



Information Communication Technology (ICT) Infrastructure Specifications

Manual

(Local Area Networks and Data cabling)

For

Department of Health

KwaZulu Natal



CONFIGURATION MANAGEMENT			
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Russell Meade	Dept of Health
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Contributors

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Contacts

Name	Responsibility Area	Contact Number
Gavin Labuschagne	Data Networking Equipment	083-2749627
Mike Elston	Data/Voice Cabling, Electrical and UPS requirements	083-4406295



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1. Introduction

This document covers the total ICT Infrastructure specifications as required by Department of Health KwaZulu Natal. All new network infrastructure installations as well as upgrades to existing infrastructures must fully comply with this specification as a minimum. It is to be noted that not all the specifications in this document need to be adhered to, in order to deliver a technically correct installation, however this detail will be negotiated with the Department and will be described and agreed upon in the URS, before the planning and execution of a task.

2. Scope of Document

2.1 Networking Design and implementation rules

- 1.1.1 Networking design principles.
- 1.1.2 DOH Institution Categories.
- 1.1.3 Local Area Networking (LAN) wired equipment standards.
- 1.1.4 Local Area Networking (LAN) wireless equipment standards.
- 1.1.5 LAN Security equipment standards.
- 1.1.6 Equipment cabinet implementation rules.
- 1.1.7 LAN documentation.

2.2 Data Cabling design and execution rules

2.3 Distribution Wall Boxes and Cabinets

- 1.2.1 Data and voice cable distribution panels or frames.
- 1.2.2 Active equipment.
- 1.2.3 Power elements.

2.4 Copper Data Cabling

- 1.3.1 The supply, installation, testing and certification of UTP, STP and FTP
Category 5e and Category 6 Data cables and termination hardware.

2.5 Voice Cabling

The supply, installation and testing of voice graded cabling:

- 1.4.1 Horizontal cables.
- 1.4.2 Backbone cables.
- 1.4.3 Connecting hardware.



2.6 Fibre Optic Cabling

The supply, installation and testing of:

- 1.5.1 Multimode and Single mode fibre optic cables, indoor and outdoor, underground and overhead.
- 1.5.2 Termination of cables.
- 1.5.3 Termination hardware.
- 1.5.4 Network and PABX Rooms: for the preparation and building of Network and PABX rooms.
- 1.5.5 Power Distribution: for the supply, installation and testing of Normal, Dedicated and UPS AC power as well as DC power.
- 1.5.6 Earthing, Bonding, Surge and Lightning Protection: provides generic Earthing, bonding and surge protection specifications to protect staff and outside plant against high voltage surges for:

Main distribution frames (MDF).

Distribution points (DP).

Cabinets.

Cable splices (joints).

Overhead and underground cables.

Metal Pathways.

2.7 Pathways

Consisting of structures that conceal, protect, support and provide access to:

- 1.6.1 Horizontal cables.
- 1.6.2 Backbone cables (Underground and overhead).

2.8 Data cabling Documentation.

2.9 Annexure A: Civil works specification.

In each of these sections the following will be specified:

1. Product technical specifications.
2. Installation specifications.
3. Marking specifications.
4. Acceptance and test plan. (ATP)
5. Documentation for sign-off.

E2E Consulting recognizes that this document is derived from different sources of information which include but which have no specific order of precedence:



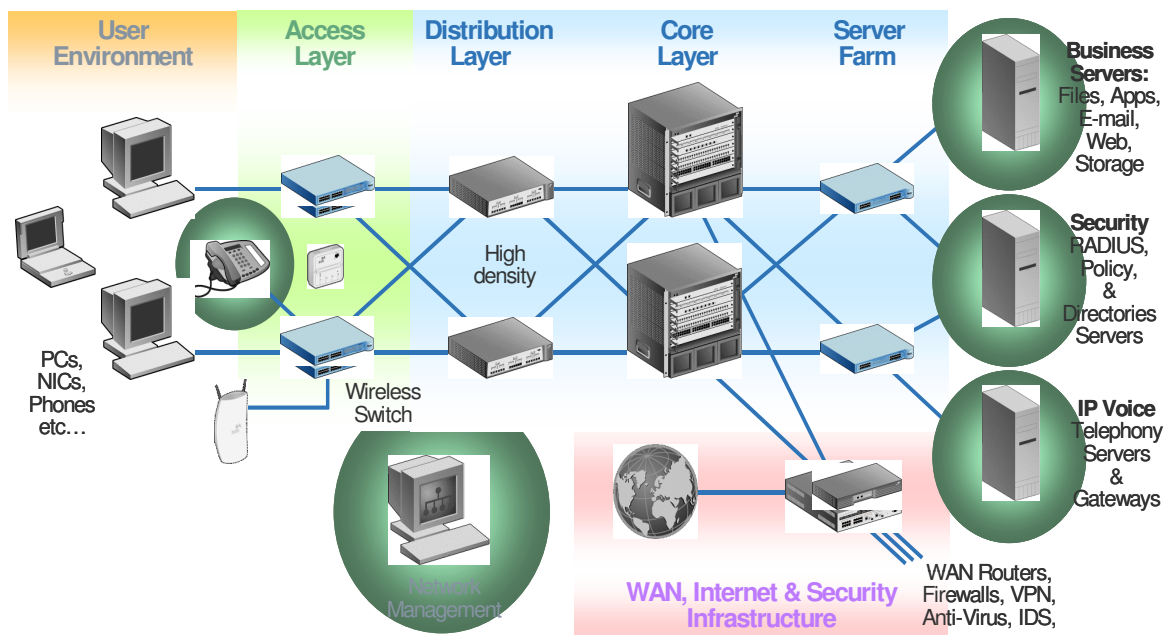
1. SITA Tender 0063 – technical requirements.
2. SITA Tender 385 – technical requirements.
3. Telkom Civil Work Specifications.
4. BICSI - Telecommunication Distribution Methods Manual – Tenth Edition.
5. Specific requirements compiled from different clients needs.

3. Network Design and Implementation rules

3.1 Networking Design Principles

Design Considerations

The following tiered architecture layers from the Edge of the network through to the Core and server farm layers must be used as a template when designing networks for the Department of Health.





CABLING STRUCTURE

The 3Com products (Department of Health Local Area Network standard) offer support for both Multi-Mode and Single-Mode Fibre Gigabit connections (SX, LX and LH).

Gigabit Ethernet Distance Parameters as Specified by IEEE 802.3z

Standard	Fibre Type	Diameter (microns)	Modal bandwidth (MHz*km)	Minimum Range (M)
1000BASE-SX	MM	62.5	160	2-220*
	MM	62.5	200	2-275**
	MM	50	400	2-500
	MM	50	500	2-550***
1000BASE-LX	MM	62.5	500	2-550
	MM	50	400	2-550
	MM	50	500	2-550
	SM	9	NA	2-5000****

These are the distances specified in the IEEE 802.3z standard; it should be noted that these distances reflect "worse case scenarios" (for installed cable) for design purposes. Longer distances can be achieved depending on the quality of the cable and the type of transceiver.

Notes:

* The TIA 568 building wiring standard specifies 160/500 MHz*km multimode fibre

** The international ISO/IEC 11801 building wiring standard specifies 200/500 MHz*km multimode fibre

*** The ANSI Fibre Channel specification specifies 500/500 MHz*km 50 micron multimode

fibre and 500/500 MHz*km fibre has been proposed for addition to ISO/IEC 11801.



****3Com products support these IEEE minimum ranges for multi-mode fibre. 3Com Gigabit Ethernet products comply with the IEEE 802.3z standard and inter-operate with any other product, which complies with this standard.

Losses per splice will vary depending on the quality and type of splice.

Maximum dB loss

The following specify the SX and LX optical parameters, which meet IEEE 802.3z/d4.2.

Multi-Mode - SX

Average Launch Power (Min) = -9.5dbm

Average Launch Power (Max) = -4dbm

Receive Sensitivity = -17dbm

Optical budget = 7.5dbm

Single-Mode - LX power budget is the same for Multi-mode - LX

Average Launch Power (Min) = -11.0dbm

Average Launch Power (Max) = -3.0dbm

Receive Sensitivity = -20dbm

Optical budget = 9dbm



NETWORK PERFORMANCE

The Department of Health requires switched 10/100 Ethernet at all end-node locations. Each connection must support both the 10BaseT and 100BaseT standards. Use of CAT-5 cabling and 'Auto sensing' on the switch ports minimizes the need for manual intervention when users are upgraded to 100Mbps.

Core network connections must support Gigabit Ethernet, in order to provide the bandwidth required.

Despite the high bandwidth, it could be desirable - in certain situations - to prioritize (or block) certain traffic. For example, the use of the available bandwidth could be controlled by prioritizing Video Conferencing applications, while blocking (at the edge) MP3 streaming, or any network traffic related to Network Games.

RESILIENCY / REDUNDANCY

When reviewing core redundancy, the following areas should be considered:

- Hardware redundancy
- Fibre / path redundancy
- Routing / protocol redundancy

Hardware redundancy can be achieved through the implementation of dual redundant Core switches linked via 3com's XRN technology and redundant power and fan unit modules.

Fibre redundancy can be achieved through multiple fibre runs between the distribution areas and the dual core switches. If one fibre path should be severed, or the ports connecting the primary fibre run should go faulty, the redundant path would dynamically take over and forward traffic.



Protocol redundancy typically refers to a standby L3 switch (router) that takes over the routing task for a particular network address should the primary L3 switch fail (VRRP – Virtual Router Redundancy Protocol). 3com's Layer 3 switches in the core of a network using XRN technology will perform this protocol redundancy.

3.2 Department of Health Institution Categories/equipment selection criteria

The 3com LAN (Wired) equipment standards for the Department of Health have been based upon the following institution categories:

DOH HEALTH FACILITIES (A FACILITY IS ANY HEALTH DEPT “FACILITY” OTHER THAN DOH CLINICS)

Wired LAN products

DOH Health Facility networks will be based on the 3com switch 5500SI/24 port switches at the edge of the network and the 3com switch 5500G E1 24 or 3com switch 5500GEI SFP 24 port switches at the Distribution layers (assuming a distribution layer is required). It must be noted that the switch 5500GEI SFP 24 port must be implemented where fibre cable concentrations exceed 8 fibre cables into a single 5500G. The core of the network within a Hospital campus will be based on the 3com switch 8800. Chassis size will vary depending on number of blades required, at least 30% expansion must be allowed for in each chassis.

Wireless LAN products

DOH Health Facility wireless networks will be based upon 3com's wireless mobility solution architecture. This architecture makes use of “Thin” or “Fit” wireless access points and wireless switch managers. The following 3com products must be implemented within wireless LAN hospital environments:

3COM WXLAN Managed access point 2750

3COM WXLAN Managed access point 3750

3COM WXLAN Controller WX4400, WX 2200, WX1200, WXR100.

3COM WXLAN switch Manager



3COM Unified switch

3COM WX antenna options:

- 6 / 9 dbi dual band omni-directional
- 3 / 4 dbi dual band ceiling mount
- 4 / 6 dbi dual band hallway
- 8 / 10 dual band panel
- 3com ultra low loss antenna cable

DOH CLINICS

Wired LAN products

DOH Clinic networks will be based on the 3com switch 4500/24 port switches at the edge of the network and the 3com switch 4500G at the Core.

Wireless LAN products

DOH clinic wireless networks will be based upon 3com's wireless mobility solution architecture. This architecture makes use of "Fat" wireless access points and wireless switch managers. The following 3com products must be implemented within wireless LAN clinic environments:

- 3COM Wireless Access Point 8760 Dual radio 11a/b/g PoE
- 3COM WX antenna options:
 - 6 / 9 dbi dual band omni-directional
 - 3 / 4 dbi dual band ceiling mount
 - 4 / 6 dbi dual band hallway
 - 8 / 10 dual band panel
 - 3com ultra low loss antenna cable



4. Local Area Networking (LAN) wired equipment standards

DOH HEALTH “FACILITIES”

4.1 EDGE SWITCH 5500si



Standard Image

3CR17151-91 Switch 5500-SI 28-Port

24x fixed 10/100 Base-TX ports

4x 1000Base-X SFP ports (all active)

3CR17152-91 Switch 5500-SI 52-Port

48x fixed 10/100 Base-TX ports

4x 1000Base-X SFP ports

Modules :

SX SFP (3CSFP91)

LX SFP (3CSFP92)

Copper SFP (3CSFP93)

LH SFP (3CSFP97)



4.2 DISTRIBUTION SWITCH 5500G SFP



3C17258-91 Switch 5500G-EI 24-Port SFP

20x 1000Base-X SFP ports
4x Combo 10/100/1000Base-T / 1000Base-X SFP ports
1x Expansion Slot (with blanking plate)
1x Removable PSU Slot (3C17266 fitted)

Modules:

3C17260 Switch 5500G 8-Port SFP Module

3C17261 Switch 5500G 1-Port 10G Module

3C17268 Switch 5500G 2-Port 10G Module

3C17262 Stacking Cable (65cm)

3C17263 Resilient Cable (1.5M)

3C17269 Long Stacking Cable (5m)

3C17264 Switch 5500G PoE PSU 24 PT

3C17265 Switch 5500G PoE PSU 48 PT

3C17266 Switch 5500G PSU 24 PT (130W)

3C17267 Switch 5500G PSU 48 PT (180W)



4.3 SERVER FARM SWITCH 5500G



3C17250-91 Switch 5500G-EI 24-port

20x fixed 10/100/1000Base-T ports
 4x Combo 10/100/1000Base-T / 1000Base-X SFP ports
 1x Expansion Slot (with blanking plate)
 1x Removable PSU Slot (3C17266 fitted)

3C17251-91 Switch 5500G-EI 48-port

44x fixed 10/100/1000Base-T ports
 4x Combo 10/100/1000Base-T / 1000Base-X SFP ports
 1x Expansion Slot (with blanking plate)
 1x Removable PSU Slot (3C17267 fitted)

3C17252-91 Switch 5500G-EI 24-port PWR

20x fixed 10/100/1000Base-T ports with PoE
 4x Combo 10/100/1000Base-T with PoE / 1000Base-X SFP ports
 1x Expansion Slot (with blanking plate)
 1x Removable PSU Slot (3C17264 fitted)

3C17253-91 Switch 5500G-EI 48-port PWR

44x fixed 10/100/1000Base-T ports with PoE
 4x Combo 10/100/1000Base-T with PoE / 1000Base-X SFP ports
 1x Expansion Slot (with blanking plate)
 1x Removable PSU Slot (3C17265 fitted)

Modules:

3C17260 Switch 5500G 8-Port SFP Module

3C17261 Switch 5500G 1-Port 10G Module

3C17268 Switch 5500G 2-Port 10G Module

3C17262 Stacking Cable (65cm)

3C17263 Resilient Cable (1.5M)

3C17269 Long Stacking Cable (5m)

3C17264 Switch 5500G PoE PSU 24 PT

3C17265 Switch 5500G PoE PSU 48 PT

3C17266 Switch 5500G PSU 24 PT (130W)



3C17267 Switch 5500G PSU 48 PT (180W)

4.4 CORE SWITCH 8800



The 3com switch 8800 chassis will be installed in any Health Facility that exceeds the 250 user total. The chassis selection will be based on the number of fibre/UTP ports required. A minimum of 40% expansion must be catered for in each chassis.

The table below includes all the switch 8800 module/chassi options:



Part #	Description	Contents
3C17500	3Com Switch 8814 14-slot, AC Starter Kit	14-slot chassis, fan assembly, one 2000W PS, one fabric, Basic software
3C17501	3Com Switch 8810 10-slot, AC Starter Kit	10-slot chassis, fan assembly, one 2000W PS, one fabric, Basic software
3C17502	3Com Switch 8807 7-slot, AC Starter Kit	7-slot chassis, fan assembly, one 1200W PS, one fabric, Basic software
3C17503	3Com Switch 8800 7 & 14-slot fan assembly	7 or 14-slot fan assembly (spare)
3C17504	3Com Switch 8810 10-slot fan assembly	10-slot fan assembly (spare)
3C17506	3Com Switch 8807 1200W AS Power Supply	1200W AC Power Supply
3C17507	3Com Switch 8800 2000W Power Supply	2000W AC Power Supply
3C17508	3Com Switch 8800 360 G bps Fabric	Fabric
3C17511	3Com Switch 8800 1-port 10GBASE-X (XENPAK)	1-port 10Gig (EX)
3C17512	3Com Switch 8800 2-port 10GBASE-X (XFP)	2-port 10Gig (EX)
3C17513	3Com Switch 8800 12-port 1000BASE-X (SFP)	12-port GE (EX)
3C17514	3Com Switch 8800 24-port 1000BASE-X (SFP)	24-port GE (EX)
3C17516	3Com Switch 8800 24-port 10/100/1000BASE-T (RJ45)	24-port BT (EX)
3CR1752191	3Com Switch 8800 Advanced Software Version 1	Base Software plus BGP-4, IS-IS, SNMPv3 Encryption.
3C17525	3Com SW8800 1-port 10GBASE-X (XENPAK) Advanced Module	1 Port 10Gig (MX)
3C17527	3Com SW8800 2-port 10GBASE-X (XFP) Advanced Module	2-Port 10Gig(MX)
3C17526	3Com SW8800 4-port 10GBASE-X (XFP) Module	4-port 10Gig (EX)
3C17528	3Com SW8800 48-port 10/100/1000BASE-T (RJ45) Module	48-port BT (EX/DX)
3C17530	3Com SW8800 24-port 1000BASE-X Advanced (SFP) Module	24-port GE (MX)
3C17531	3Com SW8800 24-port 10/100/1000BASE-T Advanced (RJ-45) Module	24-port BT (MX)
3C17532	3Com SW8800 48-port	48-port BT (EX/DX) – Reduced Memory



	10/100/1000BASE-T (RJ45) Access Module	
3C17518	3Com SW8800 1G Memory UPG Kit	1G DIMM Upgrade to support 256K Routes.
3CR1752 193 V2	3Com SW8800 Advanced SW Pack for Release 2	Advanced Software Pack Rel. 2
3C17509	3Com SW8800 PoE Power Rack	4500Watt. PS for PoE, 2+1 redundancy. Hot Swappable
3C16884	3Com SW7750/SW8800 PoE Power Supply	2500W AC Power Supply for PoE
3C17529	3Com Switch 8800 PoE Option (PoE DIMM Module)	PoE DIMM Module
3C17510	3Com SW8800 PoE Entry Module	PoE Entry Module to allow Chassis to support PoE

DOH CLINICS

4.5 Edge switch 4500



3CR17561-91 3Com Switch 4500 26-Port

24-Ports 10/100Base-TX

2-Ports 10/100/1000Base-T combo with 2-Ports SFP (mini-GBIC)

Stacking achieved by connecting switch to switch via the Gigabit ports. Redundant stacking (with a bottom to top loop-back) is not supported.

Power connection is standard AC



Height: 1.7in/43.6mm/1RU
Width: 17.3in/440mm
Depth: 10.6in/270mm
Weight: 7.3 lb / 3.3 kg

3CR17562-91 3Com Switch 4500 50-Port

48-Ports 10/100Base-TX

2-Ports 1000Base-T combo with 2-Ports SFP (mini-GBIC)*

Ships with two SFP 1000Base-T copper SFP transceivers (designated 3CSFP93-4500)

Stacking achieved by connecting switch to switch via the Gigabit ports. Redundant stacking (with a bottom to top loop-back) is not supported.

Power connection is standard AC

Height: 1.7 in / 43.6 mm / 1 RU
Width: 17.3 in / 440 mm
Depth: 10.6 in / 270 mm
Weight: 7.3 lb / 3.3 kg

3CR17571-91 3Com Switch 4500 PWR 26-Port

24-Ports 10/100Base-TX supporting IEEE 802.3af Power over Ethernet

2-Ports 1000Base-T combo with 2-Ports SFP (mini-GBIC)*

Ships with two SFP 1000Base-T copper SFP transceivers (designated 3CSFP93-4500)

Stacking achieved by connecting switch to switch via the Gigabit ports. Redundant stacking (with a bottom to top loop-back) is not supported.

Power connection is standard AC and/or DC for resilient supplemental PoE power

Toggle button for the LED display

Height: 1.7 in / 43.6 mm / 1 RU
Width: 17.3 in / 440 mm
Depth: 16.8 in / 427 mm
Weight: 13.9 lb / 6.3 kg

3CR17572-91 3Com Switch 4500 PWR 50-Port

48-Ports 10/100Base-T supporting IEEE 802.3af Power over Ethernet

2-Ports 1000Base-T combo with 2-Ports SFP (mini-GBIC)*

Ships with two SFP 1000Base-T copper SFP transceivers (designated 3CSFP93-4500)

Stacking achieved by connecting switch to switch via the Gigabit ports. Redundant stacking (with a bottom to top loop-back) is not supported.

Power connection is standard AC and/or DC for resilient supplemental PoE power



Toggle button for the LED display

Height: 1.7 in / 43.6 mm / 1 RU

Width: 17.3 in / 440 mm

Depth: 16.8 in / 427 mm

Weight: 13.9 lb / 6.3 kg

* Note: For the 50-Port, 24-Port PWR and 50-Port PWR, in actuality there are four SFP ports internally grouped as two pairs. Provided in the box with the switch are two 1000Base-T SFPs to give copper connections to each pair of SFPs. This leaves two empty SFP slots, one per pair, for flexible fiber uplink connections. Software allows the selection of only one port in each pair to be operational at any point in time, thus making them “combo ports.”

4.6 CORE/SERVER FARM SWITCH 4500G



3CR17761-91-SA: The 3Com® Switch 4500G 24-Port: 20 x 10/100/1000 plus 4 x dual personality operating 10/100/1000 or SFP. Built-in 2 x 10-Gigabit 2-Port Module slot.

3CR17762-91-SA: The 3Com® Switch 4500G 48-Port: 44 x 10/100/1000 plus 4 x dual personality operating 10/100/1000 or SFP. Built-in 2 x 10-Gigabit 2-Port Module slot.

3CR17771-91-SA: The 3Com® Switch 4500G PWR 24-Port: 20 x 10/100/1000 plus 4 x dual personality operating 10/100/1000 or SFP. Built-in 2 x 10-Gigabit 2-Port Module slot. Power over Ethernet on all 10/100/1000 ports.

3CR17772-91-SA: The 3Com® Switch 4500G PWR 48-Port: 44 x 10/100/1000 plus 4 x dual personality operating 10/100/1000 or SFP. Built-in 2 x 10-Gigabit 2-Port Module slot. Power over Ethernet on all 10/100/1000 ports.



Modules:**3C17766**

The 3Com® Switch 2-Port 10-Gigabit Module (XFP) is a slide-in module for the Switch 4500G platform providing up to two 10-Gigabit connections with its XFP-based slots. 10-Gigabit Ethernet is a standards-based method for connecting at performance 10x that of Gigabit Ethernet, and is the perfect aggregation technology when deploying gigabit to the desktop or for interconnecting core and distribution switches.

The 2-Port module uses industry-standard XFP modular transceivers, sold separately, to provide a flexible physical media connection.

3C17767

The 3Com® Switch 2-Port 10-Gigabit Local Connection Module is a slide-in module for the Switch 4500G platform providing up to two 10-Gigabit connections over a CX4 4X-InfiniBand cable of up to 3 meters. 10-Gigabit Ethernet is a standards-based method for connecting at performance 10x that of Gigabit Ethernet, and is the perfect aggregation technology when deploying gigabit to the desktop or for interconnecting core and distribution switches. This local connection technology provides an economical way to tie multiple switches together at high bandwidth over short distances.

The connection requires no additional transceiver. 3Com sells compatible CX4 cables for use with this module.

3C17775

The 3Com® CX4 Local Connection Cable – 50 cm or 1.6 feet – is a standard 4X-InfiniBand cable for use with the Switch 2-Port 10-Gigabit Local Connection Module or for other ports requiring a standard CX4 connection.

3C17776

The 3Com® CX4 Local Connection Cable – 100 cm or 3.3 feet – is a standard 4X-InfiniBand cable for use with the Switch 2-Port 10-Gigabit Local Connection Module or for other ports requiring a standard CX4 connection.

3C17777

The 3Com® CX4 Local Connection Cable – 300 cm or 9.8 feet – is a standard 4X-InfiniBand cable for use with the Switch 2-Port 10-Gigabit Local Connection Module or for other ports requiring a standard CX4 connection.



5. Local Area Networking (LAN) wireless equipment standards

DOH HEALTH “FACILITIES”

5.1 3COM WXLAN Managed access point 2750



“Fit” managed access point, usable with 3Com Wireless Switch WX1200 and Wireless LAN Controller WX4400, features dual 10/100 PoE Ethernet ports for electrical needs and added failover capability. If the access point loses either the LAN or PoE connection on either port, it will automatically failover to the other port. Single -radio for 801.11b/g. External antenna connector’s support customized installations and coverage areas. Sophisticated security features support the latest encryption and virtual LANs (VLANs) for secure remote communication.

Managed Access Points

3Com Wireless LAN Switch Managed Access Point 2750

3CRWX275075A



5.2 3COM WXLAN Managed access point 3750



“Fit” managed access point, usable with 3Com Wireless Switch WX1200 and Wireless LAN Controller WX4400, features dual 10/100 PoE Ethernet ports for electrical needs and added failover capability. If the access point loses either the LAN or PoE connection on either port, it will automatically failover to the other port. Dual-radios for both 801.11b/g and 11a operation enable simultaneous 11b/g and 11a operation thereby expanding connectivity options and bandwidth availability. External antenna connectors support customized installations and coverage areas. Sophisticated security features support the latest encryption and virtual LANs (VLANs) for secure remote communication.

Managed Access Points

3Com Wireless LAN Switch Managed Access Point 3750

3CRWX375075A

5.3 3COM WXLAN Controller WX4400, WX 2200, WX1200, WXR100.





Wireless Switch/Controller	3Com SKU #
3Com WXR100 Remote Office Wireless LAN Switch	3CRWXR10095A
3Com Wireless LAN Switch WX1200	3CRWX120695A
3Com Wireless LAN Controller WX4400	3CRWX440095A
3Com Wireless LAN 24-MAP License WX4400	3CWX4400L24A
3Com Wireless LAN Controller Spare Power Supply WX4400	3CWX4400RPSA
3Com Wireless LAN Controller WX4400 w/48 MAP Support	3CRBWX440095A48
3Com Wireless LAN Controller WX4400 w/72 MAP Support	3CRBWX440095A72
3Com Wireless LAN Controller WX4400 w/96 MAP Support	3CRBWX440095A96
3Com Wireless LAN Controller WX4400 w/120 MAP Support	3CRBWX440095A120

Management Software

3Com Wireless LAN Switch Manager for up to 10 WXs	3CWXM10A
3Com Wireless LAN Switch Manager Upgrade to Unlimited WXs	3CWXMUPA

5.4 3COM UNIFIED SWITCH



3Com Unified Gigabit Wireless PoE Switch 24 is a cost-effective layer 2 switch that combines the features of a traditional LAN switch with a centralized wireless controller. The 24 built-in copper 10/100/1000 ports support 24 wireless access points; line-rate wired switching with full power 802.3af PoE is supplied to all 24 ports providing power to access points and VoIP phones. Web-based GUI management provides intuitive and wizard-based centralized management of all wired and wireless devices. Support for 3Com Wireless 7760 11a/b/g PoE Access Point and 3Com Wireless 8760 Dual Radio 802.11abg PoE Access Point for wireless client connectivity. Delivers centralized wireless RF management, rogue detection and mitigation.



5.5 3COM WXLAN switch Manager



3com Wireless switch manager will be installed at the DOH EMS Centre and provide full remote wireless management.

3Com Wireless Switch Manager is a full-featured tool suite that enables IT managers to perform pre- and post-deployment planning, configuration, verification, management and optimization of the WLAN infrastructure. IT first imports AutoCAD® DXF™, AutoCAD DWG, JPEG or GIF floor plan files to design the WLAN offline. The planning wizard presents a drop-down menu with building materials – selecting the appropriate material automatically applies the RF attenuation factors for 802.11a and 802.11b/g. Then IT selects an area of the floor plan to provide WLAN services and can perform a coverage plan or can input the number of users and the desired average bandwidth per user to perform a capacity plan. 3Com Wireless Switch Manager calculates the number of needed Managed Access Points and places them in the floor plan, taking into account the surrounding RF attenuation as well as the channel assignments of Managed Access Points and third-party APs on floors above and below. Next, the IT manager prints a work order that shows where to install 3Com Wireless Switches and Managed Access Points. When that's done, IT can deploy hundreds of Managed Access Point configurations with one mouse click.

5.6 3COM WX antenna options

The following antenna options will be used in DOH wireless installations:

- 6 / 9 dbi dual band omni-directional



- 3 / 4 dbi dual band ceiling mount



- 4 / 6 dbi dual band hallway



- 8 / 10 dual band panel



- 3com ultra low loss antenna cable





DOH CLINICS

5.7 3com access point 8760



Cost-effective wireless networking takes on new sophistication with the Wi-Fi CERTIFIED 3Com® Wireless 8760 Dual Radio 11a/b/g PoE Access Point. Power over Ethernet (PoE) lets you design a wireless network based on optimal coverage rather than power supply location. VLANs, multiple SSIDs, WDS, and Rogue AP detection bring enterprise-class features to small and medium networks. A fully featured dual radio access point functions simultaneously with an 802.11a and an 802.11b/g. Tough 802.1X and WPA2 with TKIP/AES encryption securely extends access to business-critical applications and information. Blistering 108Mbps wireless speeds boost performance for hefty file transfers. Because each product is backed by global sales, service, and support plus technology, financial, and operational strength, you can feel confident about exercising choice with 3Com.



6. LAN Security equipment standards

6.1 DOH HEAD OFFICE

The TippingPoint 1200 (1.2 Gbps) model will be installed in a number of areas within the central Natalia LAN.



6.2 FEATURES

- Latency < 215 μ sec
- Real World TCP/UDP Traffic Mix
- Two Million+ Simultaneous Sessions
 - TCP/UDP/ICMP
- 750,000+ Connections Per Second

Client and Server Protection

- Prevent Attacks on Vulnerable Applications and Operating Systems
- Eliminate Costly Ad-Hoc Patching
- Multi-Mode Attack Blocking

Network Infrastructure Protection

- Protect Cisco IOS, DNS and Other Infrastructure
- Protect Against Traffic Anomaly, DoS, SYN Floods, Process Table Floods
- Access Control Lists

Traffic Normalization

- Increase Network Bandwidth and Router Performance
- Normalize Invalid Network Traffic
- Optimize Network Performance

Application Performance Protection

- Increase Bandwidth and Server Capacity



- Rate-Limit or Block Unwanted Traffic
- Peer-to-Peer/Instant Messaging
- Guarantee Bandwidth for Critical Applications

Digital Vaccine™ Real-Time Inoculation

- Protection against Zero-Day Attacks
- Automatic Distribution of Latest Filters

Security Management System

- Manage multiple TippingPoint Systems
- At-A-Glance Dashboard
- Automatic Reporting
- Device Configuration and Monitoring
- Advanced Policy Definition and Forensic Analysis

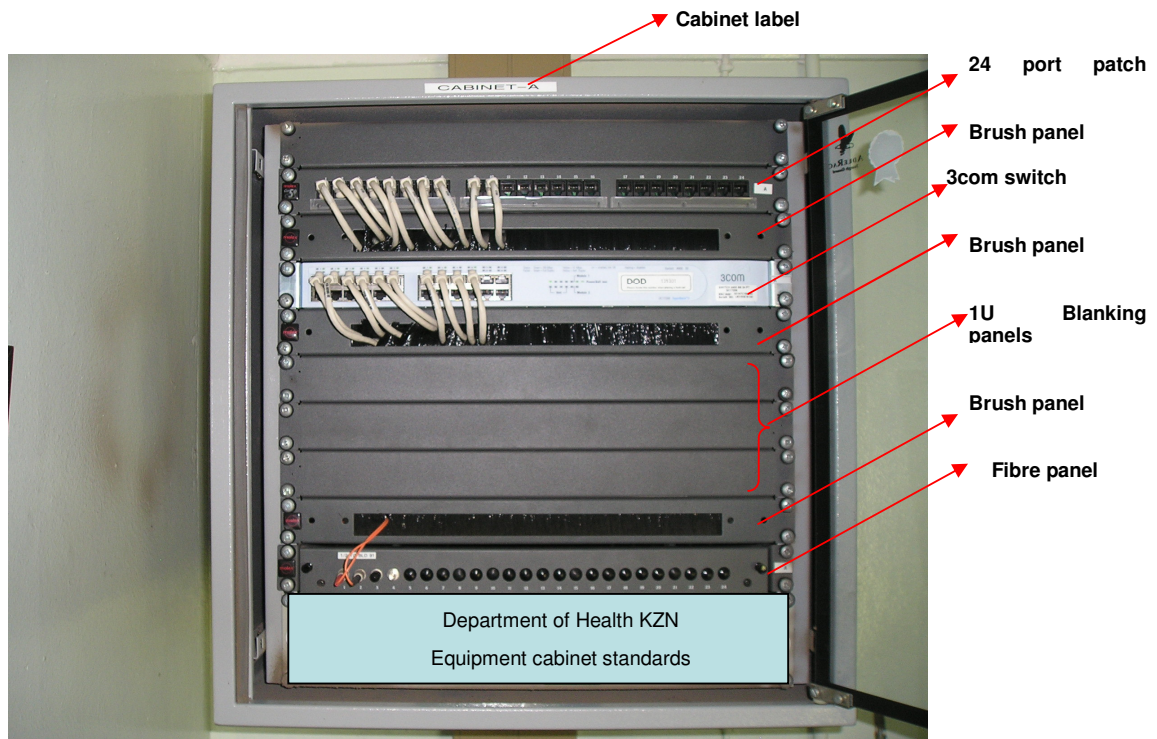
High Availability and Stateful Network Redundancy

- Dual-Power Supplies
- Layer 2 Fallback
- Active-Active or Active-Passive Stateful Redundancy
- Zero Power High Availability



7. Equipment cabinet implementation rules

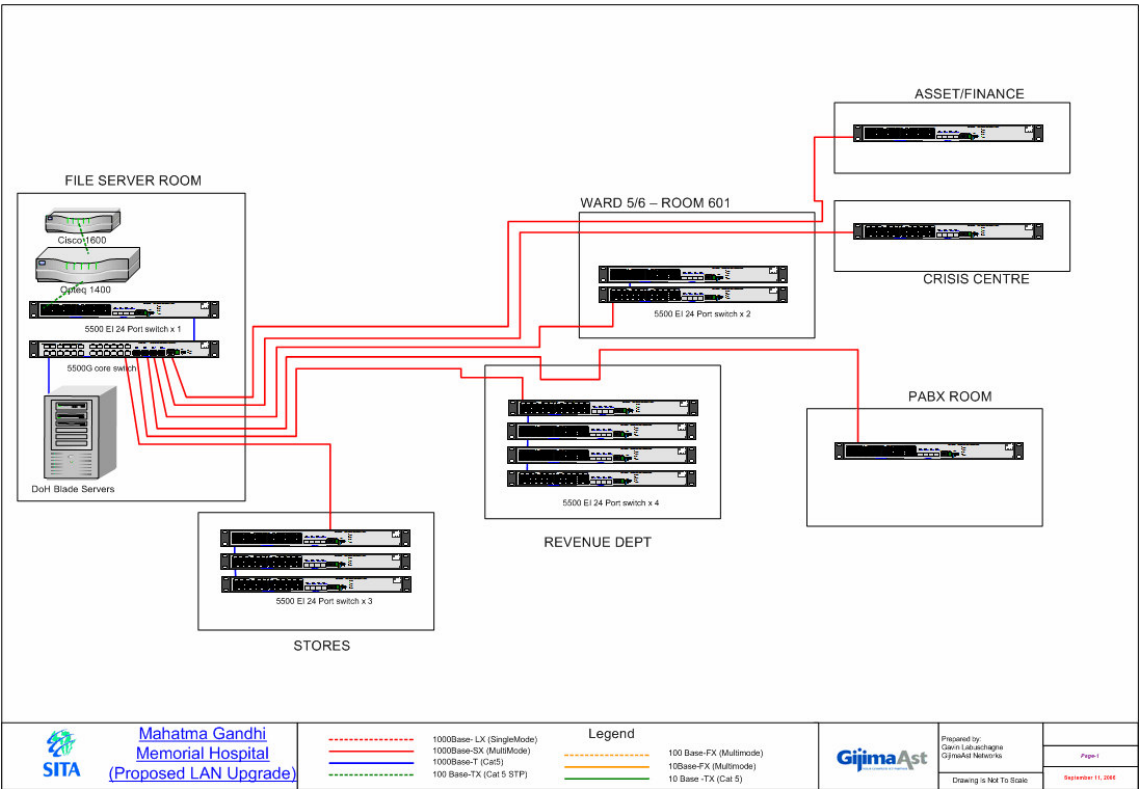
The following section outlines the basic implementation rules associated with equipment cabinets within all of the Department of Health sites (Hospitals, District offices and clinics). The picture below details how each cabinet should be configured.



8. LAN documentation

On completion of a network installation at any of the department's hospitals or clinics, the following will be supplied to the department as part of the official sign off procedure:

- Hard copy A3/A4 Network schematic diagram laminated and secured to the inside of the main equipment cabinet glass door (Diagram as shown below).
- Soft copy of the schematic diagram on CD in Visio 2003 format, CD to be labeled with the hospital/clinic name and HD/SITA Ref. number.



- The information sheet included below must also be submitted with the sign off documentation.



LAN information sheet

Site Name

Area or Floor

Switch Make

Switch Model

Switch Part Number:

Switch Serial Number

Switch Software Version

QTY Users

Stacking kits installed

SFP /GBIC

QTY's

SX

LX

TX

Switch IP Address

SNMPCommunity string

Qos

L2/3/4

VLANS

Yes	No
Yes	No

Yes	No
Yes	No
Yes	No



9. Data Cabling design and execution rules

9.1 General Design Principles

The Voice, Data and Power Network shall be designed and built to guarantee a high availability, through reliable and maintainable communication services and products, at optimum Life Cycle Cost (LCC). To design an effective communication system, the designer shall be familiar with international, national and local regulations as well as codes and industry telecommunications standards, and be able to model cost and ensure availability.

Unless otherwise specified, a STAR network topology will be followed and can include redundant links.

The following guidelines shall be followed when designing voice and data networks:

- a) All buildings which have been identified as office accommodation shall be served with a structured cable network.
- b) The size of the cable which serves the building shall make provision for service in every office of average size. Open plan spaces shall be served in accordance with office size (average office size $\pm 9 \text{ m}^2$).
- c) 40% spare capacity shall be kept in mind at all times for the voice- DP.
- d) 25% spare capacity shall be allowed for in active equipment.
- e) The minimum size UG cable supply for voice shall be no less than 10 pair.
- f) The design shall allow for all Data outlets to be within 90m of the floor distributor or multiples of floor distributors.

9.2 Client Requirement Definition

The following information shall be provided to the Designer by the client to enable him to do a suitable design:

- a) A terrain plan of all existing underground services and there relevant information, if applicable. If these plans are not available or inaccurate, SBN can not accept any responsibility for damage to underground services during excavation.
- b) All site and building/office plans.
- c) A list with building numbers and/or floors where services exist and where additional requirements for services are required.

The requirement baseline shall be accepted and signed-off by the client.



If appropriate building or terrains plans are not available the Designer will draw up the required plans at the contract rates. The designer shall draw: physical routes which indicate draw pit/manhole placement and size, pole placement and size, route sizes, distances between manholes and/or poles. This includes drawings for routes between buildings and within buildings. Drawings of the floor plan of buildings shall indicate location of routes, cabinets, outlet boxes, etc.

Building/Terrain plans shall not necessarily be of architectural standard but shall be as far as possible drawn to scale, but if not it shall be in proportion. Microsoft Visio Professional (latest version) or a suitable alternative agreed to by the parties shall be used to draw the plans. Standard symbols shall be used at all times (Legend to be used is on p 45 of this document). After completion of such plans the plans will be presented to the client for acceptance and sign-off.

After completion of the project these same updated drawings will be presented as part of the acceptance documentation.

9.3 Site Establishment

The Client will make available secure, onsite storage and office facilities, if required, to the contractor. If this is not possible, the Contractor shall quote for such site establishment as part of the project cost.

9.4 Redundant Telephone Poles and Cables

Power, communication and any cables/hardware/telephone poles, that are no longer in use, shall be identified and be removed and discarded with at contract rates. Specific effort is required to identify the redundant items. The removal of an item shall only be allowed once the appointed User representative approved the removal in **writing**. It is of **UTMOST** importance that written approval shall be obtained from the User before cable or hardware is removed. Cables/hardware that is not removed shall be retained at least in the same way as it was found.

9.5 Distribution Wall Boxes and Cabinets

The designer shall place enclosures in rooms nearby an outside wall and near the centre of a building to minimize cable lengths and optimize performance.

The enclosure size is determined by the quantity of active and passive devices to be installed in such cabinet.

9.6 Pathways

The underground and overhead infrastructure shall make provision to accommodate voice, and data networks whilst the internal infrastructure shall make provision for voice, data and power reticulation.



In principle horizontal fill ratios for conduit, cable trays and ducts shall conform to standards and manufacturer's recommendations, i.e. 50% utilization for initial installation and a maximum of 75% after expansion work.

When designing horizontal pathways, the Designer shall consider such pathway's ability to accommodate changes and minimize occupants' disruption when such pathways are accessed.

Telecommunication outlet boxes installed in drywall, plaster or concrete block shall be at least 100mm x 100mm x 57mm.

The Designer shall:

- a) Locate telecommunication pathways away from sources of EMI.
- b) Consider the aesthetic appearance of the cabling pathways within offices and other visible areas.
- c) Plan outlets to be within 3 metres of the user station.
- d) Preferably plan all cables to be installed in an enclosed compartment to protect cables from rodents and other damage.

9.7 Conduit

Standard conduit: 20mm PVC or galvanised bosal.

Use flexible conduit only in situations where it is the only practical solution. If flexible conduit is used, increase the conduit size to the next industrial available size.

Conduit runs shall be designed to:

- a) Run in the most direct route possible with no more than two 90 degree bends.
- b) Contain no continuous sections longer than 30m.
- c) Withstand the environment to which they will be exposed to.
- d) For runs longer than 30m, draw boxes shall be installed at no longer than 30m intervals.

9.8 Ceiling distribution

- a) Ceiling distribution is acceptable if the:

Ceiling is adequate and suitable.

Ceiling space is available for cabling pathways.

Ceiling space is used only for horizontal cables serving the floor below.

Areas used for cabling pathways are fully accessible from the floor below.

Ceiling tiles are removable and placed at a height of no greater than 3,4m or the ceiling void is accessible through a trap door.



- b) Connecting hardware like 10 Way disconnect modules or telecommunications equipment shall not be placed in the ceiling space.
- c) Ceiling space shall:
 - i) Allow for 75mm of clear vertical space above conduits.
 - ii) Allow for 300mm of clear vertical space above the tray or raceway for overhead ceiling cable tray or raceway system.
 - iii) Not allow horizontal pathways to rest directly on or be supported by ceiling panels.
 - iv) Allow for human movement if the ceiling structure is not removable panels.

9.9 Overhead Cable Routes

The size and type of poles to be used on an overhead route are, apart from the load carrying capacity of the pole, also determined by important factors like ground clearance and the type of activity in the vicinity of the pole.

9.10 Fibre Optic Cabling

- a) The key factors in determining which optical fibre cable to use in a design are:
 - i) Active equipment interface requirements.
 - ii) Distance between devices.
 - iii) Bandwidth requirements.
 - iv) Redundancy requirements.
- b) Multimode fibre optic cable lengths and bandwidth limitations:

2000m for data rates of 155Mb/s or less.

550m for data rates of 1Gb/s or less.

300m for data rates of 10 Gb/s or less. (Laser Optimized Fibre)

If the distance exceeds the above limitations, consider single mode fibre.

The designer of an optic fibre system shall minimize splices whenever possible. No more than three through-splices are allowed in a fibre optic cable link.

The backbones for cabling will be a minimum of 6-core fibre between buildings and 4-core fibre between floors in a building.



Each fibre cable installed shall have at least one spare fibre pair.

9.11 Network and PABX Rooms

Network rooms and PABX rooms may share the same physical floor space, but shall in any event always be in close proximity off each other.

A network and PABX room shall be designed to accommodate both current and future applications. Its design shall have provisions for growth and the ability to go through numerous equipment replacements and upgrades during its life-cycle, with minimal service disruption and cost. These rooms shall contain only approved components and be designed for easy operation and maintenance.

The Designer shall ensure enough floor space is available to accommodate all the active and passive components to be installed in the computer room with still enough room for cabinet doors to open as to ensure that technical staff can work without restrictions.

In a campus environment, these rooms shall preferably be in the centre of the campus to minimize cable distances and optimize performance.

PABX and Network rooms shall be situated on outside walls of a building to ensure uncomplicated construction of building entries into these rooms and preferably not in a below ground level room.

These rooms shall be located so that it is accessible for the delivery of large equipment.

The Designer shall pay attention to EMI from electrical power supply transformers, motors, generators, x-ray equipment, radio transmitters, radar transmitters and induction heating devices. Photocopiers shall not be closer than 3m from these rooms.

PABX and Network Room Layouts shall be submitted as part of the design and quote.

9.12 Earthing and Bonding

All exposed metallic elements of the cable system and cable containment system shall be earthed (grounded) for safety and electromagnetic compatibility requirements.

9.13 Electromagnetic Interference (EMI)

To decrease the EMI susceptibility, the design shall:



Use metal conduit for electrical power circuits. Electrical circuits shall be fully enclosed by solid-wall metal conduit.

Use solid-wall metal conduit for telecommunication circuits. Telecommunication circuits shall not be installed into conduit containing electrical power conductors.

Do not use isolated grounding circuits unless the equipment manufacturer mandates.

Maintain adequate physical separation between electrical noise sources and susceptible telecommunication circuits or equipment.

Use surge protection devices to reduce transients that emanate from inductive devices being switched off. Locate external surge protection devices as close as possible to the source of transient.

Prevent telecommunication circuits from running in close proximity of any florescent light.

Use grounded conduits and enclosures.

Maintain a distance from electrical power transformers.

Minimize proximity to radiating antennae and towers.

Provide common bonding of the grounding point of multiple surge protection devices placed on both the electrical power and signal circuits of the telecommunications unit.

Use well balanced twisted-pair copper cabling.

Always assume electrical noise exists in the proximity of any electrical equipment.

10. Distribution Cabinets

10.1 Product technical specifications

- a) IDF/DF Cabinet shall be a metal cabinet with dimensions 2000 mm (H) x 600 mm (W) x 350 mm (D), **where a 3com 5500G switch is being installed it MUST BE NOTED THAT a 1000mm (D) cabinet must be installed, or alternatively collars installed.** The cabinets shall have a powder coated finish and shall be lockable. Two keys shall be provided. The colour will be determined in the URS.
- b) 19" Floor Standing Cabinets shall conform to the following standards:
 - i) Have an Aluminium frame.
 - ii) Dimensions 15U to 47U (H) x 600mm (W) x 800 mm or 1000 mm (D)
 - iii) Fitted with four punched profiles and four depth reducers. For heavily loaded Cabinets, the depth reducers may be increased.
 - iv) Fitted with a set of four adjustable metal feet (50mm in diameter and 75mm height)
 - v) Fitted with blank floor plates.
 - vi) Fitted with four high performance ball bearing low noise fans fitted in a tray at the top of the cabinet. The fans shall expel air from the cabinet.
 - vii) Fitted with a tinted safety flexi glass door and three lockable metal doors. All doors shall be removable without the use of tools. All doors



- shall be lockable with the same key. Two keys shall be supplied for each cabinet.
- viii) The colour of the cabinet will be determined in the URS. The cabinet shall be powder coated.
- ix) Be fitted with a metal power duct with a circuit breaker in the following configuration: 15U to 25U – 5 Way power. 34U to 47U – 10 Way power.

c) 19" Wall mounted Wall Boxes: A Wall Box will conform to the following standards:

- i) Shall be of the swing frame type.
- ii) Shall be reversible. (Swing in both directions)
- iii) Shall have a weight carrying support between the cabinet housing and the frame to ensure that the cabinet lock does not carry any weight in the locked position.
- iv) Dimensions 9U or 12U (H) x 600mm (W) x 400mm (D)
- v) Fitted with a set of two punched profiles
- vi) Fitted with two high performance ball bearing low noise fans fitted on the sides of the cabinet. One fan shall expel air from the cabinet and the other impels air into the cabinet.
- vii) Fitted with a lockable tinted safety flexi glass door. The frame and the door shall be lockable with the same key. Two keys shall be supplied for each cabinet.
- viii) The colour of the cabinet will be determined in the URS. The cabinet shall be powder coated.
- ix) Shall be fitted with a 5 Way metal power duct with a circuit breaker.
- x) Shall have cable entries at the bottom and top of the wall box.

10.2 Installation Specifications

Cabinets shall be installed according to the following standards:

IDF/DF Cabinet: The cabinet shall be mounted level with four M8 rawl bolts. After installation both doors of the cabinet shall be able to open at least 90 deg.

19" Floor Standing Cabinets: The cabinet will be located in a position where at least three doors can open entirely except where cabinets are placed alongside each other. The cabinet will stand securely and level on all four feet.

19" Wall Boxes: Wall Boxes shall be mounted at least 2m AFF or as high as the ceiling allows. The wall box shall be fitted level on solid walls with four M8 rawl bolts. Wall boxes will not be fitted to temporary structures such as dry walls.

All cabinets could be fitted with blank panels in all un-utilized positions if required.

The cabinet layout will be discussed with the client prior to the installation.



10.3 Marking Specifications

All cabinets shall be marked with a label with a unique number for that cabinet in the building it is situated in.

All labels will be permanent and printed black on white with a font size of at least 12 mm.

The label will be fitted in the middle on the top of the cabinet, not on the glass door.

The label on cabinets will be as follows: "Cabinet X/Y" where:

X – Floor on which the cabinet is situated as designated by the building owner (Eg: -2, -1, G, 1, 2, ...).

Y– Cabinet number, which will be numbered A, B, C etc for more than one cabinet per floor.

The keys shall be supplied with tags and labels indicating the cabinet number.

The labels of an IDF/DF cabinet shall conform to the above but the identifying number shall indicate the IDF/DF number.

10.4 Acceptance and Test Plan (ATP)

The Contractor shall submit samples of cabinets (complete with doors, power ducts, fans etc.) and labels to be installed to the client for approval. This approval will be a once off event – thereafter a delivery note from the supplier indicating that the approved item was utilized will be sufficient for the acceptance certificate.

The Contractor shall inspect, complete and present a certificate to the Contractor PM, certifying that:

- The installed cabinets are approved by the CLIENT and that a certificate certifying such approval and the delivery note for the installed items are available on request.
- The position as indicated on the valid design, the actual installed position and the position as indicated on the floor plan are identical.
- Cabinets are earthed correctly in accordance with the requirements of Earthing, Bonding, Surge and Lightning protection specifications.
- Identification of source of electrical supply.
- Cabinets are without dents and shall be scratch free.
- Cabinets are fitted with the correct fans and power ducts.
- Cabinets are labelled correctly.
- Wall mount cabinets are fitted level on solid walls with four M8 rawl bolts and where applicable at least 2 meter AFF and that the door and cabinets can open/swing at least 90 degrees.
- Floor Standing Cabinets are located in a position where all four doors can open entirely. The cabinet will stand securely and level on all four feet.
- Fans are installed correctly.
- All relevant documentation is presented and that the documents are correct and complete.



10.5 Documentation to be presented with every submission for signoff

- Contractor's inspection certificate, certifying the aspects nominated for inspection in the ATP.
- Cabinet layout.
- Cabinet position and number on the floor plan.
- IDF/DF Cabinet/Box position and number on the floor plan.
- Site plan with position of sleeves and cable routes shown.

11. Copper Data Cabling

11.1 Product technical specifications

Category 6: cables and connecting hardware specified up to 250Mhz. The performance of Category 6 corresponds to Class E as specified in ISO/IEC 11801 Ed.2:2002 or to a specification certified as an equivalent specification by the CLIENT.

All products installed shall be branded indicating the manufacture's name and the product category, while all cables shall be stamped with the following details:

Name of manufacturer.

Specification it has been tested to (TSB 568B or ISO/IEC 11801, etc).

Name of testing laboratory that verified conformance to specification.

Cable rating (CAT 6).

NVP

Proposed Patch-Lead colour utilisation:

Data Normal	Grey
Telephone	Black
Radio	Green
Cross Over	Blue
1 Gbps Uplink	Orange
1 Gbps Server Uplink	Lilac
100 Mbps Server	Yellow



Uplink	
100 Mbps Uplink	Red

11.2 Installation Specifications

Only products of the same manufacturer shall be installed per site and installation shall be done according to the manufacture's (OEM's) specifications and OEM certification shall be obtained after completion.

On certified sites where extensions need to be done, the product installed shall be similar to the existing installed base.

The following installation specifications, supplementing the OEM specifications shall be applicable:

Components from only one category shall be installed throughout the system.

Preferably outlets shall be flush-mounted and shall be installed in a pre-punched skirting cover plate, punched with two 37mm x 22mm holes. The data outlet shall be fitted in the left hole.

Maximum cable length shall not exceed 90m. The combined length of the patch-lead and fly-lead shall not exceed 10m.

Only horizontal cabling channel will be accepted, having the effects that both the fly-lead and patch-lead are moulded factory manufactured leads and are tested.

A floor distributor will not serve more than one floor. More than one floor distributors may be planned per floor.

When installing, the maximum pull-force for 4-pair horizontal balanced twisted pair cables is 12kg.

Only termination tools as specified by the specific manufacturer shall be used.

Data outlets shall not be placed directly under power sockets.

Cables installed inside cabinets shall be secured in such a manner as to ensure free movement of doors and covers.

Cables installed in swing frame cabinets shall be secured in such a manner to allow the cabinet swing to open completely without adding any strain on the cables.

Cable shall not be attached to ceiling suspension wires, frames or structures.



Cables shall preferably be enclosed at all times.

Power separation distances.

	Without Divider, or with Non- Metallic Divider	Aluminium Divider	Steel Divider
Unscreened power cable and unscreened IT cable	200mm	100mm	50mm
Unscreened power cable and screened IT cable	50mm	20mm	5mm
Screened power cable and unscreened IT cable.	30mm	10mm	2mm
Screened power cable and screened IT cable	0mm	0mm	0mm

11.3 Marking Specifications

All labeling shall be printed permanent ink PVC labels. All printed labels shall be black on white with a font size of at least 8 mm.

Labeling shall be done as follows:

Patch Panels: A, B, C etc: from the top to bottom of the cabinet. The label will be on the left side of the Patch Panel.

Wall Outlet: GAA01 where:

G – Floor on which the cabinet is situated.

A – Cabinet number

B – Patch Panel Number

01 – Port on Patch Panel

The cable will be labeled with the same number at the back of the Patch Panel and at the back of the wall outlet no more than 50mm from the termination.

11.4 Acceptance and Test Plan (ATP)



The Contractor shall inspect, complete and present a certificate to the Contractor PM, certifying that:

- That only products from the OEM as specified on the order were used.
- The positions as indicated in the valid design, the actual installed positions and the positions as indicated on the floor plan are identical.
- Outlets and Patch panels are labelled correctly.
- That installation is done according to the manufacturer's specifications for a channel installation.
- All points are tested and the test results documented according to the manufacturers guidelines for Channel Tests and at least a 15 year site warranty shall be obtained after installation.
- That the above specifications, supplementing the OEM specifications are adhered to and that such adherence are verified and that an inspection report to that extent is available.
- That all test equipment has been calibrated and that the calibration certificates are available and valid on request.
- All relevant documentation is presented and that the documents are correct and complete.

11.5 Documentation to be presented with every submission for signoff

- The certificate certifying the aspects mentioned in the ATP.
- Manufacturer's quality inspection form.
- Test results (Hard and native soft copy).
- Manufacturer's warranty certificate.
- Floor plans indicating the point positions and numbers.



12. Voice Cabling

Note: Where UTP Cat5e or Cat6 are installed as the voice cables, the above specification for "Copper Data Cabling" will be adhered to.

12.1 Product technical specifications

a) Underground cables:

Will be in accordance with SA Telkom Specification 260 – Cable Underground Aluminum Polyethylene Laminated.

All cables will be 0,5mm² conductor size.

b) Indoor cables:

Shall comply with Telkom Specification 271V for Cable, Indoor, PVC Insulated and PVC Sheathed (IEC colour coded).

All cables will be 0,5mm² conductor size.

c) Overhead cables

Figure-Eight Self Supporting Aerial Cable shall be used for overhead distribution.

0,5mm²- conductor aerial cable shall be used. However, 0,63mm²- conductor aerial cable may be used, after written permission from the CLIENT, where resistance and attenuation demands such.

d) Connecting hardware, enclosures and outlets:

Shall be branded products with unique product codes.

Enclosures for an IDF/DF shall be: a Krone wall mounted frame, Krone 300A or Krone 250A enclosure/s.

Enclosures for a DP shall be a Krone 201D enclosure or equivalent.

Only Krone LSA profile 10 pair disconnect modules shall be supplied.

Back mount frames shall be stainless steel.

Wall outlets shall preferably be a flush mounted RJ11/45 telephone socket, which will be inserted in a pre-punched skirting plate with two 38mm x 22mm holes punched and be in accordance with the requirements of data outlets installed in the right side of the dual punched face-plate.

The preferred products for connecting hardware and enclosures are the Krone product range.



12.2 Installation Specifications

INSTALLATION OF IDF/DF AND DP BOXES

a) IDF/DF

If UG cables larger than 100 pairs are incoming on a distribution point in a building it shall be terminated on a Krone wall mounted frame.

Krone wall mounted distribution frames will be installed using 6mm Approved Wall plugs and washers. The frame will be installed in an IDF/DF Cabinet as specified. A frame will consist of the following:

Two Krone 10 pair back-mount frames. The depth of which shall be 49mm or more.

Two jumper hooks at the top and two at the bottom of each vertical.

Each vertical shall be fitted with 20 Krone LSA profile 10 pair disconnect modules in blocks of 10 and a fixed label holder at the top of each block.

Verticals shall be earthed to each other with at least a 10mm insulated flexible earth cable.

A block of ten 10-way modules in a vertical shall be sequentially numbered with Krone numbers i.e. the first 10-way shall be numbered 0 and 10 and the 10th 10-way shall be numbered 9 and 100.

b) IDF/DF Krone 300A Boxes

One or two Krone 300A distribution boxes each complete with a 11-way back mount frame depth of 22mm, 10 Krone LSA profile 10 pair disconnect modules, a fixed label holder (at the top of the left box only) and four jumper rings shall be installed in buildings as per design, 1,5m AFF.

Each 10-way shall be sequentially numbered with standard Krone numbers i.e. the first 10-way shall be numbered 0 and 10 and the 10th 10-way shall be numbered 9 and 100.

c) IDF/DF Krone 250A Boxes

One or two Krone 250A distribution boxes each complete with a 6-way back mount frame depth of 11mm, Krone LSA profile 10 pair disconnect modules, a fixed label holder (at the top of one box only) and four jumper rings shall be installed in buildings as per design, 1,5m AFF.

Each 10-way will be sequentially numbered with standard Krone numbers i.e. the first 10-way shall be numbered 0 and 10 and the 6th 10-way will be numbered 5 and 60.



d) DP 201D Boxes

Krone 201D (or equivalent) termination boxes shall be installed in buildings for the termination of 10 pair underground and indoor telephone cables to be used for services in these buildings. Incoming cables shall be terminated on the inside of the 201D's terminals.

PVC pipes shall be installed in the top part of the 2-way metal ducting to be used as cable routes to the 201D termination boxes. This is done to prevent communication and AC power cables from crossing each other directly.

All distribution boxes and termination boxes will be installed using 6 mm approved wall plugs on fixed walls, and 6 mm spring toggles on dry walls and bolts and lock nuts on corrugated iron buildings. Distribution boxes and termination boxes will be installed at such a place that it cannot be accidentally damaged.

High Pair Cable Count:

Number	Tip	Ring	Colour	Pair Count
1	White	Blue	White-Blue	001-025
2	White	Orange	White-Orange	026-050
3	White	Green	White-Green	051-075
4	White	Brown	White-Brown	076-100
5	White	Slate	White-Slate	101-125
6	Red	Blue	Red-Blue	126-150
7	Red	Orange	Red-Orange	151-175
8	Red	Green	Red-Green	176-200
9	Red	Brown	Red-Brown	201-225
10	Red	Slate	Red-Slate	226-250
11	Black	Blue	Black-Blue	251-275
12	Black	Orange	Black-Orange	276-300
13	Black	Green	Black-Green	301-325
14	Black	Brown	Black-Brown	326-350
15	Black	Slate	Black-Slate	351-375
16	Yellow	Blue	Yellow-Blue	376-400
17	Yellow	Orange	Yellow-Orange	401-425
18	Yellow	Green	Yellow-Green	426-450
19	Yellow	Brown	Yellow-Brown	451-475
20	Yellow	Slate	Yellow-Slate	476-500
21	Violet	Blue	Violet-Blue	501-525
22	Violet	Orange	Violet-Orange	526-550



23	Violet	Green	Violet-Green	551-575
24	Violet	Brown	Violet-Brown	576-600
25	Violet	Slate	No Binder	

INSTALLATION OF CABLING

a) Underground Copper

Underground cables will be installed between buildings as per design.

The cable shall be hauled into pipes by hand or by means of a winch and hauling jig.

The direction of hauling shall be such that the clockwise end is away from the larger (upside) exchange. Cable is usually supplied with the clockwise end at the outside or running end.

Unless specifically approved by the Client, all cables shall be hauled by using a cable grip and swivel. Lubrication shall be by means of Polywater or approved substitute only. Under no circumstances is petroleum jelly to be used for lubrication.

Sufficient slack shall be left in the camber to ensure the correct positioning of the joint in the chamber.

Where it is necessary to haul the cable through a break in the pipeline, precautions shall be taken to avoid damage to the cable. The cable shall either be manhandled at such points or protected by means of bell mouths to ensure that there is no damage caused to the cable by the pipe edges.

At pull-through manholes the cable shall be bent into position and clamped to the support brackets. Where no brackets exist, brackets shall be installed as directed by the Client.

After hauling, all cable ends are to be sealed unless jointing is to begin immediately. In order to achieve this effectively a Cap shall be shrunk onto the end of the cable using a gas torch with a soft flame after first cleaning the cable sheathing with mentholated spirits.

On pressurized cable ensure that at least one of the Caps on a length has a Schraeder valve fitted to allow re-pressurization and checking of pressures.

b) Indoor

Indoor cables shall be installed in existing or new ducting from the frames, 300A and 250A boxes and terminated on the inside of the 201D's terminal strip. No more than one 10 pair indoor cables shall under no circumstances be terminated on a single 201D box.

Indoor cable shall be routed in approved pathways as specified in "Pathways".

Two pair indoor cables shall be installed in existing or new ducting between a 201D box and a flush mounted RJ11/45 telephone socket, which will be inserted in a pre-punched skirting plate with two 38mm x 22mm holes punched. The voice keystone will be inserted on the right.

The telephone cords will be supplied by the Client.



OVERHEAD CABLING

a) Copper Cable

Suspended cable (also referred to as “Lashed Cable” shall under no circumstances be deployed, unless for a very specific reason and no alternatives are available.

A maximum of two drop wires may be erected in one direction (between subsequent poles or feeding one direction/ building). If more drop wires are required to provide more services beyond the local DP (in the same direction), then the drop wires shall be replaced with aerial cable and a further local DP established to avoid multi drop wires in the same direction.

The maximum permissible span length for single- pair or multi- pair drop wires is 50 meters.

The maximum permissible span length for aerial cable under normal loading conditions is 60 meters.

Cable shall be laid out along a route either from a drum placed on a truck or trailer or from a stationary drum at one end of the run, care being taken not to damage the sheath by pulling the cable over rough surfaces.

Vehicles shall not be allowed to run over a cable. Where necessary, protection shall be provided by batons laid on either side of the cable or the cable shall be temporarily supported during erection across roads and driveways.

Cable Tensioning:

Aerial cable shall be tensioned in accordance with the following table:-

Span Length (m)	60	50	40
Temperature C	Sag (mm)	Sag (mm)	Sag (mm)
-7	520	350	210
-3	530	360	220
0	540	370	220
3	550	370	230
6	560	380	230
9	570	390	230
12	580	390	240
15	590	400	240
18	600	410	250
21	610	420	250
24	620	420	260
27	630	430	260
30	640	440	270
33	660	450	270



36	670	460	280
39	870	470	290
42	690	480	290
45	700	480	300
48	720	490	300
51	730	500	310

All underground copper cables shall be terminated on Disconnect 10 pr Krone modules.

CROSS CONNECTION OF SERVICES

Different services can be identified by means of the colour coding of the cross connection wire used at the MDF and distribution points. The following cross connection coding shall be used:

Red/Black	Telephone lines
Blue/White	Data
Black/White	Through connection
Green/White	Radio
Brown/White	Alarms

12.3 Marking Specifications

a) Underground

The cables shall be marked as follows:

- At each end of a cable as close as possible to the distribution frames
- In each manhole/draw pit
- At each point where the cable exits or enters a building.

The marking method of the underground cables shall be by means a Carrier Strip-on method. The identification shall be "50PR/123:456".

Where:

50PR – is the copper pair count

123 – is the building from

456 – is the building to



b) Indoor

New indoor cables between the Krone frames and sub-frames (300A and 250A) installed in the different buildings and between the sub-frames and the 201D distribution boxes, shall be marked using the Carrier Strip-on method. The cables shall be marked at each end of the cable as close as possible to a termination point and at each point where the cable exits or enters a room. The cable may only be numbered once in a room if the direction of the cable is not changed in that room.

The identification for indoor cables shall be CA/ID/xx where xx is the sequential numbering per building starting at 01.

The indoor cables between Telkom equipment, BMS and radio services shall be identified uniquely for the services. The same marking material and method shall be utilized.

The two pair cables shall not be marked.

c) Distribution frames and boxes

The distribution frames, 300A, 250A and the 201D boxes shall be marked with permanent ink PVC labels. All printed labels shall be black on white. The label shall be at least 100 x 10mm and the character size shall be 80 % of that of the label. The identification shall be DF/MF/01 for the MDF and DF/IF/xx for the 22-way frames, 300A and 250A termination boxes which are used as intermediate frames, where xx is sequential numbering starting at 01. The identification of a 250A box used as a distribution frame will be DF/DF/xx where xx is sequential numbering starting at 01. The identification of a 201D box used as a distribution point shall be DF/DP/xx where xx is sequential numbering per building starting at 01. The numerical number of a 10 pair indoor cable, terminated on a 201D box, and the numerical number of the 201D box, shall be the same.

The Krone verticals on the MDF room shall be identified on the Krone blank labels in alphabetical order from left to right. Each row shall be identified as follows: first block of 10 modules A1 – 200, 2nd block A101 – 200, 3rd block A201 – 300 and the 4th block A301 – 400. Each vertical shall be numbered as such with the specific alphabet letter.

The start of an underground cable shall be marked on the blank and on the sequential blank label/s by the cable's allocated identification or shall be marked on a Krone hinged label by the cable's allocated identification.

The cables from the PABX shall be numbered on hinged labels indicating the card position in the PABX.

The verticals of back mount frames shall be identified as for the MDF.

The 300A, 250A and 201D termination boxes shall be identified with the label fitted on the lid of the box. All labels will be permanent and printed black on white with a font size of at least 12 mm.

d) Overhead

All Overhead Distribution Points shall be numbered in accordance with the working plans provided. Black paint and stencils or 50mm black stick on letters shall be used as decided by the Client.



12.4 Acceptance and Test Plan (ATP)

The supplier shall submit samples of material other than Krone and labels to be used to the CLIENT for approval. This approval will be a once off event and the contractor shall thereafter use only the material from the submitted OEM and labels produced from the process that produced the approved labels.

The Contractor shall inspect, complete and present a certificate to the Supplier PM, certifying that:

- That only products from the OEM as specified on the order were used.
- The positions and numbers of IDF,DF, DP and wall outlets as indicated in the valid design, the actual installed positions and the positions as indicated on the floor plan are identical.
- IDF,DF, DP and wall outlets are labeled correctly.
- All cable pairs are tested and the test sheet will be presented.
- That the above specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- All relevant documentation is presented and that the documents are correct and complete.

DOCUMENTATION TO BE PRESENTED WITH EVERY SUBMISSION FOR SIGNOFF

- The certificate certifying the aspects mentioned in the ATP.
- Test results.
- Floor plans indicating the IDF,DF, DP and wall outlets positions and numbers.



12.5 Fibre Optic Cabling

PRODUCT TECHNICAL SPECIFICATIONS

a) Fibre Cable Performance Specifications:

i) Single Mode Fibre 9/125

Optical Properties

Attenuation at 1310 nm	0.38 dB/km
Attenuation at 1550 nm	0.25 dB/km
Cable Cut-Off Wavelength	< 1260 nm
Mode Field Diameter @ 1310 nm	9.2 +- 0.5mm
Zero Dispersion Wavelength nm	1300 – 1320
Zero Dispersion Slope ps/(nm ² .km)	< 0.092
Dispersion: 1285 nm 1330 nm ps/(nm.km)	3.5
Dispersion: 1525 nm 1575 nm 19ps/(nm.km)	

Geometric Characteristics

Core Cladding Concentricity Error	0.8 mm
Core Non Circularity	<6%
Cladding Diameter	125 +- 2 mm
Cladding Non Circularity	1.5%
Coating Diameter 10mm	245 +-
Coating Concentricity	<10mm
Coating Non-Circularity	<5%

ii) Multi Mode Fibre Graded Index 50/125

Optical Properties

Attenuation at 850nm	2.504 dB/km
Attenuation at 1300 nm	0.704 dB/km
Bandwidth at 850 nm	400 MHz.km



Bandwidth at 1300 nm	800 MHz.km
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Geometric Properties

Core Diameter	50 +- 3mm
Numerical Aperture 0.015	0.200 +-
Cladding Diameter	125 +- 2 mm
Core/Cladding Non Circularity	3.0 mm
Cladding Non Circularity	2%
Coating Diameter mm	245 +- 10
Coating Concentricity	< 15 mm
Coating Non-Circularity	< 5 mm

PHYSICAL CABLE SPECIFICATIONS

Optical Fibre Cable shall conform to the following specifications:

a) Outdoor Optical Fibre Cable

i) Heavy Duty Duct Cable:

- Polyethylene water resistant sheath.
- Core Binder
- Aramid strength member.
- Interstitial water blocking material.
- Gel filled loose tubes.
- Colour coded fibres.
- Non-metallic centre strength member.

b) CST Armoured Cable:

- Polyethylene outer sheath.
- Plastic coated corrugated steel tape armour.
- Polyethylene bedding sheath.
- Core Binder
- Aramid strength member.
- Interstitial water blocking material.
- Gel filled loose tubes.
- Colour coded fibres.
- Non-metallic centre strength member.

c) Short Span Aerial Cable:

- UV resistant Polyethylene outer sheath.



- Double layer aramid strength member.
- Gel filled loose tubes.
- Colour coded fibres.
- Non-metallic centre strength member.

d) Armotube Cable:

- Polyethylene outer sheath.
- Plastic coated corrugated steel tape armour.
- Polyethylene bedding sheath.
- Non-metallic centre strength member.
- Gel filled loose tubes.
- Colour coded fibres.

e) Low Count Duct Cable:

- Polyethylene/LSZH outer sheath.
- Non-metallic strength member.
- Gel filled loose tubes.
- Colour coded fibres.

INDOOR OPTICAL FIBRE CABLE

a) Indoor LAN Cable:

- PVC/LSZH outer sheath.
- Non-metallic strength member.
- Gel filled loose tubes.
- Colour coded fibres.

b) All cables shall be stamped with the following details:

- The name of the manufacturer.
- The type of cable.
- Length marking.
- Date of manufacture.

These markings shall be clearly marked on the cable sheath at intervals of not more than 1m throughout the whole length of cable.

SPLICE ENCLOSURES AND FIBRE TAILS

All products installed shall be branded indicating the manufacture's name and the product code.

Splice enclosures shall be 24 Way 19" Rack Mountable.

Mid couplers installed shall either be of the SC or SFF type. ST mid-couplers will only be installed on existing ST site. Polymer mid-coupler will not be installed.



Only approved dome joints are to be used and shall consist of the following:

Shall be waterproof

O-ring seal

Heat shrink for cables

Screw type bracket to seal lid.

Wall mount brackets

Splice organizer

Type 2 to 4way

Seal unused inlets with plugs

Fibre patch cables are to be factory assembled, terminated and certified to the relevant standards.

INSTALLATION SPECIFICATIONS

Indoor backbone fibre optic cables shall have a minimum bend radius of 10 times the cable's outside diameter when under no load and 15 times the cable's outside diameter when being pulled. OSP backbone optical fibre cables shall have minimum bend radius of 10 times the cable's diameter when under no load and 20 times the cable's outside diameter when being pulled.

Vertical optic Fibre Cables:

Use tight buffer cables in buildings where the vertical rise of an optic fibre cable exceeds 20m. Use cable strain relieve at the top of each vertical rise and thereafter at 1m intervals. If for some reason, tight-buffer cable can not be utilised, cables in riser shafts shall be looped at each floor.

Cable drums shall be supported with an axle on trestles.

During installation the cable shall be laid out in a figure 8 method.

Twisting of cable is not allowed.

Do not leave any slack at intermediate manholes unless there shall be a joint introduced for future developments. Planning shall indicate this.

Fit slack Box/dome joint in manhole 100mm from manhole roof if possible or any other practical position.

Cable slack shall be a minimum 15 meters on both cables to enable splicing to take place outside of manhole inside the splicing vehicle.

**Hauling Tension**

CABLE SIZE	MAXIMUM HAULING TENSION*
12 FIBRE UG	1200N
24 FIBRE UG	1200N
48 FIBRE UG	1500N
72 FIBRE UG	2000N
96 FIBRE UG	2000N
144 FIBRE UG	2600N
12 FIBRE CST	2800N
24 FIBRE CST	2800N
48 FIBRE CST	3200N
72 FIBRE CST	4200N
96 FIBRE CST	4200N
144 FIBRE CST	5200N

***Hauling is carried out with a cable sock capable of transferring sufficient load to the cable strength member materials (zero slippage occurs)**

Cables shall be hauled at a constant speed so as not to be subjected to unnecessary stress.

Short Span Aerial Cable (Non- metallic self- supporting cable) will be used on overhead pole routes.

Only 17,20 and 25 poles per km routes shall be considered for cable with a PVC (Poly Vinyl Chloride) outer sheath. Cable with a High-Density Polyethylene outer sheath can be installed on span lengths of up to 150 meters.

The “short span” series are compact loose tube aerial self-support cables specifically designed for installation on pole routes with 70m spans, but are suitable for a multitude of self-supporting applications.

Though these cables are not ideally suited to the duct environment, they can be used as such, to avoid unnecessary splicing at the end of self-supporting routes.

Only installation hardware verified according to the suppliers Clamp approval specification to be used.

Cable slack shall be coiled into a glass re-enforced plastic box which is fitted to an arm on the pole.

Tension table for installing Circular Metal Free Polyethylene Sheathed Aerial Optic Fibre Trunk Type Cable



Fibre count	Span-Length (m)	Tension (N)	Sag (mm)
4-24	40	480	260
	50	520	400
	59	590	490
	67	575	650
	83	640	900
	100	760	1100
	120	750	1600
	150	750	2500
24-48	40	730	260
	50	740	400
	59	845	490
	67	820	650
	83	820	1000
	100	850	1400
	120	850	2000
	150	890	3000

The optic fibre cable shall be terminated in 19" rack mountable 24 way fibre splicing termination trays directly on mid-couplers or be spliced onto unjacketed pigtails connected to the mid-couplers. The position of the splice tray in the cabinet shall be established before the installation commences.

The Splice tray shall house sufficient splice organizers.

All splices shall be protected with splice-protectors.

All cores in a cable shall be terminated at both ends.

Direct Termination or fusion splicing may be performed on the patch panel.

Always adhere to minimum bending radii when routing fibres in the termination drawers.

Unused slots shall be blanked off both in the front and back of the splice tray.

Fibre optic patch leads shall be duplex patch leads used for connection of the single-mode or multi-mode fibre optic cables to equipment. The length of a patch lead shall be as required.

The connectors to be fitted on the patch leads shall match the connectors on the equipment/termination devices.

Cable slack at termination points shall be 5 meters and 15 meters at splicing manhole.

**FIBRE OPTIC COLOUR CODE**

Fibre Strand Colour	Fibre Tube Colour
Blue	Blue
Orange	Orange
Green	Green
Brown	Brown
Slate	Slate
White	White
Red	Red
Black	Black
Yellow	Yellow
Violet	Violet
Rose	Rose
Aqua	

MARKING SPECIFICATIONS

The marking method of the fibre optic cable shall be by means a Carrier Strip-on method. The cable shall be marked at each end of the cable as close as possible to a termination point and in each manhole/draw pit. The identification shall be "4FO/123 1A:456 2B".

Where:

- 4FO – is the fibre count
- 123 – is the building from
- 1A – is the cabinet from
- 456 – is the building to
- 2B – is the cabinet to

Fibre warning tags shall be attached to the cable in the same positions as the cable identifier. The warning tag shall at least be printed with the following: "WARNING: Fibre Optic Laser Beam". The tag shall be clearly visible.

Secure label and warning tag on fibre cable with cable ties.



Fibre splice trays shall be labelled in the following manner: A, B, C etc: from the top to bottom of the cabinet. The label will be on the left side of the Patch Panel.

The mid-couplers will be labelled as follows (The label will indicate the destination of the fibre): "123/G/A/B/1-4", where:

- a) 123 – building number
- b) G – Floor
- c) A – Cabinet Number
- d) B – Fibre Optic Patch Panel Number
- b) 1-4 – Mid-coupler numbers.

All labelling shall be printed permanent ink PVC labels. All printed labels shall be black on white with a font size of at least 8 mm.

ACCEPTANCE AND TEST PLAN (ATP)

The Contractor shall submit samples of splice trays (complete with mid-couplers, splice organizers, dust cover etc.), labels and warning tags to be installed to the CLIENT for approval. This approval will be a once off event – thereafter a delivery note from the supplier indicating that the approved item was utilized will be sufficient for the acceptance certificate.

Fibre Optic Cabling Testing

On completion of a fibre link an acceptance testing of a fibre link with an O.T.D.R. or a light source and power meter shall be performed from both ends. The readings shall then be recorded and the bi-directional event and average link loss shall be calculated.

The test results shall be stored in both hard and soft copies for the acceptance documentation.

Maximum connector mated pair loss shall not exceed 0.75dB.

Maximum connector loss shall not exceed 0.5dB.

Maximum splice loss shall not exceed 0.3dB.

The Contractor shall inspect and complete an inspection certificate, certifying that:

- The installed products are approved by the CLIENT and that a certificate certifying such approval and the delivery note for the installed items are available on request.
- The splice trays are installed in the correct positions in the cabinet.
- Splice Trays are labelled correctly.
- Fibre cables are labelled correctly. (Fibre identifier and warning tags)
- That the above specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- All relevant documentation is presented and that the documents are correct and complete.

**Documentation to be presented with every submission for signoff**

- Contractor's inspection certificate, certifying the aspects nominated for inspection in the ATP.
- Fibre optic test results. (Hard and native soft copy)
- Fibre optic wiring schedule.

13. Network and PABX Rooms

13.1 Product technical specifications

All products related to: distribution cabinet, data, voice, fibre optic, power distribution, earthing and pathways shall conform to the specifications specified in the specific section of this document.

a) Floor Covering:

Floor Covering shall be Heavy Duty Vinyl Sheeting (The color shall be determined by the CLIENT).

b) False floor:

Access floor system shall consist of interchangeable square panels selected to meet specific load requirements. Panels shall be supported by adjustable pedestal assemblies which positively locate, engage and secure panels with a minimum height of 200mm AFF. Where floor coverings are supplied by the access floor manufacturer, the type, colour and pattern shall be selected by the client.

c) Pedestal Bases:

Shall be fabricated of an aluminium base with not less than 144cm square of bearing area and assembled to a stud or tube which is designed to engage the pedestal head assembly; secure to sub-floor in accordance with manufacturer's instructions.

d) Pedestal Heads:

Shall be of all aluminium head plate with a corresponding stud or tube which is designed to engage the pedestal base assembly. The head shall be the proper type to positively locate the floor panel or to receive a stringer system.



e) Stringer System:

Stringer system shall be all aluminium construction, designed and fabricated to interlock with pedestal head and to form a modular grid pattern with members under edges of all field floor panels.

f) Corner-lock Fastener:

(Include this section if a corner-lock-bolt down panel system is required). Floor panels shall be provided with four corrosive resistant, nylon fasteners which are retained by the pedestal heads. Panels shall be removable by releasing the four fasteners and shall remain positively locked onto the pedestal head without the fasteners in place.

Load Performance Tables	Class 1	Class 2	Class 3
Type of Load			
Concentrated Load (25mm x 25mm)	2.9kN	4.5kN	5.6kN
Uniformly distributed loads p/m ²	9kN	13.5kN	15.6kN
Impact Load	40kg	55kg	65kg
Pedestal Assembly: Axial Load	22.7kN	22.7kN	22.7kN
Panel Specifications			
Panel Size	600mm x 600mm	600mm x 600mm	600mm x 600mm
Top Sheet	0.7mm	0.9mm	1.1mm
Bottom Sheet	1.0mm	1.0mm	1.3mm
Pull test on pedestal base	10kg	10kg	10kg
Fire Rating	Class 1 - 60min	Class 1 - 60min	Class 1 - 60min

g) AC Power

A 16 Way white distribution box shall be installed complete with an earth leakage unit and dual pole isolator. The feeder cable and the circuit breakers for the DB shall be determined by the amount of sockets to be installed and the load of all the devices. Minimum feeder cable size shall be 6 mm².

A second AC Box, colored red, for the UPS supply will be installed and will feed the UPS power points. Unused slots shall be blanked off.



h) DC Power

A 10-way direct current box complete with two 30A and three 20A circuit breakers shall be fitted in the PABX room. The –48V from the PABX batteries and the –48V to the PABX rectifier shall be connected to this box with 16mm² red and flexible insulated cables. Equipment requiring –48 volts shall be connected to this box with 6mm² red and black soft, flexible insulated cables. Unused slots shall be blanked off. The wiring of the DC reticulation shall be approved by the Client before any work will commence. The circuit breakers in the box will be identified with indelible printed labels.

i) Uninterrupted Power Supply (UPS):

Off Line and Online Dual conversion UPS systems shall be installed depending on specific requirements. The switchover time for Off Line UPS's shall be 4 ms or less. The capacity of the UPS will be according to the load and duration of battery time required for the specific application. The UPS shall have a serial communications port to be connected to a server for auto shut-down procedure shall the UPS battery power reach critical stages during power failures. The make and other features of the UPS will be negotiated with, and accepted by the client prior to the purchase of such UPS. Backup power units could be planned as per user requirement.

j) Security

A steel security door shall be installed at all doors of the PABX and network rooms.

Two options of locking such door will be considered, depending of the client's needs:

A door lock with keypad and battery backup shall be fitted for opening of the door. A manual release button shall be fitted inside the room. An override function shall be supplied to open the door from the outside only in case of an emergency. If this option is installed together with a fire protection system, the door lock will release automatically in case the fire protection system is activated.

Alternatively a four leaver lock and four sets of keys will be installed.

The choice of options above shall be made on a per project basis by the CLIENT.

The door shall be fitted with a pneumatic door closing device if required.

All windows that can open shall be fitted with burglar bars.

A detailed schematic drawing of all steel works shall be presented to the CLIENT for approval prior to the installation thereof. If similar installations happen on different sites, this approval will only be a once-off event.



k) Fire Protection

Two options of fire protection will be considered, depending on the clients needs:

- i) One fire extinguisher will be installed in the equipment room and PABX room and one on the outside next to the entrance door of both rooms. The extinguishers will be filled with CO2 with at least a 5kg capacity.
- ii) Electronic fire detection and protection system which will conform to the following specifications:
 - Automatic detection of a fire will be by means of ionization combustion gas smoke detectors.
 - The detectors are grouped together in zones and cabled back to the control cabinet.
 - A set of 24 V DC batteries together with an automatic constant potential charger provides standby power.
 - Connection facilities are available for the transmission of an alarm signal to the Fire Brigade and EMS.
 - A fire condition is signalled both visually and audibly at the alarm panel.
 - The gas control and status unit controls the gas extinguishing system.

13.2 Environmental Monitoring System (EMS)

THE EMS SHALL COMMUNICATE EITHER VIA GSM OR DIRECT TELKOM LINES.

A) THE FOLLOWING CONDITIONS SHALL BE MONITORED:

- i) Flood

This means that there is water present under the access floor, which poses a threat to the electrical and networking reticulation. Sensors shall be placed at pre-determined positions under the access floor in order to sense any possible leaks.
- ii) Fire alarm

Early warning in the case of a fire or if gas is about to be discharged into the room.
- iii) Temperature

An independent temperature sensor shall be installed in the server room. The sensor will alarm if the temperature exceeds a pre-determined limit, usually between 22 and 26 degrees Celsius, at the discretion of the client.



iv) UPS power

Four alarms shall be obtained directly from the UPS: These are: *Mains power failure*, *Bypass active* (which means that the power load is not being supported by the UPS, and that the load is being directly supported by mains, exposing the system to the threat of crashing due to mains power failure or voltage fluctuation and power spikes), *Common alarm* (a generic alarm which indicates that the UPS needs maintenance for any one of several reasons) and a *Low battery charge warning* (which indicates that the batteries are discharging, and not being replenished, due to mains and/or generator failure).

v) Generator power

An alarm shall be obtained from the generator, which can vary considerably depending on what is provided by the manufacturer. The following alarms shall be available from the plant: *Generator running* (which indicates that the set has started, which is critical following a power failure, and *Common alarm* (which means that the controller has detected a fault which requires the services of a maintenance technician).

vi) Air Conditioning

An air-conditioner with sufficient capacity for the room size and the heat dissipation of the active equipment shall be supplied. The air-conditioner shall be a split unit. The manufacturer's equipment to be used shall be negotiated with the CLIENT prior to the installation thereof.

vii) Lighting

1,5m double fluorescent light and cover shall be supplied.

viii) Work Surfaces

The work surfaces shall be a Formica sheet with a minimum thickness of 30mm. The minimum dimensions of the workbench shall be 3m (L) x 900mm (D) x 800mm (H). The front of the Formica top shall have a post-formed edge. The supporting framework of the bench shall be made of at least 25mm square tubing and shall be painted with a base coat and black enamel.

ix) Cable trays

Heavy duty galvanized type cable trays shall be installed underneath and alongside the length and width of the false floor in the PABX and network rooms. The width of the trays required for the routing of the cables shall not be less than 304mm and the depth shall be 76mm. Matching fittings i.e. couplings, corners (90 and diagonal), stoppers etc.... shall be used.



Where no false floor exists, cable trays shall be suspended from the roof according to the manufacturer's specification.

A light duty galvanized type cable tray shall be installed alongside the top and bottom of the new MDF for support or the cables to be terminated on the frame. The width of the tray required shall not be less than 228mm and the depth shall be 19mm.

13.3 Installation Specifications

All installations related to: distribution cabinet, data, voice, fibre optic, power distribution, earthing and pathways shall conform to the specifications specified in the specific section of this document.

WALL REQUIREMENTS

Network and PABX room walls shall:

- i) Extend from the finished floor to the structural ceiling.
- ii) Be covered with at least two coats of fire-retardant white paint.
- iii) Be fire-rated as required by the applicable codes and regulations.

FLOOR COVERING

The floor shall be level, clean and sealed before installation commences. The Heavy Duty Vinyl Sheeting shall be fixed with a high quality contact adhesive.

FALSE FLOOR

Special attention shall be given to the area where the equipment cabinets shall be installed. The equipment's floor loading shall be adhered to.

The floor edges shall be finished off with suitable trimmings. It is to be noted that both entrance doors are opening to the inside of the room. The floor and the void underneath the floor shall be left clean with all debris removed.

The structural floor shall be poured concrete that has been sealed to provide dust and humidity control.

Do not proceed with installation until sub-floor surfaces are clean, dry, and clear of other trades and ready to receive access flooring.



The raised floor shall be level within +3.2 mm (1/8 in.) overall and within +1.6 mm (1/16 in.) in any 3.05 m (10 ft) distance.

Floor to be rigid and free of rocking panels.

All cable openings in floor panels shall have plastic edging to prevent damage to cables.

DC POWER

The cables from the batteries will be routed in metal ducting.

Batteries shall be installed, as per design.

UNINTERRUPTED POWER SUPPLY

The UPS will be positioned to allow easy access for future maintenance and as close as possible to the newly installed DB's.

The feeder and supply cables will be installed in flexible conduit, with enough slack to move the UPS to open all covers. The flexible conduit will be connected to the metal power skirting and the UPS with appropriate adaptors.

SECURITY

Security doors and burglar proofing shall be welded onto existing steel structures or brackets. Alternatively the doors and burglar proofing shall be fitted onto walls with M12 rawl-bolts. Rawl-bolts shall be welded onto the brackets after tightening of such rawl-bolts. All steel shall be painted with a metal primer and two coats of black enamel paint.

FIRE PROTECTION

Fire protection system shall be installed according to the manufacturer's specification.

All cables installed shall be enclosed.

ENVIRONMENTAL MONITORING SYSTEM (EMS)

EMS shall be installed according to the manufacturer's specification.

All cables installed shall be enclosed.

AIR CONDITIONING

Power to the air conditioner shall be fed from a separate circuit breaker in the white distribution board in the network room or PABX room. An isolator shall be installed next to the air conditioner, inline with the AC feed. A water overflow pipe shall be fitted on the outside and to floor level to prevent dripping water.



LIGHTNING

One 1,5m double fluorescent light and cover shall be installed for each 9 m² floor space allocated as network and PABX rooms. The light fittings shall be installed at a minimum of 2,6m AFF. Light switches shall be installed at entrance doors. Dimmer switches shall not be installed.

WORK SURFACE

A workbench shall be installed in the equipment room. The bench shall be at a right angle against two walls if the room allows. The right angle shall be by means of a 45° angle. A detailed schematic drawing of the framework shall be presented to the client for approval before manufacturing of such framework. This approval will be a once-off event for similar installations. The framework shall be painted with a metal primer and two coats of black enamel paint.

All redundant infrastructure and cables shall be removed.

MARKING SPECIFICATIONS

All labeling shall be printed permanent ink PVC labels. All printed labels shall be black on white with a font size of at least 8 mm.

All labeling inside the PABX and Network room shall conform to the relevant specification of the specific installation.

ACCEPTANCE AND TEST PLAN (ATP)

The contractor shall submit samples of labels to be used to the CLIENT for approval. This approval will be a once off event and the contractor shall use only labels produced from the process that produced the approved labels.

The Contractor shall inspect, complete and present a certificate to the SPM, certifying:

- That only approved product as specified on the order was used.
- The room layout and all products positions as indicated in the valid design, the actual installed positions and the positions as indicated on the floor plan are identical.
- All required labeling are correct.
- All electrical points are installed according to "Power Distribution".
- All Cabinets supplied are according to specification as described under "Distribution Cabinets".
- All data points are installed according to "Data Cabling".



- All voice points are installed according to “Voice Cabling”.
- That the above specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- The UPS is tested: after commissioning of the UPS the supply to such UPS will be switched off. The power on the output of the UPS will be monitored. No power-dip is visible and the UPS runs without power for at least 10% of the time of the UPS capacity. The UPS manual, keys, serial communications cable and auto shut-down software are supplied.
- The Air-conditioning units are tested: the units are running and blowing cold air into the room. The drain pipe is installed on the outside of the building to ground level.
- The fire protection system is tested by a registered fire marshal and a certificate of compliance is presented.
- The EMS is tested according to the manufacturers ATP.
- All relevant documentation is presented and that the documents are correct and complete.

DOCUMENTATION TO BE PRESENTED WITH EVERY SUBMISSION FOR SIGNOFF

The certificate certifying the aspects mentioned in the ATP.

All documentation that is relevant and is described in the following sections:

- Distribution Cabinets
- Data Cabling.
- Voice Cabling.
- Fibre Cabling
- Power Distribution.
- Earthing and Bonding.
- Pathways.
- Documentation.

CERTIFICATE OF COMPLIANCE FOR THE FIRE PROTECTION SYSTEM

Test results for the EMS in accordance with the manufacturers prescriptions.

The room layout indicating:

The position of the door;

Access holes;

Cable risers;

Cable runways and access ducts for the overhead and under floor application;

AC (Normal, Dedicated and UPS) and DC power point positions and numbers;

Air-conditioning;

Earthing/bonding point

Distribution frames

Lightning;

Position of any other equipment which may be accommodated in the room



Workbench
Light switch
Cabinet positions.

13.4 New Server rooms

Additional specifications

- All new server rooms should be a minimum of 12 square meter's in size and be housed with dual power skirting on at least 3 of the walls and have a minimum of 6 dedicated UPS plug sockets.
- A fire proof door must be fitted with access control and an automatic door closing mechanism.
- An approved fire detection system as well as an approved fire dampening system (Co2 or Norse gas system) must be installed as specified previously.
- The fire detection system must have a manual / auto switch on the out side of the new server room door this is for safety purposes when entering the server room to prevent the release of the fire detection gas.
- All new server rooms must be fitted with a minimum of a 12000 BTU Air conditioner which will be of a "split unit type"
- A minimum of 4 network points per server room mounted on the power skirting
- A minimum of a 5kVA UPS system must be installed in all new server room with (on line serves)
- A dedicated electrical DB must be installed and only the equipment in the new server room must run off this.
- Were possible a raised floor needs to be installed and must be of the fire proof type and be at least 250mm in height and have a tile lifter.
- Access into the new server room must be a minimum 110mm PVC pipe, if access is coming for out side of building and if access is from the ceiling then a cable tray of a minimum of 300mm wide and must be mounted the correct way with P2000 and this must be installed from the ceiling to floor level and as close as possible to the new network cabinet.
- Access control must be feed from the dedicate UPS supply and have an exit button mounted on the inside door wall.
- The new server room must be sealed off correctly to prevent dust from entering the room.
- A heavy duty lockable security gate must be fitted to the external entrance of the room
- Ideally windows should not be provided but, if so, heavy duty burglar bars must be fitted on the inside
- A burglar alarm system must be fitted
- Access into the room must not be possible via the ceiling.
- Where possible the ceiling must be solid concrete or heavy gauge mesh must be securely fitted to prevent access
- The server room must be situated in an area which is away from the general public and areas used by patients



14. Power Distribution

PRODUCT TECHNICAL SPECIFICATIONS

All material which for part of the power distribution shall conform to **SABS 0142 and SANS 10142-1:2006**.

Distribution boards shall be factory manufactured: white for normal power and red for generator power and blue for UPS power.

INSTALLATION SPECIFICATIONS

All electrical reticulation shall conform to **SABS 0142 and SANS 10142-1:2003** installation specifications.

No more than 6 power sockets shall be installed on a 20A circuit.

SUPPLEMENTARY REQUIREMENTS

No more than 6 power sockets shall be installed on a 20A circuit.

All power outlets shall be flush-mounted in metal power skirting. For any other type of installation, written permission shall be obtained from the CLIENT prior to such installation.

Registered electricians shall supervise all activities and perform terminations themselves.

If the specifications of the Local Authority having jurisdiction differs from the above standard, these Local Authority specifications shall have precedence.

All power outlets shall consist of a cluster of one dedicated (Red) and one normal (White) 16A Plug assemblies or according to specific Client requirements.

Open spaces on distribution boards shall be blanked off.



CABINET POWER

The power plug sockets inside the cabinets shall be a red dedicated 15 Amp socket, and feed from a dedicated circuit. No electrical wire joints shall be accepted on power feeding the cabinet or any equipment installed.

MARKING SPECIFICATIONS

All labeling shall be printed permanent ink PVC labels. All printed labels shall be black on white with a font size of at least 8 mm.

Labeling on the power outlets shall be done as follows:

"X"/"Y"/"Z". Where "X" is the DB number, "Y" is the circuit breaker number and "Z" is the socket count on the specific circuit.

Distribution Boards shall be labeled according to **SABS 0142 and SANS 10142-1:2003**.

ACCEPTANCE AND TEST PLAN (ATP)

The Contractor shall inspect, complete and present a certificate, certifying that:

- That only product according to **SABS 0142 and SANS 10142-1:2003** were used.
- The positions as indicated in the valid design, the actual installed positions and the positions as indicated on the floor plan are identical.
- Outlets are labeled correctly.
- That installation is done according to **SABS 0142 and SANS 10142-1:2003 installation** specifications.
- All points are tested and the test results documented. The method will be discussed.
- That the above specifications, supplementing the **SABS 0142 and SANS 10142-1:2003** specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- All relevant documentation is presented and that the documents are correct and complete.



DOCUMENTATION TO BE PRESENTED WITH EVERY SUBMISSION FOR SIGNOFF

- The certificate certifying the aspects mentioned in the ATP.
- Power Wiring Schedule
- Test results sheet.
- Floor plans, indicating normal and dedicated point positions and numbers.
- Certificate of Compliance (COC). (SANS 10142-1:2006)



15. Earthing, bonding, surge & lightning protection

The contents of these standards are regarded as the minimum requirements, and form the basis for the drafting of specific specification, procedure and / or work instructions.

15.1 Product technical specifications

All material which for part of earthing and bonding shall conform to **SANS 10142-1:2003**.

15.2 Installation Specifications

COMMUNICATION EARTH

A communication earth with an earth impedance of not more than 5 Ohms shall be installed at all the Network and PABX Rooms.

The earth shall be connected with a 70mm² flexible insulated copper conductor to an 8 way earth bus-bar to be fitted inside the Network and/or PABX Room. The 70mm² insulated copper conductor shall be cad-welded to the earth mat or earth rods.

A communication earth of less than 50 ohm impedance shall be installed outside all buildings where an underground cable has to be terminated. The earth shall be connected with 16mm² flexible insulated copper conductor to the metal back mount frame of the Krone frame/ box installed in a building. The 16mm² insulated copper conductor shall be cad welded to the earth mat or rod and a crimped lug shall be fitted at the other end for connection to the frame / box.

After installation of the earth system the contractor shall measure the resistance of the earth and record it.

Verticals of a Krone wall mounted distribution frames shall be earthed to each other with at least a 16mm² insulated flexible earth cable.

The screens of all the underground cables terminated on the MDF shall be connected to verticals of the MDF.

The screens of underground cables terminated on intermediate frames/ boxes in buildings shall be connected to each other and not be earthed.

The screens of all the other underground cables shall be connected to the earth via an 110V metal oxide arrester.

All data cabinets shall be earthed with a 4mm² flexible insulated copper conductor to the ground bar of the power distribution board and a crimped lug shall be fitted at the other end for connection to the cabinet. The lug shall be fastened onto the cabinet with a bolt, nut and cerated washer.

All metal pathways shall be earthed with a 4mm² flexible insulated copper conductor to the ground bar of the power distribution board and a crimped lug shall be fitted at the other end for connection to the metal pathway. Where an earth pin is not available, the lug shall be fastened onto the metal pathway with a bolt, nut and cerated washer.



The metallic structure of the raised floor shall be electrically bonded to the ground to minimize static build-up. The floor panels shall have conductive contact with either the framing pedestals, or both for positive electrical grounding.

The bolted-stringer raised floor is considered by the National Electrical Code (NEC) to be electrically bonded to itself. This type of raised floor need only be interconnected to the building steel, electrical safety ground, and any other metallic structure that penetrates the perimeter of the floor to meet the required specifications.

A raised-floor structure that does not have bolted stringers shall be circled with a bonding conductor connected to the top cap area of the pedestals, routed from pedestal to pedestal, in as short a route as possible. According to the NEC, the conductor shall be bare copper wire not smaller than 16mm.

SURGE PROTECTION

230V 3-way gas arresters in dedicated 10-way magazines shall be fitted on all underground cables, terminated on the MDF and underground cables terminated on distribution frames/ boxes installed in buildings. Cognisance shall be taken regarding the dept of the 250A Krone boxes.

15.3 Acceptance and Test Plan (ATP)

The Contractor shall inspect, complete and present a certificate, certifying that:

- That only products as specified on the order were used.
- The installation is according to the approved design.
- That the above specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- That all test equipment is calibrated and that the calibration certificates are available and valid.
- All relevant documentation is presented and that the documents are correct and complete.

15.4 Documentation to be presented with every submission for signoff

- The certificate certifying the aspects mentioned in the ATP.
- The contractor's inspection report with the inspection results inspecting adherence to the above requirements.
- A copy of the certificate of compliance which covers the safety earthing of the AC installation in terms of SANS 10142-1 where Telecommunication infrastructure is bonded / earthed to the DB earth.
- A table indicating the measured earth system resistance.



16. Pathways

16.1 Product technical specifications

a) Horizontal Cable Pathways:

i) Metal Ducting:

Cable trunking shall be of the steel type, single or double, 50 mm x 75 mm x 0.8 mm. Matching fittings i.e. couplings, corners (90° and diagonal), stoppers etc. shall be used.

PVC trunking may be installed in special circumstances for reasons such as prevention of corrosion.

ii) Conduit:

PVC or metal conduit with matching couplings, adaptors, bends etc. shall be used, depending on the environmental factors to which it is exposed.

b) Backbone Cable Pathways:

Only 110mm Cable-flex pipe in 6 m lengths, complete with water seals will be supplied for underground cable routes.

The minimum size for a hauling pit for an **optic fibre** route is 800mm measurement with the 1,000mm length being in line with the duct run to accommodate minimum bending radius (300mm) for optic fibre cables and hauling equipment.

A good quality nylon rope with a thickness of at least 7mm square shall be supplied for all pipe routes for future hauling of a cable.

16.2 Installation Specifications

All horizontal pathways that protrude through fire-rated barriers shall be fire stopped in accordance with the applicable codes.



16.3 Installation of Ducting

Metal ducting, shall be installed in offices for the routing of data, voice and power cables. Approval shall be obtained to utilize any other type of trays, piping or ducting. The ducting shall be installed at least against two walls in offices in buildings, but could be changed per site. The ducting shall run against the full length of a wall. All ducting accessories shall be fastened with pop-rivets or self tapping screws. Self tapping screws used within installations shall be cut/shortened and rounded off to avoid damage to cables. Single ducting shall be used for routes where only power cables are required. It is to be noted that vertical runs of these type of ducting shall in certain instances, be required. The colour of the ducting shall be determined per project by the client and shall be standard colour coded. Where ducting exists, the colour shall be matched with these of the existing ducting. It may be required that one-way ducting be integrated with two way ducting fitted in certain offices.

Ducting shall be fastened to permanent structures by means of 6mm Approved plastic fasteners with non- corrosive flat washers with a minimum diameter of 25mm. Fasteners shall be spaced one meter apart with double fasteners at the end of the ducting and shall be offset when used for the installation of 100mm or more ducting. The method of an alternative installation shall be addressed during the design and/or site inspection phase to comply with other building structures. The method of fastening on non-permanent structures, shall be spring toggles on dry walls, and stainless steel bolts and lock nuts on corrugated iron buildings, with the same washers and spacing as above.

Grommets/glands shall be used for protection of cables that are routed through holes in metal.

Ducting will be routed through walls in a straight line. A section of the lid shall be fitted at the points where the ducting is routed through a wall before such wall is patched and painted. The piece of the lid shall protrude 50mm on each side off the wall. Where damage takes place the structure shall be restored to its original condition as far as possible. In cases where this is not possible an alternative shall be agreed upon. Block paint shall be done where walls were damaged and repaired.

Cables shall be protected from rough or sharp edges by means of rubber grommet or protective material. All burrs on edges of ducting shall be neatly filed to prevent damage to cables.

200mm special purpose plates shall be installed for installation of flush type, telephone, data and dedicated (red) and ordinary (white) 16A power sockets in the metal ducting. No cables shall be visible from the front. Blanks shall be fitted in spaces where a telephone or data socket is not fitted.

The lids of the ducting shall be removed and stored in a safe place. The fitting of the lids shall only be done after all cabling has been completed and accepted. Temporary supporting devices shall be supplied to keep wiring in place during the installation phase.

Where ducting is installed against the roof of a floor with the lids facing downwards, permanent supporting devices shall be supplied to keep wiring in place to prevent the lids from carrying the weight of the cables.



16.4 Installation of Conduit

Preferred conduit: 20mm PVC or galvanised bosal.

a) Install conduit runs to:

- a) Run in the most direct route possible with no more than two 90 degree bends.
- ii) Contain no continuous sections longer than 30m.
- iii) Withstand the environment to which they will be exposed to.
- iv) For runs longer than 30m, install pull boxes

Conduit shall be fastened with saddles of the correct size and of a similar material of which the conduit is manufactured off.

Saddles shall be spaced one meter apart and shall be fastened to permanent structures by means of 6mm Approved plastic fasteners. The method of fastening on non-permanent structures, shall be spring toggles on dry walls, and stainless steel bolts and lock nuts on corrugated iron buildings.

b) Bend Radii:

If the conduit has an internal diameter of 50mm or less, the bend radius shall be at least 6 times the internal conduit diameter.

If the conduit has an internal diameter of more than 50mm, the bend radius shall be at least 10 times the internal conduit diameter.

The colour of the conduit shall preferably match the colour of the walls.

16.5 EGA Tubing

Use EGA Tubing only in situations where it is the only practical solution and after written permission from the CLIENT.

EGA shall be fastened by means of 6mm Approved plastic fasteners to permanent structures, with spring toggles on dry walls and stainless steel bolts and lock nuts on corrugated iron buildings.

Fasteners shall be spaced one meter apart.



16.6 Civil Works

a) Manholes and Draw-pits:

- i) All manholes and draw-pits shall be built as indicated on terrain plans.
- ii) Civil works for manholes and draw pits shall be done as specified in Annexure A: Civil Works Specification.
- iii) The top of a manhole/draw pit shall protrude in the middle at least 100mm above ground level with a slope towards the outside perimeter. This is to prevent any water from gathering on top of a manhole/ draw-pit.
- iv) The light duty lids shall be used for the draw pits and the heavy duty for the manholes. Both lids shall be filled with cement.
- v) The compaction around the manhole/draw pit shall be as specified in SABS 1200 DB paragraph 5.7. This shall be done by using a mechanical device such as a wacker or a plate compacter.
- vi) Cable Hangers shall only be fitted as called for in the Project Specification.
- vii) Manhole / Jointing Pits shall be aligned with the trench direction (for perpendicular duct entry) or the curb/road and shall only be shifted or adjusted to by-pass obstructions by other services (if the manhole cannot be re-located).
- viii) Written permission of deviation from plans / specifications shall be obtained.

b) Trenching:

- i) All trenching of routes shall be done as indicated on the terrain plans.
- ii) Trenching will be carried out to a minimum standard as specified in Annexure A: Civil Works Specification.
- iii) Trenching will be preferably be done in a straight lines.
- iv) Utmost care shall be taken before any digging of trenches and manholes commences. An appropriate cable locator shall be used to determine the location of any underground cables. Steel water pipes surrounding the area where civil works shall be done shall be located using the same locator.
- v) The contractor shall take full responsibility for any damage to the existing services indicated on a drawing supplied by the Client or pointed out to the contractor by means of route markers. In case of damage to such services during execution of their task, the contractor shall take immediate action to repair such services. If such repair actions are not being taken promptly, the client shall have the right to nominate a work team to do such repairs. Cost of such repairs shall be for the contractors account.
- vi) Where the existence of any underground services is suspected, pilot holes shall be dug to ensure that damages to these services are prevented and minimized.
- vii) The Contractor shall take precautions to prevent cable trenches from being hazardous to personnel and public and shall have the responsibility of safeguarding all structures, roads, water and sewage works, or other property from the risk of subsidence or damage.
- viii) The trench shall be back filled in 300 mm layers of soil (sieved through a 50 mm mesh) and compacted per layer.



- ix) Backfill material, which did not pass through the 10 mm mesh, may not be re-used for backfilling. Suitable backfill shall be imported as required. The contractor shall remove the unsuitable backfill material from site. No claims for additional costs incurred in this regard will be considered. The tendered rates for excavations shall include for backfilling, importation of suitable backfill, re-compaction and removal of unsuitable material from site, all as specified.
- x) The dimensions of the trenches, as specified in Annexure J1: Civil Works Specification.
- xi) No trees or plants will be removed without written approval of the CLIENT.
- xii) Pipe entries have to be finished off neatly at all places.
- xiii) Written permission of deviation from plans / specifications shall be obtained.

c) Building Entries

All building entries shall be 110 mm unless differently specify.

At least four x 110mm entries shall be made into the Network or PABX rooms.

Different types of entries are allowed and shall be approved per project prior to commencement:

- i) A sump type entry to a building shall be made between a manhole/draw pit and from underneath the building foundation to the floor level. Buildings where a 110mm pipe is fed to shall have a floor entry of 400mm (L) x 400mm (W) x 400mm (D). The construction of the entry shall be such that it can support an aluminium chequered plate top cover with at least 6mm thickness. The top cover shall be recessed to be level with the floor. The inside of the entry shall have a smooth finish. The floor covering shall be reinstated with the same type of covering and method as the original floor covering.
- ii) A 110mm pipe to a building shall also be from underneath the building foundation and be fitted such that it is within the metal cable duct to be fitted alongside an interior wall. An opening of at least 90mm shall be made in the length of the double ducting for ease of cable hauling.
- iii) One 110 mm PVC pipe with a 90 degree bend and inspection hole shall be fitted at pre-manufactured or temporary building on the outside of the building and through the wall where the floor is raised above the ground level on the outside. The height of the pipe on the outside shall not exceed 1200mm from the ground level. The inside entry shall be directly into the metal ducting in a room. The opening into the ducting shall not be smaller than the diameter of the pipe.

The cable entry to buildings with brick walls shall be made through the wall and by removing the outer bricklayer of a double wall. The entry inside the building shall be made directly into the double metal ducting installed in a room. The opening into the ducting shall not be smaller than the diameter of the pipe.

Utmost caution shall be taken not to damage the structure of the building. The restoration of the wall on the outside shall be as close as possible to the original state.



The pipe entry will be sealed off at the building entry side only. This is to prevent any water from entering the sump type building entry.

Any other type of entry shall be done according to the designer specification.

d) Poles

10,0m heavy wooden poles shall be used for all backbone routes where aerial cable needs to be provided.

Maximum permissible span for aerial cables is 60 meters.

10,0m light wooden poles shall be used for routes carrying only drop wires.

Maximum permissible span for single pair or multi pair drop wires is 50 meters.

Holes shall be excavated in the positions as indicated on the working drawings and/ or way-leave plans. If it is necessary to excavate an oblong hole the longer side shall be at right angles to the proposed pole route.

The size of the holes shall be kept to the practical minimum necessary taking into account the possible use of excavation equipment. The walls shall be vertical to ensure a minimum disturbance of earth. The depth of holes shall be **one** meter. In sloping ground the depth of the hole shall be measured from the lowest point in the ground surface.

Arms, bracing straps, cable support fittings, kick pipes and cross connection boxes shall be attached to each pole in accordance with requirements at each point.

Poles shall be set plumb and aligned with the other poles in the route.

The hole shall be filled in layers of not more than 300mm and each layer well rammed. Surplus ground shall be banked up round the pole base.

Where poles are situated such that the planting of stays is impracticable the poles shall be set in concrete. These poles being indicated on the relevant drawing.

e) Stays and Struts

Stays or struts shall be fitted to the overhead route to withstand the stresses to which an overhead route is subjected.

Terminal stays shall be fitted at terminal poles (first-pole and end-poles) to withstand the pull of the overhead cable and wires.

Stays shall be fitted to poles where there is a change in the direction of the route or where there is a change in the gradient of the route. (Angle stays).

Stays shall be fitted at poles to withstand the wind force where needed. (Wind stays).

Alternative staying methods can be used where there is not enough space to fit a stay. These are overhead stays, tubular stays and struts, stays fitted by means of an Angle Stay Bracket or poles set in concrete- determined by specific requirements and constraints.

Wooden poles set in concrete shall be used in preference to alternative staying methods.

The spread/ height ratio for stays shall be as follows:



4/0,4mm support wire (20, 30 pr cable).

A ratio of 1:1 is required.

3/ 0,4 support wire (6, 10, 14 pr cable)

A ratio of 0,6:1 is required.

The hole for a stay shall be dug so that the stay plate bears against undisturbed earth. The depth of the hole shall be 1.3m. A slot shall be cut for the stay rod which shall protrude from the ground and be in line with the pole route in the case of a line stay or bisect the angle in the case of an angle stay. The rod shall not be bent. The ground shall be returned in layers of 300mm and layers shall be well rammed. The threaded portion of a stay rod shall be oiled.

The butt of the strut shall rest on solid ground at a vertical depth of at least 750mm. The top of the wooden strut shall be shaped to fit the line pole to which it shall be bolted with a 16mm diameter bolt. All cut surfaces shall be treated with creosote as supplied.

16.7 Marking Specifications

The manholes/draw pits shall be indelibly identified with the abbreviation “T xxx” where xxx is an alphabet letter and sequential numbering starting at 1 for each route.

16.8 Acceptance and Test Plan (ATP)

The Contractor shall submit samples all products to be used to the CLIENT for approval. This approval will be a once off event – thereafter a delivery note from the supplier indicating that the approved item was utilized will be sufficient for the acceptance certificate.

The Contractor shall inspect, complete and present a certificate to the QAR, certifying:

- That only product as specified on the order was used.
- The positions as indicated in the valid design, the actual installed positions and the positions as indicated on the base layout plan are identical.
- Manholes and Draw Pits are labeled correctly.
- That the above specifications are adhered to and that such adherence is verified and that an inspection report to that extent is available.
- All relevant documentation is presented and that the documents are correct and complete.



16.9 Documentation to be presented with every submission for signoff

- The certificate certifying the aspects mentioned in the ATP.
- The contractor's inspection report with the inspection results inspecting adherence to the above requirements.
- Base Layout:
 - Shall not necessarily be to scale but shall be a true reflection of the physical building layouts on a base.
 - Shall indicate position and size of underground routes.
 - Shall indicate position, size and number of manholes or draw pits or poles and the distances between such manholes or draw pits or poles.
 - Shall indicate building entries.

17. Documentation Requirements

All pages of deliverable documentation provided by the Contractor shall indicate:

Document Name

Site Name, Building , Floor

Version number

Date

Approval

Deliverable documentation per project shall consist of:

Tasking Documentation

Tasking documentation will mostly be the purchase order issued by the client but can also be in the form of an incident call.

Quotation

The correct version of the quotation or quotations corresponding to the tasking document.

Pre- and Post Inspection Report

A document completed by the contractor on site indicating any damage to the Client's property before and after installation. The document is signed by both the contractor and the client before and after installation.



Building Floor and Layout Plans shall:

- Be to scale or shall indicate measurements.
- Indicate walls and doors with the correct swing position.
- Indicate data, voice, power point and termination enclosures positions and numbers.
- Indicate all pathways – position, type and size.
- Indicate all distribution panels and boards.
- Indicate cabinet position/s.
- Indicate the building entry or entries position/s and size/s.

Logical Network Design

- Is a drawing indicating all network devices and interface modules pertaining to the specific design as well as the logical connection between such devices.
- Shall indicate the medium over which data communication takes place.
- Shall indicate the data rate at which data communication takes place.

Base Layout

- Shall not necessarily be to scale but shall be a true reflection of the physical building layouts on a base.
- Shall indicate position and size of underground routes.
- Shall indicate position, size and number of manholes or draw pits or poles and the distances between such manholes or draw pits or poles.
- Shall indicate building entries.

Data backbone layout

- Shall indicate the physical cable layouts between buildings or floors.
- Shall indicate the cable type and size.

Voice backbone layout

- Shall indicate the physical cable layouts between buildings or floors.
- Shall indicate the cable type and size.

Voice connectivity sheet

- Shall be in the form of a spreadsheet.
- Shall indicate where all cable pairs emanate and terminates.
- Shall indicate all cross connects.



Power connectivity sheet

Shall be in the form of a spreadsheet.

Shall indicate the termination of dedicated, UPS and normal power point numbers per circuit.

Shall indicate distribution board and circuit breaker number.

Fibre Optic connectivity sheet

Could be in the form of a drawing or spreadsheet.

Shall indicate where all the cores in fibre optic cables emanates and terminates.

Through splices shall also be indicated.

This document shall therefore indicate both the tube colour and the core colours.

Cabinet Layout

Shall be a drawing indicating:

Cabinet size and number.

All active and passive equipment installed in the cabinet and the numbers thereof.

Copper test results

Shall include data and voice copper test results.

Data copper test results shall be tester generated.

Data copper test results shall be according to the manufacturer's specification.

Voice copper test results could be in a spreadsheet format indicating connectivity resistance for each pair.

Fibre optic test results

Shall be a power source – light meter test.

Both single and multi mode cables shall be tested.

Multi mode shall be tested at both 850nm and 1300nm.

Single mode shall be tested at both 1310nm and 1500nm.

Shall be a tester generated test result.

Earthing test results

Shall be in the form of a spreadsheet.

Shall indicate the original soil resistivity.

Shall indicate the measured earth system resistance.

Certificates

The data manufactures system certificate.

The power Certificate of conformance (COC)



A certificate of compliance, which covers the safety earthing in term of SANS 1014-1.

Quality Documentation














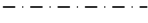

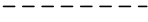


Shall be as described in the ATP of the specific section.

All documentation will be presented in both hard and soft copies.

The soft copies of all tester generated test results shall be in the native format.



LEGEND to be used:

	TELEPHONE OUTLET
	DATA OUTLET
	NORMAL SINGLE SWITCHED ELECTRICAL SOCKET OUTLET
	DEDICATED SINGLE SWITCHED ELECTRICAL SOCKET OUTLET
	NORMAL DOUBLE SWITCHED ELECTRICAL SOCKET OUTLET
	DEDICATED DOUBLE SWITCHED ELECTRICAL SOCKET OUTLET
	DEDICATED SINGLE SWITCHED UPS ELECTRICAL SOCKET OUTLET
	DEDICATED DOUBLE SWITCHED UPS ELECTRICAL SOCKET OUTLET
	DATA/VOICE CABINET
	SERVER CABINET
	ELECTRICAL DISTRIBUTION BOARD
	ALUMINIUM POWER POLE COMPLETE WITH 4X NORMAL ELECTRICAL OUTLET 4X DEDICATED ELECTRICAL OUTLET 4X DATA OUTLET 4X TELEPHONE OUTLET
	TELEPHONE DISTRIBUTION PANEL
	MS1 POWER SKIRTING
	MS2 POWER SKIRTING
	PIPE
	EGA TRUNKING
	CABLE ROUTE



18. Abbreviations

ICTI: Information Communication Technology Infrastructure

LCC: Life Cycle Cost

UG: Under Ground

DP: Distribution Point

EMI: Electro-magnetic interference

PABX: Private Automatic Branch Exchange

Mb/s: Megabits per second

Gb/s: Gigabits per second

RMS: Root Mean Square

IDF: Intermittent Distribution frame

DF: Distribution Frame

MDF: Main Distribution Frame

AFF: Above Finished Floor

ATP: Acceptance and Test Plan

UTP: Unshielded Twisted Pair

STP: Shielded Twisted Pair

FTP: Foiled Twisted Pair

ISO: International Organization for Standardization

IEC: International Electro technical Commission

ACR: Attenuation to crosstalk ratio

OEM: Original Equipment Manufacturer

RFP: Request for Proposal

LSA: (20 Krone LSA profile 10 pair disconnect modules)

BMS: Bandwidth Management System

LSZH: Low Smoke Zero Halogen

PVC: Polyvinyl Chloride

OSP: Out-side Plant

OTDR: Optical Time Domain Reflectometer

dB: Decibel

HDD: Heavy Duty Duct

LCD: Low Count Duct

kN: Kilo Newton

kg: Kilogram



ms: Milly seconds

AC: Alternating Current

DC: Direct Current

EMS: Environmental Monitoring System

GSM: Global System for Mobile Communications

UPS: Uninterruptible Power Supply

DB: Distribution Board