Eskom	SPECIFICATION	Camden Power Station

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1 Introduction

This document contains the Technical Specification for Camden Power Station's CCTV and IAC upgrade project, which includes the specification required to design the coal gate structural steel canopy, and a ramp for the disabled people at the main security gate furthermore refurbishment of the 5.7 km fence, the Camera's that will be installed on the fence Perimeter, new ash dam, Water treatment plant, East and West CW pump house, Coal truck gate,12 metre level Turbine floor (behind turbine), Zero metre level (Next to Roshcon Operator House) HVAC, New Ash dam offices, Coal plant including weighbridge, new AWR pumphouse, Reclamation dam, Coal stockyard dam and new AWR C&I Equipment Room and at the coal stockyard.

The audit findings and recommendations to ensure compliance and adherence to the national key point requirements and the inadequate coal booking and COLLOP management structure control.

2 Supporting Clauses

2.1 Scope

2.1.1 Purpose

This document shall describe the scope to appoint an engineering, procurement, and Construction contractor to perform the detailed design, supply, Install and commissioning of the CCTV cameras.

2.1.2 Applicability

This document shall apply to Camden power station only.

2.1.3 Effective date

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

[1] ISO 9001 Quality Management Systems

[2] 240-53114002 Engineering Change Management Procedure

[3] 240-53113685 Design Review Procedure

[4] 383-CMDN-BEEC-D00035-15 Required Operational Capability Report for Camden IAC and CCTV upgrade project

[5] 240-86738968 - Specification for Integrated Security Alarm System for Protection of Eskom Installations and its Subsidiaries

[6] 240-56356396 Earthing and Lightning Protection Standard

[7] 240-56227443 Requirements for Control and Power Cables for Power Stations Standard

[8] 240-91190304 Specification for CCTV surveillance with intruder detection.

[9] 240-55863502 Definition of OT and OT/IT Collaboration accountabilities

[10] 32-273 information security IT/OT and third-party remote access standard

[11] 240-79669677 Demilitarised zone designs for operational technology.

[12] 240-86973501 Engineering Drawing Standard – Common Requirements

[13] 240-71432150 Plant Labelling Standard

[14] 240-109607736 Eskom KKS Key Part Standard

[15] 240-66920003 Documentation Management Review and Handover Procedure for Gx Coal Projects

[16] 240-65459834 Project Documentation Deliverable Requirement Specification.

[17] 240-54179170 Technical Documentation Classification and Designation Standard.

2.2.2 Informative

[1] 383-CMDN-BBBH-D00154-22 Engineering Change Assessment for Camden IAC and CCTV upgrade project

[2] 240-78980848 - Specification for Non-Lethal Energized Perimeter Detection System (NLEPDS) for protection of Eskom Installations and its subsidiaries

[3] 240-91190304 - Specification for CCTV Surveillance with Intruder Detection

[4] SANS 60287-3-2 2010 Electric Cables – Calculation of current ratings

[5] 240–53114002 Eskom Project Engineering Change Management Procedure

[6] SANS 10222-5-2, Electrical security installations Part 5-2: CCTV installations – Application guidelines.

[7] SANS 10222-5-1-1, Part 5-1-1: CCTV installations — CCTV surveillance systems for use in sec240-55863502: Definition of OT and OT/IT Collaboration Accountabilities unity applications — Operational requirements

[8] 240-78980848 - Specification for Non-Lethal Energized Perimeter Detection System (NLEPDS) for protection of Eskom Installations and its subsidiaries

[9] SANS 60287-3-2 2010 Electric Cables – Calculation of current ratings.

[10] SANS 2220-2-5 - Access control systems Part 2-5: Biometric readers.

[11] SANS 2220-2-6 - Access control systems Part 2-6: Access cards

[12] SANS 2220-1-7 - Electrical security systems Part 1.7: Intruder alarm systems: Power units

[13] 240-56364535-Structural Design and Engineering Standard

[14] 240-57127955-Geotechnical and Foundation Engineering Standard

[15] SANS10160-5 :2011 Basis of structural Design of buildings and industrial structures

[16] SANS 10162 :1 2005 Structural Steel Design

[17] SANS 2001-BE1:2008 Construction Standard; Part BE1 Earthworks

[18] SANS10144:2012 Detailing of steel reinforcement for concrete

[19] SANS 2001-CC1 Construction works Part CC1: Concrete works (structural)

[20] SANS 2001-BE Construction works Part BE1: Earthworks (general)

[21] SANS 2001-BS1 Construction works Part BS1: Site clearance

[22] SANS 2001-CC2 Construction works Part CC2: Concrete works (minor works)

[23] SANS 471 Portland cement (ordinary, rapid-hardening, and sulphate-resisting)

[24] SANS Methods 5856 Bulking of fine aggregates

[25] SANS Method 860: 1994 Concrete tests – dimensions, tolerances and uses of cast specimens.

[26] SANS Method 861-2: 1994 Concrete tests – sampling of freshly mixed concrete.

[27] SANS Method 861-2: 1994 Concrete tests – making and curing of test specimens.

[28] SANS Method 862-1: 1994 Concrete tests – consistency of freshly mixed concrete – slump test.

[29] SANS Method 863: 1994 Concrete tests – compressive strength of hardened concrete.

[30] SANS 878 Ready-mixed Concrete Sealing compounds for the building and construction industry, two-component, polyurethane-base

[31] SANS 1305 Sealing compounds for the building industry, one-component, rubber-base

[32] SANS 1083 Aggregates from natural sources - Aggregates for concrete

[33] SANS 0142 Wiring Code.

[34] SABS 0100 Reinforced concrete.

[35] SABS 10162 Structural steel design.

2.3 Definitions

Definition	Description
Camera	A device for recording visual images in the form of photographs or video signals.
CCTV	A system consisting of camera equipment, storage, monitoring and associated equipment for transmission and controlling purposes
CCTV Cable	The cable type used to connect the cameras to the (Digital Video Recording) DVR.

DVR/NVR	1. A device where the video the security cameras are capturing is recorded, stored, and managed. The recorded video is retrieved to the monitor via LAN.
Monitor	An output device which displays information in pictorial form.
Monitoring	(Relating to component condition) process of verifying that interconnections and components are functioning correctly; (relating to operator activity) viewing live images in order to detect events or incidents
Network switch	A computer networking device that connects devices together on a computer network by using packet switching to receive, process, and forward data to the destination device.
Power Supply	An electrical device that supplies electric power to the camera.
PTZ camera	A camera that is capable of remote directional and zoom control.
Server	A computer designed to process requests and deliver data to another computer over the internet or a local network.
Video Management System	Software used to connect to multiple DVRs or NVRs and view the footage from the attached cameras.

2.4 Abbreviations

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Abbreviation	Explanation
C&I	Control and Instrumentation
NKP	National Key Point
CCTV	Closed Circuit Television
DVR	Digital Video Recording
IAC	Integrated Access Control
ID	Identity
IP	Internet Protocol
LCD	Liquid Crystal Display
PSU	Power Supply Unit

Abbreviation	Explanation
PTZ	Pan, Tilt and Zoom
SANS	South African National Standards
SAPS	South African Police Service
SOW	Scope of work
BNC	Connector / disconnect radio frequency connector used for coaxial cable (male/female)
UCC BNC	Ultra-Clarity Cable BNC Splitter (Male / Female)
CAT4/5	Cable to connect CCTV camera to a DVR
HDMI	High-Definition Multimedia Interface

2.5 Roles and Responsibilities

- The EDWL will ensure that governance is followed during the design process leading up to construction. The EDWL will facilitate and ensure continuous management of the requirements for plant design and will ensure the requirements set out in this report are met during plant design.
- The Authoriser checks that the EDWL has applied the right procedures and governances during the design process.
- The Site Representative will collaborate between engineering and site to ensure that the information and data used during design are according to the client's requirements.
- The LDE/s will ensure that the work required for the designs are carried out and that the correct procedures and governances are adhered to.

2.6 Process for Monitoring

Eskom Design Review Procedure [2]

2.7 Related/Supporting Documents

CCTV Camera layout PID's

3 Technical specification

3.1 Civil scope

The design shall consider the current conditions and provides a solution. The civil scope requirements include the design of the coal gate structural steel canopy with reinforced concrete foundation. The structural design shall provide elevated platform with staircases, which will enable security personnel access to inspect coal trucks when entering and leaving the station. Also, the design shall provide a ramp for the disabled people at the main security gate.

3.1.1 DESIGN BY THE CONTRACTOR

3.5.1.1 Responsibility for the design

The *Contractor* assumes full responsibility for the design of the whole and every portion of the *works*. The *Contractor's* detailed design is approved by the *Contractor's* Engineering Council of South Africa (ECSA) professionally registered engineer. The *Contractor* is mandated by the *Employer* in terms of Construction Regulations 2014: Duties of Designer, 6(1) g to fulfil the duties described therein. Any risk associated with the *Contractor's* design is highlighted to the *Employer* together with mitigation measures. These risks are included in the risk register.

3.1.2 Survey

The Contractor is required to conduct a tachometric survey to determine the size, elevation, and location of the current as-built information of the existing structures. The topographical survey will also determine the position of cast-in items requiring removal or which may obstruct placement of the newly proposed structure.

3.1.3 Geotechnical investigations

- The *Contractor* is required to conduct necessary geotechnical investigations on the in situ and perimeter soils/materials.
- The Geotechnical Investigation will determine, identify, and outline the geological and geotechnical nature of the material, and determine geotechnical input parameters required for the design. The geotechnical investigation will pay particular attention to the proceeding in-situ permeability's and how these may be improved (where required).
- The *Contractor* provides a comprehensive geotechnical report for the geotechnical investigation findings.
- The *Contractor* provides a comprehensive geotechnical report for the geotechnical investigation findings.
- The geotechnical report is compiled by professionally registered geotechnical engineering or a professionally registered engineering geologist. The geotechnical report will contain, as a minimum.
    - Factual information and interpretive results,
    - Site Location & Description,
    - Project Geological Setting both Regional and Local; inclusive of geological and geo-hydrological hazards (where applicable),
    - Description of fieldwork including equipment used,
    - All Geological and Geo-hydrological surface and sub-surface conditions as determined by intrusive ground testing, with related drawings,
    - Discussions of all in situ and laboratory tests and classifications,
    - Analysis and Recommendations – this shall include all recommendations for bearing capacities, settlements, foundations, earthworks, excavation and embankments.
    - The *Employer* reviews and accepts the geotechnical investigation report prior to commencement of design *Works*

3.1.4 Design for the proposed structure

- The Contractor submits the detailed design report and drawings for acceptance before any construction can take place.
- The Contractor submits a consolidated a detailed design report signed by a professionally registered Civil Engineer which includes, as a minimum: Survey drawings (including raw data), design criteria/parameters, specifications and standards that were used, loadings, assumptions, calculations and results including detailed design calculations, design models, sources of information and any record of other information associated with the completed *Works.*
- The contractor provides detailed drawings Issued for Construction. Drawings are submitted in PDF and MicroStation 2D formats (DWG All submitted drawings to be signed by a professionally registered Civil Engineer with the ECSA registration number stated on drawing. Provide construction specifications for the *Works* including measurement and payment items.
- For structural analysis the Star pro V8I will be used.
- From the areas listed in the introduction, the contractor is required to undertake in designing, sizing, testing, installing, commissioning, and handover of the electrical works as stated in the requirements below.
- The contractor cannot commence any of the installation work until the detailed design is complete and accepted by the Employer. This shall be indicated as a milestone in the project execution programme.

3.2 CABLING

3.2.1 General

- All cabling required to make the electronic services installation operational shall be supplied and installed as a part of this contract.

- All terminated cabling shall be neatly tied/loomed to prevent damage to terminations and interference or obstruction of other services. Strain relief shall be provided for cables connected to rack mounted equipment.

- All cables shall have stranded copper conductors and shall be PVC insulated with overall PVC sheath, unless otherwise specified.

- Coaxial cables shall be used to connect the CCTV cameras to the nearest DVR/NVR port. The DVR/NVR port shall be housed in the nearest building close to the section of cameras mounted. The nearest Power source (Distribution board or Plug) shall be used to power the DVR/NVR.

- All cabling shall be concealed and installed on metal cable tray, cable duct or conduits.

- All cabling shall be concealed and installed on metal cable tray, cable duct and conduits.
- Cabling shall be installed with due regard to future removal and replacement of cables.
- All cables shall be new and delivered on site in unbroken reels, and with the “manufacturer’s” label attached. Due consideration shall be given to voltage drop when calculating cable sizes. Installation and cable route shall be to the satisfaction of the Engineer.
- Cables shall be installed in a manner eliminating any possibility of strain on the cable itself or on cable terminations.
- No joints or connections will be permitted. Adequate loose cable shall be left behind all equipment to facilitate removal for inspection, adjustment, or replacement.
- Any bending, jagged edges or any other forms of damage or deformation of cable trays or wire ways shall be made good, before cables are installed.
- Conduit shall be thoroughly cleaned and have all burrs removed before the drawing in of any cable.
- The tray shall be supported at every change in direction of the cable tray route. The minimum radius of any bend of the tray is to suit the minimum bending radius of the largest cable on the tray.
- Cable trays shall be firmly secured in position in such a manner to cause as little obstruction to walkways etc., as possible.
- Hangers, supports and anchors for wire ways and equipment, shall be designed and installed regarding appearance and convenience as well as for adequate strength and rigidity. Only professional quality fixing material and methods shall be used. Nails and glue are not acceptable.
- Where equipment’s to be supplied and installed under this specification require special cabling these cables shall be provided as part of this contract.
- It shall remain the responsibility of the contractor to design the cabling system network and determine the type of cable required for interconnection of the various components, which make up the total system to be installed, to comply with the contract documents.
- Cable Damage during the installation of cable should any kinks or abrasions to insulation, braiding, sheathing, or armouring occur, the affected cable shall be withdrawn and replaced with new cable at no additional cost to the Client.

- Choice of cables shall be based on camera manufacturer recommendations.

- Either fibre or electrical signals may be used for camera communication. Cost should be considered when choosing between Cat 5 and fibre communication cables. In high EMF environments CAT6 or fibre should be considered.

- Where electrical cables are used, they should be unshielded twisted pair (UTP) cable, such as CAT5.

- UTP cabling is cost efficient, has high noise immunity, lower loss per length than coax and allows for high-quality long-range transmission.

- For analogue cameras a UTP balun connector may be implemented for the cabling between the camera and the DVR. Cat5 is recommended over coaxial cable as it is thin and flexible cable making it easy to string between walls. Due to its smaller size, more cat5 lines can be run through a conduit than with coax cable. If necessary, active balun connectors may be used to transmit signals over larger distances.

- Cable selection and routing shall always be done in such a way that operation of cameras is not affected by interference. This may be achieved by separating AC power cables from communication cables, shielding cables, or a combination of the two. It should not be necessary to separate DC power from communication cables. It should not be necessary to separate fibre communication cables from AC power cables.

- Cable Numbering generally, all cables shall be allocated and identified with a unique cable number.

- All cable cores and wires shall be numbered at all termination points with "slip-on" interlocking type cable markers. Split-ferrule types are unacceptable. In the case of multicore cables each core shall be numbered.

- All cables including patch leads shall be clearly labelled. Labels shall be affixed within 50mm of each termination.

3.2.2 Cables shall be fitted with tags at the following points:

- On the cable sheath next to the gland at each end

  - In cable pits/manholes

  - In all vertical data risers

  - At any additional point on the cable sheath (or around the core bunch) where the preceding requirements are not readily traceable from the core terminations

  - Any inspection/junction box cable identification tags shall be orientated uniformly to read left to right from the logical viewing point horizontally; and from bottom to top viewed from the right were installed vertically.

3.2.3 Duplication of cabling and equipment identities shall not be allowed.

3.2.4 All cable numbers shall be reflected on the relevant As-Built drawings

3.3 Electrical scope

3.3.1 Power supply points

- For the cameras that will be situated at the Station perimeter fence, Coaxial cables will be come from the Cameras to the DVR/NVR port located at designated buildings. If the building is too far from the camera location, the lighting Distribution boards along the fence can be used to power the cameras. The board which powers the lighting DB along the fence will be used to house the DVR/NVR and the backup power supply.

- The DVR/NVR port and UPS (with a backup of 5 hours) shall be securely mounted to prevent theft of the UPS battery and the DVR/NVR port.

- For the other areas as stipulated in the introduction, the power supply to the DVR/NVR can be tapped off from the local Distribution board or 380V board in the switchgear room. Tapping power from the 380V board in the switchgear room will depend on the risk assessment coming from the engineer.

- In the case where 380V board in the switchgear room is granted by the engineer, the contractor must make use of the “Spare” MCB’s or bucket to carry out the power connection.

- The contractor is responsible to make sure that all the modified Distribution boards and circuits in the switchgear room must be clearly labelled and coded as per 240-71432150 Plant Labelling Standard [17], 240-109607736 Eskom KKS Key Part Standard [18], 240-93576498 KKS Coding Standard [19] and 240-109607332 Eskom Plant Labelling Abbreviation Standard [20].

- For emergency backup power, the contractor is responsible for sizing, manufacturing/procuring, installation and commissioning the UPS that will be used to provide backup power to the DVR/NVR and the Servers in the Security office.

- All Distribution boards shall be earthed. The distribution boards shall be rated IP65.

3.3.2 Coordination and Separation of Services

- Services for each respective section and system shall be installed physically separate from other systems. Adjacent services shall run approximately parallel. Crossing services shall cross at approximate right angles.

- The following separation distances shall be adhered to:

  - Power cables – 100mm.

  - ELV and Communication cables to parallel power cables – 300mm

  - ELV and Communication cables to power cables crossed at 90 – 100mm.

  - Any trade to finish floor level – 80mm

  - Any trade to structure – 20mm.

3.3.3 Coordination and Feasibility

- The constructions drawings, schematics and specification will indicate the main routes and positions for the various services installations and equipment in relation to the building and other services**.**

- The Contractor shall be responsible for onsite coordination details with the building structure and other services. The contractor shall deliver to the main contractor in accordance with the scheduled works program:

➢ Details of all types of cabling to be installed as part of the Sub-contract works
➢ Block schematic cable diagrams indicating all system interconnecting cables including cable routes and cable types complete with core make up and numbers
➢ Detailed floor plans indicating cable routes and designated circuit identification
➢ Wiring diagram detailing system interconnections and cable/core identification.

3.3.4 WIRE TERMINATING AND MOUNTING HARDWARE

- Every terminal strip shall be numbered and named.
- Cable glands shall be of the compression ferrule type with "O" ring seals.
- Terminations of cable cores and wires shall be made using spade, pin or bootlace ferrule type crimp-on lugs.
- Lugs may only be crimped with controlled pressure crimping tools of the correct size for the lug used.
- Thin, collapsing pipe type ferrules shall not be used. High quality wire strippers shall always be used, and care taken not to nick or otherwise damage the strands.
- Terminals shall be located so that all connections can be made easily.
- When wiring of different potentials and types of supply use the same terminal rail, a clear space or barrier shall be provided between terminal blocks.

3.3.5 EARTHING SPECIFICATIONS

- The Earthing connection to the security equipment shall be no more than a 1Ω connection.
- The Earthing shall be done from a single (SPUR Distribution Point) point to each part of the security installation e.g., Equipment/Wiring Closets, Service and Central Equipment Locations etc.
- No daisy chaining of the Earthing connection shall be allowed, except as described in the section on high-rise buildings. The reticulation for the earth connection shall be done with no less than 70 mm² Green Isolated Copper Conductor (GICC). The same spur point shall be connected to the Electrical Earth. The connection to the Electrical Earth can be done with Bare Copper Conductor (BCC) with a cross sectional area of no less than 70 mm².
- The copper conductors shall be terminated in a lug which shall be bolted to the Earthing bar.
- The Earthing bar shall not be smaller than 6mm x 50mm x 300mm. No more than 1 conductor per lug and no more than 1 lug per terminal point on the earthing bar will be tolerated. The lugs shall be crimped, or CAD welded to the conductor and shall be inspected by the Engineer prior to acceptance. The security and electrical earths shall be run in separate conduits and be separated by no less than 1 m. The earthing conductors may cross each other and any other electrical cable at a 90° angle.
- All Earthing bars, screws, lugs & isolators shall comply with the SANS 0142 Wiring Code, SANS Earthing Specification & all relevant IEC standards.
- Any conducting material that has been anodized, e.g., aluminium may not be used as an earth busbar unless special precautions have been taken to ensure that the anodizing material has been removed where the earthing connections are made.
- All connections between racks or sub-racks used to transmit audio, video, radio frequency or digital data must be made using co-axial type wiring having the correct matching impedance and must be to the manufacture’s specification.

3.3.6 LIGHTNING AND SURGE PROTECTION SPECIFICATION

- The Contractor shall provide and install all the necessary surge protection devices, for the protection of the electronic control equipment, communication, and data lines. Surge Protection devices shall protect all AC and DC circuits from the effect of lightning induced over voltages, internally generated transients and utility switching transients.

- Surge protection will be required on the incoming power supply to the electronic equipment and shall be done at the single point where the supply enters the building. Lightning protection shall be installed from Live to Earth (L-E), Neutral to Earth (N-E) and from Live to Neutral (L-N) on a single-phase supply. If a 3-phase supply is used lightning protection shall be required on each phase individually (L1-E, L2-E, L3-E & N-E). If the same supply is reticulated to another building additional lightning protection shall be required where it enters the next building. The protection shall be as described above.

- The Bidder must allow for additional surge suppression and voltage stabilisation equipment if this is required to protect his equipment or to guarantee its correct operation.

- The test pulses shall be applied at intervals of not less than one minute.

- The surge protection equipment may be built into the equipment being protected. If the provided internal protection is inadequate to meet this specification, then additional external protection must be provided.

- There shall be an earth bar in the lower corner of each enclosure and shall be sized to accept 16mm square BCW. The Bare Copper Wire shall be terminated at the nearest earth mat.

- AC protection devices can be in the equipment cabinet and must be installed prior to any distribution (i.e., multi-outlets).

- Surge protection devices shall be chosen in such a way that the protected circuit shall still function to specification despite the introduction of series and/or shunt impedances by the protecting devices.

3.4 IP surveillance and digital video recording specification

- This part of the specification covers the design, supply, installation, and commissioning of all equipment for the IP surveillance system. The system shall be type Geutebrück to match the existing Eskom standard and the entire installation shall function as a single integrated IP surveillance system.

- The IP surveillance system shall consist of IP cameras connected via a dedicated security IP network to the video management and recording server.

- The new video surveillance installation shall be fully integrated with the existing operator's workstation and GUI installed in the main security control room.

- From a very general point of view, IP surveillance system cannot be considered as a security matter such as physical security, anti-intrusion or access control are to be.

- IP surveillance must be considered as an add-on module to existing security devices.

- The main interest of an IP surveillance system is to help the operator make a good decision concerning a doubt about security issues and the movement control of staff, contractors, and visitors.

3.4.1 The aim of the IP surveillance equipment is to:

- Resolution of doubt.
- Surveillance of the usual and unusual staff, contractors, and visitors' activities.
- The consideration that pictures must be used for general purpose, remote management and archiving as to cover the direct staff process followed by the operators. This means that, normally, the IP surveillance system will be designed as a dedicated video server allowing surveillance of activities, general surveillance activities on separate and / or shared cameras and allowing remote use.

3.4.2 The following components of the system shall form part of this contract:

- Indoor and outdoor IP colour cameras, housings, and mountings
- Digital video recording servers/ Network video servers.
- Power supply units (If required)

3.5 SYSTEM DESCRIPTION

- All cameras shall be from the digital IP type. The cameras shall be selected for suitability for internal and external surveillance.
- All cameras will be from the colour type and if the lighting conditions are too poor, Day/Night cameras will be used.
- Indoor cameras shall be standard vandal resistant ceiling/wall mount fixed dome and fitted with built in variable focal, auto iris lenses to ensure optimal optical efficiency. Where no false ceiling is available cameras will be mounted against wall.
- Outdoor cameras shall be mounted in purpose made weatherproof housings to protect the camera from dust, rain and strong winds.
- All camera signal, data and power cable will be wired to the equipment cupboard closest to its position.
- The video data signal cable (Cat6 UTP) will be terminated to the LAN via a multi-port TCP/IP data switch inside the 19” equipment rack cabinet. All cameras and switches will be Power-Over-Ethernet compliant.
- A suitable communication path shall be provided to ensure reliable transmission of control signals from the control equipment to any pan/tilt/zoom camera assemblies.
- The system shall be motion detection activated. All activities shall be recorded on a centralised archive storage server.
- All signal, control and power cables shall be installed inside conduit, trunking, and cables racks/baskets.
- The Contractor shall agree with the engineer all routes. All cables shall be protected against lightning damage.
- The correct angles of view will be set up for each individual camera. The Contractor will supply the Engineer with snap shots of each camera installed showing the viewing angle as part of the close out documentations All lenses shall be of glass type lens and not plastic.
- The MPEG-4/H.264 codec must be ratified and licensed with the relevant Licensing Authority.
- Servers and computers which are not designed and built by major brand name manufacturer will not be considered as an approved equal**.**

3.6 C&I Scope

3.6.1 CAMERAS

- **Indoor/Outdoor Fixed Vandal Resistant Dome Cameras.**

No.	Item	Description
1	Type/Imager	High Resolution 1/3"
2	Video Resolution	Scalable 160 x 120 up to 1920 x 1440 pixels
3	Video Streaming	Dual-Streaming H.264 and MJPEG
4	Data Rate	9.6 Kbs to 6 Mbs
5	Network Protocols	TCP/IP, HTTP, FTP, UDP, ICMP, ARP, DHCP, NTP, RTP, RTSP, RTCP, SMTP, IGMP, ZERONF, QoS Layer 3
6	Ethernet	10/100 BaseT Auto Sensing, Half/Full Duplex
7	Day/Night function	Removable IR cut filter
8	Minimum illumination	0.88 Lux / F1.3 (IR cut filter) Colour 0,15 Lux / F1.3 (IR pass filter) B&W
9	Power Input	12Vdc, 24Vac or PoE IEEE 802.3af compliant
10	Setup	Remote via WEB browser/Local via Telnet
11	Lenses	Auto Iris 2.6-10mm
12	Housing	Vandal Resistant cast Aluminium, Polycarbonate Dome; IP65
13	ONVIF (Open Network Video Interface Forum) conformant - guarantees interoperability between network video products regardless of manufacturer	

3.6.2 VIDEO SURVEILLANCE CONTROLLING AND RECORDING SYSTEM

- The product described in this specification shall be a pure IP Video Management System (VMS) that shall be established on one or multiple standard Intel, multi-CPUs, standard PC platform, with 100Mbit or 1GBit network interface.

- The solution must work on open standard, camera control software with multi-channel and multi-vendor support, using standard IP network cameras and/or IP network video servers for conversion of PAL/NTSC cameras.

- The solution must be fully scalable in both number of cameras, recording PC's, recorded frames per second on the entire system, and scalable in the recording capacity, with both local storage and network storage.

- The VMS system shall be designed as a distributed architecture for a full redundant operation.

- The VMS system shall support both NTSC and PAL video formats from fixed Colour/B&W cameras, High Speed Dome PTZ cameras, infrared cameras, X-Ray cameras, low light/IR cameras, IP cameras and IP domes, and any other camera that provides a composite NTSC/PAL 1v p-p video signal.

- The VMS shall be based on a 10/100/1000 Ethernet networked based video and shall not utilize DVR technology. A digital recorder that requires the installation of coax cables from camera to recorder will not be considered as an approved alternate system.

- The VMS shall be a software-based solution running Ethernet network communication protocol between all IP cameras, camera encoders, operator stations and the network video recorders.

- The VMS system shall be based on high quality directly network-attached cameras or analogue cameras connected to video-to-IP encoders. The VMS shall support multiple video compressions simultaneously. Web based cameras are not approved as high-resolution security cameras.

- The VMS system shall sustain full operation using standard (4CIF) and Mega-pixel (720p, 1080p) video resolutions. The system shall support all cameras at maximum frame rate and resolution while maintaining less than 80% load on the server.

- The VMS recording server(s) shall as a minimum provide multi-video compression support and shall simultaneously record video and provide these signals for live monitoring or archive playback. These recorders shall have two1Gbs network interface and shall only be of a major brand name manufacturer of computers and servers.

- The VMS storage system shall be based on advanced recording methods and shall not rely on the Windows Operating System to manage storage. The VMS storage as a minimum shall provide RAID 5 redundancy, a technology that employs the simultaneous use of two or more hard disk drives to achieve greater levels of performance, reliability, and/or larger data volume sizes.

- The VMS recording server shall provide for a minimum of 16 internal hot-swappable hard-drives for all video recording. A separate solid-state drive (SSD) shall be installed for the operating system. Storage not designed and build by major brand name manufacturer will not be considered. The unit will also be fitted with hot-swappable redundant power supply.

- The VMS storage server shall support a minimum of 40-50Mbs throughput and shall record all video from all the IP cameras in the native video format of each (e.g. H.264, MJPEG, etc. video compressions) for a period of 30 days available for online viewing. Each camera shall have an option for independent retention period.

- The VMS shall record all video in real time simultaneously at bandwidth ranging from 8 Kbytes/sec to 8Mbytes/sec, frame rates ranging from 1ips to 25ips PAL and resolution ranging from CIF (352x288) to full HD (1920×1080). In general, all cameras will be setup to record at 8fps and 720p resolution, but each camera will be setup individually based on the specific requirements.

- The system shall be flexible and as a minimum the compression scheme shall be able to run in one of several bandwidth selections. Each stream bit rate target shall be configurable.

- The VMS shall have a capacity to switch and control as a minimum the number of cameras noted on the drawing plus 20 percent capacity for expansion and unlimited digital monitors.

- The VMS shall record all video from all IP cameras to the Hard Drive of the recording system and simultaneously be capable of recording to an external archiving system if required.

- The VMS shall be able to set each camera frame rate, bit rate and resolution independently from other cameras in the system and altering these settings shall not affect the recording and display settings of other cameras.

- The VMS shall provide a multicast network communication for video monitoring. This video stream shall be independently setup from the recording stream.

- The VMS video monitoring module shall allow for multiple flat panel monitors to be connected to a single computer. Each monitor shall have independent controls and shall support multi camera views.

- The VMS video monitoring module shall provide each user with the ability to view multiple cameras on one PC all at 25ips PAL while recording at a lower frame rate for more efficient video storage. The system shall maintain the capability to add additional flat panel monitors for other applications.

- The VMS shall have the capability to program each viewing station to view and control selected cameras only.

- The VMS shall provide alarm management module that shall be able to set any monitor or groups of monitors to automatically display cameras in response to alarm and/or event inputs. The alarm management shall be able to reset automatically or manually alarmed video and shall allow for multiple modes of alarm handling capability, these modes to be programmed within the same system.

- The VMS shall provide a reporting utility for tracking but not limited to the following options. Video and images shall be stored with reports for documenting events:

1. Alarms

2. Incidents

3. Operator logs

3.6.3 Service requests

- The VMS shall provide file export tool for export of single frames of video in J-PEG, BMP, etc. file formats and for export of motion video files in AVI, MPEG, etc. file format for transport and playback on computers utilizing a Windows environment.

- The VMS shall provide a Windows based GUI (Graphical User Interface)

- The GUI shall allow full control of the VMS recording servers from a user defined graphic image control system. This system shall allow the import of maps in the format of standard windows-based images such as bmp, tiff or Jpeg. Control icons such as cameras, viewer options, alarm inputs & control outputs shall be user definable.

- In run time mode, that GUI shall not only provide map access to the cameras and functions, but also get symbols or icons changing depending on various system status information, for example a camera symbol displays the camera status, whether OK or not, whether armed analytics or not, whether in alarm status or not, etc.

- The GUI software shall provide both, standard icons as well as the possibility of importing any user symbol for any status display.

- The VMS shall be based on a true open architecture that allow for use of non-proprietary PC and storage hardware that shall not limit the storage capacity and shall allow for gradual upgrades of recording capacity.

- The VMS shall support a built-in digital video matrix switcher that shall provide full matrix operation that shall be responsible but not limited to the following key functions:
- Have the capability of creating camera sequences.
- Have the capability of creating multiple camera views on one screen.
- Have the capability to create and execute VB or .NET scripts on events or on schedules.
- The VMS shall support a built-in Watchdog module that shall monitor operation of all services and automatically restart them if they are malfunctioning. The Watchdog shall be responsible for restarting the application or in a last resort restart the server in case of malfunction of software components.
- The VMS shall allow for installation of Anti-Virus and network security Software.
- The contractor shall provide the required computers for the VMS client and servers. These computers shall be of the most current state of the art technology available at the time of installation and as minimum shall support the minimum requirements of the manufacturer.

3.6.3.1 The design document shall include:

a) The equipment (make and model) to be used

b) electronic copies of all equipment data sheet. This should include user and installation manuals if possible.

c) An overall system diagram showing the interconnections between equipment.

1. Connections between equipment should be labelled with communication protocol (RS485, TCP/IP, NO/NC contact) or voltage level.

2. Final Design: Wiring colours and numbers and terminal names/numbers to be indicated for all connections.

d) Power supply details including:

1. The power supply point(s) to be used, including MCB numbers.

2. The backup power solution to be used at the site.

e) If the preferred 110V DC power option the following shall be included (arranged by Eskom representative):

1. Document from the relevant DC engineer confirming that the 110V DC supply can be used for the CCTV system. This document should include calculations that show that the site backup power requirements can still be achieved with the additional load of the CCTV system.

f) If the 220V AC Power Option is to be used then the following will be supplied:

1. Expected backup time including calculations.

2. Make, Model and Capacity of batteries to be used

g) A site layout (see Figure 3) showing:

1. The placement of all cameras and detection equipment

2. The purpose of each camera

3. The expected field of view of all cameras

4. The detection area of all detection equipment

5. The various alarm zones on the site, with zone name and number

6. The routes for indoor cabling, clearly marking the trunking or overhead racks to be used / installed.

7. The routes for cabling to outdoor equipment and motorized gate through existing cable trenches and dedicated trenches. Cable exit points shall be clearly marked.

8. Cable and wire numbering philosophy and methodology.

9. The position of the security cabinet

10. Position of yard/junction boxes.

h) The layout of equipment in the security cabinet.

i) The layout of equipment in yard boxed (if used).

j) The design document shall be accepted by an Eskom Security Systems Engineer before any installation begins.

k) The site-specific Health and Safety plan shall be accepted by an Eskom Health and Safety practitioner before any installation begins.

3.7 Documentation

On completion of the installation the contractor shall provide Eskom with the following documentation:

a) Detailed as-built drawings of the installation including the following:

1. A site layout diagram indicating the position of all equipment and devices installed. A complete cable block and wiring diagram with cable & wire numbers.

2. A site layout diagram indicating the position of all equipment and devices installed

3. Coverage plots of the areas covered by cameras' fields of view.

b) Manuals and training for the CCTV surveillance system. The manuals shall include the following:

1. An overview of the CCTV and intruder detection system, including the equipment block schematic

2. The functions and features of each item of equipment.

3. Individual operating instructions for each item of equipment.

4. Detailed operating instructions for all modes of operation of the CCTV system.

c) Manufacturer's technical and maintenance specifications for each item of equipment installed.

d) All documents shall be provided in soft and hard copy. Drawing's softcopies shall be provided in as MicroStation 2D files in .dwg format. Other soft copy documents shall be provided as pdfs.

e) All system and camera settings shall be recorded, so that they can be confirmed and reproduced as required.

1. Where possible these settings and configurations shall consist of backup files which can be loaded onto the relevant equipment in the case of malfunction or replacement.

2. Where the equipment does not allow for softcopy backups, an electronic document listing the settings may be provided.

3.7.1.1 f) The client will provide the contractor with the latest available drawings for the areas which the electrical works will be conducted as stated in the introduction.

3.7.1.2 h) The contractor is responsible for providing a detailed updated drawings pack which are supplied to the Engineer for electrical works carried out at 380V Switchgear rooms. Examples of these drawings are switchgear schedules, Cable schedules, cable block diagrams, etc.

3.7.2 DOCUMENTATION MANAGEMENT AND CONFIGURATION MANAGEMENT.

The contractor and Camden configuration management shall be responsible for the following during the design change:

- As-built plant drawings.
- Document Management
- Plant coding and Labelling.
- Design change management.

3.7.2.1 Document Management

All documents supplied by the *Contractor* shall be subject to Eskom's approval. The language of all documentation shall be in English. The *Contractor* shall include the *Employer*'s drawing number in the drawing title block. This requirement only applies to design drawings developed by the *Contractor* and his or her Subcontractors. Drawing numbers will be assigned by the Employer as drawings are developed.

3.7.2.2 Document identification

3.7.2.3 Drawings Format and Layout

The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of Engineering Drawing Standard. Drawings issued to Eskom will be a minimum of one

hardcopy and an electronic copy. All *Contractors* are required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in pdf format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted. Drawings issued to Eskom may not be “Right Protected” or encrypted.

3.7.2.4 Document Submission

All project documents must be submitted to the delegated Eskom Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction **Error! Reference source not found.**. To portray a consistent image, it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction. The *Contractor* is required to submit documents as electronic and hard copies and both copies must be delivered to the *Eskom Representative* with a transmittal note.

- In addition, the Contractor shall be provided with the following standards which must be adhered to:
  - Documentation Management Review and Handover Procedure for Gx Coal Projects
  - Project Documentation Deliverable Requirement Specification.
  - Technical Documentation Classification and Designation Standard

3.7.3 Engineering Change Management

All Design change management shall be performed in accordance with the latest revision of the Eskom Project Engineering Change Management Procedure and the Employer shall ensure that Contractor is provided with latest revisions of this procedure. Any uncertainty regarding this procedure should be clarified with the Employer. All design reviews will be conducted according to the Design Review Procedure.

3.7.4 As-Built Plant Drawings

- The contractor shall be responsible to update all existing drawings of the “as-built plant” with the new system information.
- New drawings are to be supplied where changes have been made to the plant.
- The following drawings/diagrams will be required:
  - Datasheets of all new equipment
  - Piping and Instrumentation drawings of as is plant
  - Hydraulic calculations
    - With design points
    - Without design point
  - Isometric drawings
  - Mechanical detail design report
  - Process flow diagrams of as is plant
  - Water supply curve at the interface with the existing system
  - Pipe stress analysis
  - Spray density
  - Nozzle specification
  - Valve Specification

- Design temperature

3.7.5 Plant Coding & labelling

3.7.5.1 Plant Coding

- Plant Coding shall be undertaken by the employer and as such the service provider shall make available the following documentation to code:
  - Piping and Instrumentation Diagrams (P&IDs)
  - Interface list
  - Process flow diagrams (PFDs)
- Employer will only code the KKS code defining Documentation listed above. The employer will assign a coding practitioner who will interact with the Service Provider in coding the plant as listed above. It may be required that the person be based at the Service provider's offices full time. The Service Provider will then be required to include allocated codes to all other designs and related documentation. It is also the responsibility of the Service Provider to consistently apply the KKS codes throughout the rest of the technical documentation.
- The Service provider shall ensure that all documentation is coded (as per the codes assigned by the Practitioner) prior submission to Employer for review.
- Camden power station coding and plant labelling shall conform to the following Plant standards:
  - Camden KKS Coding Procedure [14]

3.7.5.2 Plant Labelling

- It is the responsibility of the Contractor to manufacture and install labels according with Plant Labelling Standard
- The Coding practitioner shall facilitate base lining of all equipment lists from the contractor, and only baseline equipment lists shall be used as a basis for the production of labels. Coding and labelling of components inside electrical and C&I panels shall be done by the Service provider.

3.7.6 Procedure, Guidelines & other Documents

The applicable procedures, guidelines and other relevant documentation to commission, operate, maintain and engineer the plant/system shall be supplied with the system, by the contractor. This will include as a minimum the following:

- Piping and instrumentation diagrams
- General arrangement and layout drawings
- System description providing all technical specifications
- Operating and control philosophy
- Data sheets and equipment lists
- Temperature rating of detection bulbs
- Testing and commissioning procedures.
- Quality Control Plan

3.8 Installation

- To ensure quality workmanship and sound installation practice, it is imperative that the contractor adheres to the specifications and standards supplied by Eskom. Should there be any uncertainty with regards to the specifications; the contractor is to contact the Eskom employee responsible for the project for guidance.

- Only contractors with experience in CCTV and alarm system installations shall do installations. To this end the tenderer shall provide a CV of relevant experience and references.

- All installers shall adhere to the OHS Act (Occupational Health and Safety Act) of 1993 when installing the system. Contractors and sub-contractors shall meet the requirements specified by Eskom Health and Safety specifications.

- All equipment shall have a mechanical earth connected to the site earth according to Eskom standards.

- All equipment shall be designed and specified for a minimum realisable operational life 10 years under the prevailing environmental conditions unless otherwise agreed to by Eskom during the tender evaluation stage.

- All equipment shall be labelled in accordance with the design diagrams, with durable, weather resistant labels.

- Cable and wiring marking shall be in accordance with Eskom standard 240-64636794, Standard for Wiring and Cable Marking in Substations.

- All cables and wires shall be marked with a unique identification, at all terminations, in accordance with the cabling and wiring diagrams supplied.

- All of the splices and connections shall be mechanically secure and shall provide electrical contact without stress on connections and terminals. Splicing is strongly discouraged but if unavoidable, splices used shall have insulation equivalent to that of the wires being joined.

- Any hole which insulated conductors pass through shall be provided with a smooth, rounded bushing, or shall have smooth, rounded surfaces upon which the insulated conductors may bear.

- Wireways shall be smooth and free from sharp edges, burrs, fins, or moving parts that may damage wiring.

- All internal wiring connections shall be made with a solder lug or pressure terminal connector a terminal lug shall be arranged such that in any position it cannot contact the metal enclosure, non- energized accessible metal parts or other electrical circuits. Alternatively, the shank of the lug shall be provided with insulation equivalent to that of the conductor.

- Terminal blocks shall be in accordance with Eskom standard 240-70413291, Specification for Electrical Terminal Blocks.

- The CCTV installation shall be signed off as accepted by Eskom's appointed Project Engineer for the security system installation.

3.9 Security Cabinet

- The security cabinet/panel shall contain all the control equipment of the intruder detection and the surveillance system (digital video recorder (DVR), communication equipment, public address (PA) etc.

- Cabinet shall be a freestanding swing frame panel or a freestanding server cabinet.
- Cabinet shall be designed to limit dust ingress which could affect effective operation of equipment.
- All points of cable entry shall be through glands to secure the cables.
- Access to the inside of the cabinet shall be restricted and controlled by means a physical lock to which only authorized security personnel and Eskom employees from the Risk Department shall have access. Cabinet shall be alarmed for tempering and remain armed when main alarm system is disarmed. This is subject to regional requirements.
- Cabinet design shall take into consideration airflow and heat distribution. Equipment shall be laid out such that units that generate the most heat are at the top.
- There shall be a dedicated Aux power supply distribution module with a suitably sized incomer isolator and suitably sized load MCBs per piece of equipment.
- The incomer supply DB MCB for this module must be correctly sized to protect the incomer cable in order to prevent nuisance trips.
- Cables shall be neatly routed in trunking.
- Cable ties or similar shall be used for cable management.
- Where possible equipment in the security cabinet shall be 19-inch rack mountable or DIN rail mounted equipment. Where 19” or DIN rail mounting is not available, equipment shall be neatly secured on shelves.
- Equipment or connection accessed regularly shall be accessible from the front of the panel or shall be wired to a terminal rack accessible from the front.
- Equipment shall be suitably earthed to the cabinet, and the cabinet shall be earthed to the substation earth.
- Eskom shall approve the layout design before the cabinet is populated.

Figure 1: Example of Well Organised Security Equipment Cabinet.

3.10 Perimeter Camera System Layout

- The installation of fixed cameras shall be done primarily to cover the inside perimeter of the site yard.

- The purpose of the perimeter cameras is detection. Perimeter cameras shall provide control room operators a method to confirm when an alarm is generated that an intruder has breached / approached the perimeter.

- At selected sites it may be appropriate for the cameras field of view to cover the outside perimeter of the fence, supporting detection before the perimeter is breached. This will depend on detection method used and the likelihood of false alarms from movement just outside the perimeter.

- There shall be a thorough analysis of the site's layout before installing any cameras and perimeter detection to ensure that the entire site perimeter has been covered. This must include mapping each camera's field of view and range of view on the site layout drawings to ensure that the perimeter is 100% covered.

- The view of the camera shall be free of any hindering obstacles such as walls, trees, or buildings.

- The installation of cameras shall be done so as not to hinder existing vehicle accessibility paths to the installed power plant.

- Where it is possible to obtain visuals at an angle of the fence, it shall be ensured that there is no obstacle between the camera and the face of the fence being monitored.

- Every camera has a 'dead spot' directly in front of it, where it will not be able to see. The size of this dead spot is determined by height and angle at which the camera is mounted, and the camera's field of view. Perimeter cameras shall be arranged so that the dead spot of each camera is covered by the field of view of another camera.

- Should there be obstacles or poor visuals, additional cameras shall be installed to cover the span of fence.

- There shall be no 'dead spots' in the invisible wall. Where a method of detection has an inherent dead spot, the dead spot of each device shall be covered by another device (e.g. Cameras with overlapping fields of view).

- The perimeter detection method should be divided into zones matching the areas covered by the perimeter cameras. This shall enable the operators at the security control room to determine which area has been disturbed and which visual to use from the camera covering that section of fence where the incident occurred. Zone names must be the same on site as in the video management system. These zones and zone names shall be reflected on the site layout provided with the system documentation.

General Camera Requirements

Cameras shall meet all specifications listed in sections:

- Warrantee and Certification

- General Physical Requirements

- General Electrical Requirements

Cameras may be analogue or IP cameras

Before installation begins the camera layout, including expected fields of view and dead spots, shall be documented, and signed off by an Eskom Engineer.

3.10.1 Installation

- The installation of the camera and brackets shall be as indicated in the manufacturer's guidelines.
- Brackets used to secure the camera shall be robust and shall minimize vibration.
- Brackets shall be capable of being "lock tight" to reduce the possibility of accidentally moving.
- All brackets shall be "cable managed" so that cable entering the housing is enclosed within the bracket from the support to the housing, allowing no cable to be exposed.
- The cables shall be marked with at least the camera name and number.
- Dome and PTZ cameras shall be mounted with appropriate brackets which prevent the pole from being in the camera's field of view.
- The manufacturer's specifications for all cameras shall at minimum meet the requirements in Table 4 below. Note that meeting the minimum requirements 'on paper' does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment (described in section 3.5.3.2) is essential when evaluating CCTV cameras.

3.10.1.1 **Table 4: Minimum Manufacturer Specifications for Cameras**

Characteristic	Description	Requirements

1) Automatic Gain Control (AGC)	Automatic gain control (AGC) increases the cameras sensitivity automatically when the ambient light deteriorates.	At least 30dB.
2) Back Light Compensation (BLC)	Electronically compensates for high background lighting to give details which would normally be silhouetted.	Back light compensation must be implemented.
3) Coverage Distance	The distance covered visually between a fixed camera's position and the next camera.	The camera's specified coverage distance shall be 10% further than is required by the site security design.
4) Frames Frequency	The number of frames per second (fps).	Minimum 8 fps
5) Lens	A camera lens is a curved piece of transparent glass that focuses the image in a camera. A camera lens is not a single lens, but a combination of lenses to bend the light entering the camera in such a way that it can be captured.	The lens shall be chosen to suit the application and the functional requirements of the site.
6) ONVIF Compliance	ONVIF (Open Network Video Interface Forum) is an international specification with the aim of 'promoting and developing global standards for interfaces of IP-based physical security products.	If cameras are IP Cameras, they shall be ONVIF compliant. It must however be noted that ONVIF compliance does not guarantee compatibility between systems.
7) Image Format	The approximate size of a camera image detection device.	1/3 inch or larger
8) Remotely Configurable	Ability to change camera settings through a network.	All cameras' settings (except focal length and focus) shall be remotely configurable, either via the DVR, or directly using Ethernet.
9) Resolution	Resolution determines picture quality. The higher the resolution the better the picture quality.	A minimum horizontal resolution of 600 TV lines or 800 pixels.
10) Signal to Noise Ratio (SNR)	The ratio between useful television signal and disturbing noise signal.	The signal to noise ratio shall be ≥ 52dB.
11) White Balance Control (WBC)	Automatically adjusts a colour camera's colour to maintain white areas.	Camera shall implement wide dynamic range and white balance control functionality to compensate for bright areas.
12) Wide Dynamic Range	Ability of camera to provide clear images when there are very light and very dark areas simultaneously in the camera's field of view.	Camera shall have Wide Dynamic Range

Table 4: Minimum Manufacturer Specifications for Cameras

3.10.2 General Requirements for Outdoor Cameras

Outdoor cameras shall meet all specifications listed in section **General Camera Requirements**; additional requirements are listed below:

- As far as possible, outdoor cameras shall be positioned “North to South” to avoid sunlight on the lens. In some cases, this is not possible; therefore, all cameras shall have wide dynamic range (WDR) functionality.

The power cable shall be steel wire armored cable.

- The camera shall be well protected from the elements and vandalism by mounting it within an appropriate housing.
- The camera housing shall have an IP rating of at least 65.
- The camera housing shall have a sun visor and be steel constructed.
- The camera housing shall be weather-proof, environmental, corrosion and vandalism resistant as well as UV resistant.
- Harsh environments such as coal power plants may require a harsh environment housing. Similarly, cameras at coastal sites will need added corrosion protection.
- If necessary, a junction box with a minimum rating of IP 65 may be installed on the camera support pole. The junction box shall be used to protect any connections and additional equipment necessary for the camera operation. Equipment housed in the junction box should be kept to a minimum as much equipment as possible shall be housed in the equipment room / relay house.
- If used, the junction box shall be mounted on the cement pole support, below the camera.
- If used, the junction box shall be lockable (lock and key, not a panel key) and alarmed.
- All openings of the housing and junction box, used as well as unused, shall be properly sealed to prevent any water or insects from entering the housing.

In addition to meeting the requirements of 4, outdoor cameras shall at minimum meet the requirements in 5 below.

NOTE: Meeting the minimum requirements ‘on paper’ does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment is essential.

Table 5: Additional Minimum Manufacturer Specifications for Outdoor Cameras

Characteristic	Description	Requirements
Sun Damage Resistance	Resistance of sensor a) thermal damage from the sun.	Camera sensor shall be protected from sun damage. Mechanical Shutters are susceptible to failure and will not be accepted.

3.10.3 Fixed Thermal perimeter cameras

- The purpose of perimeter cameras is to provide confirmation of an intruder when an alarm is generated by the perimeter intruder detection system. Since even the best perimeter detection would generate some false alarms, resources can be better managed if intrusion confirmed before armed response is sent to a site.

- Since the images from good thermal cameras are not affected by weather conditions (fog, rain, snow), or glare, it is preferred that the perimeter cameras be thermal. It is also preferred that these thermal cameras provide perimeter detection using 'video analytics', either built into, or as an addition to, the perimeter cameras. Other detection methods (or combination of detection methods) may be used if they are able to meet the functional requirements specified here.

- Thermal cameras shall meet all specifications listed in section General Camera Requirements, and General Requirements for Outdoor Cameras.

- If video analytics on the cameras is used as a method of intruder detection, the video analytics shall meet all specifications listed in 3.9.3 - Perimeter Detection System.

- Thermal perimeter cameras shall be installed along the perimeter of the site yard as described in section above.

- In addition to meeting the requirements of Tables 4, and 5, thermal cameras shall at minimum meet the requirements in Table 6 below.

Note that meeting the minimum requirements 'on paper' does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment (described in section 3.5.3.2) is essential when evaluating CCTV cameras.

Table 6: Additional Minimum Manufacturer Specifications for Thermal Cameras

Characteristic		Description		Requirements	
a)	Detector Type	b)	Sensor used to detect thermal radiation	c)	Uncooled micro bolometer
d)	Automatic Gain Control (AGC)	e)	Increases the camera's sensitivity automatically when	f)	Must have Automatic Gain Control
g)	Resolution	h)	Resolution determines picture quality. The higher the resolution	i)	At least 320 x 240

Thermal Sensitivity	Minimum change in temperature which the detector can differentiate between.	<100mK

3.10.4 Fixed perimeter cameras – non thermal

- Fixed cameras shall meet all specifications listed in section **General Camera Requirements**, and section **General Requirements for Outdoor Cameras.**
- Fixed cameras shall be installed along the perimeter of the site yard.
- If non thermal perimeter cameras are to be used, the design must explicitly address how the effects of weather will be mitigated.
- In addition to meeting the requirements of Tables 4, and 5, fixed perimeter outdoor cameras shall at minimum meet the requirements in Table 7 below.

NOTE: That meeting the minimum requirements 'on paper' does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment (described in section 3.5.3.2) is essential when evaluating CCTV cameras.

Table 7: Additional Minimum Manufacturer Specifications – Fixed Perimeter Cameras

Characteristic	Description	Requirements
1) Infrared	2) Lighting in invisible frequency spectrum used for low-lighting conditions	3) Use 850 or 940nm wavelength Distance cover
5) Sensitivity	6) Minimum light level required to get a usable / acceptable	7) The minimum sensitivity shall be 0.0002 lux for color

- Sensitivity Minimum light level required to get a usable / acceptable video picture. The minimum sensitivity shall be 0.0002 lux for color images and 0.00002 lux for monochrome images.

3.10.5 PTZ camera

- The purpose of the PTZ cameras is to track intruders to help response teams pinpoint the location of intruders. Intruder tracking can be automatic or manual.

- If method of perimeter detection is visual, it is less necessary to have PTZ cameras since the presence of intruders will already have been confirmed visually.

- If, however perimeter detection is non visual, and there are no corresponding perimeter cameras, then the use of one or more PTZ(s) is recommended if possible.

- PTZ cameras are an expensive piece of equipment and should only be installed if it is possible to achieve their primary objective of assisting response teams or onsite security. If communications to the site are over GPRS, then the latency of communications will likely render manual control of the PTZ impossible. In this case automatic tracking and preset positions shall be used. Regardless of the communication medium, the feasibility of using the PTZ shall be tested per site. If it is not possible to control the PTZ effectively to track a suspect, then a PTZ shall not be installed. In this case more fixed cameras can be installed to cover strategic areas.

- PTZ cameras should be seen as an optional piece of equipment to be used only where it can add value.

- One or more PTZ cameras may be installed within the yard depending on the risk and the layout of the site.

- The PTZ camera shall be positioned in the yard in such a way as to cover most of the critical points. Positioning shall be site dependent and shall be informed by the site PSD,In the case where there are no perimeter cameras, the perimeters are the critical points to be covered by the PTZ.

- Where there are perimeter cameras the critical points to be covered by the PTZ are:

- Cable trenches,

- Building Entrance

- Gate entrances.

- Minisubs, RMUs or Metering Kiosks.

- Outdoor storage areas.

3.10.6 The PTZ camera unit shall be installed in one of the following manners:

- On a 7.2m or 9.1m Eskom approved cement pole (See D-DT-0011& D-DT0012 for guidance). The installation shall be done according to the latest revision of D-DT-0332 (LV and MV Foundation Pole Arrangement).
- A steel pole attached to a building. SANS 1431 grade 300WA or 4360 grade 43A steel shall be used.
- A bracket attached to an already installed Eskom lighting mast.
- PTZ cameras shall meet all specifications listed in section 3.10.2 - General Camera Requirements, and section
- General Requirements for Outdoor Cameras. Additional requirements are listed below:
- The PTZ's zooming capabilities shall be powerful enough to meet the purpose of the PTZ
- The PTZ camera shall be remotely controllable by an operator to pan, tilt, zoom, focus, mobilize the iris, switch the camera on/off and place the camera in a pre-set position.
- The PTZ camera shall be controlled by a hardwired cable.
- If there are no perimeter cameras, then the PTZ shall be able to see the perimeter by means of thermal imaging or a built-in infrared spotlight.
- The PTZ shall have preset positions. When a preset position is chosen by the controller, the PTZ shall immediately go to that position.
- Preset positions shall include zoom level.
- It shall be possible to label the preset positions with a descriptive name.
- The PTZ shall be capable of having at least 10 pre-sets.
- Preset positions at each site shall include all gates, doors, various points on the perimeter boundary and high-risk assets (trenches, transformers, rolls of cable).
- It is preferable that the PTZ have built in analytics and be set to 'patrol' the yard during normal operation.

- If the PTZ does not have analytics, then during normal operation it should be set to a useful 'home' position (e.g. gate).
- When an alarm triggers the PTZ shall zoom into the area where the alarm happened. If a person is detected, the PTZ shall follow the motion of that person.
- The control signals from an operator shall take preference over the patrol and tracking functions.
- Preset positions at each site shall include all critical points on the site.
- In addition to meeting the requirements of Table 4, and 5, PTZ shall at minimum meet the requirements in Table 8 below.
- Note: That meeting the minimum requirements 'on paper' does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment (described in section 3.5.3.2) is essential when evaluating CCTV cameras.

Table 8: Additional Minimum Manufacturer Specifications for PTZ Cameras

a) **Characteristic**	b) **Description**	c) **Requirements**
d) Pan Speed	e) Speed at which the PTZ camera can pan the full 360°	f) Minimum 6° per second
g) Pan Range	h) Angle through which the PTZ	i) 360 º
j) Tilt Range	k) Angle through which the PTZ can tilt	l) Minimum 90º (-10º +80º)
m) Optical Zoom	n) Range of focal lengths through which the camera can zoom without reducing resolution	o) Minimum 3.2mm – 138.5mm (43x) (Site dependent)
p) Digital Zoom	q) Maximum that camera can zoom while decreasing the resolution.	r) Minimum 16x
s) Light Sensitivity	t) Minimum light level required to get a usable / acceptable video picture.	u) The minimum sensitivity shall be 0.0007 lux for colour images and 0.000007 lux for monochrome images.

- Pan Speed Speed at which the PTZ camera can pan the full 360° Minimum 6° per second
- Pan Range Angle through which the PTZ can pan 360 ºTilt Range Angle through which the PTZ can tilt Minimum 90º (-10º +80º)
- Optical Zoom Range of focal lengths through which the camera can zoom without reducing resolution Minimum 3.2mm – 138.5mm (43x) (Site dependent)
- Digital Zoom Maximum that camera can zoom while decreasing the resolution. Minimum 16x
- Light Sensitivity Minimum light level required to get a usable / acceptable video picture. The minimum sensitivity shall be 0.0007 lux for colour images and 0.000007 lux for monochrome images.

3.10.7 Indoor Cameras

- When deemed necessary by the site risk assessment, indoor cameras shall be used inside building on the site.
- Indoor cameras shall meet all specifications listed in General Camera Requirements. Additional requirements are listed below:

3.10.8 General

- The camera field of view shall include the entrance to the room/building as the point of interest.
- Where there is more than one entrance, more indoor cameras may be necessary, as determined by the risk assessment.
- Indoor cameras may be dome, fixed or bullet cameras
- Indoor cameras shall have infrared lighting.
- The purpose of the camera shall be observation and / or identification in the case of forced entry depending on the site requirements. Depending on the bandwidth available it may be appropriate to have observation quality on the live stream and identification quality only on recordings.

- Backlight compensation with wide dynamic is particularly necessary for cameras looking at entrances. The effectiveness of these features must be tested at time of day when the sun in most directly shining into the entrance. If tests show that the backlight compensation is not sufficient then lighting shall be used to achieve the camera's purpose.

- Indoor cameras may be ceiling or wall mounted depending on the site.

- The camera shall be housed in a vandal proof housing with an IP rating of at least 51.

- The camera field of view shall be adjustable via an adjustable bracket or built-in manual pan-tilt mechanism.

Figure 17: Indoor camera inside room

- In addition to meeting the requirements of Table 4, indoors cameras shall at minimum meet the requirements in Table 9 below.

- Note: Meeting the minimum requirements 'on paper' does not necessarily mean that a camera can perform as necessary. For this reason, the demonstration of equipment (Table 9: Additional Minimum Manufacturer Specifications for Indoor Cameras.

- Day/Night Function Ability to compensate for poor lighting conditions Camera shall have day/night function

- Electronic Shutter (ES) Compensates for moderate light changes in indoor applications without the use of auto iris lenses. Electronic shutters shall be used.

- Infrared Lighting in invisible frequency spectrum used for low-lighting conditions. Camera shall have infrared.

- Minimum illumination Minimum light level required to get a usable / acceptable video picture. The minimum illumination shall be 0.0002 lux for color images and 0 lux for monochrome images.

3.10.9 Digital Video Recorder / Network Video Recorder

- A Digital video recorder (DVR) or Network Video Recorder (NVR) shall be used to record relevant video footage as well as to allow access to live streaming footage from the security control room. For simplicity, this document uses the term 'DVR' to refer to either a DVR or NVR, since both devices perform the same function.

- The DVR shall be integrated with the alarms from both the perimeter detection system and the indoor intruder detection system and shall connect to the Video Management System.

3.10.10 DVR Functionality

- In the event of an alarm being triggered (from camera or intrusion detection system) when the system is armed the system shall:
- Record footage from relevant cameras. Relevant cameras are those with a field of view of the triggered zone and may include PTZ cameras or fixed cameras adjacent to the triggered zone depending on the site.
- The footage recorded shall be for 5s second before the event triggered, the time of the actual event (however long motion is detected by the camera) and at least a 15 second post event time. This recording shall be at the full resolution of the camera.
- Send a signal to the Security Control Room, including the zone that was triggered.
- Send short video clip / series of still pictures from the camera covering the zone where the alarm triggered to the security control room. This shall be at a resolution suitable for the communication medium used. The quality of the footage received at the security control room shall be such that the controller can clearly identify whether the intruder detection was triggered by a human (detection).
- Allow for the security control room to remotely access the site to stream live footage from the system. This live streaming may be at a lower resolution than the recorded footage but shall be of a high enough resolution to allow for observation by the controllers.
- Allow for the security control room to operate any PTZ cameras installed on site, including using pre-set positions.
- Allow for the controller to speak over the PA system or play a pre-recorded message on site.
- In the event of movement being detected when the system is not armed, the system shall:
- Record footage from relevant cameras for 5s second before the event, the time of the actual event (For however long motion is detected by the camera) and at least a 15 second post event time. This recording shall be at the full resolution of the camera.

3.10.11 Compatibility:

- The DVR shall be able to integrate with a wide range of cameras from different manufacturers.
- The DVR shall be ONVIF compliant. It must however be noted that ONVIF compliance does not guarantee compatibility between systems.

- The DVR shall allow for simultaneous use of different model cameras with different resolutions.

Recording and streaming

- It shall be possible to configure the DVR to record on any motion event or only when an alarm event is generated.
- Simultaneous recording on site and streaming to the security control room shall be possible.
- It shall be possible to stream video at a lower resolution and frame rate than the footage is recorded on site.
- Recording: Shall be such that identification can be achieved on cameras with identification as the purpose.
- All footage shall be time and date stamped
- It shall be possible to search events and recorded footage based on a combination of date, time, event and motion in a specific part of the camera's field of view
- The recording media shall be a removable, hot swappable and lockable.
- All footage shall be kept for a minimum of 30 days. To achieve this, the hard drive size should initially be calculated to be large enough to store 30 hours of continuous recording from all cameras. After 30 days of normal event-based operation on site, the hard drive space used shall be checked and the hard drive upgraded if necessary.
- It shall be possible to 'flag' important footage so that it will not be overwritten.
- When the hard drive is full, the DVR shall continue to record by overwriting the oldest recordings first. Flagged footage shall not be overwritten.

Frame Rate

- The frame rate shall be adjustable
- A frame rate of at least 25fps shall be achievable by the DVR
- Recommended frame rate for streaming video: 2-5 fps
- Recommended frame rate for recordings: 6fps or larger

Video Compression

- Compression standards such as H. 264, MPEG4 or equivalent may be used for streamed video
- A compression standard such as MJPEG or equivalent may be used for streamed video
- Video compression shall be used appropriately such that the specified purpose of each camera (detection/observation/recognition/identification) can be achieved for recordings and streaming of footage.
- The DVR shall enable the syncing of time between sites, and between cameras as specified in section

3.10.12 Remote Connections

- It shall be possible to remotely view live or recorded video over the network (with appropriate access rights).
- It shall be possible to configure all DVR settings over the network (with appropriate access rights).
- It shall be possible to download recordings on site or offsite.

Video Monitor

a. It shall be possible to plug a Video Monitor into the DVR (site specific) Security

- The DVR shall be password protected.
- The DVR shall cater for a minimum of 10 individual users with assigned access rights.
- There shall be a minimum of 2 access levels:
- Level 1 shall provide viewing of footage only, with no ability to delete footage or view or change settings.
- Level 2 shall provide full administrative rights.
- Hardware and I/O connections

b. The DVR shall have input contacts for connecting to alarm signals from the alarm system It is recommended that DVR have an 'error' output which will output a signal to the alarm system if there is an error with the DVR.

- DVR shall have an on off switch and status LED

System Logging:

- The DVR shall keep a time stamped electronic log of the following:
- User who has logged in to make changes.
- Changes made
- System Errors
- Interruption of Camera feeds

Video Management System (VMS)

A video management system (VMS) is the software which allows one to view and manage the CTTV cameras at multiple sites. It is the VMS which operators at the security control room will be using to receive alarms from sites, receive short clips of incidents and through which they will connect to remote sites to view live streaming video. The VMS is the central tool to being able to detect and respond to security incidents on site.

- The network infrastructure shall adhere to the principles laid out in the following Eskom Documents:
- 240-55410927 - Cyber Security Standard for Operational Technology [7
- 240-55683502 - Definition of Operational Technology (OT) and OT / IT Collaboration Accountabilities[8]

3.10.13 Logs

- A strategy for moving monitoring of sites to a different third party, or Eskom premises when the contract expires.
- The VMS shall connect to CCTV cameras and DVRs via the Eskom OT network, a third-party network, or a combination of the two.

- The VMS shall be capable of a 'Client-Server' configuration. The server shall be housed at an Eskom site and the security control room shall connect to the server using client software, over a secure, dedicated link.

- Authorized Eskom employees using the client software shall be able to connect to the server via the Eskom Corporate Network.

- The VMS system shall be able to connect to a minimum of 500 sites and 4000 cameras. Not all installations will need this many connections, but it shall be possible to upgrade the system to accommodate these numbers.

- The VMS design shall cater for failover and allow for a redundant architecture.

- The system shall allow for at least 5 simultaneous client connections.

- The frame rate and resolution of camera connections shall be reduced in order to provide smooth footage over the communication medium.

3.10.14 Features

- The VMS shall be able to connect to a wide range of CCTV NVRs and DVRs.

- Where there are already CCTV components installed, the VMS shall be compatible with the existing install base of CCTV equipment. As part of the enquiry documentation Eskom shall provide a list of CCTV equipment installed

- The VMS system shall be ONVIF Compliant. It must however be noted that ONVIF compliance does not guarantee compatibility between systems.

- Be able to connect to cameras with a wide range of different resolutions (from CIF (352x240) to 5 Megapixel). Typically the higher resolutions will only be used when monitoring is on site.

- All security control room activities as described in section 3.12 Security Control Room, shall be possible using the VMS system.

- The VMS system shall allow for Access Control integration.

- The VMS shall be linked to an NTP/SNTP timeserver to synchronise the time on the VMS system.

- The VMS shall be able to operate as a time server to synchronise the times of downstream systems at remote sites.

- Shall allow an administrator to make customizable reports on events, system status etc.
- The VMS shall allow the security control room operators to view whether a site is armed or disarmed.
- It shall be possible to draw up a list of all sites which are disarmed.

3.10.15 Network Security

- The system shall comply with 240-55410927: Cyber Security Standard for Operational Technology which serves to guide the implementation of Cyber Security principles in the OT environment
- All connections to the Eskom OT networks shall be firewalled as per 240-79669677: Demilitarized Zone (DMZ) Designs For Operational Technology
- All connections to the Eskom corporate network shall be firewalled and approved by Eskom Group IT.
- Remote Access to the Eskom network shall adhere to 32-273: Information Security – IT/OT and Third-Party Remote Access Standard.
- The Engineering design shall follow both IT and OT governance processes as per 240-55863502: Definition of OT and OT/IT Collaboration Accountabilities.
- The VMS shall allow for individual, password protected user rights.
- There shall be a minimum of 2 access levels:
- Level 1 shall provide viewing of footage only, with no ability to delete footage or view and change network settings
- Level 2 shall provide full administrative rights.
- The system shall keep a time and date stamped log of all logon events
- The system shall keep a log of all administrative changes made on the system, including who made the change.

3.10.16 Video Recording and Streaming

- The primary purpose of the VMS shall be to view live footage. Due to network constraints the primary place for saved recordings shall be on site. However, for investigation and training purposes, it shall be possible for the VMS to record footage which has been streamed to the security control room and to export that footage.

- The VMS shall support simultaneous recording and streaming of footage.

- The VMS shall support streaming at a wide range of resolutions, depending on the network bandwidth and the camera being connected to.

- The VMS shall enable different client workstations to stream from different cameras simultaneously.

- The VMS shall enable a continuous streaming ‘video wall’. This shall be customizable, allowing for resizable viewing panes.

- The VMS shall support recording and playback of files using H.264, MPEG and MJPEG video compression

- The VMS shall be able to trigger recordings based on: Schedule, Manual trigger, alarm, event

- Be able to stream and record using various frame rates (8fps -25fps). Typically, the higher frame rates will only be used for live footage when monitoring is on site.

- The VMS shall be able to use a wide range of different communication links to different sites. This will range from poor 3G connections to high latency satellite, to fibres. It shall be possible to cater for different frame rates and resolutions per site depending on the bandwidth and cost of the communication medium.

- All recordings shall be electronically watermarked and show time and date.

- It shall be possible to search events and recorded footage based on a combination of date, time, event and motion in a specific part of the camera’s field of view

- Playback in slow motion and at high speed shall be possible.

- The player shall allow for multichannel playback, which allows users to play recorded video from several cameras simultaneously. This is useful if tracking suspects moving on a site.

- The system shall be able to perform mass export of archived footage.

- It shall be possible to ‘cut’ footage to export only the portion of footage that is of interest

- As a guideline, the system shall cater for at least 7 days of continuous recordings from each of the security control room monitors, streaming from 5 of the highest frame rate and resolution cameras installed.

Example

The security control room has 2 people monitoring sites from separate workstations. The highest resolution cameras installed are 1Mpx cameras streaming at 10fps

Calculation, Determine file size of 1 hour of footage: Either record an hour of footage, or use one of the many 'CCTV file size calculators' available online.

Approximate size of 1 hour of footage in H.264 = 1.5G Approximate size of 7 days of footage: 252G

Approximate size of 7 days of footage for 5 x 1Mpx cameras = 1.26T~1.25T So, for two monitoring stations you will need 2.5T of hard drive space.

It shall be possible to 'flag' important footage so that it will not be overwritten.

When the hard drive is full, the oldest recordings shall be overwritten first. Flagged footage shall not be overwritten.

Event Management

The VMS shall:

- Support 'black screen monitoring': In normal state, no video is shown. When an alarm triggers at a site the controller sees a series of still images or a short video clip of the zone where the alarm was triggered. The controller can then choose to stream video from the site.
- Support an event queue to allow the management and acknowledgment of multiple alarm events.
- It shall be possible to look at a new event without having acknowledged a previous event.
- Support PTZ control including PTZ pre-set positions.
- Allow the transmission of voice from the controller to the PA system on site.
- Allow for the controller to control lights at the site.

- Allow controller to view the location of alarms and cameras on a site layout
- Allow controller to view the location and status of all sites on a map
- Enable comments from controller to be linked to an event.
- It shall be possible to 'escalate' incidents to another workstation running the client software e.g. another controller or an Eskom National Security Control Centre.
- Log events and actions for auditing purposes
- A highly recommended feature is the ability of the VMS system to track movement and highlight which area of the camera field of view has triggered an alarm (This could be software based or a feature of the cameras or video analytics on site).
- The VMS system shall have high usability (be 'user friendly'). Usability is a difficult thing to quantify but can be broadly defined as consisting of [26] :
- Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
- Efficiency: Once users have learned the design, how quickly can they perform tasks?
- Memorability: When users return to the design after a period of not using it, how easily can they re- establish proficiency?
- Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- Satisfaction: How pleasant is it to use the design?
- Before choosing a VMS, system Eskom shall view a demonstration of the VMS product. The service provider shall be able to demonstrate all of the features specified above, this shall include administrative tasks as well as security control room tasks. The evaluator(s) shall use the system themselves as part of this demonstration rather than simply being shown the system in operation.

3.10.17 Hardware

Server shall meet Eskom IT requirements for servers including:

- An HP server shall be used

- Server shall be 19” rack mountable
- The operating system shall be Window Server 2008 r2
- Symantec antivirus shall be installed (can be provided by Eskom IT support)
- Server shall connect to Eskom IT servers for antivirus and Windows security updates.
- Server shall meet with the VMS manufacturer’s hardware requirements.
- Server shall be housed in a secure, access-controlled environment.

3.10.18 Training and Support

- There shall be local support for the VMS product.
- Product support in the closest City to the installation
- The tenderer shall provide Eskom with details of their support network as well as the service levels in terms of turnaround time to attend to technical problems.
- Operator and administrator training shall be provided
- Documentation on the hardware installation shall be provided (see section b)
- Instruction manuals shall be provided (see section b)

3.10.19 Security Control Room

- The CCTV surveillance shall be monitored by Eskom staff, or an Eskom approved security company located within a secured central security control room. The security control room shall be equipped such that the security control room operators shall, for each site, be able to:
- Select each individual camera within the site to view footage from the respective camera.
- Operate additional lighting installed.
- Select a program to sequentially switch the cameras.
- Operate the zoom, pan and tilt throughout the complete range of each PTZ camera installed.

- Operate the PA systems installed in the respective sites
- Security Control Room Operators
- While the system equipment may perform optimally, any failure on the operator's part will lead to a performance degradation of the entire CCTV surveillance system. When selecting security control room operators there are various skills that need to be considered.
- The security control room operators shall have the ability to work under pressure, have vigilant capabilities and maintain the ability to perform under widely fluctuating work levels.
- Operators should be well trained so that they are fully conversant with the use of all items of equipment and are able to deal with any operational circumstances that might confront them.
- Operator training shall include coping with equipment malfunction.
- Operators shall be trained to operate the remote PA system.
- Operators shall be trained in the verbal procedure to be followed when addressing an intruder via the PA system.

The functions of security control room operators shall include being able to operate each camera in order to:

1. Obtain individual camera views as well as the duration.
2. Make adjustments to attain the appropriate lighting for the specific camera.
3. Select a program to sequentially switch the cameras.
4. Operate the pan-and-tilt and zoom applications throughout the complete range, where fitted.
5. Use the on-screen menu with crisp, sharp images that do not deteriorate with usage or downloading.

3.10.20 Records, for record purposes, the security control room shall have a maintenance/repair logbook. This logbook may be software based or paper based. The security control room operators shall record the following in a chronological order:

- Date and time.
- Fault specific details.

- Fault notification to responsible Eskom employee.
- Any re-notification.
- Commencement date and time of repairs / inspections / maintenance.
- Completion date and time of repairs / inspections / maintenance.
- Signature of responsible Eskom employee, next to each new entry.
- Replacement spares required and installed.
- CCTV and intruder detection equipment maintenance contractor attendance log details for routine and breakdown maintenance.
- The language medium shall be in English.

1.1 Request-To-Exit Devices

- Request-to-exit devices shall be provided to allow a person to exit an access controlled, monitored door.
- Request-to-exit devices shall be a robust, vandal resistant momentary touch free exit sensor, using optical infrared technology with a detection range from 1 to 100mm
- The unit shall be IP-55 stainless steel plate with red/blue status LED and shall be mounted in flush, wall boxes
- Quantity and location of request-to-exit devices shall be as noted on the Bill of Quantities and drawings.
- Emergency Release Break-Glass-Units
- Green break glass units shall be installed on the secure side at each controlled door wired to directly release the door magnet and raise an alarm when activated.
- The units shall be fitted with a plastic resettable actuator of activation. The actuator will be reset with a special key if activated.
- The unit shall be fitted with a hinged clear plastic protective cover
- Indoor Waist Height High Speed stile
- Waist height 900mm and 700mm wide single lane configuration complete with 8mm thick toughened Glass Wings, directly connected to high speed motor
- High speed opening/closing to prevent simultaneous entry by two persons;
- Entry and exit direction controlled by the access control system;
- Turnstile PLC control with adjustable operational modes;
- If no pass-through, release is cancelled again after an adjustable period (time out);
- Fire alarm trigger to activate barriers to remain in the open position for free access;
- Power voltage will be 220Vac, 300W;
- Turnstile(s) will be fit on a concrete floor and fixed with raw bolts and nuts.
- Quantity, type, finishing and location of the turnstile(s) shall be as specified in the Bill of Quantities. Emergency doors, gates and infill pieces

- Emergency egress provision shall be provided at each control point where booths or turnstiles are employed. Emergency doors shall match the controlled equipment and shall be equipped with magnetic locks controlled via a re-settable break glass unit on the secure side of the system as well as by means of a push button at the nearest manned security point. Further to the above, the emergency doors shall automatically unlatch on receipt of a fire signal from the buildings fire detection system.

3.11 Integrated access control requirements

- The IACS must primarily cater for Eskom's integration requirements and must form the basis to engage with all the disparate systems in the physical security environment.

- The IACS (Integrated Access Control System) shall be the standard Physical Access Control across Eskom with capabilities to integrate with but not limited to CCTV, Lifts, Canteen Management System, Transportation System, Building Management Systems and other security / business subsystems to provide a unified security management system.

- The system shall be capable of providing access control for Corporate Offices and any other Eskom buildings, Power Stations, Dx and Tx substations, Mini substations, Sites under construction, Control Rooms, Technical Services Centres, Customer Walk-in Centres, Laboratories, Water treatment plants, Visitor Centres, Stores, Workshops, Canteens, Medical Centres, Fire Stations, Boardrooms, Conference facilities, Eskom Telecommunications Radio Sites, Maintenance or service centres, Server Rooms, Gyms, Kitchens, Boarding/Accommodation and Bus areas. In addition to providing access control to different site types, the system shall also be able to provide access control to equipment requiring restricted access such as metering kiosks and RMU(s). The integrated Access Control system shall achieve the following general requirements:

- The system shall be able to transfer data to SAP for Time and attendance data.
- Each user authorization shall be uniquely definable.
- Operator terminals shall be protected by terminal security such as password policy.
- All actions on the system shall be traceable and auditable. These actions must be kept for a minimum period of 90 days.
- The system shall allow for an allocated employee number (unique number) to be changed when a contractor or visitor becomes a permanent employee with Eskom (i.e. a scenario must be allowed for whereby a person can initially be registered as a visitor/contractor and then upgraded to permanent employee status, without having to re-register the person).
- The system shall be able to automatically disable a visitor or contractor on the required date of termination as entered by the registrar on the registration facility at the date of registering.
- A visitor shall be disabled after leaving the site or designated place of visit/work, this function must be reversible whereby a person can be enabled should he require entering the premises again. Depending on the specified elapsed time after the initial authorisation was granted, to allow return access the full process of authorisation must be followed, otherwise a verification process must be followed.
- The system shall have a full anti-pass back facility to control the flow of personnel from one zone to the other, (i.e., once a person has successfully fingerprinted and has passed through the access control point, access must be blocked in terms of the zone he has just left – i.e., preventing a scenario whereby a person can allow another person through an access control point based on his fingerprint)
- High risk areas access shall be granted only to personnel working in that area. Additional access shall only be granted if the necessary approval has been given by the responsible person of that area and shall be automatically disabled as soon as that person leaves the area.
- The system shall allow for overrides, interlocking and other functions as they become necessary to operate and optimize the system by the administrator at a remote location.
- The system shall be able to interface with existing software packages and therefore an open protocol software platform will be required.
- It shall be possible for the operator to bypass anti-pass back rules selectively such as one host having multiple visitors.

- The system shall have lockdown functionality in emergency situations.
- System shall allow for online changes to be made.
- Real-time online debugging shall be possible.
- The system shall be either fail safe or fail secure, as required.
- The application for change or update of access shall be completed on a standardised eForm.
- There shall be a dedicated “Master” station to assist in roll call in the event of an evacuation.
- Indicating who was in the building at the time of evacuation and if all are accounted for at the assembly point.

3.12 TESTING AND COMMISSIONING

The successful bidder shall note that it is a requirement of this tender that a detailed testing

and commissioning schedule be prepared for the full testing and commissioning of the complete system.

- This full schedule will be available four weeks after appointment of the successful bidder. And commissioning schedule shall be to the approval of the Engineer.
- It must be noted that no piece meal hand over will be acceptable and that the entire integrated system shall be inspected and tested once all work as detailed in this specification has been completed.
- When the electronic system is ready for service, commissioning shall take place to check whether the correct quantities of equipment have been delivered and the installation is in accordance with the specifications. Commissioning shall be performed in co-operation with the successful bidder’s personnel and representatives of Client and Engineer.
- The date of commissioning will be scheduled by the Contractor and has to be approved by the Client.
- Practical Completion will only be issued once the electronic system installation satisfies the operational performance requirements of the contract and the Engineer is satisfied that all security systems can operate effectively.

- All individual building levels and subsystems shall be thoroughly tested in the presence of, and to the satisfaction of, the Engineer or their authorised representative. Performance and acceptance testing shall include a thorough inspection (point by point) of the entire installation and verification that the installation complies with the requirements of the specification.

- Performance and acceptance testing to determine whether the integrated security system achieves the required level of performance will only be undertaken after all routine testing, adjusting, commissioning, approvals and building work associated with the contract are complete and the works have been fully tested and commissioned by the Contractor.

- Details of the testing required for each system and equipment shall be included in the Contractor's quality plan.

- The integrated security system testing, and commissioning shall be conducted both during normal daylight hours and again at night after hours, as required and to the approval of the Engineer.

- The contractor shall supply all labour, materials and equipment required to fully commission and test the complete installation.

- All costs associated in demonstrating that the integrated security system performs as required by the contract, shall be borne by the contractor.

The following testing shall be conducted:

- Factory Demonstration testing at the location nominated by the Engineer.

- Commissioning testing at the installation.

3.12.1.1 Performance and Acceptance testing at the installation.

- Testing and commissioning shall allow for any programmed staging of works as detailed in the Contractor works program. Where staging of works is applicable elements of the works may require testing on several occasions because of the integration/relocation and commissioning of services and equipment as building works progress.

- The Contractor shall conduct all tests and inspections, as required by the Engineer, to ensure that the systems and all other works comply with the requirements of the Contract.

- Equipment, which fails to operate correctly or is found to be installed incorrectly shall be repaired or replaced by the Contractor. Where any test is unsuccessful the defective equipment shall be repaired appropriately and subjected to retesting.

- The contractor shall provide written notice of intention to test to the engineer not less than 21 working days prior to the conduct of test.

3.12.2 Factory Demonstration Test.

The purpose of the factory acceptance test is to:

- Demonstrate that the system being provided by the Contractor operates as specified in the tender documentation. It is not expected that the full system be operational at this time, but that each sample subsystem under test, can be demonstrated to its full potential in a system environment.

- Allow the opportunity for all stakeholders and involved parties, to physically observe and operate the system and to provide input and feedback for final system configuration to ensure the client's needs and requirements have been fully addressed.

- Allow a final opportunity to consider possible design changes, with minimum impact on costs and integration during the construction phase; Finalise the design and functionality of the system configuration.

- Present a methodology and the documentation of procedures to be used during the commissioning phase of the project.

The factory demonstration shall include, as a minimum:

- Operational samples of all equipment proposed to be supplied as part of the contract.

- An operational model (limited in scale) of the sample equipment to demonstrate

the functionality of each sub-system that comprises the fire detection and security services system.

- The operational model shall demonstrate the overall alarm handling, monitoring, reporting and methodology of operation of the proposed integrated fire detection and security services system.

3.12.3 Factory Demonstration Test Specification:

Supply a factory demonstration test specification to the Engineer for comment a minimum of 28 days prior to the demonstration date. The factory demonstration test specification shall include as a minimum:

- Introduction providing an overview of the factory demonstration aims, test procedures and agenda.

- Functional block diagram of the test demonstration detailing equipment and connectivity (including interfaces) for the test session.

- Restrictions on equipment operation for the test e.g. RF devices which may be connected via line to simulate field operation;

- List of equipment being used in the demonstration including any test equipment or additional equipment used in the demonstration.

3.12.4 Detailed test procedures fully describing:

- The specification requirement being demonstrated

- The exact procedure to be implemented to demonstrate compliance with the specified requirement

- The expected outcome from the demonstration

- Test result check boxes i.e. pass/fail.

- Remarks field to provide additional clarification as a result of the demonstrated function.

- Factory test sign-off sheet for the contractor and engineer authorized representatives to confirm test results.

3.12.5 Commissioning

- The commissioning of the system shall be done in the presence and to the satisfaction of an authorized representative of the client.

- The contractor shall fully test and commission electronic systems to ensure that correct operation of all systems prior to final performance and acceptance testing with the Engineer.

- All equipment, material, etc., which may be necessary for these tests shall be supplied by the contractor, including a suitable smoke generator.

- The contractor shall do his own complete commissioning tests before the actual first take-over tests are done. This is to satisfy himself that everything is working and is in accordance with the specification.

3.12.6 During the conduct of commissioning the contractor shall:

- Confirm that all equipment is fully operational and provides the required functionality.
- Provide a comprehensive final commissioning report outlining all test results.
- Constructed details, performance test data on all cables and any other information deemed necessary for future records.
- Supply all labour, materials and equipment required to fully commission and test the installation to the satisfaction of the engineer.
- Allow for minor programming changes and adjustments because of testing and commissioning and/or final performance and acceptance testing.
- Repair or replace any equipment that fails to operate correctly, or is considered by the engineer, to be installed incorrectly.
- Supply all passwords installed as part of these works to the engineer.

Performance and Acceptance Testing

Final performance and acceptance testing to be conducted with the Engineer shall, as a minimum, include:

- Physical inspection of each point and device.
- Test function of each point and device.
- Test alarm response and annunciation of each point and device.
- Check logging and recording of activity for each alarm point and device.
- Test required interface with other systems for each alarm point and devices.
- Confirmation that each system performance complies with the project specification.

On completion of the works the contractor shall satisfy the engineer that the security services installation operates in accordance with the requirements of the contract.

3.13 TRAINING

- Prior to commissioning of the installation, the contractor shall provide comprehensive training of all staff and nominated maintenance personnel, to the approval of the Engineer and the Client.
- Maintenance staff demonstrates a complete understanding of the location and connectivity of the various elements of the electronic services installation.
- All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on Site by the Client.
- The training documentation must be submitted to the Engineer for evaluation and approval. No training will commence on site prior to the written approval of the Engineer. Should the Engineer not approve the drawings all documentation will be referred to the Contractor for re-evaluation and submission to the Engineer.
- Documentation must be sent to the Engineer at least 14 working days prior.
- commencement or scheduling of training programs of the operational staff on site.

4 Acceptance

This document has been seen and accepted by:

Name	Designation
Rhulani Mlambo	LDE-Electrical
Nkanyiso Shozi	LDE-Civil
Nombulelo Lukhele	Design and specification

5 Revisions

Date	Rev.	Compiler	Reason for change
30 May 2022	1	G Mandlazi	Original document

6 Development Team

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

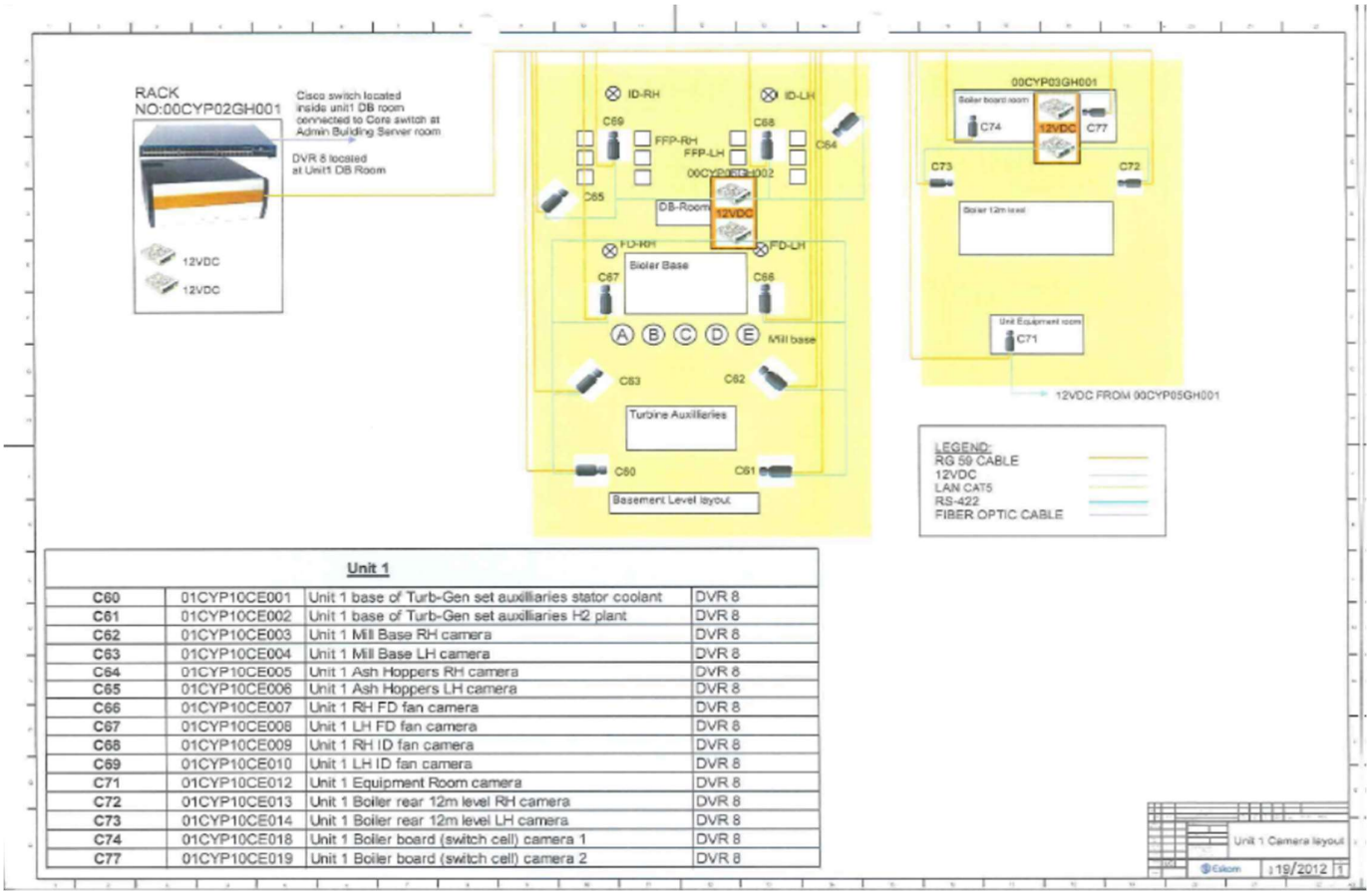
- Rhulani Mlambo
- Nkanyiso Shozi

- Nombulelo Lukhele

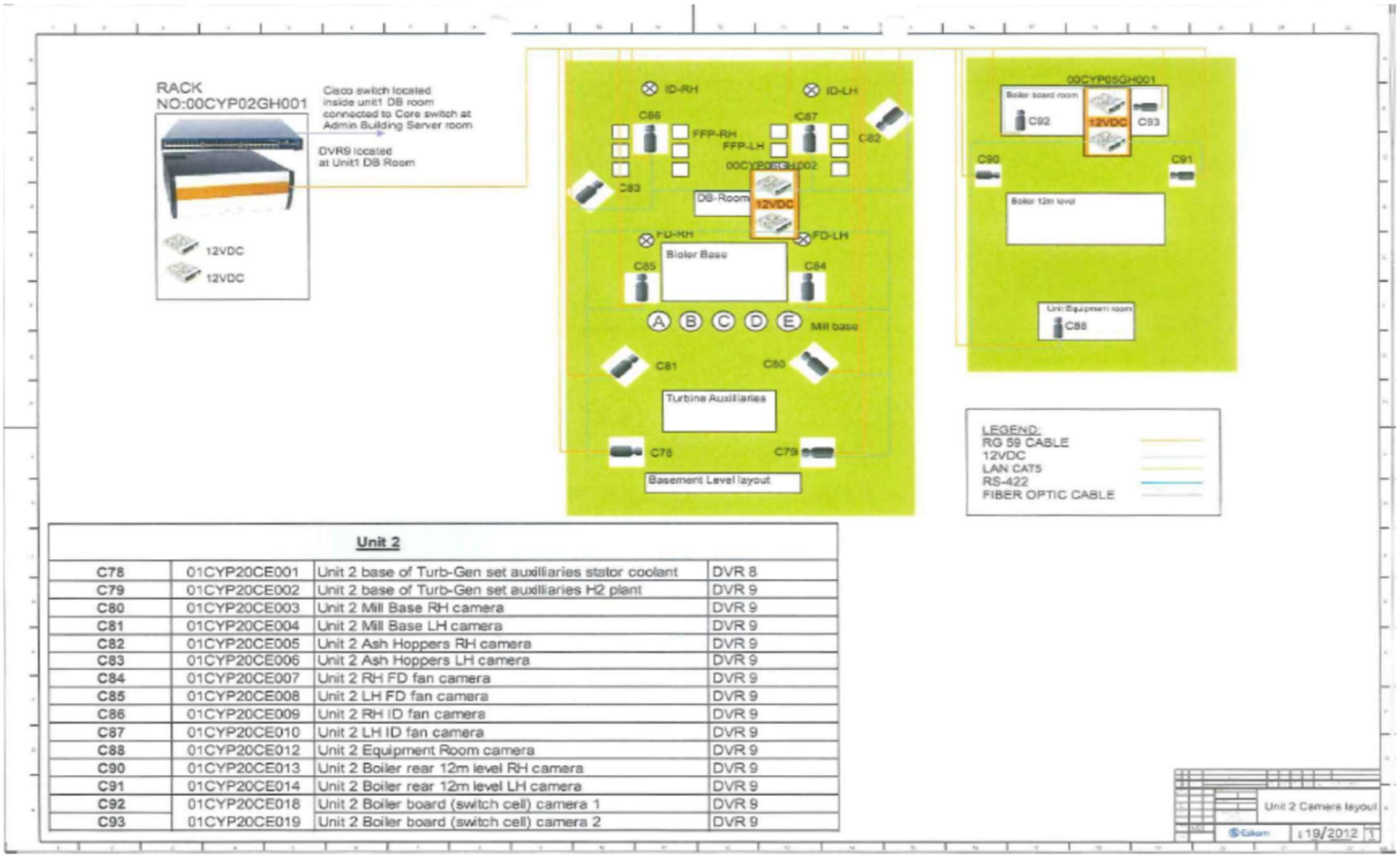
7 Acknowledgements

None.

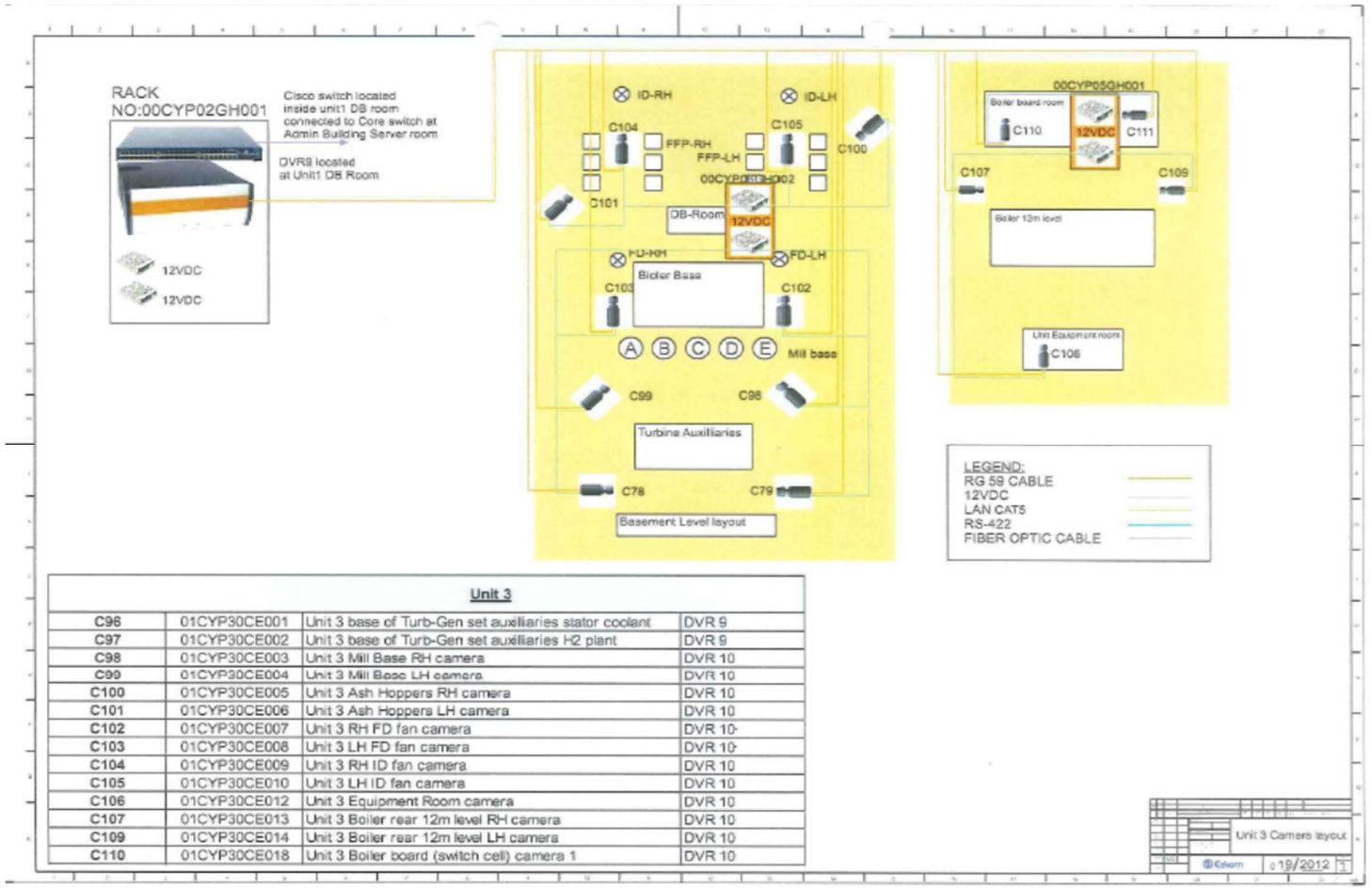
Appendix A



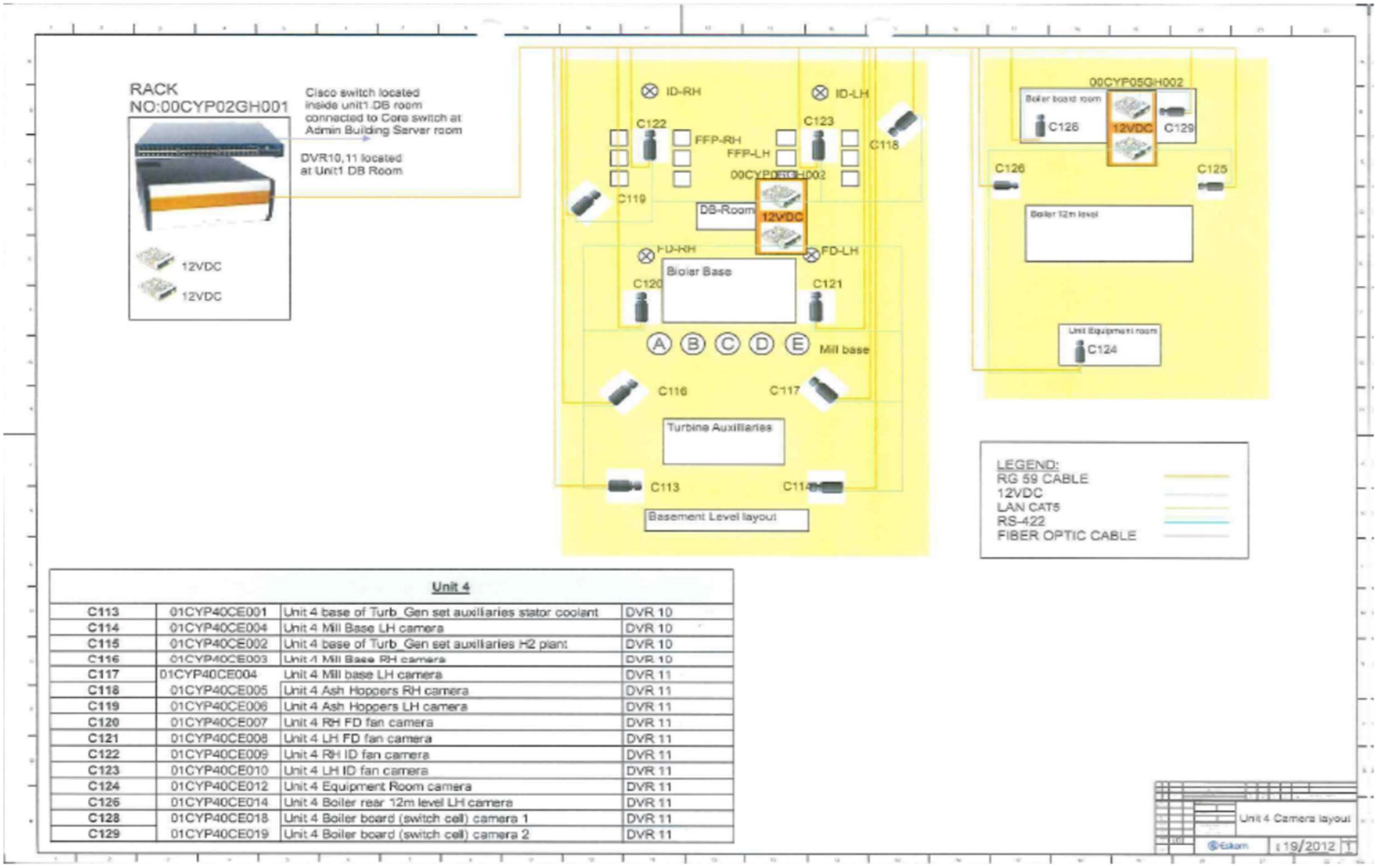
Unit 1			
C60	01CYP10CE001	Unit 1 base of Turb-Gen set auxilliaries stator coolant	DVR 8
C61	01CYP10CE002	Unit 1 base of Turb-Gen set auxilliaries H2 plant	DVR 8
C62	01CYP10CE003	Unit 1 Mill Base RH camera	DVR 8
C63	01CYP10CE004	Unit 1 Mill Base LH camera	DVR 8
C64	01CYP10CE005	Unit 1 Ash Hoppers RH camera	DVR 8
C65	01CYP10CE006	Unit 1 Ash Hoppers LH camera	DVR 8
C66	01CYP10CE007	Unit 1 RH FD fan camera	DVR 8
C67	01CYP10CE008	Unit 1 LH FD fan camera	DVR 8
C68	01CYP10CE009	Unit 1 RH ID fan camera	DVR 8
C69	01CYP10CE010	Unit 1 LH ID fan camera	DVR 8
C71	01CYP10CE012	Unit 1 Equipment Room camera	DVR 8
C72	01CYP10CE013	Unit 1 Boiler rear 12m level RH camera	DVR 8
C73	01CYP10CE014	Unit 1 Boiler rear 12m level LH camera	DVR 8
C74	01CYP10CE018	Unit 1 Boiler board (switch cell) camera 1	DVR 8
C77	01CYP10CE019	Unit 1 Boiler board (switch cell) camera 2	DVR 8



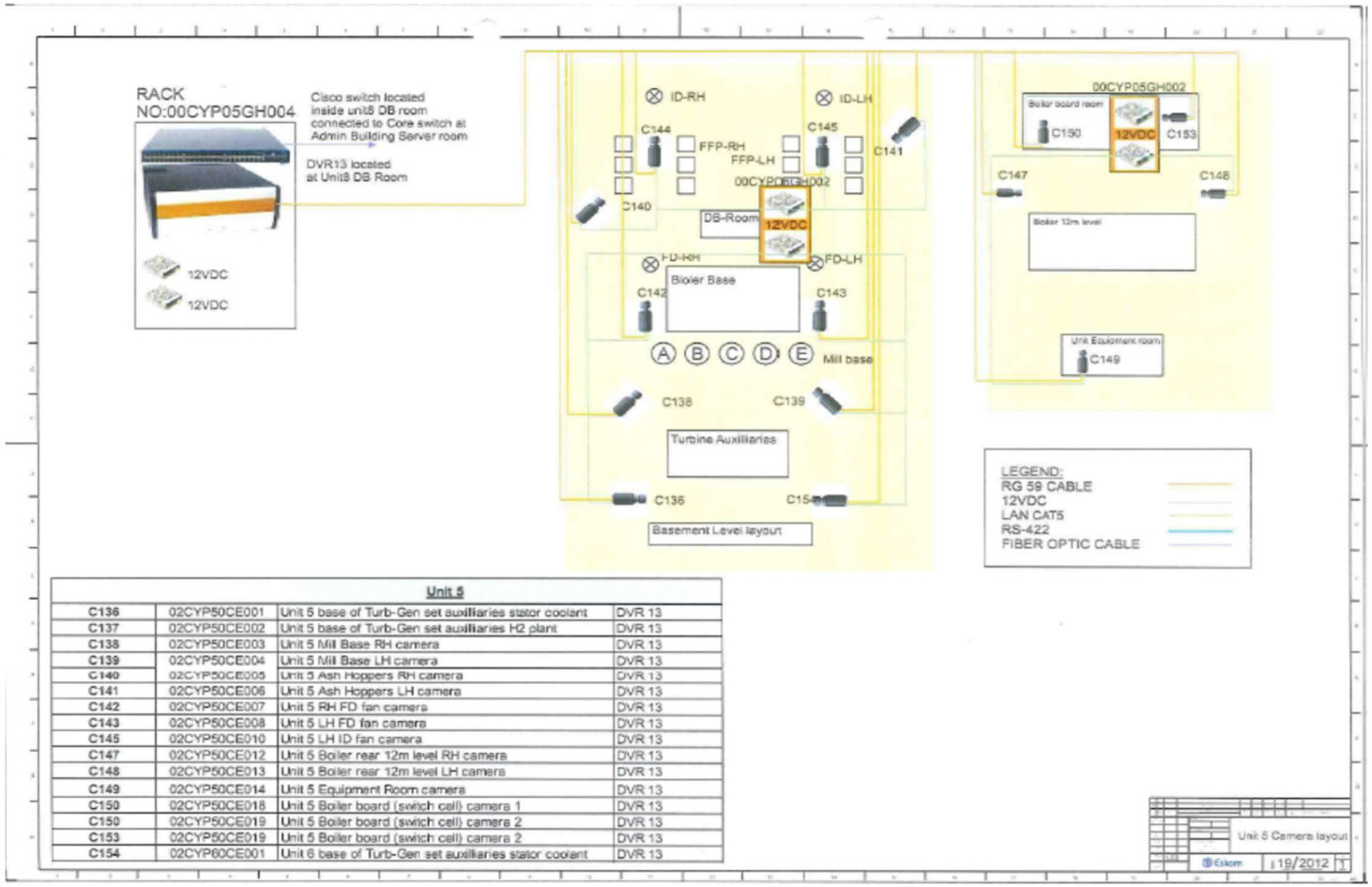
Unit 2			
C78	01CYP20CE001	Unit 2 base of Turb-Gen set auxiliaries stator coolant	DVR 8
C79	01CYP20CE002	Unit 2 base of Turb-Gen set auxiliaries H2 plant	DVR 9
C80	01CYP20CE003	Unit 2 Mill Base RH camera	DVR 9
C81	01CYP20CE004	Unit 2 Mill Base LH camera	DVR 9
C82	01CYP20CE005	Unit 2 Ash Hoppers RH camera	DVR 9
C83	01CYP20CE006	Unit 2 Ash Hoppers LH camera	DVR 9
C84	01CYP20CE007	Unit 2 RH FD fan camera	DVR 9
C85	01CYP20CE008	Unit 2 LH FD fan camera	DVR 9
C86	01CYP20CE009	Unit 2 RH ID fan camera	DVR 9
C87	01CYP20CE010	Unit 2 LH ID fan camera	DVR 9
C88	01CYP20CE012	Unit 2 Equipment Room camera	DVR 9
C90	01CYP20CE013	Unit 2 Boiler rear 12m level RH camera	DVR 9
C91	01CYP20CE014	Unit 2 Boiler rear 12m level LH camera	DVR 9
C92	01CYP20CE018	Unit 2 Boiler board (switch cell) camera 1	DVR 9
C93	01CYP20CE019	Unit 2 Boiler board (switch cell) camera 2	DVR 9



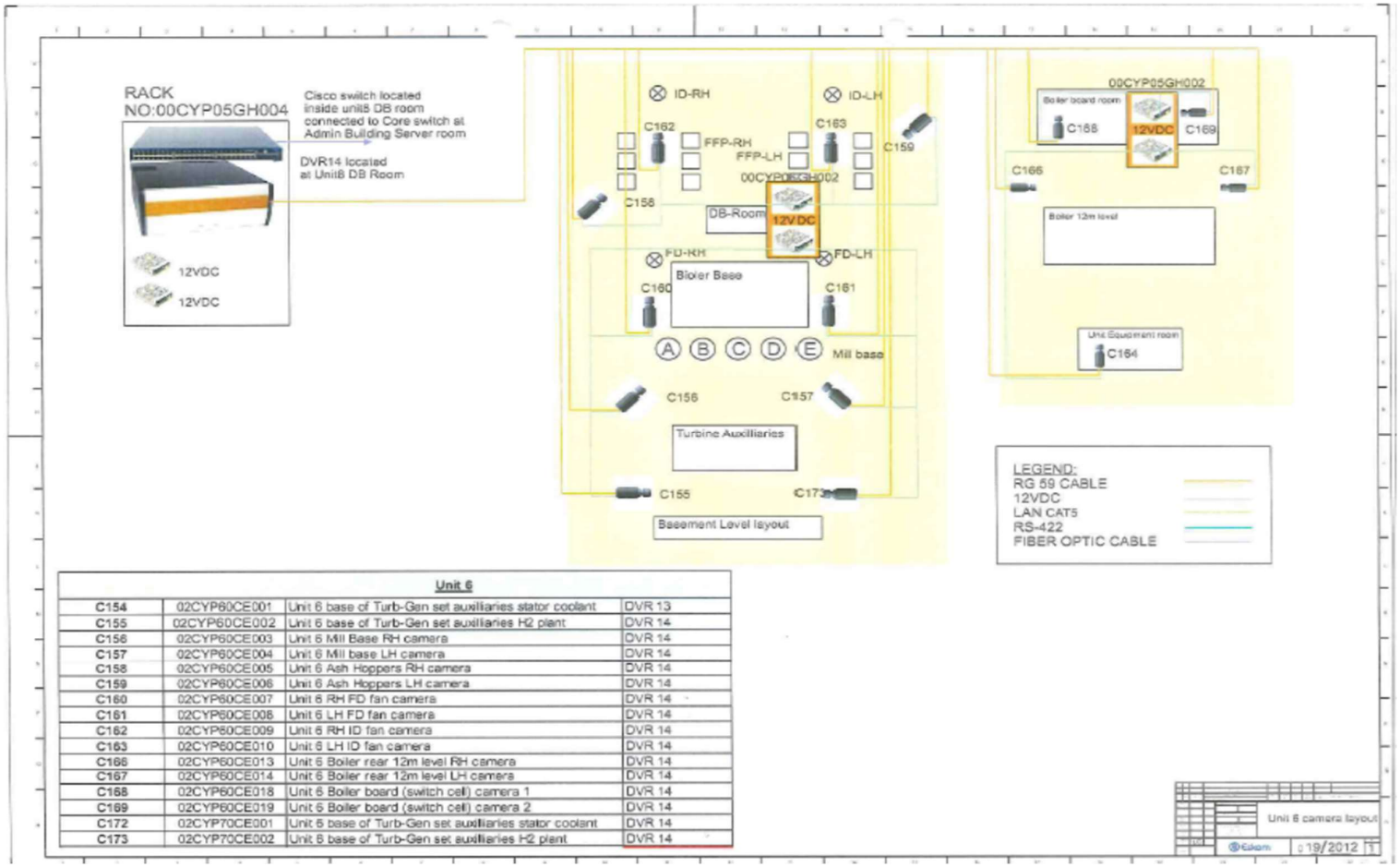
Unit 3			
C96	01CYP30CE001	Unit 3 base of Turb-Gen set auxiliaries stator coolant	DVR 9
C97	01CYP30CE002	Unit 3 base of Turb-Gen set auxiliaries H2 plant	DVR 9
C98	01CYP30CE003	Unit 3 Mill Base RH camera	DVR 10
C99	01CYP30CE004	Unit 3 Mill Base LH camera	DVR 10
C100	01CYP30CE005	Unit 3 Ash Hoppers RH camera	DVR 10
C101	01CYP30CE006	Unit 3 Ash Hoppers LH camera	DVR 10
C102	01CYP30CE007	Unit 3 RH FD fan camera	DVR 10
C103	01CYP30CE008	Unit 3 LH FD fan camera	DVR 10
C104	01CYP30CE009	Unit 3 RH ID fan camera	DVR 10
C105	01CYP30CE010	Unit 3 LH ID fan camera	DVR 10
C106	01CYP30CE012	Unit 3 Equipment Room camera	DVR 10
C107	01CYP30CE013	Unit 3 Boiler rear 12m level RH camera	DVR 10
C109	01CYP30CE014	Unit 3 Boiler rear 12m level LH camera	DVR 10
C110	01CYP30CE018	Unit 3 Boiler board (switch cell) camera 1	DVR 10



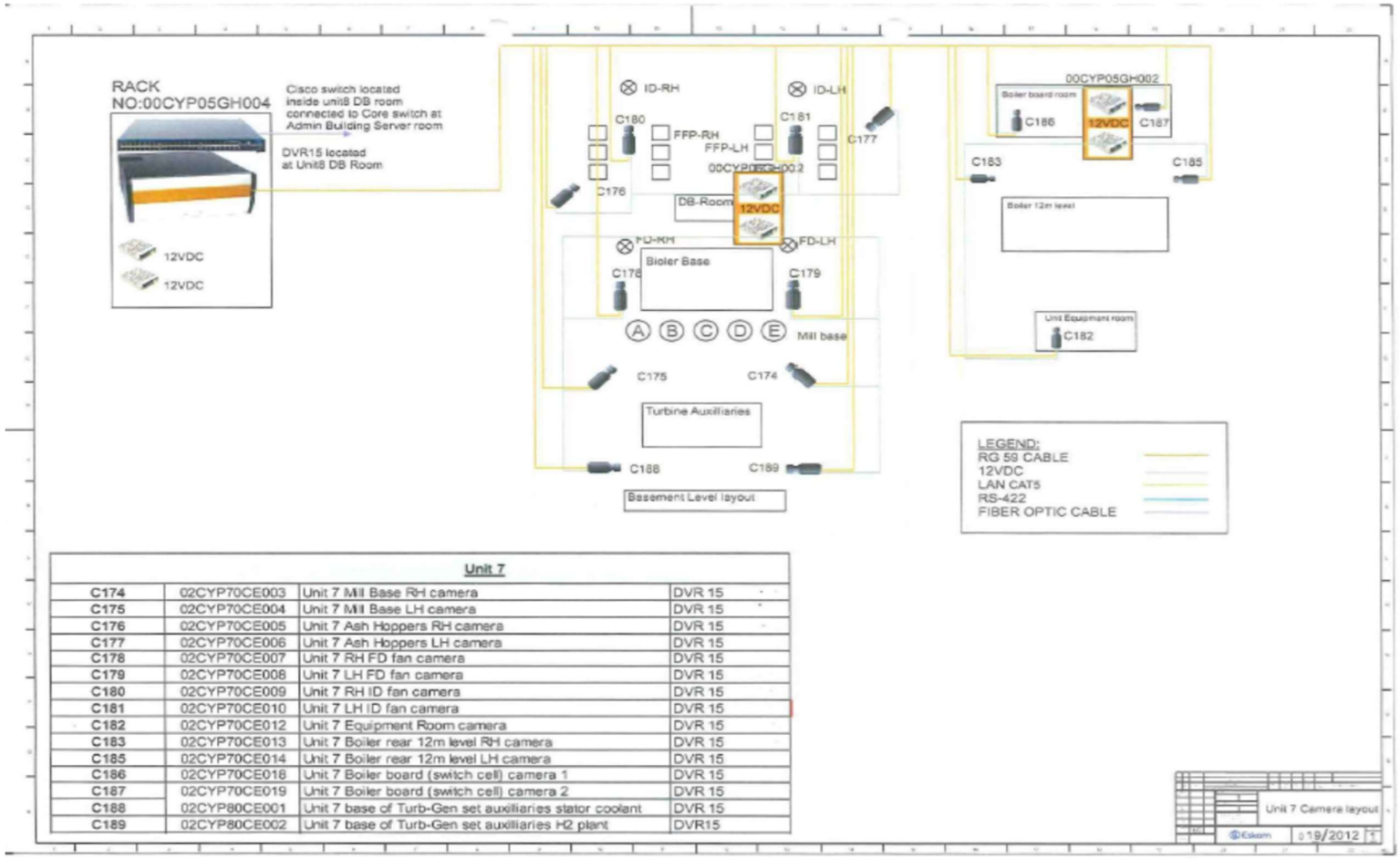
Unit 4			
C113	01CYP40CE001	Unit 4 base of Turb_Gen set auxiliaries stator coolant	DVR 10
C114	01CYP40CE004	Unit 4 Mill Base LH camera	DVR 10
C115	01CYP40CE002	Unit 4 base of Turb_Gen set auxiliaries H2 plant	DVR 10
C116	01CYP40CE003	Unit 4 Mill Base RH camera	DVR 10
C117	01CYP40CE004	Unit 4 Mill base LH camera	DVR 11
C118	01CYP40CE005	Unit 4 Ash Hoppers RH camera	DVR 11
C119	01CYP40CE006	Unit 4 Ash Hoppers LH camera	DVR 11
C120	01CYP40CE007	Unit 4 RH FD fan camera	DVR 11
C121	01CYP40CE008	Unit 4 LH FD fan camera	DVR 11
C122	01CYP40CE009	Unit 4 RH ID fan camera	DVR 11
C123	01CYP40CE010	Unit 4 LH ID fan camera	DVR 11
C124	01CYP40CE012	Unit 4 Equipment Room camera	DVR 11
C126	01CYP40CE014	Unit 4 Boiler rear 12m level LH camera	DVR 11
C128	01CYP40CE018	Unit 4 Boiler board (switch cell) camera 1	DVR 11
C129	01CYP40CE019	Unit 4 Boiler board (switch cell) camera 2	DVR 11



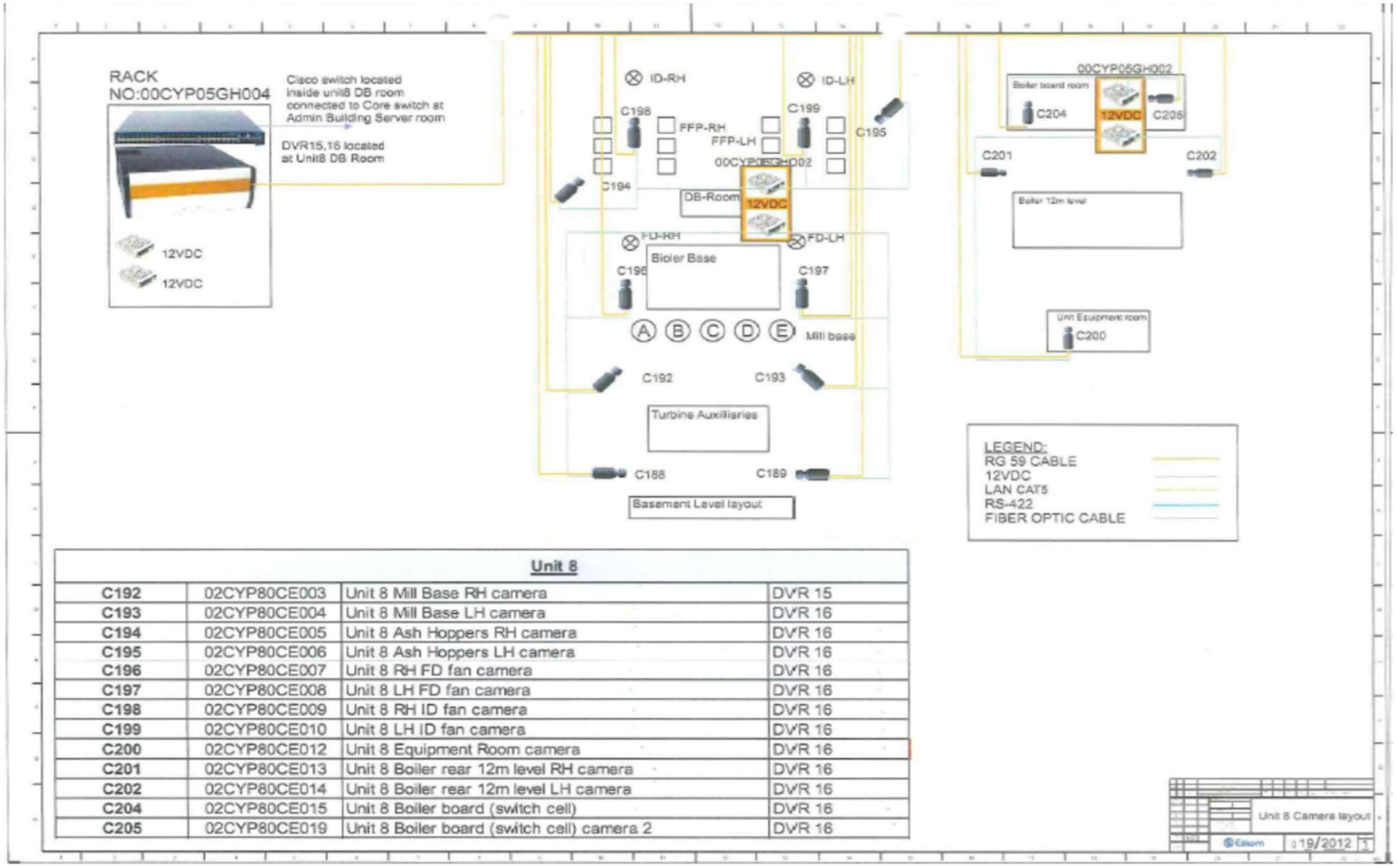
Unit 5			
C136	02CYP50CE001	Unit 5 base of Turb-Gen set auxiliaries stator coolant	DVR 13
C137	02CYP50CE002	Unit 5 base of Turb-Gen set auxiliaries H2 plant	DVR 13
C138	02CYP50CE003	Unit 5 Mill Base RH camera	DVR 13
C139	02CYP50CE004	Unit 5 Mill Base LH camera	DVR 13
C140	02CYP50CE005	Unit 5 Ash Hoppers RH camera	DVR 13
C141	02CYP50CE006	Unit 5 Ash Hoppers LH camera	DVR 13
C142	02CYP50CE007	Unit 5 RH FD fan camera	DVR 13
C143	02CYP50CE008	Unit 5 LH FD fan camera	DVR 13
C145	02CYP50CE010	Unit 5 LH ID fan camera	DVR 13
C147	02CYP50CE012	Unit 5 Boiler rear 12m level RH camera	DVR 13
C148	02CYP50CE013	Unit 5 Boiler rear 12m level LH camera	DVR 13
C149	02CYP50CE014	Unit 5 Equipment Room camera	DVR 13
C150	02CYP50CE018	Unit 5 Boiler board (swich cell) camera 1	DVR 13
C150	02CYP50CE019	Unit 5 Boiler board (swich cell) camera 2	DVR 13
C153	02CYP50CE019	Unit 5 Boiler board (swich cell) camera 2	DVR 13
C154	02CYP60CE001	Unit 6 base of Turb-Gen set auxiliaries stator coolant	DVR 13



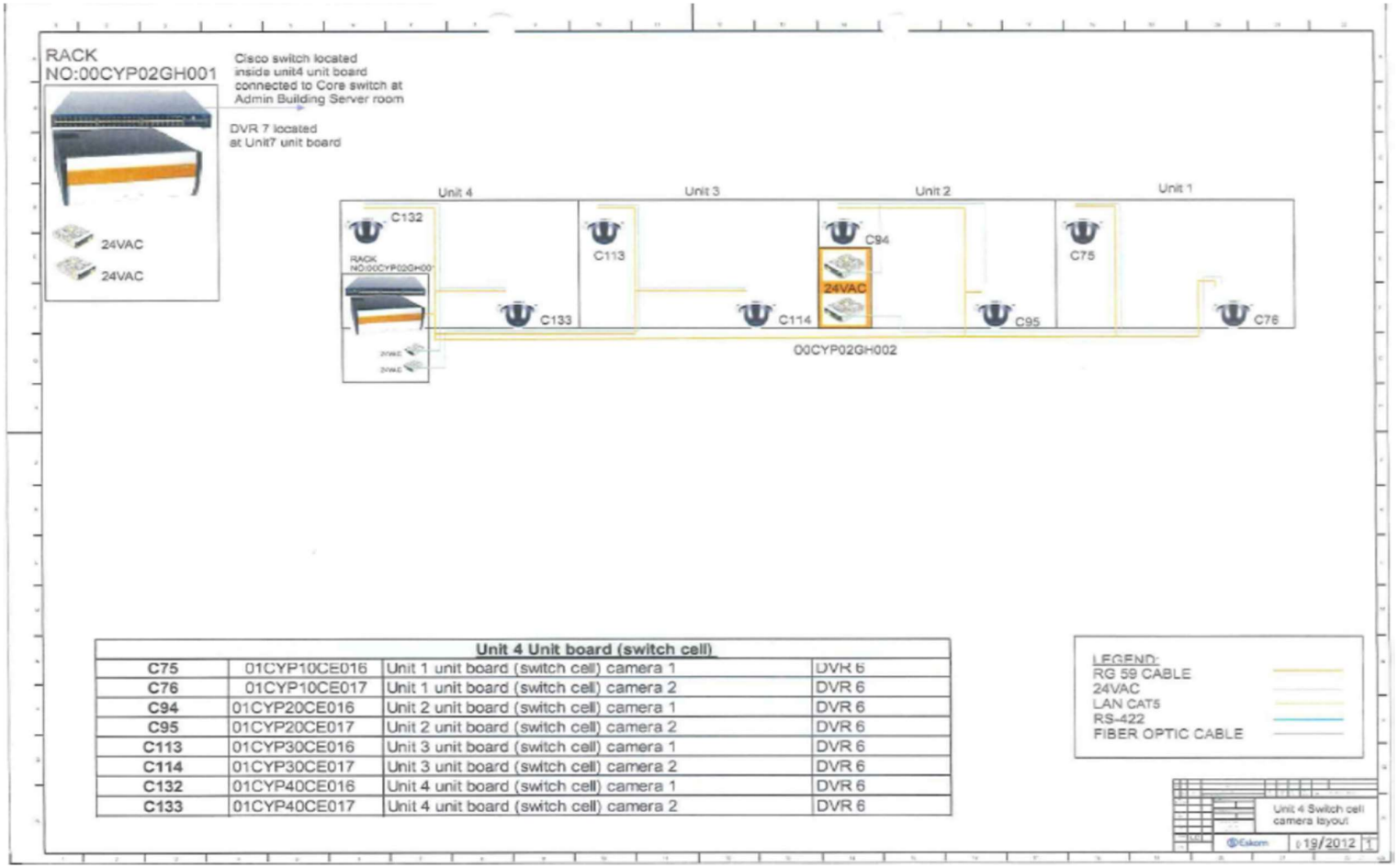
Unit 6			
C154	02CYP60CE001	Unit 6 base of Turb-Gen set auxiliaries stator coolant	DVR 13
C155	02CYP60CE002	Unit 6 base of Turb-Gen set auxiliaries H2 plant	DVR 14
C156	02CYP60CE003	Unit 6 Mill Base RH camera	DVR 14
C157	02CYP60CE004	Unit 6 Mill base LH camera	DVR 14
C158	02CYP60CE005	Unit 6 Ash Hoppers RH camera	DVR 14
C159	02CYP60CE006	Unit 6 Ash Hoppers LH camera	DVR 14
C160	02CYP60CE007	Unit 6 RH FD fan camera	DVR 14
C161	02CYP60CE008	Unit 6 LH FD fan camera	DVR 14
C162	02CYP60CE009	Unit 6 RH ID fan camera	DVR 14
C163	02CYP60CE010	Unit 6 LH ID fan camera	DVR 14
C166	02CYP60CE013	Unit 6 Boiler rear 12m level RH camera	DVR 14
C167	02CYP60CE014	Unit 6 Boiler rear 12m level LH camera	DVR 14
C168	02CYP60CE018	Unit 6 Boiler board (switch cell) camera 1	DVR 14
C169	02CYP60CE019	Unit 6 Boiler board (switch cell) camera 2	DVR 14
C172	02CYP70CE001	Unit 6 base of Turb-Gen set auxiliaries stator coolant	DVR 14
C173	02CYP70CE002	Unit 6 base of Turb-Gen set auxiliaries H2 plant	DVR 14



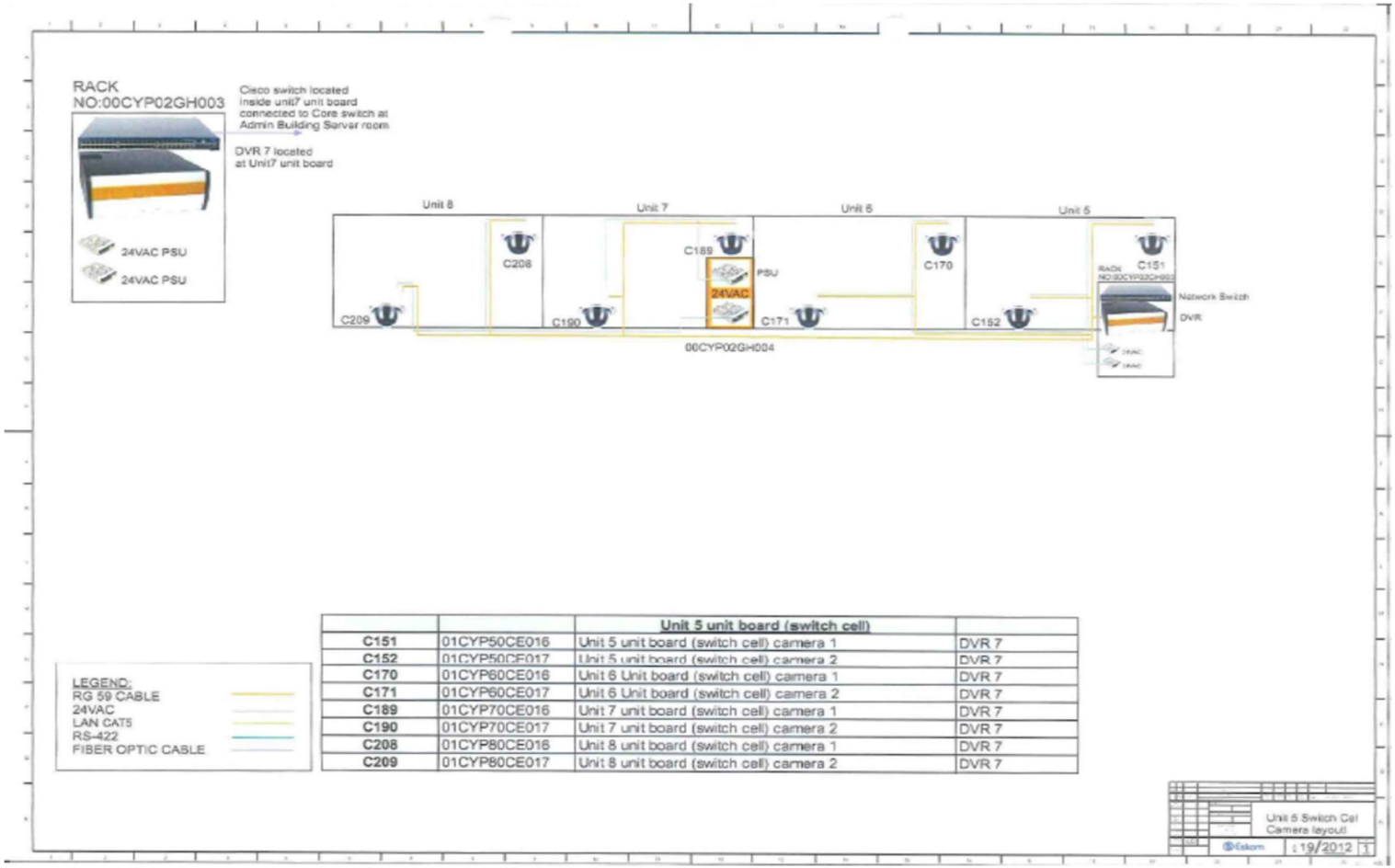
Unit 7			
C174	02CYP70CE003	Unit 7 Mill Base RH camera	DVR 15
C175	02CYP70CE004	Unit 7 Mill Base LH camera	DVR 15
C176	02CYP70CE005	Unit 7 Ash Hoppers RH camera	DVR 15
C177	02CYP70CE006	Unit 7 Ash Hoppers LH camera	DVR 15
C178	02CYP70CE007	Unit 7 RH FD fan camera	DVR 15
C179	02CYP70CE008	Unit 7 LH FD fan camera	DVR 15
C180	02CYP70CE009	Unit 7 RH ID fan camera	DVR 15
C181	02CYP70CE010	Unit 7 LH ID fan camera	DVR 15
C182	02CYP70CE012	Unit 7 Equipment Room camera	DVR 15
C183	02CYP70CE013	Unit 7 Boiler rear 12m level RH camera	DVR 15
C185	02CYP70CE014	Unit 7 Boiler rear 12m level LH camera	DVR 15
C186	02CYP70CE018	Unit 7 Boiler board (switch cell) camera 1	DVR 15
C187	02CYP70CE019	Unit 7 Boiler board (switch cell) camera 2	DVR 15
C188	02CYP80CE001	Unit 7 base of Turb-Gen set auxiliaries stator coolant	DVR 15
C189	02CYP80CE002	Unit 7 base of Turb-Gen set auxiliaries H2 plant	DVR15

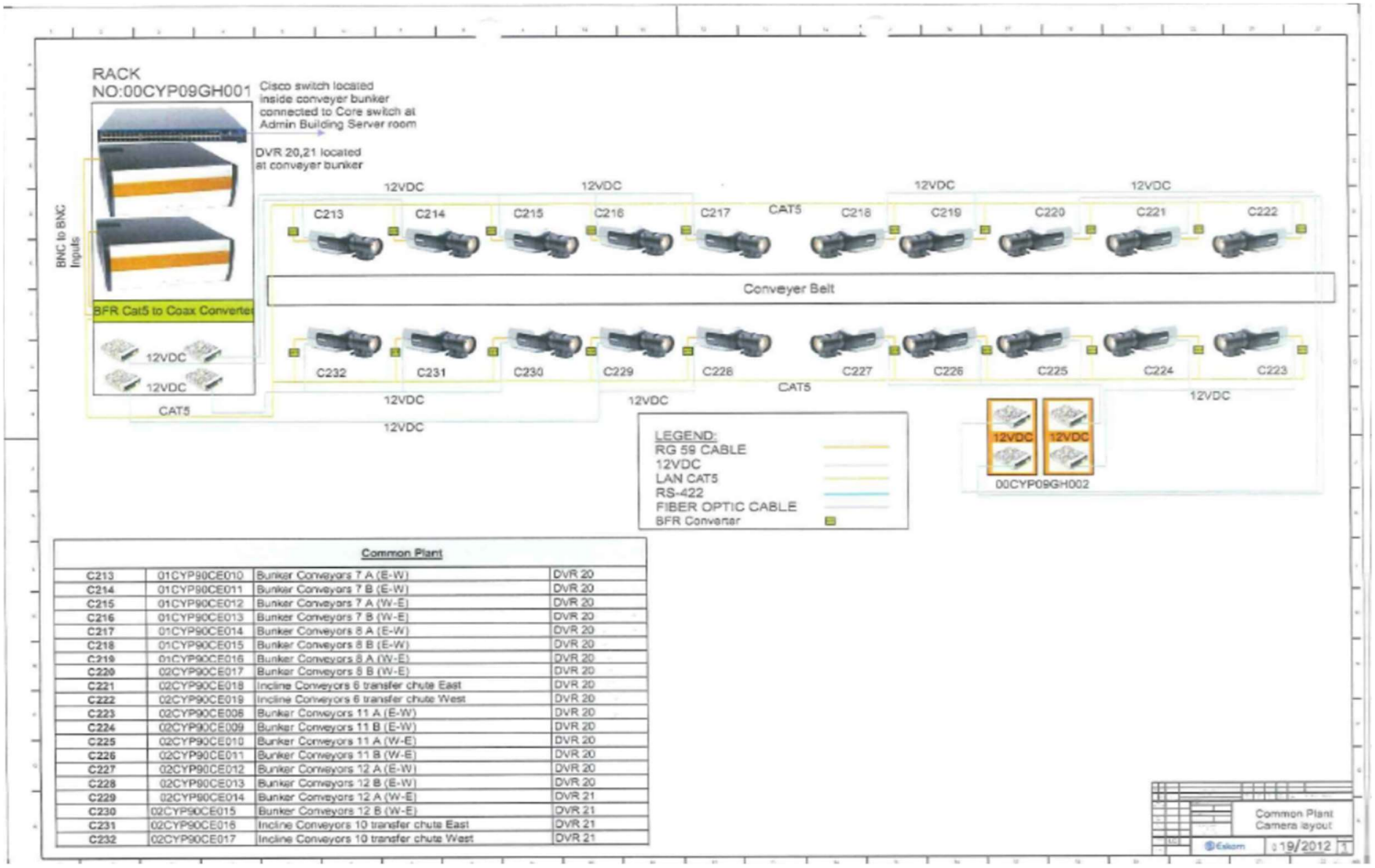


Unit 8			
C192	02CYP80CE003	Unit 8 Mill Base RH camera	DVR 15
C193	02CYP80CE004	Unit 8 Mill Base LH camera	DVR 16
C194	02CYP80CE005	Unit 8 Ash Hoppers RH camera	DVR 16
C195	02CYP80CE006	Unit 8 Ash Hoppers LH camera	DVR 16
C196	02CYP80CE007	Unit 8 RH FD fan camera	DVR 16
C197	02CYP80CE008	Unit 8 LH FD fan camera	DVR 16
C198	02CYP80CE009	Unit 8 RH ID fan camera	DVR 16
C199	02CYP80CE010	Unit 8 LH ID fan camera	DVR 16
C200	02CYP80CE012	Unit 8 Equipment Room camera	DVR 16
C201	02CYP80CE013	Unit 8 Boiler rear 12m level RH camera	DVR 16
C202	02CYP80CE014	Unit 8 Boiler rear 12m level LH camera	DVR 16
C204	02CYP80CE015	Unit 8 Boiler board (switch cell)	DVR 16
C205	02CYP80CE019	Unit 8 Boiler board (switch cell) camera 2	DVR 16



Unit 4 Unit board (switch cell)			
C75	01CYP10CE016	Unit 1 unit board (switch cell) camera 1	DVR 6
C76	01CYP10CE017	Unit 1 unit board (switch cell) camera 2	DVR 6
C94	01CYP20CE016	Unit 2 unit board (switch cell) camera 1	DVR 6
C95	01CYP20CE017	Unit 2 unit board (switch cell) camera 2	DVR 6
C113	01CYP30CE016	Unit 3 unit board (switch cell) camera 1	DVR 6
C114	01CYP30CE017	Unit 3 unit board (switch cell) camera 2	DVR 6
C132	01CYP40CE016	Unit 4 unit board (switch cell) camera 1	DVR 6
C133	01CYP40CE017	Unit 4 unit board (switch cell) camera 2	DVR 6





Common Plant			
C213	01CYP90CE010	Bunker Conveyors 7 A (E-W)	DVR 20
C214	01CYP90CE011	Bunker Conveyors 7 B (E-W)	DVR 20
C215	01CYP90CE012	Bunker Conveyors 7 A (W-E)	DVR 20
C216	01CYP90CE013	Bunker Conveyors 7 B (W-E)	DVR 20
C217	01CYP90CE014	Bunker Conveyors 8 A (E-W)	DVR 20
C218	01CYP90CE015	Bunker Conveyors 8 B (E-W)	DVR 20
C219	01CYP90CE016	Bunker Conveyors 8 A (W-E)	DVR 20
C220	02CYP90CE017	Bunker Conveyors 8 B (W-E)	DVR 20
C221	02CYP90CE018	Incline Conveyors 6 transfer chute East	DVR 20
C222	02CYP90CE019	Incline Conveyors 6 transfer chute West	DVR 20
C223	02CYP90CE006	Bunker Conveyors 11 A (E-W)	DVR 20
C224	02CYP90CE009	Bunker Conveyors 11 B (E-W)	DVR 20
C225	02CYP90CE010	Bunker Conveyors 11 A (W-E)	DVR 20
C226	02CYP90CE011	Bunker Conveyors 11 B (W-E)	DVR 20
C227	02CYP90CE012	Bunker Conveyors 12 A (E-W)	DVR 20
C228	02CYP90CE013	Bunker Conveyors 12 B (E-W)	DVR 20
C229	02CYP90CE014	Bunker Conveyors 12 A (W-E)	DVR 21
C230	02CYP90CE015	Bunker Conveyors 12 B (W-E)	DVR 21
C231	02CYP90CE016	Incline Conveyors 10 transfer chute East	DVR 21
C232	02CYP90CE017	Incline Conveyors 10 transfer chute West	DVR 21