

	TECHNICAL REQUIREMENT SPECIFICATION	NUCLEAR ENGINEERING
---	--	----------------------------

Title: **Technical Requirement
Specification for Replacement
Penetration I&C Terminals - mod
16001**

Document Identifier: **240-161645104**

Alternative Reference Number: **END-926**

Area of Applicability: **Nuclear Engineering**

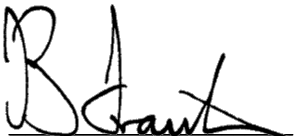
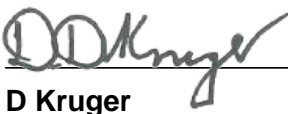

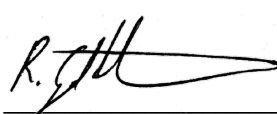
Functional Area: **Engineering**

Revision: **1**

Total Pages: **34**

Next Review Date: **NOT APPLICABLE**

Disclosure Classification: **Controlled Disclosure**

Compiled by	Reviewed by	Functional Responsibility	Authorised by
			
B Trautmann Snr Engineer	D Kruger Snr Engineer	N Mtoko NTP Manager	R Goldstein Manager Design Engineering
Date: 2021-05-13	Date: 2021-05-13	Date: 2021-05-14	Date: 2021/05/20

Nuclear Additional Classification Information

Business Level: **3**

Working Document: **3**

Importance Classification: **Critical Safety Related (CSR)**

NNR Approval: **No**

Safety Committee Approval: **No**

ALARA Review: **No**

Functional Control Area: **Design Engineering**

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

Content

	Page
1. Introduction.....	5
2. Supporting Clauses	5
2.1 Scope	5
2.2 Normative/Informative References	6
2.3 Definitions	8
2.4 Abbreviations	9
2.5 Roles and Responsibilities	9
2.6 Process for Monitoring.....	9
2.7 Related/Supporting Documents.....	9
3. Existing Design.....	10
4. Problems with the Existing Design.....	10
5. Design Change Requirements.....	11
5.1 Normal Environmental Conditions	11
5.2 Accident Environmental Conditions	11
5.3 Classification	11
5.4 Chemical Characteristics of Process Fluid(s)	11
5.5 General Requirements	12
5.6 Equipment Qualification Requirements.....	12
6. Quality Assurance and Inspection Requirements.....	13
6.1 Quality Assurance Program.....	13
6.2 Inspections	14
6.3 Non-conformances	14
7. Site Work Requirements.....	15
7.1 Spares and Special Tools.....	15
7.2 Rigging Requirements.....	15
7.3 Installation Requirements	15
7.4 Inspection and Testing Requirements	15
8. Commissioning and Performance Testing	16
8.1 Commissioning.....	16
9. Documentation	17
9.1 General	17
9.2 Detailed Final Design	17
9.3 Calculations, Reports, Models, Drawings, etc.....	17
9.4 Operating and Maintenance Manual Requirements.....	18
9.5 Testing and Commissioning Plan	18
10. Plant Computer Interface (KIT) Requirements	18

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

11. Human Factors	18
11.1 Design for safety	18
12. Acceptance.....	18
13. Revisions.....	18
14. Development Team	19
15. Acknowledgements	19
Appendix A : Detailed Requirements Matrix	20
Appendix B : DETAILED SCOPE	29

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

1. Introduction

This technical requirement specification (TRS) describes the client requirements in respect of modification number 16001. It is intended to describe the functional and technical requirements for the design, supply of material, delivery, removal and disposal of existing, installation, testing and commissioning of the plant change.

2. Supporting Clauses

2.1 Scope

The scope of supply for modification 16001 comprises of the following:

- A detailed design document according to 331-86 [16] populated in the latest detailed design template available from Design Engineering,
- Supply of material,
- Delivery to Koeberg Nuclear Power Station,
- Removal of existing equipment,
- Installation of new equipment,
- Testing and verification of the modified system,
- Disposal of removed material,
- All documents and document updates as required by this specification,
- Qualification Documentation (environmental qualification test reports and seismic qualification test reports),
- Providing support for regulatory approval (resolution of regulator review comments),
- Complete Quality Assurance Document Package (QADP), including the manufacturing QADP.

The scope of supply does not include the following (*Employer* supply):

- For work performed in the controlled zone, Eskom will be responsible to provide rigging equipment, scaffolding and tools as available from the NAB tool store,
- The *Employer* will make available the plant in accordance with the outage schedule,
- The *Employer* will make available the plant for inspection walk downs in a suitable outage preceding the implementation outage,
- The *Employer* will allow access to the Koeberg main documentation centre for access and retrieval of documentation for the purposes of the scope s defined in this TRS,
- NNR licensing activities.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

2.1.1 Purpose

The purpose of this document is to provide technical requirements for modification 16001 at Koeberg Nuclear Power Station.

2.1.2 Applicability

This document shall apply to Koeberg Nuclear Power Station.

2.1.3 Effective date

This document is effective from the Authorisation date.

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

{Regulatory}

- [1] OHS Act Occupational Health and Safety Act No. 85 of 1993
- [2] NNR NIL-01 Var 19 Nuclear Installation Licence 01 Variation 19
- [3] RG-0027 Interim Guide For Ageing Management and LTO (Section 6)

{Quality}

- [4] ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications
- [5] ISO 9001 Quality Management Systems
- [6] NNR RD-0034 Quality and Safety Management Requirements for Nuclear Installations

{Electrical}

- [7] IEEE 317 Standard for Electric Penetration Assemblies in Containment structures for Nuclear Power Generating Stations
- [8] IEEE 323 Standard for Qualifying class 1E equipment for Nuclear Power Generating Stations
- [9] IEEE 344 Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
- [10] SANS 10142-1 Wiring of Premises. Part 1: Low voltage installations

2.2.2 Informative

{Koeberg – General}

- [11] 36-943 Drawing Standard
- [12] 238-102 Nuclear Safety Level 2 Supplier Quality Management Requirements

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

- [13] 240-89294359 Nuclear Safety, Seismic, Environmental, Quality, Importance and Management System Level Classification Standard (KSA-010)
- [14] 240-127002040 Procurement Quality Engineering Requirements (KSA-089)
- [15] 240-86973501 Engineering Drawing Standard – Common Requirements
- [16] 331-86 Design Changes to Plant, Plant Structures or Operating Parameters (KAA-815)
- [17] 331-93 Guide for Classification of Plant Components, Structures and Parts (KGA-003)
- [18] 331-94 Importance Category Classification Listing (KLA-001)
- [19] 331-170 Requirements for Protective Coatings for use at KNPS (KSA-106)
- [20] 331-172 Standard for Repair / Replacement of Installed Mechanical Components (KSA-031)
- [21] 331-186 Equipment Qualification Programme
- [22] 331-496 Equipment Qualification File Template (New Equipment And Existing Equipment)
- [23] KAA-501 Project Management Process for KNPS Modifications
- [24] KAA-648 Administration and Responsibilities for Requalification Testing
- [25] KAA-709 Process for Performing Safety Evaluations, Screenings, and Safety Justifications
- [26] KAA-751 The Control of Chemical Products at KNPS
- [27] KBA0901G00256 Nuclear Island Room Identification
- [28] KFA-006 Testing Procedure For Plant Modifications
- [29] KGA-025 Screening And Safety Evaluation Guide
- [30] KLA-023 Outage Preparation Milestone Checklist
- [31] KSA-011 Requirements for Controlled Documents
- [32] KSA-132 Lifting and Rigging Program
- {Koeberg – Project Specific}
- [33] 331-433, rev. 2 Detailed Design review report (KFU-026).
- [34] EPP DSE System Manual – Airlocks and Penetrations (includes EZP)
- [35] GGG-1299 Guide for Technical Writing
- [36] KBA0000G001000 Z2 Koeberg Nuclear Power Station Graphic Symbol
- [37] KBA0022E021004 Electrical Penetration Lists
- [38] KBA1215H03102 Technical Specification MV and LV Penetrations
- [39] KBA1215H03120 Electrical Penetrations
- [40] KWM-EM-EPP-002 Electrical Penetrations Replacement
- [41] KWM-IC-EPP-U01 Partial Calibration of EPP Pressure Gauges
- [42] KWR-TP-EPP-005 Checking The Leakage Rate of Containment Electrical Penetrations
- [43] MM306, 545 Maintenance Manuals for Auxitrol Penetrations
- [44] Mod 02253 Modification “Improved Containment Electrical Penetrations”
- [45] SOW Scope of Works for Modification 16001

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

[46] SAR II-11.3.3 Containment Electrical Penetrations

2.3 Definitions

2.3.1 Contractor: service provider, consultant or supplier that has been deemed successful (via a tender process) to provide the required service.

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

2.3.3 Public domain: published in any public forum without constraints (either enforced by law, or discretionary).

2.3.4 Requirement: A condition or capability needed by a user to solve a problem or achieve an objective.

2.3.5 Scope of Supply: The sum of the products, services, and results to be provided as a project.

2.3.6 Shall, should, may: "Shall" is used to denote a requirement, "should" a recommendation and "may" to denote permission.

2.3.7 Trigramme: System identification scheme consisting of three alpha characters, used to identify plant systems, and, in conjunction with a number and a Bigramme, used to construct the Functional Location of plant components.

2.3.8 Acceptance: The *Employer's* use of this word on the *Contractors* documentation (including drawings, procedures, schedules, and so on) means that the *Employer* has observed no deviation from the requirements of this specification. The *Employer's* acceptance does not relieve the *Contractor* of its obligation to adhere to all the requirements of this specification and all applicable laws and regulations. The *Employer's* acceptance shall not relieve the *Contractor* of any responsibility for sufficiency, accuracy, or quality of workmanship.

2.3.9 Accepted with Comments: Indicates that changes or clarifications are required to the document in order to satisfy the requirements of this specification or the quality expectations of the *Employer*. The Contractor is expected to incorporate the *Employer's* comments and resubmit the document to the *Employer* for acceptance prior to implementation unless specifically identified by the *Employer* as approved with comments, fabrication can proceed. The *Employer's* acceptance to proceed with fabrication does not relieve the *Contractor* of its obligation to adhere to all the requirements of this specification and all applicable laws and regulations. The *Employer's* acceptance to proceed with fabrication shall not relieve the *Contractor* of any responsibility for sufficiency, accuracy, or quality of workmanship.

2.3.10 Not Accepted: Indicates that the document as submitted does not satisfy the requirements of this specification or the quality expectations of the *Employer*. The *Employer* shall provide a reason (not necessarily specific comments) for not accepting the document. If the

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

Employer requires the document, the document shall be revised and resubmitted for acceptance. The document cannot be used for fabrication until it has been dispositioned by the *Employer* as accepted or accepted with comments,

2.4 Abbreviations

Abbreviation	Explanation
AR	Availability Related
CSR	Critical Safety Related
DSE	System Description Manual (Dossier du Système Élémentaire)
EQ	Equipment Qualification
EPA	Electrical Penetration Assembly
EQR	Employer's Quality Representative
EZP	System Trigramme for the containment electrical penetrations system
FAT	Factory Acceptance Test
KNPS	Koeberg Nuclear Power Station
MM	Maintenance Manual
NDA	Non-Disclosure Agreement
NNR	National Nuclear Regulator
OCC	Outage Control Centre
OE	Operating Experience
OEM	Original Equipment Manufacturer
QA	Quality Assurance
QADP	Quality Assurance Data Package
QC	Quality Control
QCP	Quality Control Plan
SR	Safety Related
SWP	Site Work Package
TRS	Technical Requirement Specification

2.5 Roles and Responsibilities

Not applicable.

2.6 Process for Monitoring

Not applicable.

2.7 Related/Supporting Documents

Related and supporting documents necessary for the interpretation of these technical requirements are listed in Section 2.2. The Eskom documents listed can be supplied on request, possibly after the signing of a Non-Disclosure Agreement (NDA).

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

3. Existing Design

At Koeberg, the containment electrical penetration assemblies (EPAs) for I&C circuits were manufactured by Auxitrol. Each EPA has feedthroughs which are sealed inside pressurised canisters, thus creating a mechanical containment seal. Each feedthrough comprises a bundle of conductors suitable to the application, Voltage and Current requirements. Each conductor wire is insulated with a coating of Kapton.

The conductor ends are terminated on terminal block arrangements on the inside and outside of containment. These terminal block arrangements are housed in sealed Terminal Boxes.

All the electrical penetrations are Class 1E classified and are used for both 1E and non-1E signals.

Outside containment: All the terminal blocks are AIR-LB. They are 'quick connect' style terminal blocks and the wire ends have insulated crimped lugs which are pushed onto a male spade on the terminal block. This style of connection is also referred to as 'FASTON' and is extensively used at Koeberg in numerous Class 1E applications.

Inside containment: Weidmuller (SAK 4) terminal blocks are installed for class 1E instrumentation signals. These are 'screw clamp' style terminal blocks and the wire ends are secured by means of screws. These SAK 4 terminal blocks are qualified in accordance with IEEE-323-1974.

4. Problems with the Existing Design

Simulated LOCA and Steam Line Break (SLB) tests on the SAK 4 terminals revealed high leakage current values (reduced insulation resistance) at typical I&C voltages, i.e. transmitter circuits, RTDs and control circuits. Refer to the SOW [33] §1.2 for additional information. The original environmental qualification testing of these terminals blocks did not adequately quantify the additional leakage current under accident conditions.

Consequently, penetration terminals, specifically in penetrations 513, 515 (Train A), and 529, 533 (Train B) that carry accident-qualified I&C signals, are not adequately qualified for accident conditions. The table below lists the instruments which require a qualification upgrade:

Feed-through	Instrument signals requiring modification								
513-A	RCP030MT	RCP033MT	RCP031MT	RCP034MT	RCP005MP	RCP011MN	RCP039MP		
513-B	ETY101MP	ARE058MN	ARE059MN	ARE060MN	RCP028MT	ETY201MP	RCP025MD	RCP040MD	RCP052MD
515-A	RCP060MT	RCP057MT	RCP058MT	RCP013MP	RCP007MN	RCP061MT			
515-B	ETY103MP	RCP027MD	RCP042MD	RCP054MD	RIS027MP	RIS021MN	RIS028MP	RIS022MN	RIS029MP
515-C	ARE052MN	ARE053MN	ARE054MN	VVP004MD	VVP005MD	VVP006MD	RCP055MT	RCP152MM	RCP153MM
529-A	RCP045MT	RCP048MT	RCP046MT	RCP049MT	RCP006MP	RCP008MN	RCP026MD		
529-B	ETY102MP	ETY202MP	RCP041MD	RCP053MD	RIS024MP	RIS018MN	RIS025MP	RIS019MN	RIS026MP
529-C	ARE055MN	ARE056MN	ARE057MN	RCP043MT	RCP252MM				
533-A	RCP037MP	ARE010MN	ARE020MN	ARE030MN	VVP001MD	VVP002MD	VVP003MD	ETY104MP	

Appendix B includes a detailed wire-by-wire listing of the scope of penetration modification.

Although the Kapton-insulated feedthroughs in the penetrations are qualified to perform the required safety functions under ageing and harsh environment conditions, the Kapton insulation is likely to be damaged during the replacement of the terminal blocks, as it brittles with age.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

The feedthroughs for accident-qualified signals must therefore be replaced with PEEK-insulated feedthroughs.

NB: Inadequate Accident Qualification of these penetration components is the only design deficiency. There is no deficiency in the design function.

5. Design Change Requirements

A detailed requirements matrix containing all technical requirements associated with the design change is provided in Appendix A. Supporting information is provided in the sections below.

5.1 Normal Environmental Conditions

Working pressure	:	approximately atmospheric	[DSE]
Working temperature	:	45°C (max)	[EVR]
Radiation	:	25 - 1000 µSv/h (Yellow)	[KBA0901G001004]
Humidity	:	60% - 80%	

5.2 Accident Environmental Conditions

Working pressure	:	500 KPa (abs)	[SAR II 4.2.2]
Working temperature	:	140°C	[SAR II-1.9.2.4.8]
Radiation	:	> 10000 µSv/h	
Humidity	:	100%	

5.3 Classification

5.3.1 Component classification

Components	Classification number	Safety Class	Seismic Class	Environmental Class	Quality Level	Importance Class
1/2 EPP *** TW	0201/87Q	1E	1A	3	Q1	CSR

5.3.2 Service classification

Services	Classification number	Quality Level	Importance Class	RD-0034 Level
Design service	0004/09Q	Q1	CSR	L2*

*Note: Q1/CSR usually indicates RD-0034 Level1. However, this modification entails replacement of parts, by standard catalogue parts from the OEM, which are entirely contained within qualified components. In addition, the replacement activity is in accordance with existing Eskom procedures listed in this specification.

5.4 Chemical Characteristics of Process Fluid(s)

The feedthrough canisters are pressurised to 250 kPa (g) with Nitrogen.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

5.5 General Requirements

- 5.5.1** The *Contractor* shall provide a detailed design document, in accordance with the requirements of 331-86 [16], on the prescribed *Employer* template. The design document must describe the design, supply, installation, testing and commissioning aspects of the modified systems.
- 5.5.2** The *Contractor* shall ensure that all design interfaces such as mechanical, electrical and I&C connections are fully compatible with the existing plant and systems in use. Deviations shall be reported and presented to the *Employer* for acceptance.
- 5.5.3** The design shall comply with all references stated in this specification. The latest authorised revisions at the time of *Contract* award shall be used.
- 5.5.4** The equipment and components specified herein shall conform in all respects with applicable International and National laws and regulations.
- 5.5.5** As a minimum, the equipment and components specified herein shall be designed and manufactured in accordance with the edition and addenda of the codes, standards, and regulations identified in section 2.2 of this specification. The *Contractor* shall not adopt code interpretations, or exceptions to requirements listed in the referenced standards unless authorized by the *Employer*.
- 5.5.6** The requirements of this specification shall take precedence if they are more stringent than the requirements specified in the codes, standards, and regulations.
- 5.5.7** In order to simplify spares holding and staff training requirements, any equipment installed should as far as possible be similar to existing equipment.

5.6 Equipment Qualification Requirements

- 5.6.1** Equipment shall be qualified in accordance with IEEE 323 [8], IEEE 344 [9] and KBA1215H03102 [38].
- 5.6.2** In any case where the OEM does not supply the replacement feedthroughs, the feedthroughs shall comply with IEEE 317 [7].
- 5.6.3** The Equipment Qualification File Template, 331-496 [22] shall be completed, including Qualified Life, and any required inspections and maintenance to maintain such Qualified Life.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

6. Quality Assurance and Inspection Requirements

6.1 Quality Assurance Program

- 6.1.1** The *Contractor* shall be qualified in accordance with the requirements of 238-102 [12] to perform Level 2/Q1 work in accordance with classifications contained in section 5.3.
- 6.1.2** The *Contractor*, and its subcontractors, shall have a Quality Management System that conforms to the applicable requirements of ISO 9001:2015 [5].
- 6.1.3** The *Contractor* shall identify, in purchase documents to subcontractors, all applicable quality and QA requirements imposed by the *Employer's* specification on the *Contractor* and shall ensure compliance thereto.
- 6.1.4** The *Contractor* shall provide Quality Control Plans (QCP's) as well as Inspection and Test Plans (ITP's) to the Employer for review and acceptance for various phases of all works carried out prior to commencement of the works. The *Employer* reserves the right to add hold and witness points.
- 6.1.5** The *Employer* Quality Control (QC) representative and the *Contractor* shall review these QCP's/ITP's jointly and the actual scope of quality control and inspection required for the *Contract* agreed upon.
- 6.1.6** The *Contractor* shall submit an updated copy of the QCP's and ITP's.
- 6.1.7** At least one of the *Contractor* engineering personnel required to sign as Compiler, Reviewer and Approver of documents and drawings, for the required processes in KAA-501 [23] and 331-86 [16], shall be a registered professional engineer or equivalent, as approved by the *Employer* in accordance with ECSA guidelines.
- 6.1.8** The *Contractor* is hereby informed that any work product arising from this specification may be submitted to the National Nuclear Regulator or other regulatory bodies as required by South African laws and regulations
- 6.1.9** *Contractor* personnel performing the design and installation work shall be qualified by means of formal technical qualifications and have sufficient experience with work of similar nature.
- 6.1.10** All test certificates and documentation shall be in English, using SI units.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

6.2 Inspections

- 6.2.1** The *Employer* shall have the right to establish inspection and hold points for which the *Contractor* shall give advance notification. In addition, the *Employer* can establish temporary notification points to ensure resolution of temporary quality problems.
- 6.2.2** Mandatory hold points are considered to be those tests, inspections, and operations which require witnessing by the *Employer's* Quality Representative (EQR) and beyond which operations shall not proceed without written consent of the *Employer*.
- 6.2.3** Witness points are critical steps in manufacturing and testing where the *Contractor* and subcontractors are required to notify the *Employer* in advance of the activity so it can be witnessed. The *Contractor* and subcontractors can proceed with work past the activity if the EQR is not available at the designated time.

6.3 Non-conformances

- 6.3.1** No deviation or departure from any requirement of this specification is acceptable without written approval from the *Employer*.
- 6.3.2** The *Contractor* shall promptly document and notify the *Employer* of all non-conformances from the specification and proposed remedial actions.
- 6.3.3** Non-conformance shall be identified as correctable or uncorrectable. Uncorrectable non-conformances are considered to be conditions that cannot be corrected within the specification requirements by rework or replacement.
- 6.3.4** Requests for deviations from codes and standards are not permitted.
- 6.3.5** The non-conformance register and all closed non-conformances, inclusive of all engineering work, justifications, corrective actions history and *Contractor* and *Employer* approvals, shall be part of the End of Manufacturing report.
- 6.3.6** All subcontractor non-conformances shall be reported, addressed and managed as stated above.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

7. Site Work Requirements

7.1 Spares and Special Tools

7.1.1 The *Contractor* shall ensure that special tools suitable for replacing and testing Auxitrol feedthroughs are available.

7.1.2 Tools shall be calibrated as applicable (for example crimping tools).

7.2 Rigging Requirements

7.2.1 All rigging and lifting operations shall be in accordance with and comply with requirements listed in the *Employer* Lifting and Rigging Programme KSA-132 [32].

7.2.2 The Rigging File must be submitted to the *Employer* for review and approval before any rigging and lifting activities commence.

7.3 Installation Requirements

7.3.1 Installation shall only occur in accordance with the outage plan, permit to work and suitable plant conditions (reactor defueled).

7.3.2 Particular note shall be made of the Train being worked on, Train A (513 and 515) or Train B (529 and 533) penetrations, due to potential risk to other circuits on the Train.

7.3.3 The mechanical seal shall be ensured and checked as part of the installation process of each PEEK-insulated feedthrough.

7.3.4 The wire routing, unbundling and new labelling for each new feedthrough shall match the layout and neatness of the original installation.

7.4 Inspection and Testing Requirements

7.4.1 Prior to the performance of any test, the *Contractor* shall submit copies of the test procedures to the *Employer* for review and approval. Testing shall not commence until the Contractor has received a copy of the procedure that has been approved by the *Employer* and all of the Employer's comments have been incorporated.

7.4.2 All instrumentation and equipment used for the performance of any test shall be calibrated. Furthermore, the instrumentation shall be of the appropriate range and shall be certified to have the accuracy required by the procedure. The calibration and accuracy shall be marked on the instrument, and full documentation shall be available for review.

7.4.3 All pressure gauges used for testing must have a calibration certificate. Gauge calibration certification validity is a period of maximum 6 months. Gauges to be calibrated by approved SANAS laboratory, or equivalent if abroad.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

7.4.4 Material test certification and reports as specified in this specification shall be included as part of the End of Manufacture report.

7.4.5 Testing with the instrument loops isolated shall include insulation testing and wire to wire verification according to drawings and for low impedance continuity.

8. Commissioning and Performance Testing

8.1 Commissioning

8.1.1 It is the *Contractor's* responsibility to perform the commissioning in accordance with the agreed commissioning procedures in the design document and conform to this specification.

8.1.2 The *Contractor*, with the assistance of the *Employer's* commissioning team, is responsible for commissioning.

8.1.3 It is the *Contractor's* responsibility, with the assistance and input from the *Employer's* commissioning team, to establish project commissioning policies and plans which cover:

- a) Development and approval of commissioning programs and procedures.
- b) Safety assurance and statutory requirements.
- c) The coordination of the *Contractor's* commissioning interfaces with the *Employer's* existing commissioning programs and procedures.
- d) The scheduling and monitoring of commissioning activities.
- e) The availability of personnel, plant, material and equipment resources.
- f) Conduct inspections necessary for the issue of a completion certificate.
- g) Ensure that Defects are timely rectified.

8.1.4 After the testing done under 7.4.5, commissioning shall include basic functional verification of each instrument loop. A suggested method is to tie all loops in a feedthrough to zero potential except for the loop under test. Correct operation at a single point (preferably full scale) would be adequate to verify the loop.

8.1.5 Commissioning shall be completed while easy access to containment is still possible.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

9. Documentation

9.1 General

9.1.1 Drawings submitted to the *Employer* by the *Contractor* shall fulfil the *Employer* standard drawing practice as per 240-86973501 [15].

9.1.2 All symbols shall be used as specified in reference KBA0000G001000 [36].

9.2 Detailed Final Design

9.2.1 The *Contractor* shall provide the *Employer* with a detailed design document according to the requirements of 331-86 [16] that includes all information relating to the design, supply, installation, testing and commissioning of the modified system as required in this specification.

9.2.2 It is the *Employer's* preference to concur with the scheme design (Part A) before work commences on the installation and procurement specifications (Parts B and C). This is done to ensure agreement is reached, between the *Contractor* and the *Employer* and other stakeholders, on important technical design and manufacturing aspects and to facilitate approval of the final and complete deliverable.

9.2.3 The *Contractor's* Detailed Design shall contain all the requirements as stated in the *Employer's* Detailed Design review report 331-433 (KFU-026) [33].

9.2.4 The detailed design shall be presented to the *Employer's* Design Engineering (SDE) Group at Koeberg. The *Employer* shall review all design and technical documents completed by the *Contractor* for acceptance and thus also reserves the right to forward any such documents to third party reviewers as part of the *Employer's* internal procedures.

9.2.5 The final design and design documents will be issued for acceptance review by the *Employer*. Only after all review comments have been successfully resolved and the document updated will the document be accepted and signed by the *Employer*.

9.2.6 The *Contractor* will be informed by the *Employer* when the final design is accepted.

9.3 Calculations, Reports, Models, Drawings, etc.

9.3.1 The *Employer* shall have complete and unrestricted ownership right to all calculations, technical reports, models, drawings, design documents, (except computer codes that constitute a pre-existing program or method and are designated as proprietary to the *Contractor*), procedures and other written information developed solely for the *Employer* by the *Contractor* in the course of its performance under the contract.

9.3.2 A complete set of post installation "as built" drawings shall be provided as part of the Quality Assurance Data Package (QADP).

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

9.4 Operating and Maintenance Manual Requirements

9.4.1 Maintenance Manuals as listed in section 2.2 shall be updated (marked up) to reflect changes made by this modification. Such markups shall be supplied with the detailed design.

9.4.2 The maintenance manual shall include a spares list and maintenance programs.

9.5 Testing and Commissioning Plan

9.5.1 As part of the detailed design, the *Contractor* shall provide to the *Employer* for acceptance a post-installation testing and commissioning plan in accordance with KFA-006 [28] and KAA-648 [24].

10. Plant Computer Interface (KIT) Requirements

N/A

11. Human Factors

11.1 Design for safety

As this is an equipment replacement modification, the design shall ensure that the configuration, such as layout and numbering, remain as close as possible to the original, in order to prevent error traps.

12. Acceptance

This document has been seen and accepted by:

Name	Designation
Zia Mia	Senior Engineer, Containment Leak Rate Testing Programme Engineer
Kabelo Moroka	Senior Engineer – Materials Reliability Group

13. Revisions

Date	Rev.	Compiler	Remarks
May 2021	1	B Trautmann	Original.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

14. Development Team

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

- None.

15. Acknowledgements

- Kabelo Moroka, for supply of critical information and guidance.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

Appendix A: Detailed Requirements Matrix

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commis sioning	Certificates Required (QA Requirement)	Record of Change
0.0	General Requirements								
0.1	The scope of supply as described in Section 2.1 shall be provided in accordance with the processes prescribed by references [23] and [16].			KAA-501 331-86					
0.2	The modification shall comply with all references stated in Section 2.2. The latest authorised revisions at the time of contract award shall be used								
0.3	The Modification 02253 designed and implemented the same accident qualification upgrade (§4) to 7 instrument channels. The methodology and material are a useful guide for this modification. Note however, that unlike 16001, 02253 was for non-1E signals.			Mod 02253 [44]					
0.4	An important departure from Modification 02253 is that this modification shall not move signals to different feedthroughs or terminal numbers. Instead, all feedthroughs used by the signals in the scope of this modification shall be upgraded to PEEK-insulated, and have their terminals on the containment side crimped. Refer to Appendix B.			Mod 02253 [44]					
0.5	The primary objective of these requirements is to remedy the deficient accident qualification of the I&C penetrations as listed in §4. Therefore all physical changes are limited to the internals of the existing penetrations including their terminal boxes.								
1.0	Design Requirements								
1.1	Mechanical considerations								
1.1.1	Mechanical requirements relate only to installation and testing, in order to ensure the integrity of the containment boundary.			The primary function of the electrical penetrations is to maintain containment integrity, while carrying power and signals across the containment boundary.					

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **21 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commis sioning	Certificates Required (QA Requirement)	Record of Change
1.2	Electrical considerations								
1.2.1		Power supplies to I&C circuits shall be isolated prior to work on the associated penetration.			Standard work practises.				
1.2.2		Insulation resistance and earth resistance shall be tested according to applicable Eskom procedure.			KWM-EM-EPP-002 [40]				
1.3	I&C considerations								
1.3.1		Wiring to and from the penetrations shall remain unchanged, including termination and wire numbering corresponding to particular sensors and signals.							
1.3.2		The penetration wiring associated with those instruments listed in §4 shall be crimped inside containment, in place of the SAK 4 terminals.							
1.3.3		The crimped terminals shall be insulated and protected by K1-qualified Raychem Tubing.							

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **22 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
1.4	Seismic considerations								
1.4.1		The seismic qualification of the penetrations shall remain intact.			IEEE 344 [9]				
1.4.1.1			Procurement of components shall include suitable seismic requirements.		IEEE 344 [9]				
1.4.1.2			Installation, mounting, fastening and wiring practises shall maintain the seismic qualification.		Auxitrol Spec.			COC	
1.5	Material selection								
1.5.1		The materials chosen shall be compatible with the equipment classification. The design shall consider using the materials used for modification 02253, if suitable.		Design 02253 [44]					
1.5.2		The replacement feedthroughs and associated mechanical parts shall be from the same OEM (Auxitrol) or the OEMs successor and shall be designated replacement parts to suit the existing canisters							
1.5.3		Protective coating shall comply with reference [19]		331-170					
2.0	Procurement Requirements								
2.1	RD-0034 level of suppliers: Suppliers of goods and services shall conform (or be assessed to conform if required) to the relevant RD-0034 level as indicated in Section 5.3.								
2.2	Procurement shall be in accordance with a Procurement Specification. The existing OEM specification could be used as a basis, but would need modification to include new requirements such as the PEEK insulation.								
2.2.1		The Procurement Specification shall include a requirement that the procured equipment, when installed on plant, shall not diminish the 1E/K1 qualification of the existing installation. Such an assurance shall be included into the equipment QADP.							

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **23 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
2.3	Obsolescence considerations								
2.3.1		A recommended spare parts listing shall be provided, suitable for a life of at least 20 years of normal operation							
3.0	Manufacturing Requirements								
3.1	The equipment to be manufactured are all standard catalogue items. However, QADPs are to be provided, documenting the Quality Assurance processes applied during manufacture of the components procured for this <i>Contract</i> .								
4.0	Transport Requirements								
4.1	Equipment shall be under the supervision and insurance of the <i>Contractor</i> during all stages of packaging and shipping of the equipment								
4.2	No shipment of equipment shall take place without an associated factory release authorised by Eskom or its appointed representative								
4.3	The <i>Contractor</i> shall ensure that the manufacturer's recommendations regarding shipping and packaging are adhered to..								
5.0	Storage Requirements								
5.1	The storage location on site shall be determined prior to Eskom Receipt Inspection.								
5.2	The <i>Contractor</i> shall advise Eskom of any special provisions regarding storage								
6.0	Installation Requirements								
6.1	Implementation shall occur during each of a unit 1 and a unit 2 refuelling outage.								
6.1.1		Work shall only proceed on equipment belonging to one train at a time. This shall be coordinated with the OCC.							
6.1.2		Feedthroughs shall only be replaced during periods when containment conditions are such that the 8m airlock is open.							

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **24 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
6.1.3		Standard OEM procedures and/or Eskom procedures shall be used to remove and replace feedthroughs and to test for seal integrity.			Auxitrol Spec. KWM-EM-EPP-002 [40] KWM-IC-EPP-U01 [41] KWR-TP-EPP-005 [42]				
6.2	Marking and identification								
6.2.1		There shall be no change in wire and terminal numbering.							
7.0	Interface Requirements								
7.1	Instrument loops associated with the feedthroughs being worked on shall be powered down and preferably isolated.								
8.0	Testing and Commissioning Requirements								
8.1	The <i>Contractor</i> shall produce a full testing and re-qualification procedure								
8.2	The installation on the plant shall be comprehensively tested. As an example, the system shall be tested as follows:								
8.2.1		Static Testing							
8.2.1.1		Per feedthrough:	Insulation and continuity testing on all new feedthrough wires.		KWM-EM-EPP-002 [40]				

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **25 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
8.2.1.2		Per Penetration:	Perform the calibration KWM-IC-EPP-U01 [41]. Perform the in-service inspection of the penetration leak rate KWR-TP-EPP-005 [42]	CLRTPRM SRSM and OTS	KWM-IC-EPP-U01 KWR-TP-EPP-005				
8.2.1.3			Instrument loop checks shall be performed to a sufficient degree to validate the work done.						
8.2.2		Dynamic Testing							
8.2.2.1			None.						
8.3	All OEM prescribed test prior to first start-up shall form part of the testing plan prescribed in 8.1								
8.4	The <i>Contractor</i> shall provide a start-up checklist to be used prior to putting the equipment into operation								
8.5	The <i>Contractor</i> shall provide factory and site acceptance testing procedures for review and acceptance by Eskom								
8.6	All persons performing testing and inspections shall be appropriately qualified and authorised according to the provisions of 10.0, as well as the following specific requirements: SAT: Personnel involved to be submitted to Eskom for acceptance.								
9.0	Disposal Requirements								
9.1	Removed equipment can potentially be contaminated								
9.1.1		Equipment shall be decontaminated, resulting in conventional waste.		KSA-048					
9.1.2		Conventional waste shall be recycled where possible.		KAE-012					

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **26 of 34**

10.0	Documentation Requirements								
10.1	The <i>Contractor</i> may review all existing information related to the modification in possession of the Employer at its documentation centre								
10.2	The <i>Employer</i> will not deliver or supply the information to any <i>Contractor</i> . The <i>Employer</i> will provide the necessary access to the <i>Contractor</i> to said information. Documentation clerks will be made available to assist with information retrieval								
Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
10.3	All existing drawings and documentation that will be affected by this project will be updated as part of the documentation for this project.								
10.4	Quality Assurance Documentation	The following, as a minimum, shall be submitted as part of a comprehensive Quality Assurance Data Package:							
10.4.1			Manufacturing & Test Records						
10.4.2			Supplier's Certificates of Conformance						
10.4.3			Supplier's Inspection & Test Certificates						
10.4.4			Equipment Qualification Test Reports						
10.4.5			Inspection Release Reports						
10.4.6			Completed FATs & SATs shall form part of the QADP						
10.4.7			Bill of Material, Suppliers and Serial Numbers of Installed Items						
10.4.8			Overhaul Procedures and Specifications						
10.4.9			Test Procedures and Specifications						
10.4.10			Shipping and storage Records						

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **27 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
10.4.11			Recommended Spares List						
10.4.12			Detailed Manufacturing Drawings						
10.4.13			Commissioning-related documentation						
10.5	All documentation shall be provided to Eskom in searchable PDF electronic format								
10.6	The documents & drawings shall be in English and technical parameters shall be in SI units								
10.7	Technical documentation shall be compiled in accordance with GGG-1299 [35]			GGG-1299					
10.8	Provide all drawings in either the native MicroStation file or the Drawing Interchange File (.DXF) format								
10.9	All final drawings and documents shall be in ISO size paper and format								
10.10	Eskom shall provide the Contractor with a sequence of KBA drawing numbers that shall be used on any new drawings								
10.11	Drawings submitted to Eskom by the <i>Contractor</i> shall fulfil the Eskom standard drawing practice as per reference [15], [11].								
10.12	All mark-ups of existing KNPS documents / drawings shall use the latest revision available in the documentation centre at the time of submission to Koeberg.								
10.13	All tabular data shall be submitted in Microsoft Excel (.XLSX) format								
11.0	Environmental Requirements								
	None								
12.0	Regulatory Requirements								
12.1	The following documents shall be compiled and submitted by the <i>Contractor</i> to enable Eskom to submit the design package to the NNR for implementation approval:			NNR NIL-01 [2] KAA-501 [23]					
12.1.1		Safety Review							
12.1.2		Risk Impact Analysis							
12.1.3		Implementation Safety Case							

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

**Technical Requirement Specification for
Replacement Penetration I&C Terminals - mod 16001**

Unique Identifier: **240-161645104**

Revision: **1**

Page: **28 of 34**

Reference	Requirement (Level 1)	Requirement (Level 2)	Requirement (Level 3)	Justification Source	Codes and Standards	Verification and Testing (Design & Plant)	Commissioning	Certificates Required (QA Requirement)	Record of Change
12.1.4		Commissioning Requirements Document							12.1.4
12.1.5		Configuration Management Document							12.1.5
12.1.6		Independent Design Review Report							12.1.6
13.0	Training Requirements								
13.1	None								
14.0	Maintenance Requirements								
14.1	The <i>Contractor</i> shall provide Eskom with a list of spare parts required to perform preventative maintenance on the new equipment. This list will include relevant OEM part numbers for procurement purposes								
15	Safety Requirements								
15.1	Nuclear Safety								
15.1.1		A safety screening and/or evaluation performed in accordance with reference KAA709 [25] and KGA-025 [29] will be required for this modification.							
15.2	Conventional Safety								
15.2.1		The modification shall not introduce additional risks to personnel or plant integrity							
16	Project Management Requirements								
16.1	The management of this project shall be in accordance with KAA-501 [23] and 331-86 [16]								

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

Appendix B: DETAILED SCOPE

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
513	RCP030MT	RCP M300	1GN	513-A	01	RCP M301	1GN
513	RCP030MT	RCP M300	1RD	513-A	02	RCP M301	1RD
513	RCP030MT	RCP M300	1WH	513-A	03	RCP M301	1WH
513	RCP030MT	RCP M300	1PU	513-A	04	RCP M301	1PU
513	RCP030MT	RCP M300	SC	513-A	05	RCP M301	SC
513	RCP033MT	RCP M302	1GN	513-A	06	RCP M303	1GN
513	RCP033MT	RCP M302	1RD	513-A	07	RCP M303	1RD
513	RCP033MT	RCP M302	1WH	513-A	08	RCP M303	1WH
513	RCP033MT	RCP M302	1PU	513-A	09	RCP M303	1PU
513	RCP033MT	RCP M302	SC	513-A	10	RCP M303	SC
513	RCP031MT	RCP M304	1GN	513-A	11	RCP M305	1GN
513	RCP031MT	RCP M304	1RD	513-A	12	RCP M305	1RD
513	RCP031MT	RCP M304	1WH	513-A	13	RCP M305	1WH
513	RCP031MT	RCP M304	1PU	513-A	14	RCP M305	1PU
513	RCP031MT	RCP M304	SC	513-A	15	RCP M305	SC
513	RCP034MT	RCP M306	1GN	513-A	16	RCP M307	1GN
513	RCP034MT	RCP M306	1RD	513-A	17	RCP M307	1RD
513	RCP034MT	RCP M306	1WH	513-A	18	RCP M307	1WH
513	RCP034MT	RCP M306	1PU	513-A	19	RCP M307	1PU
513	RCP034MT	RCP M306	SC	513-A	20	RCP M307	SC
513	RCP005MP	RCP M308	1RD	513-A	21	RCP M309	1RD
513	RCP005MP	RCP M308	1WH	513-A	22	RCP M309	1WH
513	RCP005MP	RCP M308	SC	513-A	23	RCP M309	SC
513	RCP011MN	RCP M310	1RD	513-A	24	RCP M311	1RD
513	RCP011MN	RCP M310	1WH	513-A	25	RCP M311	1WH
513	RCP011MN	RCP M310	SC	513-A	26	RCP M311	SC
513	RCP039MP	RCP M312	1RD	513-A	27	RCP M313	1RD
513	RCP039MP	RCP M312	1WH	513-A	28	RCP M313	1WH
513	RCP039MP	RCP M312	SC	513-A	29	RCP M313	SC
513	SPARE			513-A	30		
513	RCP025MD	RCP M314	1RD	513-B	01	RCP M315	1RD
513	RCP025MD	RCP M314	1WH	513-B	02	RCP M315	1WH
513	RCP025MD	RCP M314	SC	513-B	03	RCP M315	SC
513	RCP040MD	RCP M316	1RD	513-B	04	RCP M317	1RD
513	RCP040MD	RCP M316	1WH	513-B	05	RCP M317	1WH
513	RCP040MD	RCP M316	SC	513-B	06	RCP M317	SC
513	RCP052MD	RCP M318	1RD	513-B	07	RCP M319	1RD
513	RCP052MD	RCP M318	1WH	513-B	08	RCP M319	1WH
513	RCP052MD	RCP M318	SC	513-B	09	RCP M319	SC
513	ETY101MP	ETY M300	1RD	513-B	10	ETY M301	1RD
513	ETY101MP	ETY M300	1WH	513-B	11	ETY M301	1WH
513	ETY101MP	ETY M300	SC	513-B	12	ETY M301	SC
513	ARE058MN	ARE M301	1RD	513-B	13	ARE M302	1RD
513	ARE058MN	ARE M301	1WH	513-B	14	ARE M302	1WH

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
513	ARE058MN	ARE M301	SC	513-B	15	ARE M302	SC
513	ARE059MN	ARE M303	1RD	513-B	16	ARE M304	1RD
513	ARE059MN	ARE M303	1WH	513-B	17	ARE M304	1WH
513	ARE059MN	ARE M303	SC	513-B	18	ARE M304	SC
513	ARE060MN	ARE M305	1RD	513-B	19	ARE M306	1RD
513	ARE060MN	ARE M305	1WH	513-B	20	ARE M306	1WH
513	ARE060MN	ARE M305	SC	513-B	21	ARE M306	SC
513	RCP028MT	RCP M588	1RD	513-B	22	RCP M589	1RD
513	RCP028MT	RCP M588	1WH	513-B	23	RCP M589	1WH
513	RCP028MT	RCP M588	1PU	513-B	24	RCP M589	1PU
513	RCP028MT	RCP M588	SC	513-B	25	RCP M589	SC
513	SPARE			513-B	26		
513	SPARE			513-B	27		
513	ETY201MP	ETY M905	1RD	513-B	28	ETY M903	1RD
513	ETY201MP	ETY M905	1WH	513-B	29	ETY M903	1WH
513	ETY201MP	ETY M905	SC	513-B	30	ETY M903	SC
515	RCP060MT	RCP M338	1GN	515-A	01	RCP M339	1GN
515	RCP060MT	RCP M338	1RD	515-A	02	RCP M339	1RD
515	RCP060MT	RCP M338	1WH	515-A	03	RCP M339	1WH
515	RCP060MT	RCP M338	1PU	515-A	04	RCP M339	1PU
515	RCP060MT	RCP M338	SC	515-A	05	RCP M339	SC
515	RCP057MT	RCP M340	1GN	515-A	06	RCP M341	1GN
515	RCP057MT	RCP M340	1RD	515-A	07	RCP M341	1RD
515	RCP057MT	RCP M340	1WH	515-A	08	RCP M341	1WH
515	RCP057MT	RCP M340	1PU	515-A	09	RCP M341	1PU
515	RCP057MT	RCP M340	SC	515-A	10	RCP M341	SC
515	RCP058MT	RCP M342	1GN	515-A	11	RCP M343	1GN
515	RCP058MT	RCP M342	1RD	515-A	12	RCP M343	1RD
515	RCP058MT	RCP M342	1WH	515-A	13	RCP M343	1WH
515	RCP058MT	RCP M342	1PU	515-A	14	RCP M343	1PU
515	RCP058MT	RCP M342	SC	515-A	15	RCP M343	SC
515	RCP061MT	RCP M344	1GN	515-A	16	RCP M345	1GN
515	RCP061MT	RCP M344	1RD	515-A	17	RCP M345	1RD
515	RCP061MT	RCP M344	1WH	515-A	18	RCP M345	1WH
515	RCP061MT	RCP M344	1PU	515-A	19	RCP M345	1PU
515	RCP061MT	RCP M344	SC	515-A	20	RCP M345	SC
515	RCP013MP	RCP M346	1RD	515-A	21	RCP M347	1RD
515	RCP013MP	RCP M346	1WH	515-A	22	RCP M347	1WH
515	RCP013MP	RCP M346	SC	515-A	23	RCP M347	SC
515	RCP007MN	RCP M348	1RD	515-A	24	RCP M349	1RD
515	RCP007MN	RCP M348	1WH	515-A	25	RCP M349	1WH
515	RCP007MN	RCP M348	SC	515-A	26	RCP M349	SC
515	SPARE			515-A	27		
515	SPARE			515-A	28		
515	SPARE			515-A	29		
515	SPARE			515-A	30		
515	RCP027MD	RCP M350	1RD	515-B	01	RCP M351	1RD

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
515	RCP027MD	RCP M350	1WH	515-B	02	RCP M351	1WH
515	RCP027MD	RCP M350	SC	515-B	03	RCP M351	SC
515	RCP042MD	RCP M352	1RD	515-B	04	RCP M353	1RD
515	RCP042MD	RCP M352	1WH	515-B	05	RCP M353	1WH
515	RCP042MD	RCP M352	SC	515-B	06	RCP M353	SC
515	RCP054MD	RCP M354	1RD	515-B	07	RCP M355	1RD
515	RCP054MD	RCP M354	1WH	515-B	08	RCP M355	1WH
515	RCP054MD	RCP M354	SC	515-B	09	RCP M355	SC
515	RIS027MP	RIS M312	1RD	515-B	10	RIS M313	1RD
515	RIS027MP	RIS M312	1WH	515-B	11	RIS M313	1WH
515	RIS027MP	RIS M312	SC	515-B	12	RIS M313	SC
515	RIS021MN	RIS M314	1RD	515-B	13	RIS M315	1RD
515	RIS021MN	RIS M314	1WH	515-B	14	RIS M315	1WH
515	RIS021MN	RIS M314	SC	515-B	15	RIS M315	SC
515	RIS028MP	RIS M316	1RD	515-B	16	RIS M317	1RD
515	RIS028MP	RIS M316	1WH	515-B	17	RIS M317	1WH
515	RIS028MP	RIS M316	SC	515-B	18	RIS M317	SC
515	RIS022MN	RIS M318	1RD	515-B	19	RIS M319	1RD
515	RIS022MN	RIS M318	1WH	515-B	20	RIS M319	1WH
515	RIS022MN	RIS M318	SC	515-B	21	RIS M319	SC
515	RIS029MP	RIS M320	1RD	515-B	22	RIS M321	1RD
515	RIS029MP	RIS M320	1WH	515-B	23	RIS M321	1WH
515	RIS029MP	RIS M320	SC	515-B	24	RIS M321	SC
515	RIS023MN	RIS M322	1RD	515-B	25	RIS M323	1RD
515	RIS023MN	RIS M322	1WH	515-B	26	RIS M323	1WH
515	RIS023MN	RIS M322	SC	515-B	27	RIS M323	SC
515	ETY103MP	ETY M304	1RD	515-B	28	ETY M316	1RD
515	ETY103MP	ETY M304	1WH	515-B	29	ETY M316	1WH
515	ETY103MP	ETY M304	SC	515-B	30	ETY M316	SC
515	ARE052MN	ARE M313	1RD	515-C	01	ARE M314	1RD
515	ARE052MN	ARE M313	1WH	515-C	02	ARE M314	1WH
515	ARE052MN	ARE M313	SC	515-C	03	ARE M314	SC
515	ARE053MN	ARE M315	1RD	515-C	04	ARE M316	1RD
515	ARE053MN	ARE M315	1WH	515-C	05	ARE M316	1WH
515	ARE053MN	ARE M315	SC	515-C	06	ARE M316	SC
515	ARE054MN	ARE M317	1RD	515-C	07	ARE M318	1RD
515	ARE054MN	ARE M317	1WH	515-C	08	ARE M318	1WH
515	ARE054MN	ARE M317	SC	515-C	09	ARE M318	SC
515	VVP004MD	VVP M303	1RD	515-C	10	VVP M304	1RD
515	VVP004MD	VVP M303	1WH	515-C	11	VVP M304	1WH
515	VVP004MD	VVP M303	SC	515-C	12	VVP M304	SC
515	VVP005MD	VVP M305	1RD	515-C	13	VVP M306	1RD
515	VVP005MD	VVP M305	1WH	515-C	14	VVP M306	1WH
515	VVP005MD	VVP M305	SC	515-C	15	VVP M306	SC
515	VVP006MD	VVP M307	1RD	515-C	16	VVP M308	1RD
515	VVP006MD	VVP M307	1WH	515-C	17	VVP M308	1WH
515	VVP006MD	VVP M307	SC	515-C	18	VVP M308	SC

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
515	RCP055MT	RCP M586	1RD	515-C	19	RCP M587	1RD
515	RCP055MT	RCP M586	1WH	515-C	20	RCP M587	1WH
515	RCP055MT	RCP M586	1PU	515-C	21	RCP M587	1PU
515	RCP055MT	RCP M586	SC	515-C	22	RCP M587	SC
515	RCP152MM	RCP M981	1RD	515-C	23	RCP M983	1RD
515	RCP152MM	RCP M981	1WH	515-C	24	RCP M983	1WH
515	RCP152MM	RCP M981	1PU	515-C	25	RCP M983	1PU
515	RCP152MM	RCP M981	SC	515-C	26	RCP M983	SC
515	RCP153MM	RCP M985	1RD	515-C	27	RCP M987	1RD
515	RCP153MM	RCP M985	1WH	515-C	28	RCP M987	1WH
515	RCP153MM	RCP M985	1PU	515-C	29	RCP M987	1PU
515	RCP153MM	RCP M985	SC	515-C	30	RCP M987	SC
529	RCP045MT	RCP M320	1GN	529-A	01	RCP M321	1GN
529	RCP045MT	RCP M320	1RD	529-A	02	RCP M321	1RD
529	RCP045MT	RCP M320	1WH	529-A	03	RCP M321	1WH
529	RCP045MT	RCP M320	1PU	529-A	04	RCP M321	1PU
529	RCP045MT	RCP M320	SC	529-A	05	RCP M321	SC
529	RCP048MT	RCP M322	1GN	529-A	06	RCP M323	1GN
529	RCP048MT	RCP M322	1RD	529-A	07	RCP M323	1RD
529	RCP048MT	RCP M322	1WH	529-A	08	RCP M323	1WH
529	RCP048MT	RCP M322	1PU	529-A	09	RCP M323	1PU
529	RCP048MT	RCP M322	SC	529-A	10	RCP M323	SC
529	RCP046MT	RCP M324	1GN	529-A	11	RCP M325	1GN
529	RCP046MT	RCP M324	1RD	529-A	12	RCP M325	1RD
529	RCP046MT	RCP M324	1WH	529-A	13	RCP M325	1WH
529	RCP046MT	RCP M324	1PU	529-A	14	RCP M325	1PU
529	RCP046MT	RCP M324	SC	529-A	15	RCP M325	SC
529	RCP049MT	RCP M326	1GN	529-A	16	RCP M327	1GN
529	RCP049MT	RCP M326	1RD	529-A	17	RCP M327	1RD
529	RCP049MT	RCP M326	1WH	529-A	18	RCP M327	1WH
529	RCP049MT	RCP M326	1PU	529-A	19	RCP M327	1PU
529	RCP049MT	RCP M326	SC	529-A	20	RCP M327	SC
529	RCP006MP	RCP M328	1RD	529-A	21	RCP M329	1RD
529	RCP006MP	RCP M328	1WH	529-A	22	RCP M329	1WH
529	RCP006MP	RCP M328	SC	529-A	23	RCP M329	SC
529	RCP008MN	RCP M330	1RD	529-A	24	RCP M331	1RD
529	RCP008MN	RCP M330	1WH	529-A	25	RCP M331	1WH
529	RCP008MN	RCP M330	SC	529-A	26	RCP M331	SC
529	RCP026MD	RCP M332	1RD	529-A	27	RCP M333	1RD
529	RCP026MD	RCP M332	1WH	529-A	28	RCP M333	1WH
529	RCP026MD	RCP M332	SC	529-A	29	RCP M333	SC
529	SPARE			529-A	30		
529	RCP041MD	RCP M334	1RD	529-B	01	RCP M335	1RD
529	RCP041MD	RCP M334	1WH	529-B	02	RCP M335	1WH
529	RCP041MD	RCP M334	SC	529-B	03	RCP M335	SC
529	RCP053MD	RCP M336	1RD	529-B	04	RCP M337	1RD
529	RCP053MD	RCP M336	1WH	529-B	05	RCP M337	1WH

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
529	RCP053MD	RCP M336	SC	529-B	06	RCP M337	SC
529	RIS024MP	RIS M300	1RD	529-B	07	RIS M301	1RD
529	RIS024MP	RIS M300	1WH	529-B	08	RIS M301	1WH
529	RIS024MP	RIS M300	SC	529-B	09	RIS M301	SC
529	RIS018MN	RIS M302	1RD	529-B	10	RIS M303	1RD
529	RIS018MN	RIS M302	1WH	529-B	11	RIS M303	1WH
529	RIS018MN	RIS M302	SC	529-B	12	RIS M303	SC
529	RIS025MP	RIS M304	1RD	529-B	13	RIS M305	1RD
529	RIS025MP	RIS M304	1WH	529-B	14	RIS M305	1WH
529	RIS025MP	RIS M304	SC	529-B	15	RIS M305	SC
529	RIS019MN	RIS M306	1RD	529-B	16	RIS M307	1RD
529	RIS019MN	RIS M306	1WH	529-B	17	RIS M307	1WH
529	RIS019MN	RIS M306	SC	529-B	18	RIS M307	SC
529	RIS026MP	RIS M308	1RD	529-B	19	RIS M309	1RD
529	RIS026MP	RIS M308	1WH	529-B	20	RIS M309	1WH
529	RIS026MP	RIS M308	SC	529-B	21	RIS M309	SC
529	RIS020MN	RIS M310	1RD	529-B	22	RIS M311	1RD
529	RIS020MN	RIS M310	1WH	529-B	23	RIS M311	1WH
529	RIS020MN	RIS M310	SC	529-B	24	RIS M311	SC
529	ETY102MP	ETY M302	1RD	529-B	25	ETY M303	1RD
529	ETY102MP	ETY M302	1WH	529-B	26	ETY M303	1WH
529	ETY102MP	ETY M302	SC	529-B	27	ETY M303	SC
529	ETY202MP	ETY M904	1RD	529-B	28	ETY M902	1RD
529	ETY202MP	ETY M904	1WH	529-B	29	ETY M902	1WH
529	ETY202MP	ETY M904	SC	529-B	30	ETY M902	SC
529	ARE055MN	ARE M307	1RD	529-C	01	ARE M308	1RD
529	ARE055MN	ARE M307	1WH	529-C	02	ARE M308	1WH
529	ARE055MN	ARE M307	SC	529-C	03	ARE M308	SC
529	ARE056MN	ARE M309	1RD	529-C	04	ARE M310	1RD
529	ARE056MN	ARE M309	1WH	529-C	05	ARE M310	1WH
529	ARE056MN	ARE M309	SC	529-C	06	ARE M310	SC
529	ARE057MN	ARE M311	1RD	529-C	07	ARE M312	1RD
529	ARE057MN	ARE M311	1WH	529-C	08	ARE M312	1WH
529	ARE057MN	ARE M311	SC	529-C	09	ARE M312	SC
529	RCP043MT	RCP M590	1RD	529-C	10	RCP M591	1RD
529	RCP043MT	RCP M590	1WH	529-C	11	RCP M591	1WH
529	RCP043MT	RCP M590	1PU	529-C	12	RCP M591	1PU
529	RCP043MT	RCP M590	SC	529-C	13	RCP M591	SC
529	RCP252MM	RCP M982	1RD	529-C	14	RCP M984	1RD
529	RCP252MM		1WH	529-C	15		1WH
529	RCP252MM		1PU	529-C	16		1PU
529	RCP252MM		SC	529-C	17		SC
529	SPARE			529-C	18		
529	SPARE			529-C	19		
529	SPARE			529-C	20		
529	SPARE			529-C	21		
529	SPARE			529-C	22		

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.

PEN No	Trigramme	CABLE INT	CORE4	FEEDTHRU	WIRE	CABLE EXT	CORE6
529	SPARE			529-C	23		
529	SPARE			529-C	24		
529	SPARE			529-C	25		
529	SPARE			529-C	26		
529	SPARE			529-C	27		
529	SPARE			529-C	28		
529	SPARE			529-C	29		
529	SPARE			529-C	30		
533	RCP037MP	RCP M356	1RD	533-A	01	RCP M357	1RD
533	RCP037MP	RCP M356	1WH	533-A	02	RCP M357	1WH
533	RCP037MP	RCP M356	SC	533-A	03	RCP M357	SC
533	ARE010MN	ARE M319	1RD	533-A	04	ARE M320	1RD
533	ARE010MN	ARE M319	1WH	533-A	05	ARE M320	1WH
533	ARE010MN	ARE M319	SC	533-A	06	ARE M320	SC
533	ARE020MN	ARE M321	1RD	533-A	07	ARE M322	1RD
533	ARE020MN	ARE M321	1WH	533-A	08	ARE M322	1WH
533	ARE020MN	ARE M321	SC	533-A	09	ARE M322	SC
533	ARE030MN	ARE M323	1RD	533-A	10	ARE M324	1RD
533	ARE030MN	ARE M323	1WH	533-A	11	ARE M324	1WH
533	ARE030MN	ARE M323	SC	533-A	12	ARE M324	SC
533	VVP001MD	VVP M315	1RD	533-A	13	VVP M316	1RD
533	VVP001MD	VVP M315	1WH	533-A	14	VVP M316	1WH
533	VVP001MD	VVP M315	SC	533-A	15	VVP M316	SC
533	VVP002MD	VVP M317	1RD	533-A	16	VVP M318	1RD
533	VVP002MD	VVP M317	1WH	533-A	17	VVP M318	1WH
533	VVP002MD	VVP M317	SC	533-A	18	VVP M318	SC
533	VVP003MD	VVP M319	1RD	533-A	19	VVP M320	1RD
533	VVP003MD	VVP M319	1WH	533-A	20	VVP M320	1WH
533	VVP003MD	VVP M319	SC	533-A	21	VVP M320	SC
533	ETY104MP	ETY M305	1RD	533-A	22	ETY M317	1RD
533	ETY104MP	ETY M305	1WH	533-A	23	ETY M317	1WH
533	ETY104MP	ETY M305	SC	533-A	24	ETY M317	SC
533	SPARE			533-A	25		
533	SPARE			533-A	26		
533	SPARE			533-A	27		
533	SPARE			533-A	28		
533	SPARE			533-A	29		
533	SPARE			533-A	30		

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd, Reg No 2002/015527/30.