also have their “TO” and “FROM” relationships indicated on the spreadsheet.

2) In addition to this, the contractor shall provide fully detailed spreadsheets as per 3.3 as minimum (in MSExcel 2007 or later version) in adherence to the Eskom requirements.

5. SMARTPLANT 3D DESIGN INTEGRATION WITH OTHER 3D DESIGN TOOLS

5.1 OVERVIEW

SmartPlant 3D is data-centric and rule based system designed to be used in a heterogeneous design environment on the execution of either a greenfield project when multiple EPC companies work in parallel on the same project using different design tools; or when new design (modification) work is done as a brownfield project in an existing plant (and where old 3D models can exist in a different data format than SmartPlant 3D).

5.2 PREFERRED METHOD OF 3D MODEL DELIVERY

The preferred model is a SmartPlant 3D (S3D) Model. The System shall allow the plant model or models of the plant systems to be exported to an industry standard 3D format. This is necessary to support analysis or detailing work which cannot be performed in the System. The System shall export basic metadata captured in the plant model, such as the weight of model components, in a system standard format with the 3D export to allow these attributes to be used in external tools.

5.3 THIRD PARTY 3D MODEL SPECIFICATIONS

The SmartPlant Reference 3D functionality facilitates the attachment of external 3D data as part of a reference model. Such external data might have been published from another Smart 3D model or form a third party model. The data from external models is expected as a set of graphic and data files.

Various file types from different sources can be converted using the Convert to ZVF utility which is bundled with SmartPlant 3D.

Supported formats are listed in Table 1 which summarises the application and the required delivered format for the model and related data.

Table 1: Model delivered format

If a third party is using this application		They deliver this format	
Company	**3D Application**	**3D Graphic File**	**Object Properties (Extension)**
Intergraph	PDS, Frame Works Plus SmartPlant 3D Alias piping data, SP Spoolgen	dri, dgn vue idf, pcf, pod	drv, tag drv, tag drv, tag
AVEVA	PDMS	rvm	att, drv
Autodesk	AutoCAD	dwg, dxf	drv
Bentley	MicroStation j MicroStation V7 & V8 MicroStation XM AutoPlant PlantSpace	dgn, prp, dtm	drv
ICAS	CADWorx Equipment CADWorx Plant CADWorx Plant Professional	dwg	drv

5.4 RECEIVING DATA FROM CONTRACTORS

The WGS84/L027 World Coordinate Reference System shall be used by Eskom projects unless a specific coordinate system is defined by that project. This will enable the model to be attached to SmartPlant 3D without any transformation. The model shall be submitted in phases, preferably at the end of each month as well as end of each design phase and these models shall be consolidated on SmartPlant 3D.

The contractor supplying the 3D model shall facilitate the transfer of the 3D model to Eskom system. The supplied model shall be colour coded according to SANS 10140-3. The model shall be supplied making use of Metric measuring system and the units of measure shall be set to millimetre (mm).

5.5 STRUCTURE AND IDENTIFICATION

All plant items shall be KKS/AKZ/RDS/trigram coded to the equipment level .Where specific components need to be located on the models and drawings component level KKS/AKZ/RDS/trigram is required. The model shall be structure according to Eskom Plant Breakdown Structure (PBS).

- Tags for all Electrical/C&I/Mechanical equipment in their scope of design, Item number and name, dimensions, material etc.
- Coordinates for all tags in x / y / z format
- Servitudes including tags, descriptions, and locations.
- A list of required attributes submitted from suppliers.

User defined custom created fields containing Meta data information

5.6 TECHNICAL DOCUMENTATION

The following information/lists/reports shall be submitted with the 3D Model:

- Piping specification manual
- Piping Design Manual

- Design information
- Reference Data Workbooks for Piping specifications

5.7 MODEL SIZE CONTROL

Sizes of files to be submitted will be according to model size acceptable by Eskom and must be controlled for easy exchange. Models shall be submitted with simple geometry indicating only the outer envelope, to facilitate space management, and external interfaces (nozzles, electrical connections, fixing details).

6. AUTHORISATION

This document has been seen and accepted by:

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7. REVISIONS

Date	Rev.	Compiler	Remarks
February 2016	0.1	Godwin Fuhnwi	Updated draft document
March 2016	1	Godwin Fuhnwi	Final Document for Authorisation and Publication

8. DEVELOPMENT TEAM

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