ANNEXURE B: FUNCTIONAL AND TECHNICAL SPECIFICATIONS FOR FIRE DETECTION SYSTEMS CARLOW ROAD COTTLESLOE

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1 FUNCTIONAL SPECIFICATIONS FOR FIRE DETECTION SYSTEM

1.1 GENERAL REQUIREMENTS

a) The fire detection and alarm system shall comprise of main fire alarm control panels, optical smoke sensors, heat sensors, and optical smoke/heat sensor with integral sounder units, manual call points, electronic sounders, repeat panels, and interface units, each with its own short circuit built-in isolators. All loop cabling and any other components and accessories deemed necessary for a safe, reliable and satisfactory system will conform to **SANS 10139** (Fire Detection and Alarm Systems for Buildings)
b) Contractor will train and instruct client's personnel in the correct use, operation and supervision of the system, prior to the handing over of the project.
c) The system will be configured to allow on site modifications with the minimum of disruption using the PC based software to facilitate future changes or alterations to the buildings.

1.2 SYSTEM DESCRIPTION

a) The fire detection and alarm system will be designed to facilitate accurate identification of the source of heat / smoke / fire in their early stages to minimize occurrences of false alarms due to faulty equipment, electrical transients, system faults etc.
b) The fire alarm control panels will make final decision on whether a fire or fault exists by comparing the plotted patterns from a fire sensor against known fire and fault patterns held in its memory.
c) System will be true Analogue with the ability to print the output from a fire sensor over a period of time.
d) All system components and devices will be connected to two-wire loop circuits (as shown in the typical schematics) with each component having its own individual built-in isolator.
e) Removal or disconnection of any component from the loop will not affect the functioning and performance of other components and the system.
f) System will be of safe addressable type i.e. all the devices on the loops of the FACP will be allocated addresses automatically from the panel at the time of system power up on a numerically lowest unused value basis (algorithms) and also given an address during commissioning, the value of which will be stored in non-volatile memory, within the electronics module of the outstation. This value will be read during loop allocation and provided it is valid will be used to setup the outstations primary address.
g) SAFE Addressing will cover the benefits of Soft Addressing and also overcome the limitations of Hard Addressing. This means that if the devices are inserted or removed all the existing devices will keep the same address.
h) The panel will allocate the address in strict sequential order when the loop is powered up to speed up commissioning and ensure that it is impossible for two devices to have the same address.
i) Fire Detection and Alarm Systems, which rely only on soft addressing or hard addressing techniques, are not acceptable.
j) Facilities will be provided to constantly monitor and check the following circuits and fault conditions:

   i. The power supply to the loop /s;
   ii. For open-circuit, short-circuit, earth fault and any other fault condition in the loop wiring;
   iii. For communication failure and errors in all cards and loops
   iv. For faults in keyboard and printer circuits
   v. Monitoring of all devices status every 1.3 minutes to create a table of each 1 analogue channel for event analysis

k) All devices Optical/Heat Sensor, Optical Smoke, Beacon Sounder, Fire Alarm Interface Units, Manual Call Points, etc. will be installed on the same loop.
l) All devices will be assigned a maximum of 32-character alphanumeric label. In case of fire, fault or warning, the label of device sensing threshold will appear on visual display unit of the panel.
m) Any correction in label will have to be carried out from the built-in keyboard of FACP. Use of separate PC or tools for on-site programming will not be acceptable.
n) Any event i.e. Fire, fault or warning will be recorded with time, date and place of occurrence in the memory of FACP. These events can either be displayed on VDU or printed, as required.
o) Provision will be done at the fire alarm control panels to silence the loop powered alarm sounders but the visual indication will remain until the system is reset.
p) It will be possible to change the sensitivity of analogue sensors from fire alarm control panel only.
q) The sensitivity will be varied automatically, if required, by time zoning feature whereby it allows sensors to be programmed to respond at different sensitivities relative to any time of day, and any day of week.
r) Facility to introduce / change delay periods in operating loop powered individual sounders / group of sounders /speaker circuits, will be possible to program from FACP without the need to change any hardware.
s) The main fire alarm control panels will be located as shown on the schematics and the floor drawings.

1.3 SYSTEM OF OPERATION

In the event of a fire being reported from the smoke/heat Detectors, activation of manual call points the sequence of alarm operation will be as follows:

a) If a fire condition is reported from a smoke or heat detector, Manual Break Glass, then the evacuation alarm tone will be done by the electronic sounders in the same zone. Then after a certain delay (to be agreed at the time of commissioning) or after 3 minutes the alarm has not been acknowledged, the evacuation tone from the sounders will activated in the adjacent fire zones. Or on the floor directly above and below. All other floors or zones will be given the Alert tone. The evacuation of the building will be staged in phases to allow orderly movement of people.

Activation of the fire alarm system will directly initiate some or all of the following to be agreed as a part of the overall engineering policy.

i. Signal to all elevator machine rooms indicating fire status (to control lifts)
ii. Release doors normally locked by magnetic devices.
iii. Release doors normally held open by magnetic devices
iv. Shutdown mechanical equipment ventilation plant

1.4 SYSTEM, COMPONENTS AND DEVICES.

i. The panel will be computer controlled using analogue technique to detect smoke / heat / fire conditions. The panel will be complete with, but not limited to, the following elements:

➢ Visual display unit capable of displaying LCD Alphanumeric 40 characters x 8 line display minimum backlit display.
➢ Built-in 40-character thermal printer operating when the access door is open there will also be an option to enable the printer when the door is closed.

➢ Built-in full QWERTY keyboard. Labelling of devices will be done from this keyboard. Also, this keyboard if required will do any correction in label and onsite programming & maintenance.
➢ Integral rechargeable sealed lead acid battery and charger, with 26-hour back up in the event of supply mains failure.
➢ Essential controls - sound alarms, silence alarms and reset fire. These will be enabled by a key switch.
➢ Cancel fault buzzer
➢ Fire, fault, warning and power on lamps.
➢ Simple menu driven function keys with password protection will allow users to an extensive range of software-based features such as:
    - Last 100 fire events
    - Last 255 system events
    - Current fault and warning logs.
    - Analysis of analogue sensor information
    - Interrogation of sensor cleanliness
    - Loop map connections
    - Enable/ disable sensors, zones, sounders, interface unit channels.
    - Fire plan configuration menus
    - Outstation label changes
    - Address allocation
    - Status of outstation
    - Status of all cards
    - Printer on, off, line feed and test facilities.
    - Address allocation including SAFE addressing.
➢ All control buttons and keyboard will be enclosed behind a lockable cover.
➢ Up to 256-device capacity per 1km loop.
➢ RS 232/ RS 485 computer communication ,Ethernet option.
➢ Will have minimum of 2 Master alarm circuits 24V 400Ma max per circuit.
➢ Will have a secure networking facility to indicate a remote zone and remote zone text across the network.

ii. Sensors

All analogue sensors and bases shall be provided by the contractor/supplier of the control equipment. The sensor bases for interfacing between the loop wiring and the sensor head shall not contain any electronics. The base fixings shall be suitable for SA industry standard or conduit boxes. All bases shall have the necessary connections for sending repeat fire signals to a remote LED unit.

The sensors provided shall be lockable into position if required and removal of locked sensors shall be achievable only through the use of the appropriate removal tool. Sensor removal tools should be provided on completion of the contract as part of the spare parts profile. The removal of a sensor from its base shall not affect the continuity of the detection loop.

The following types of analogue sensors will be available as standard:

- Heat sensor
- Optical Heat sensor
- Beam sensor (transmitter and receiver) with 7 programmable sensitivity settings

All of the above shall be compatible with the aforementioned base providing inter-changeability between sensor heads without the requirement for switch settings. All sensors will also have an integral short circuit isolator, which in the event of a single cable fault will isolate the faulty section of cable and retain all devices on the loop operationally in less than 1 second.

The sensitivity off all sensors will be adjustable from the control panel. This may be carried out manually to manage false activation issues or automatically using the system clock i.e. day/night settings for specific risks. It shall be possible to programme sensors within a range of sensitivity levels from State 0 (high level) through to State 15 (disabled).

Each sensor will possess an integral Red LED giving a flashing indication of a fire signal or a continuous indication for certain fault conditions. The integral LED can also be enabled/disabled to provide operational status i.e. short flashes that indicate the unit is powered and communicating with the control panel.

iii. Manual Call Points:

The manual call points shall be electrically compatible with all of the aforementioned sensor types. Each device shall contain its own microprocessor giving a 1 second response time from initiation. The MCP shall be available as a semi-flush mounting unit fixing to a standard single gang recessed box or as surface mounting unit on a matching red plastic back box.

The MCP will have the ability to be tested functionally without the need to remove the front cover or breaking the glass with a special test key (supplied as standard). The key shall insert in the front facia of the MCP ensuring easy access of the key at all times. The key will also be used to reset the MCP when fitted with a resettable plastic element. The option to retrofit a clip-on transparent plastic cover to prevent accidental or malicious activation should be available as standard.

iv. ALARM SOUNDERS

Alarm Sounders are all Electronic sounders Addressable and loop powered and Standard Evacuate & Alert tone with voice messaging Programmable tones selectable by control panel.
Synchronisation of all sounders to be fully synchronised with all other analogue addressable loop powered sounder speech devices on the system.

The safe addressable Alarm Sounders will be loop wired and loop signalled and provided with built-in short circuit isolation and will be sited in the emergency stairwell staff/utility areas and plant rooms. The sounders will be configured via software to operate individually or in sectored groups, totally independent of the way they have been connected to the loops. The sounders will have the synchronization feature to ensure that all the sounders give alert and evacuate tones that are totally in phase. Conventional Sounders that "free-run" and therefore be out of phase with each other will not be accepted.

The Sounders will have Minimum sound pressure level 102 dBA at 1 metre with frequencies of 970 Hz and 910 Hz. Variety of sounds shall be available.

v. Interface Modules:

Fire detection interface units will be directly connected to the loop to provide both inputs and outputs for the control or annunciation of other life safety, security and building management systems. These units shall be

either self-contained wall mountable units or DIN rail mounting units for fitting within 3rd party control.

Equipment/panels. Each device will incorporate a short circuit isolator as standard to maintain system integrity in the event of an equipment failure or wiring fault. As standard six variants will be available:

(i) 4 channel input and/or output interface
(ii) 1 channel Low Voltage input/output interface (iii)1 channel Low Voltage input only interface (iv)Mains Voltage 240V 13A switched output interface
(v) Mains powered 4 channel interface with monitored integral power supply unit, battery standby and 250mA output circuits
(vi)Key switch operated single channel interface

1.5 INSTALLATION

i. Fire alarm components will be installed directly to conduit outlet boxes at the following mounting heights above finished floor level, measured to the centre of box unless stated otherwise.
ii. Fix manual call station semi-recessed at 1.5m. heights above finished floor.
iii. Automatic smoke and heat sensors: Ceiling mounted
iv. Alarm sounders: 2.20m above finished floor

1.6 WIRING AND WIRING FACILITIES:

i. Supply and install the necessary conduit, enclosed trucking to the Fire Cable and accessories and wiring for the fire alarm system.
ii. All cables associated with Fire Alarm installation will be of fire resistant 2 core 1.5 sq. mm.
iii. Multi core cables having more than 2 cores will not be allowed for loop wiring due to inadequate separation and possible interference problems.
iv. All wiring will be installed to provide complete and satisfactory function system in all respects.
v. All cable terminations at components and junction boxes will have identification tags, indicating throughout the system.
vi. The Fire Alarm/Detection system wiring will be completely independent from the other system wiring in all respects in accordance with the IEE Regulations.

1.7 TESTING AND COMMISSIONING

i. After the installation is complete, the contractor will conduct operating and commissioning tests.
ii. The equipment will be demonstrated to operate in accordance with the requirements of the specification.
iii. The system installation, testing and commissioning will be as per Local approvals and requirements.
iv. The fire alarm system will be completely programmed in accordance with Fire Department requirement.
v. A company trained representative will personally supervise the complete installation and final testing of the system.
vi. All tests will be carried out in the presence of the Client or persons authorized by the consultant / client.

vii. Upon the completion of the acceptance tests, the representatives will instruct operatives in the proper operation, maintenance programming, configuration, and testing of the system.

viii. The vendor will provide equipment and /or software which is necessary to allow field modification of the programming and configuration.

2 TECHNICAL SPECIFICATIONS FOR FIRE DETECTION SYSTEM

2.1 2 Loop Analogue Addressable Fire Alarm Panel

a) Loop capacity:	127 addresses
b) Power Requirements:	Panel (Quiescent at 24 VDC) 4 loops 420mA Load of panel only, excluding any external devices Panel (Alarm at 24 VDC) 820mA 25% of zones in alarm Per Loop (Quiescent at 24 VDC) 70mA Fully loaded loop, with 127 ZP devices, not in alarm
c) Power Supply:	Input 220 Vac 50 Hz + or -10% 0.75 Amps Optional input DC 24 to 50 volts load dependent User output 24 Vdc (nominal) up to 3.0 Amps Battery charge 28.2 Vdc 1.2 Amps
d) Wiring:	2-core screened (to local codes and standards)
e) Monitoring:	Loop wiring Open and short circuit fault, earth leakage, sensor removed and wrong device type
f) Switched outputs (standard):	Sounder circuits (programmable) 2 x dual (monitored) Fire (common) 1volt free N/O or N/C 1volt free N/O or N/C Fault (common) 1volt free N/O or N/C (software set) Remote manned centre (fire) 1 monitored Remote manned centre (fault) 1 monitored
g) Switched I/O (optional & programmable):	Non-loop devices, sounder circuits, relay outputs, transistor outputs monitoring inputs 768 total max
h) Indicators:	System status 87 light emitting diodes, text display 4 line, 160-character, LCD (back lit)
i) Printer:	24 character (built into front door)
j) Software:	Firmware and site configuration programming – Flash memory
k) Communications ports:	Port 1 Planner, RS 232 Port 2 Network, RS 485 / fibre optic
l) Selectable features:	Common sounders, Coincidence alarm, RMC fire, RMC fault, Zone walk test, Control output, Output delays, Alarm counter, Sounder silence delay, Alarm verification
m) Standby batteries:	2 x 12-volt sealed lead acid - up to 28 Ah accommodated inside panel enclosure
n) Temperature range:	-5°C to +40°C
o) Humidity range:	10% to 90% RH (non-condensing)
p) Environmental:	IP30 (indoor installation)

2.2 Analogue Addressable Optical Smoke Detectors

a) Mounting:	Plugs into surface or semi recessed base
b) Area coverage:	Optical: $100m^2$, subject to local codes
c) Wiring:	2-core loop
d) Monitoring:	Open and short circuit fault. Sensor removal and device type.

e) Indication:	Alarm LED (red)
f) Operating voltage:	19.5 to 20.5V max. line loss 4V
g) Current consumption:	Quiescent: 600µA Alarm: 700µA
h) Addressing method:	7-way DIP switches in head
i) Detection principle:	Smoke: Photo electric light scatter
j) Environmental:	IP32
k) Application:	Indoor use
l) Temp range:	-10°C to +75°C
m) Humidity range:	20% to 95% RH (non-condensing)

2.3 Analogue Addressable Heat Detectors

a) Mounting:	Plugs into surface or semi recessed base
b) Area coverage:	Up to 21.3 m spacing
c) Wiring:	2 wire zonal
d) Monitoring:	Open and short circuit by end of line resistor
e) Indication:	Alarm LED (red)
f) Operating voltage:	15 - 30 volts DC
g) Current (quiescent):	<60µA
h) Current (alarm):	Max. 50mA (limited by panel) (excluding base)
i) Environmental:	IP32
j) Application:	Indoor use
k) Temp range:	0°C to +58°C
l) Humidity range:	20% to 95% RH (non-condensing)

2.4 Analogue Addressable Loop Isolators

a) Mounting:	Plugs into surface or semi recessed base
b) Wiring:	2 core "Class-A" return loop. Total loop = 75 ohms maximum Between isolators = 18 ohms maximum
c) Monitoring:	Loop Short circuit protection
d) Indication:	LED (red)
e) Operating voltage:	16-22 volts DC
f) Current (quiescent):	600µA
g) Current (fault):	800µA
h) Addressing method:	Soft addressed (does not require an address number)
i) Application:	Indoor use
j) Temp range:	-10°C to +75°C
k) Humidity range:	20% to 95% RH (non-condensing)

2.5 Analogue Addressable Manual Call Points (Indoor)

a) Mounting:	Addition of back-box for surface or single gang socket box for flush fixing
b) Wiring:	2 core loop
c) Monitoring:	Open/short circuit, removal & device type
d) Indication:	Alarm LED (red)
e) Operating voltage:	Loop 19.5 to 20.5 V

f) Current: Quiescent: 600µA
Alarm: 700µA

g) Operating principle: Micro switch

h) IP Rating: IP24D

i) Application: Type A - Indoor installation

j) Environment: Indoor

k) Addressing method: 7-way dipswitch

l) Operating principle: Micro switch

m) Temperature range: -10^{O}C to +55^{O}C

n) Colour: Red

o) Humidity range: 20% to 95% RH (non-condensing)

2.6 Analogue Addressable Loop Powered Beacon Sounders

a) Sound Projection Level [dBA/1m]: 102 dBA

b) Sound types: User configurable

c) Visual indicator: Light source: Red LED array
Light output: 1J
Flash frequency: 0.8 Hz

d) Mounting: Surface mount with plug in base

e) Wiring: 2-core loop

f) Monitoring: Open/short circuit, sound output, removal, device type

g) Operating voltage: Loop powered: 19.5 - 20.5V Externally powered: 18 - 30VDC

h) Loop current: Quiescent (when loop powered): 820µA Active (when loop powered): 9.6mA Quiescent (when externally powered): 470µA Active (when externally powered): 500µA

i) Devices per loop (max): 20 (1km loop of 1.5mm² cable, 50 m to first device)

j) Addressing method: 7-way dipswitch

k) Environmental: Application: Indoor
IP rating: IP21C

l) Operating temperature: -10°C to 60°C

m) Humidity range: 10% to 60% RH (non-condensing)

n) Colour: Red

2.7 Addressable Line Interface Unit / Line Rely Module

a) Mounting: Equipment cabinet DIN rail, or SMB-DIN1, SMB-DIN2 surface boxes

b) Wiring: 2 core loop (screened)

c) Indication: LED (red) flashing on operation

d) Operating voltage: Pulsed loop (19.5 – 20.5V)

e) Current: Quiescent: 600µA
Alarm: 700µA

f) Relay contacts: Single pole, change over

g) Max switching current: 1.0A

h) Max switching voltage DC: 30VDC

i) Max switching voltage AC: **40VAC**

j)	**Application:**	Indoor installation
k)	**IP rating:**	IP20
l)	**Temp range:**	-10ºC to +75ºC
m)	**Humidity range:**	20% to 95% RH (non-condensing)

2.8 Remote Indicator

a)	**Operating voltage:**	8.5 to 33 V DC
b)	**Current consumption:**	11 to 14 mA
c)	**Display medium:**	2 LEDs
d)	**Operating temperature:**	0 °C to +65 °C
e)	**Relative humidity:**	< 95% (non-condensing)
f)	**Ingress Protection:**	IP 40

2.9 Network Interface Card

a)	**Mounting:**	Plug and socket-fixes to allotted space on panel main control board
b)	**Comms protocol:**	RS 485
c)	**Baud rates:**	57600, 38000, 33600, 28800,19200,14400, 9600, 4800, 2400, 1200, 600, 300.
d)	**Wiring:**	Two cores twisted screened pair - 0.5mm2 minimum
e)	**Current consumption:**	70 mA (total effective load from 24V supply)
f)	**Indication LEDs:**	Green - power on Red (x3) - transmission
g)	**Temp range:**	-10ºC to +60ºC
h)	**Humidity range:**	10% to 90% RH (non-condensing)

2.10 FIRE RESISTANT CABLE – PH30 (STANDARD)

a)	**Conductor:**	1.5mm² High conductivity annealed stranded plain bunched copper wir plain copper wire
b)	**Insulation:**	High temperature fire resistant core wrapping with halogen free compo
c)	**Insulation Colour:**	DIN VDE colour code
d)	**Make-up:**	Multi-cores and Multi-pairs
e)	**Screening:**	Overall aluminium foil screen
f)	**Sheath:**	Non-toxic halogen free low smoke flame retardant compound
g)	**Sheath Colour:**	Red as a standard colour (alternative colours on request)
h)	**Required Standard:**	Fire resistance meeting the test requirements of BS EN 50200 for a 30 survival time at 840°C, which complies to SANS 10139 standard.
i)	**Voltage:**	300/500V
j)	**Performance:**	PH30 burns for 30 minutes at 840°C