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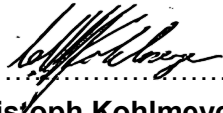
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1. INTRODUCTION

Modern control systems utilise high end processors and controllers to provide the speed, integration and processing power to achieve the required functionality and performance. With the trend to use high-end computer server equipment in today's control systems, it is important to ensure that this equipment is installed and located in the appropriate environment. Due to the critical functional nature of the systems, it is also important to ensure that they are maintained in a secure area, and to prevent uncontrolled access. Various safeguards need to be established, covering both the physical and environmental security aspects. The level of protection provided, should align with the risks to the business from both direct and indirect consequences.

2. SUPPORTING CLAUSES

2.1 SCOPE

The objective of this guideline is to provide a best practice for the determination of the physical and environmental habitat (room or permanent installation location) requirements for control system and related computer equipment at Eskom's power stations. Due to the extremely wide range of technologies and existing environments utilised at the various sites, this guideline tries to capture the more critical issues and requirements that should be considered when specifying and implementing computer equipment.

2.1.1 Purpose

To ensure the appropriate implementation of physical and environmental protection measures to manage the risks of;

- i. Unauthorised access to computer equipment,
- ii. Loss or damage to computer equipment,
- iii. Reduced reliability of computer equipment,
- iv. Loss of data (current and historical)
- v. Financial loss,
- vi. Degradation of quality and integrity of computer equipment used on the plant to complement long term health of the plant,
- vii. To ensure that Eskom is in the position to process any dispute during the guarantee period following take-over of computer equipment.

2.1.2 Applicability

This best practice guideline is applicable to the Generation Divisions. It applies to equipment rooms and all computer-based systems in the Control and Instrumentation discipline, including process automation control, monitoring and HMI systems, historians and information systems, condition monitoring systems, and engineering tools.

The following equipment is excluded from this standard:

- Personal Computers, Servers and Laptops which are used in an office environment, and not dedicated to the control system use. This equipment is subject to Eskom's normal IT standards
- Automation components that are specifically designed to be installed in uncontrolled environments.

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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] 240-56355828 - Management of Control and Instrumentation
- [2] 240-56355731 - Environmental Conditions for Process Control Electronic Equipment Used at Power Stations
- [3] 32-894 - Eskom Server Rooms and Data Centres Standard
- [4] 240-56355808 - Ergonomic Design of Power Station Control Suites Guideline
- [5] 240-56737448 - Fire Detection and Life Safety Design Standard
- [6] 240-54937450 - Fire Protection and Life Safety Design Standard
- [7] 240-103414344 - Summary of Corporate Identity Manual
- [8] SANS 10114-1 - Interior Lighting Part 1: Artificial Lighting of Interiors
- [9] SANS 10114-2 - Interior Lighting Part 2: Emergency Lighting
- [10] SANS 10142-1 - The Wiring of Premises Part 1: Low Voltage Installations
- [11] 240-55410927 - OT Cyber Security Standard
- [12] 240-56364535 - Architectural Design and Green Building Compliance Manual
- [13] 240-56364545 - Structural Design and Engineering Standard

2.2.2 Informative

- [14] Act 49 of 1995 - National Building Regulations and Building Standards
- [15] Act 85 of 1993 - Occupational Health and Safety Act

2.3 DEFINITIONS

2.3.1 Control System Computer Equipment

This is the collective term for all computer hardware components used by the control system, which is based on high-end computing functionality components. This typically includes processing units, server machines, raid memory, DAT tapes etc.

2.3.2 Server Unit

A computer that manages centralized data storage or network communications resources. A server provides and organizes access to these resources for other computers (Clients) linked to it.

2.3.3 Client

Any computer that is hooked up to a computer network that provides the user with access to files and printers as shared resources to a computer network.

2.3.4 Controlled Environment

Environments where the local conditions are subject to external control, to ensure the required physical conditions remain within a required envelope.

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2.3.5 Disclosure Classification

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

2.4 ABBREVIATIONS

Abbreviation	Description
AKZ	Anlagen-Kennzeichnungs-System
BMS	Building Management System
C&I	Control and Instrumentation
CD-ROM	Compact Disc Read Only Memory
CPU	Central Processing Unit
DCS	Distributed Control System
DMZ	Demilitarised Zone
DVD	Digital Versatile Disc
EC&I	Electrical, Control and Instrumentation
EMI	Electro-Magnetic Interference
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
IT	Information Technology
KKS	Kraftwerk-Kennzeichen-System
KVM	Keyboard, Video and Mouse
LAN	Local Area Network
OEM	Original Equipment Manufacturer
OSH	Occupational Safety and Health
OT	Operational Technology (IT Equipment used in Process Control environment)
PA	Public Announcement
SANS	South African National Standard

2.5 ROLES AND RESPONSIBILITIES

The Lead Discipline Engineer shall ensure that this guideline is referenced in all applicable designs.

2.6 PROCESS FOR MONITORING

The document shall be updated in accordance with the Eskom document review process or as business needs change.

2.7 RELATED/SUPPORTING DOCUMENTS

See Normative References.

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3. C&I EQUIPMENT & COMPUTER ROOMS REQUIREMENTS

3.1 METHODOLOGY

3.1.1 General

The approach of this guideline is to identify and address a number of the aspects to be considered in providing the physical and environmental protection required. As each situation will have its own unique requirements and constraints, this guideline will not be definitive, but tries to indicate best practice. The guideline recommends that over and above the Equipment room, the following rooms be considered in designing locations for Control System computer equipment: -

- 1) Server room 1 (can be inside or outside the Equipment Room)
- 2) Server room 2 (for operator workstations, if not housed in Server room 1)
- 3) Engineering room (mostly inside the Equipment room, or near the Central Control room, with medium level of human occupancy)

At all times Control System equipment should be installed in Equipment rooms which are environmentally controlled. Switchgear rooms are used as location only if they also have HVAC.

Where feasible, it is recommended that the guideline requirements be followed. However, if there are external constraints that require alternatives, then it is recommended that a detailed feasibility study be done regarding the particular aspect, and a site specific solution be developed. Where required, existing Eskom standards, policies and statutory requirements shall be followed.

3.1.2 Civil Requirements

3.1.2.1 Structure and location

The structure shall be sized so that it provides sufficient space for all the expected equipment, as well as a 25% additional area capacity. As a minimum, the height from the floor to the ceiling should be >2,5m to accommodate the height of cabinets, lighting, and HVAC ducting distribution. The location of the structure should be in an easily accessible place, and preferably not below ground level. Due consideration should be taken of the surrounding and overhead structures, with specific view to minimising risk of water and dust ingress, mechanical damage, fire, obstruction / limited access etc. Ambient temperatures must also be considered as they will play a role in the HVAC requirements. Where possible, the ambient air shall be clean from dust, moisture, and other contaminants to minimise the burden placed on the HVAC systems. The air intake of HVAC systems shall pass through a filtration system (solids and gases) which can be maintained. The location should also be selected to ensure minimum vibration effects. Space separation should be provided between buildings housing sensitive electronic equipment and potential fire risk from nearby buildings or outdoor fires in vegetation or storage. Where practicable, vehicles should not be parked in close proximity to the building. Furthermore, electronic equipment should not be sited where firefighting could be impeded or where there is a risk of flooding from fire-fighting operations. Considerations should be given to the provision of lightning protection for the building.

3.1.2.2 Walls

The walls shall be of a suitable material to provide the required structural strength. They must have a fire rating of at least 2 hours. Walls should be continuous from the floor to the roof (including false ceilings). The surface of the walls shall be smooth to prevent dust collection. Fire- resisting walls, including any glazing therein, should be fire resisting in terms of both integrity and insulation as per SANS 246

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3.1.2.3 Roof

The roof of the rooms should preferably be concrete, properly sealed against water ingress. If not concrete, a suitable permanent material shall be used. The roof shall form part of the structural integrity of the building. If the roof is exposed to the outside, it shall be slanted to not allow accumulation of water, and proper drainage mechanisms shall be provided to remove any water.

3.1.2.4 Ceiling

If there is a false ceiling, access shall be provided for electrical, HVAC, fire detection etc. The ceiling shall be of a fire-retardant material rated at least 2 hours. The ceiling shall not contribute to dust, fibres or other contaminants within the rooms.

3.1.2.5 Doors

There shall be at least two access locations to the Equipment room for safety. One will be a door for normal use, and this shall also make provision for access to the room for equipment and smaller cabinets. The other door can be an emergency access. There must be a self-closing mechanism on the door, and the doors should be kept locked at all times. Suitable access control to open the doors shall be provided to ensure security (see 3.1.4). For safety, it shall be possible to bypass the access control from inside the room to open the doors in an emergency. The doors must be fire resistant for a minimum of 2 hours. The door finishes must not contribute to dust or other contaminants. There should be limit switches monitoring the position of the main entry doors. The switch should be alarmed as a priority one alarm when the doors are left in the open position for period of approximately less than ten seconds.

3.1.2.6 Windows

It is preferable that there are no windows for the structure of the Equipment room. Should visibility be required from either side, this should be provided by sealed glass panels. The possibility of one-way glass should be considered to ensure privacy. Glass shall be shatterproof or laminated for safety. If glass is installed in the door, it shall only be on the top half, and of minimal size to retain the fire resistance.

However, glazing is recommended for Engineering rooms and Server rooms that are constructed inside the Equipment room.

3.1.2.7 Floor

The floor of the rooms shall be firm and smooth. It shall preferably be of an anti-static or conductive type of material and be easy to clean. If cable access requires a raised floor, it shall be of a load bearing design, with the metallic components properly earthed. The floor panels shall be of a fire resistant material.

3.1.2.8 Entrance

The entrance should have a dust lobby (unless it is already inside a controlled environment like the Equipment room), with sufficient space between the two doors to enable the one to close before the other opens. This will assist in the prevention of dust ingress, as well as assist the HVAC with maintaining positive pressure and minimising changes in temperature. The floor of the entrance should have mats suitable for collection of dirt that might be brought in from the plant. The doors should be auto-closing and have good seals when closed.

3.1.2.9 Sealing

The rooms shall be for all practical purposes sealed air-tight to enable a positive pressure to be maintained within the structure and prevent the possibility of dust ingress. Thus, any penetrations (HVAC

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ducts, Cabling etc.) from the outside must be properly sealed off with appropriate fire retardant material. (Provide at least 2 hours of fire resistance).

3.1.2.10 Water ingress

The rooms shall have no water or any other liquid reticulation within the structure. This includes potable water piping, sewerage drainpipes, fire water piping, etc. There shall not be sprinkler systems installed, due to the risk of damage to the sensitive electronic and computer equipment. The floor level within the room shall be nominally above the outside level, with a lip to ensure no water will run in should there be water outside.

3.1.2.11 Finishes

All finishes within the rooms should be selected according to functionality, durability and ease of maintenance. Wherever possible antistatic finishes should be selected. The use of carpets, textured materials and materials which could give off contaminants should be avoided. Due consideration should be given to Eskom's Summary of Corporate Identity Manual, 240-103414344.

3.1.2.12 Safety

Overall, all aspects of the room shall comply with the OSH Act requirements and all Eskom's relevant safety policies.

3.1.2.13 Access Requirements

Provision shall be made to enable adequate access for delivery and installation of the equipment. If complete cabinets or other such heavy equipment are to be handled, suitable lifting devices/crawl beams etc. shall be provided as permanent installations in the room. Bottom access for cubicles and other bulky items is used in most Equipment rooms using a crawl beam system to pick up items from the ground floor.

The size of the access doors shall be suitable for the largest components without them needing to be tilted.

Suitable locations for cable penetrations to the room from the outside shall be provided, and they shall be properly sealed before operation. Power cabling shall be separated from other cabling. Other penetrations for other services, e.g. HVAC ducting shall be securely sealed before operation.

3.1.3 HVAC

The HVAC system to the server room can be dedicated, be redundant and not be part of other HVAC systems serving rooms normally occupied by people, as the requirements are different. If it is integrated with that of the Equipment room, it be possible to control separately in order to meet different conditions. The electrical supply to the rooms HVAC system should be of an essential nature to ensure its continued operation during loss of normal supply. This can be achieved by having redundant or alternative sources should there be a failure. It is recommended that where multiple generating units are controlled with equipment in a common location, that the HVAC be redundant to prevent Multiple Unit Trip risks.

The HVAC system shall be selected to meet the performance requirements of the room, and all the heat loading within the room, plus a 25% spare capacity. For Equipment and Engineering rooms, the HVAC is designed to also meet the parameters stipulated in section 3.1.3 of document 240-56355731: Environmental Conditions for Process Control Equipment used in Power Stations standard.

For Server rooms more stringent environmental parameters are recommended. The temperature inside the server rooms shall be controlled between 18°C and 22°C, with a recommended setpoint of 20°C to allow for control within stipulated range. The rate of change of temperature shall not exceed 5°C/hour

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over a 5-minute period. The relative humidity shall be controlled between 40% and 50% without condensation. The humidity rate of change shall not be allowed to exceed 6% per hour.

Appropriate monitoring of the HVAC system shall be developed. This includes continuous monitoring of the stipulated environmental aspects, as well as developing the alarm management procedures for each of the rooms. As a minimum, temperature and humidity need to be monitored in the rooms. Alarm values shall be set to 70% relative humidity and 26°C for temperature.

Careful consideration shall be given to the responsibility of the monitoring — either part of the BMS system, or included in the actual DCS. The trended signals shall be made available in the Historian as well for historical event analysis.

3.1.4 Access control/security system

All access to the location shall be actively controlled via an appropriate access control mechanism. This access control system should cater for sufficient individual users, to enable unique access to be controlled per user. No common access should be granted to groups of users. Before receiving access authorisation to the location, each individual shall have the appropriate delegated authorisation. Additionally, Eskom Group Security must be engaged to ensure that the applicable designed architectural components adequately cater for Eskom Group Security requirements.

3.1.4.1 Physical Access

An appropriate locking mechanism shall be utilised on the Access Door to the rooms to ensure no unauthorised access is possible. The locking mechanism shall be physically sturdy and secure enough to withstand manual attempts at entry. The methodology for restricting access shall provide sufficient combinations or alternative attempts, to ensure it cannot be bypassed through repeated attempts in a short time. (e.g. combination lock, pin code etc.). Technologies utilising biometric methods for individual identification could also be used in conjunction with standard locking mechanisms.

3.1.4.2 Logical Access

The access control system shall be able to individually identify every authorised person. No common access codes should be used. If the access control is part of other access control functions on the site, then individual specific zone area authorisation shall be possible, to enable the room to be independently controlled for access. An administrative procedure shall be developed to maintain the access register, and provide for speedy addition and removal of individual access rights. If possible, it would be advantageous to link the user access rights to the room with the user access rights for the equipment in the room, to reduce the need for duplicate physical and logical access.

3.1.4.3 Monitoring Function

The access control system shall monitor all aspects of each entrance and exits to the room, and provide a log of these events. The system shall also monitor for possible "trial and error" attempts, and after some reasonable period, block the opening of the room for a long duration. If possible, this condition should be alarmed to a central appropriate monitoring point.

3.1.4.4 Emergency Access

Under emergency conditions, it shall always be possible to bypass the access control mechanism and open the access doors from the inside of the rooms. These include loss of power, fire, activation of the automatic fire suppression system etc. It should also be possible to open the door from the outside to enable emergency personnel to reach trapped or injured staff.

3.1.4.5 Visual Monitoring

If there is a concern on the security of the equipment located in the room, the possibility of installing video surveillance cameras could be considered. These systems should form part of the comprehensive site security management process.

3.1.5 Room Functionality

The main objective of the Equipment room is to house Control System cubicles. The Engineering Room is mainly for engineering workstations and documentation. The Server room(s) is mainly for the Control System servers and network equipment. Most of the requirements stipulated in this guideline are aimed solely at meeting the equipment's requirements. It is possible that staff might need to spend some time in the rooms to perform short term specific functions. These include installation, system administration, system maintenance, disaster recovery, etc. However, it should not be planned to have any staff permanently based in the rooms.

3.1.5.1 Workstations

It is recommended that a small permanent workstation be provided to enable the staff to comfortably perform their duties within the server room. Due care regarding housekeeping requirements should be taken. Mounting of workstation computers in areas of high human occupancy should be avoided to segregate the two environments. This can be achieved by use of KVM switches.

3.1.5.2 Furniture

Any furniture within the room should be selected according to its functionality. Aspects such as fire risks, cleanliness, Corporate Identity etc. should be considered. The furniture should be dedicated to the location to prevent movement in and out.

3.1.5.3 Information Storage

Due to the computer nature of the server room, it is expected that there will be a requirement to house various data and information storage mechanisms. It must be noted that the room shall not be used as the primary location for long term archival of documentation and data storage, as this should be located at a different premise for security purposes. Only day to day and reference material should be kept in the room.

3.1.5.4 Documentation storage

Any paper documentation located in the engineering room should be kept to a minimum. All documentation shall be neatly organised in files, boxes etc. Appropriate storage facilities (cupboards, shelves, drawers, cabinets etc.) shall be provided, and designed to handle the weight loading. Where possible, the documents should be stored in a fire-proof enclosing, to reduce the risk of providing combustible material.

3.1.5.5 Data Media Storage

Various forms of data media (CD-ROMs, DVDs, Tapes and USB drives) might be required within the location. All media shall be correctly packaged, and neatly organised in appropriate containers. Appropriate storage facilities (cupboards, shelves, drawers, cabinets etc.) shall be provided. Where possible the media should be stored in a fireproof enclosing.

3.1.5.6 LAN

Besides the Control System's own various network requirements, it might be necessary to have a connection to the station business **LAN** in the engineering room. The difference between the various LANs must be clearly distinguished to prevent accidental incorrect use. The interface to the IT Business

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LAN shall happen through a properly design DMZ, as per the Eskom OT Cyber Security Standard 240-55410927.

As best practice, the IT Business LAN is separate and does not share the same infrastructure as the control system LAN. The IT Business LAN can be made available in engineering room if required, but the connection points have to be clearly marked so.

3.1.5.7 Printing

If required, printing facilities for ad-hoc printing could be installed in the engineering room. However, it is not intended to be used for bulk printing and minimum paper storage should be planned. Printers should be located on appropriate furniture.

3.1.6 Fire Protection/Detection

Due to the critical nature of the equipment in the location, it is required that a proper fire detection function be continuously available to monitor the situation and bring any incident to the immediate attention of the responsible department. Whether an active fire suppression/protection system is installed or not must be determined by a detailed risk assessment study.

3.1.6.1 Fire detection

Provision shall be made for an appropriate fire detection method, to ensure valid and timeous detection of a fire within any of the equipment, and the room. This could also include individual cubicle monitoring with sensors mounted at each cubicle in the most appropriate place, as well as monitoring within the room, in cableways, under a raised floor and in the ceiling space etc. All fire detection systems shall be compliant with the relevant SANS specifications. The selection of the fire detection requirements shall be based on a detailed study to ensure the solution, including the location of the sensors, best meets the specific room and equipment requirements. Any alarm shall be linked to a system which is permanently monitored. Regular testing of the fire detection system shall be carried out to ensure its functional availability.

Fire detection is recommended as well under raised floors with cables underneath as well as cable tunnels under the Equipment room.

Lining to walls, partitioning, soffits, ceiling and voids should be made of materials which are of limited combustibility. All penetrations created for the passage of cables, should be fire stopped to maintain the fire and smoke resistance of the room enclosing the electronic equipment.

3.1.6.2 HVAC Requirements

Due to the direct link between the impact of a fire, and the ventilation systems, appropriate cognizance must be given to this during the design of the HVAC systems for the room. If the HVAC is not dedicated to the room, then fire dampers should be installed in the ducting to ensure isolation can be achieved in the event of a fire. These dampers need to be able to activate automatically and be linked to the fire detection system. A similar assessment on functionality of the HVAC system shall be performed if there is an active Fire Suppression system (e.g. CO₂ Gas etc.) installed. Where the interlocking of the fire detection causes the HVAC to be shut-down, appropriate alarms must be provided to ensure that false fire system detectors do not put the computer equipment at risk due to un-controlled ambient conditions. Ventilation duct work or service ducts serving other parts of the building should not pass through an electronic equipment area. If it is not possible to avoid this, the ductwork should be enclosed within a fire-resisting construction

3.1.6.3 Manual Fire Protection

Appropriate local fire protection equipment shall be provided. Adequate fire extinguishers shall be located both inside and external to the Equipment room. The extinguishers must be of the correct type

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and capacity for application on the equipment in the room. The personnel likely to be affected by the fire shall be appropriately trained to use the fire protection on the computer equipment. No fire hoses or sprinkler systems using water should be used. Fire-fighting equipment shall be serviced and inspected according to specifications.

3.1.6.4 Active Fire Protection

A detailed risk assessment shall be carried out to determine if an active fire suppression system shall be installed. The system shall use a suppression agent that is suitable for the equipment in the room, and suitable for human exposure. The design and operation of the system shall be specific to the room and the layout of the computer equipment installed. Appropriate safety aspects such as pre-alarming, alarming, local siren, visible activation, override of the access control system to allow evacuation, links to HVAC etc. shall all be addressed. A site-specific procedure for the control, operating, response and testing of the fire suppression system shall be developed. Appropriate training of the personnel likely to be exposed to the system must be provided. If required, appropriate breathing apparatus shall be provided at the location. All fire-fighting equipment shall be serviced and inspected according to specifications.

3.1.7 Control System and Computer Equipment Housings

The computer equipment shall be housed in mountings that have been designed specifically for the application. They shall be of a suitable quality and construction to adequately protect the equipment under all normal conditions. Wherever possible, the OEM supplier of the computer equipment should provide recommendations for its housing.

3.1.7.1 Control System Cubicles

The design of control system cubicles inside the Equipment room should be designed as per the conditions stipulated in sections 3.2.4 and 3.2.5 of the standard 240-56355731: Environmental Conditions for Process Control Equipment Used at Power Stations. Cubicle doors of natural ventilation shall be kept closed at all times, unless specific work is done on the equipment.

3.1.7.2 Cabinets

The design of the cabinets shall be suitable for the equipment to be installed. Cabinets should be appropriately configured for horizontal or vertical mounting of the equipment. Cognizance shall be taken of the heat dissipation and ventilation requirements of the specific equipment. Cabinets should be designed to operate with the doors closed at all times. Surface finishes shall be smooth to prevent collection of dust. If glass is used in the cabinets, it shall be safety approved. Size, layout, and access (front/rear) aspects shall be considered for the design of the cabinet to enable ease of access for maintenance, repair etc. No direct access shall be possible to any surface with a voltage above 50V. Suitable covers or guards shall be provided, and the voltage rating clearly indicated. Cabinets should ideally be purpose designed and built to house computer equipment, and not just a modified normal C&I cabinet. Due consideration must be given to functional distribution of computer equipment between multiple cabinets. Specific attention should be given to housing redundant servers in separate cabinets.

3.1.7.3 Server racks

Depending on the type of computer equipment supplied, it might be appropriate for dedicated server racks to be provided. These racks must be selected to comply with the hardware requirements. Server racks must be housed in appropriate cabinets (see 3.1.7.2).

3.1.7.4 Specific Environmental Requirements

If the computer equipment requires environmental conditions that cannot be guaranteed within the room, then dedicated environmentally controlled cabinets shall be provided. **Note:** This option is only pursued if

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the room cannot be air conditioned. The cabinet cooling mechanisms shall be self-contained, and designed to ensure no water ingress to the equipment by draining the exhaust water outside of the room and away from the equipment. Diffuse air into rooms away from electronic equipment and not channel cooled air directly into cubicles / cabinets if condensation is envisaged in any mode of operation. They shall provide fire and temperature monitoring, and possibly automatic fire suppression if required. The heat loading of these cabinets shall be catered for by the room HVAC to not unduly affect other equipment. The cabinets shall be maintainable on site. Appropriate monitoring of important ambient and environmental conditions shall be in place, including alarming as necessary.

3.1.7.5 Operator input devices

Appropriate facilities must be provided to enable the user to operate the computer equipment. These facilities shall be appropriately housed and mounted according to sound ergonomic principles. Where possible, items like keyboards, mice, external media storage devices, etc. should be located such that they can be enclosed via some form of housing / drawer during long times of non-use, to reduce dust ingress etc.

3.1.8 Housekeeping

To maintain the integrity and functionality of the rooms, proper housekeeping principals shall be followed on a continuous basis. This includes;

- Keeping the room neat and clean,
- Dedicated smoking and eating rooms
- Regular clean-up of the rooms and removal of refuse/waste paper etc.
- Cleaning of exposed components (keyboards etc.).
- Cleaning personnel shall only use qualified cleaning products and materials. An appropriate design shall not require cleaning more than once a week.
- No stacking of items on tables/cupboards etc.
- Cupboards and cabinets left with doors closed,
- Cabling neatly arranged, and away from walkways, preferably gathered in harnesses. After any work, all cabling to be restored to a neat configuration,
- Any documents required to be easily accessed (e.g. emergency procedures, Disaster Recovery Instructions etc.), to be kept in the room in a proper storage facility,
- Any contact details on signage to be kept up to date,
- Due attention given to, and timeous correction of any defects affecting the room (e.g. light globes, door seals etc.),
- Monitoring of the HVAC plant/cleaning filters/cleaning entrance mat etc.
- Monitoring of the fire systems,
- Annual review of the civil and mechanical aspects/finishes etc.

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3.1.9 Corporate Identity requirements

The overall room concept design, furnishings and finishes shall fully comply with the appropriate Corporate Identity guidelines as per document 240-103414344: Summary of Corporate Identity Manual.

3.1.10 Signage

Provision shall be made to provide visible signage regarding the specific regulations applicable to the location. The signs shall be permanent, clear and easily readable from a distance, and conform to Eskom's applicable corporate signage specifications. These shall include:

- No food and beverages in the room
- No cell phones/radios etc. to be used within the room. If required, this might include the exclusion of site cordless DECT PABX (or similar) handsets as well.
- No liquids (e.g. cleaning materials) to be brought into the room
- Evacuation Plan and procedure
- Emergency contact details/telephone numbers
- Location of Fire-fighting equipment
- Signage required for Automatic Fire Suppression systems
- Emergency Exit signs
- Red Zone and other site-specific restriction signs

3.1.11 Red zoning

Due to the criticality of the function of some of the cubicles and equipment inside the server room, it is recommended that the location these critical systems be formally declared a Red Zone Area (or the equivalent dependant on the BU classification methodology). This will ensure appropriate risk reviews are done, before any activity affecting the location is embarked on. This includes power interruptions, modifications etc.

3.1.12 Power Supply/Reticulation

Due to the criticality of the function of the rooms, a proper power reticulation philosophy should be developed during the design phase. This should take into account the specific power requirements of each item of equipment in the room, as well as the individual criticality of each component in the overall function. This will enable the appropriate power supply redundancy, and back-up duration to be determined and a proper power supply to be provided.

The actual power supply equipment and batteries should not be located in the engineering and server rooms, but can be nearby. The full detailed requirements for power supply and distribution should form part of the engineered design of the control system. If local shut-down UPS' are planned for individual servers, they should be selected according to the capacity and functional requirements, as well as suitability for location in the room. They shall also be monitored for faults, as well as be included in the overall power supply maintenance strategy. Due care should be given to ensure stand-alone UPS' do not degrade the total power supply concept.

3.1.12.1 Lighting

The rooms shall be suitably illuminated, to ensure adequate illumination is available at all locations in the room. Where staff will be operating or maintaining equipment, lighting should be designed according to SANS 10114-1: Interior lighting Part 1, and as a minimum the lighting should provide 630 Lx wherever staff will be working. Emergency lighting within the room shall be provided as per SANS 10114-2: Interior lighting Part 2. The lighting mechanisms and fittings should be selected to ensure they generate minimum electromagnetic interference. Energy efficient lighting and control mechanisms should also be considered.

3.1.13 Earthing

It is critical that the location be provided with a clean earth, properly distributed to all powered components. If practical, the rooms should have a separate clean earth for computer equipment and control system reference voltage, and a normal earth for the other components in the room, including lighting, cabinets etc. Due to the sensitivity of the equipment to static discharge, it is recommended that all metallic items permanently located in the rooms be earthed. This includes the cabinets, workstations, raised computer floor etc. If conductive flooring has been provided, it should also be appropriately earthed.

3.1.14 Labelling/codification

All individual items of equipment shall be appropriately labelled with a permanent label, depending on the Power Station requirements for Codification (KKS, AKZ, Trigram etc.). The label shall indicate sufficient detail to enable proper determination of the function of the device. The labels should also include the equipment code. This includes all computer type equipment, cabling, network components, cabinets and housings, etc. Care should be taken to ensure that the labels and codes are correctly documented in the associated engineering and equipment documents. Where there are no existing codes for new equipment, they shall be developed and included in the site master code database.

3.1.15 Telecommunications

3.1.15.1 Local telecommunication

Provision shall be made in the Equipment room and preferably in the Engineering room to have access to the site telecom system (PABX etc.), to enable verbal communication from the rooms to other site locations. It is preferred that this be a fixed line instrument to reduce EMI interference. It is recommended that 2-way radios not be used in the room for communication.

3.1.15.2 External access

All OEM access for the support contract shall be through a managed router as per the Eskom document, 32-214 - Information Security, Third Party Access Control Procedure. An appropriate security methodology shall be developed to ensure the integrity of the external connection, including DMZ, firewalls, standalone modems, manual connection etc. This security methodology shall be approved by the relevant IM Architectural committee.

3.1.15.3 PA system

Provision shall be made in the rooms for connection to the site PA system for emergency communication.

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3.2 RECORDS

The records to be kept are listed as follows:

- a. Record of temperature, humidity and positive pressure within the rooms
- b. Record of the access register for the rooms (down to individual in/out access)
- c. Record of the asset register of the rooms
- d. Record of the remote access security details
- e. Record of the important system security access details (Admin Passwords etc.)

Records must be kept for the duration of operation of any control system equipment and related computer equipment within the rooms. Records that are security related shall be stored appropriately. Each site should have a data management strategy to address the long-term storage requirements. This should also address the responsible parties.

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4. AUTHORISATION

This document has been seen and accepted by:

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5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2013	1.0	D.A. Govender	Document for review created from 36-574.
May 2014	0.1	D.A. Govender	First Draft for Comments Review
June 2014	1	D.A. Govender	Final Document for Authorisation and Publication
Oct 2017	1.1	K. Sobuwa	2nd Review: a) Removed ESK standard and added 240 Manual on Corporate Identity. b) Added 240 standard on OT Cyber Security c) Added 32-214 IT 3 rd Party Remote Access Control Procedure and 32-894 Eskom Server rooms and Data Centres standard d) Introduced new HVAC targets for the server rooms in sec 3.1.2.11
December 2017	2	K. Sobuwa	Final Document for Authorisation and Publication
December 2023	2.1	T. Msibi	a) Added 240 manual on Architectural Design and Green Building Compliance b) Added 240 standard on Structural Design and Engineering c) Removed all reference to Centre of Excellence and Technology d) Added reference to SANS 246 for fire resisting in terms of both integrity and insulation.

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December 2023	2.2	T. Msibi	Final Draft after Comments Review Process
December 2023	3	T. Msibi	Final Rev 3 Document for Authorisation and Publication

6. DEVELOPMENT TEAM

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

- Thokozani Msibi

7. ACKNOWLEDGEMENTS

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