PLANTECH

DETAILED TENDER SPECIFICATION FOR FIRE DETECTION AND EMERGENCY VOICE EVACUATION SYSTEMS

at the

ARMSCOR HEAD OFFICE

in

PRETORIA

GAUTENG PROVINCE

2023/05

DOCUMENT REVISION HISTORY:

Revision	Revision Date	Revision Comments	Originator	Reviewed by	Admin check
0	2022/02	Tender Issue	AM	WS	AV
2	2022/04	Tender Issue	AM	WS	AV
3	2023/05	Tender Issue	AM	WS	AV

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FILE LOCATION:

\\srv1\Projects\Plantech\2 - Active\A-2078 ARMSCOR HQ FIRE DETECTION\A-2078-72\SPECIFICATIONS

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1 DEFINITIONS AND ABBREVIATIONS

1.1 DEFINITIONS

The following terms shall, unless the context otherwise requires, have the meanings hereunder assigned to them:

acceptable, adequate : acceptable, adequate, satisfactory or suitable in the opinion of the authority having jurisdiction

Act : The National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977) as amended.

addressable system : a system in which signals from each detector or call point (or both) are individually identified at the control panel.

analogue : in the case of an initiating device is one which transmits a signal indicating varying degrees of condition.

Authority Having Jurisdiction (AHJ) : for the purposes of this sub-contract, the Authority Having Jurisdiction (AHJ) shall be:
- Plantech (Pty) Ltd;
- the relevant Fire Department;
- South African Bureau of Standards

as the case may be as determined appropriate by the engineer.

automatic / manual switch: means of converting the system from automatic to manual action.

Note: this may be in the form of a manual switch on the control panel or other units, or a personnel door interlock. In all cases, this changes the actuation mode of the system from automatic and manual to manual only or vice versa.

automatic installation : installation or part of an installation that, when activated, performs a predetermined function, such as issuing a fire alarm, without manual intervention.

Class of Fire : The letters A, AC, B, BC, ABC and D denoting the class of fire.

Class A
Fires involving solid combustible (mainly carbonaceous) materials, such as coal, paper, straw, wood, cloth, rubber and many plastics, in which combustion normally takes place with the formation of glowing embers.

Class AC
Fires involving materials of a type similar to those involved in a Class A fire and occurring in the presence of a live electrical power source such as electric cables, generators, transformers and switchboards.

Class B
Fires involving flammable liquids such as greases, oils, tars, oil-base paints, lacquers, flammable gases and liquids formed from liquefiable solids.

Class BC
Fires involving materials of a type similar to those involved in a Class B fire and occurring in the presence of a live electrical power source such as electric cables, generators, transformers and switchboards.

Class ABC
Fires involving materials of a type similar to those involved in Class A and Class B fires but occurring in the presence of a live electrical power source such as electric cables, generators, transformers and switchboards.

Class D
Fires involving metals such as magnesium, aluminium, titanium, zirconium, sodium, lithium and potassium, that burn at a high temperature and require a special type of extinguisher and extinguishing medium.

Note: The letter C in any combination of letters denotes a fire in the presence of a live electrical power source.

clearance : air gap between equipment, including piping and nozzles and unenclosed or insinuated live electrical components at
other than ground potential

competent person : a person who is a registered person in terms of Section 1 of the Engineering Profession of South Africa Act, 1990 (Act 114 of 1990)

commissioning : work necessary to place the installation and work covered by this specification into normal operating condition.

concealed : embedded in masonry or other construction, installed in spaces within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.

condition : condition of control equipment.

Note : the control equipment may be in the normal condition, the fault condition, the alarm condition, etc.

conventional : with regards initiating devices means one which can only indicate an on/off condition.

design : the planning of an installation by reasoning and calculation in accordance with generally acceptable engineering and scientific principles, and in accordance with the provisions of a standard.

design concentration : Concentration of extinguishant, including a safety factor, required for system design purpose.

detector : device that responds automatically to predetermined conditions and is classified in terms of its output.
Note 1 : a detector is part of an automatic fire detection system that contains at least one sensor that constantly or at frequent intervals monitors a suitable physical or chemical phenomenon (or both) associated with fire, and that provides at least one corresponding signal to the control and indicating equipment.

Note 2 : the decision to give the fire alarm or to operate automatic fire protection equipment may be made at the detector or at another part of the system, for example at the control and indicating equipment.

engineered system : System in which the supply of extinguishant stored centrally is discharged through a system of pipe and nozzles in which the size of which the size of each section of pipe and nozzle orifice has been calculated in accordance with relevant parts of ISO 14520

Note: The design flow rates from nozzles may vary according to the design requirements of the hazard.

expellant : The agent or agents contained in an extinguisher and providing internal pressure to expel the extinguishing medium, the pressure being either stored pressure or obtained by chemical reaction or by the release of auxiliary gas.

exposed : Not installed underground or concealed as defined above.

extinguishant : Electrically non-conducting gaseous fire extinguishant that does not leave a residue upon evaporation

extinguishing concentration : Minimum concentration of extinguishant required to : extinguish fire involving particular fuel under define experimental conditions excluding any safety factor.

exposed : not installed underground or concealed as defined above.

extinguishing medium : The product or products that cause/causes the fire to be extinguished.

fire load : the sum of the heat energy values of all combustible materials, including combustible partitions and other exposed combustible elements, contained in a component or a division.

Note: The fire load is expressed either as a timber equivalent (in kilograms per square metre), or as a heat energy value (in mega joules per square metre).

fill density : Mass of extinguishant per unit volume of container.

fire resistance : the ability of a building element or component to satisfy, for a stated period of time, the appropriate

criteria specified for stability, integrity and insulation in the presence of fire.

flooding quantity : Mass of volume of extinguishant required to achieve the design concentration within the protected volume within the specified discharge time.

gas cartridge : A cylindrical container that fits into or is attached to the extinguisher and that contains either inert, compressed or liquefied gas.

halon : A halogenated hydrocarbon used as an extinguishing medium in the form of a vaporising liquid.

hold time : Period of time during which a concentration of extinguishant greater than the fire extinguishing concentration surrounds the hazards.

install : to erect, mount and connect complete with all related accessories.

liquefied gas : Gas or gas mixture (normally a halocarbon) which is liquid at the container pressurization level at room temperature (20°C)

listed : equipment, materials, or services included in a list published by an organisation acceptable to the authority having jurisdiction and concerned with evaluation of products or services whose listing either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose.

lock-off device : Manual shut-off valve installed into the discharge piping downstream of the agent containers: or another type of device that mechanically prevents agent container actuation.

Note 1: The action of this device provides an indication of system isolation.
Note 2: The intent is to prevent the discharge of agent into the hazard area when the lock-off device is activated

LOAEL (Lowest Observe : Lowest concentration at which an adverse toxicological or physiological effect has been

Adverse Effect Level)		observed.
manual call point	:	also referred to as a break glass alarm point, shall mean a manually operated device used to initiate an alarm signal.
maximum concentration	:	Concentration achieved from the actual extinguishant quantity at the maximum ambient temperature in the protected area
maximum working pressure	:	Equilibrium pressure within a container at the maximum working temperature **Note 1:** For liquefied gases this is at the maximum fill density and may include super pressurization. **Note 2:** The equilibrium pressure for a container in transit can differ from that in storage within a building.
mimic diagram	:	topographic representation of the protected premises and their subdivisions, with indicating devices for each subdivision such that the indications of the fire alarm system can be rapidly related to the layout of the premises.
monitored wiring	:	wiring in which a failure, whether to open circuit or to short circuit, will result in a fault warning and not a fire alarm.
NOAEL (No Observe Adverse Effect Level)	:	Highest concentration at which no adverse toxicological or physiological effect has been observed.
non-liquefied gas	:	Gas or gas mixture (normally an inert gas), which, under service pressure and allowable service temperature conditions, is always present in the gaseous form.
normally unoccupied area	:	area not normally occupied by people but which may be entered occasionally for brief periods.
occupancy class	:	the particular use or the type of use to which a building or portion thereof is normally put or intended to be put.
operating temperature	:	the temperature at which a component, a fitting or

an installation functions when in normal use.

owner of the building : person having control of the premises, whether as occupier or otherwise, or any person delegated by the person having control of the premises to be responsible for the fire alarm system and the fire procedures.

pre-engineered systems : System consisting of a supply of extinguishant of specified capacity coupled to pipework with a balanced nozzle arrangement up to a maximum permitted design.

Note: No deviation is permitted from the limits specified by the manufacturer or authority

protection : - presence of

a) one or more detector(s) able to initiate actions needed to ensure the safety of life or property in the event of a fire
b) mechanical devices to prevent damage to system components from impact, abrasion, rodent attack, etc.

provision of

a) fire resistance to prevent damage to system components from fire in their vicinity
b) electrical protection to prevent temporary or permanent disruption of the system owing to over-voltage, excessive current, or high transient or radio-frequency interference (or a combination of these)

provide : to supply, install and connect up complete and ready for safe operation.

Recharging : The replacement of the extinguishing medium and, when relevant, of the expellant of an extinguisher.

Reconditioning : Prescribed measures (see SABS 1475) taken by an approved reconditioning organization at prescribed intervals to restore the extinguisher to full operational readiness, and that include a minor service, or a major service and pressure test, as relevant.

search distance	:	distance that has to be travelled by a searcher within a zone in order to determine visually the position of a fire.
sector	:	subdivision of the protected premises normally containing several zones Note: A sector may cover more than one building.
selector valve	:	Valve installed in the discharge piping downstream of the agent containers, to direct the agent to the appropriate hazard enclosure. Note: It is used where one or more agent containers are arranged to selectively discharge agent to any of several separate hazard enclosures.
shall	:	indicates a mandatory requirement and must be complied with.
should	:	indicates a recommendation or that which is advised but not required.
similar	:	of approved manufacture equal as regards to materials, weight, size and efficiency of performance to product specified by name.
smoke	:	particulate products of combustion generated by fire, whether the fire is of the smouldering or open-flame type Note: in general the particle diameters range from 1 nm (invisible smoke) to 10 pm (visible smoke).
supply	:	to purchase, procure, acquire and deliver complete with all related accessories.
smoke alarm	:	device that contains within one housing all the components, except possibly the energy source, necessary for detecting fire and giving an audible alarm
standby supply	:	electricity supply, commonly from a rechargeable battery, that is automatically connected to the fire alarm system when the normal supply fails.
state	:	outputs of a detector

suitable for use : equipment or components that are deemed in the opinion of the authority that has jurisdiction to be acceptable within their predetermined tested parameters for a particular application in a system or, in relation to any document issued by such authority, in the opinion of such authority

Note: components that have been tested and approved and bear the mark of one of the following testing authorities will normally be deemed to be suitable for fire detection:

a) Loss Prevention Council (LPC);
b) Factory Mutual (FM);
c) South African Bureau of Standards (SABS);
d) Underwriters Laboratory (UL); or
e) British Approvals Service for Electrical Equipment in flammable atmospheres (BESEEFA).

superpressurization : Addition of a gas to the extinguishant container, where necessary, to achieve the required pressure for proper system operation

testing : work and checks necessary to determine qualitative and quantitative performance of equipment, installation and workmanship.

types of detector : Detectors classified by the form of their output, as follows:

Analogue Detector
A detector that gives an output signal representing the value of the sensed phenomenon, for example a truly analogue signal or a digitally coded equivalent of the sensed value. (Note: This detector does not itself make a decision of fire.)

Aspirating Detector
Detector in which a sample of the atmosphere in the protected space is sucked by a fan or pump into a detector, which may be remote from the protected space.

Multi-State Detector
Detector that gives one of a limited number (greater than two) of output states relating to normal or fire alarm conditions and other abnormal conditions.

Two-State Detector
Detector that gives one of two output states relating to either normal or fire alarm conditions.

Open-area Smoke Imaging Detection. (OSID)
The beam projected from each Emitter contains a unique sequence of ultraviolet (UV) and infrared (IR) pulses that are synchronised with the Imager and enable the rejection of any unwanted light sources. By using two wavelengths of light to detect particles, the system is able to distinguish between particle sizes. The shorter UV wavelength interacts strongly with both small and large particles while the longer IR wavelength is affected only by larger particles. Dual wavelength path loss measurements therefore enable the detector to provide repeatable smoke obscuration measurements, while rejecting the presence of transient dust particles or solid intruding objects.

unoccupiable area : area which cannot be occupied due to dimensional or other physical constraints

wiring : conduit, fittings, wiring, junction and outlet boxes, switches, cut-outs and socket outlets and all related items.

work : all labour, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

zone : subdivision of the protected premises such that the occurrence of a fire within it will be indicated by a fire alarm system separate from an indication of fire in any other subdivision

Note : a zone will usually consist of an area protected by several manual call points or detectors (or a combination of these), and is indicated separately to assist in location of the fire, evacuation of the building and fire-fighting.

1.5 ABBREVIATIONS

Abbreviations used in these documents shall mean:

BS	:	British Standard Specification
BSI	:	British Standard Institute
DIN	:	German Standards Institute
FDVES	:	Fire Detection & Voice Evacuation System
FDIA	:	Fire Detection Installers Association
FM	:	Factory Mutual (American)
LPC	:	Loss Prevention Council
NFPA	:	National Fire Protection Association (USA)
SABS	:	South African Bureau of Standards
UL	:	Underwriters Laboratories

2 GENERAL/SCOPES OF WORKS

The contract works to be carried out consists of the detailed design, engineering, manufacturing, supply, delivery, offloading, erection, testing and commissioning into service, guarantee and maintenance of a new fire detection system, alarm system, emergency voice evacuation system.

The engineering, quality control and inspections, equipment selection, preparation of shop drawings, testing, commissioning and preparation of operating and maintenance manuals, are to be executed in a systematic manner, once programmed, under the Engineer's general supervision and direction.

Also, the decommissioning and removal of existing fire detection, alarm and emergency voice evacuation systems shall form part of this contract.

3 OCCUPATIONAL HEALTH & SAFETY (No 85 OF 1993)

The contractor is to comply in all respects to the Occupational Health & Safety Act (No. 85 of 1993), and to any amendments relating thereto.

Before construction commences, the contractor shall liaise with the employer's appointed health and safety consultant in order that a health and safety plan and specifications are adopted for the project. It shall be incumbent on the contractor to conform to the same.

4 TEMPORARY SERVICES DURING CONSTRUCTION

Temporary (construction) electricity and lighting for the Works shall be provided by the Contractor. The Contractor shall connect to the existing electricity supply at approved points and execute the necessary temporary installation.

5 ENGINEER DRAWINGS

The drawings to be prepared by the Consulting Engineer show general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the contractor to estimate the cost and to determine how the system must be installed, tested, inspected, operated, serviced and maintained.

These drawings are not dimensioned shop drawings and cannot be used as shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

Design/selection/construction details and installation arrangements for equipment and/or distribution systems which are available from either the manufacturer/supplier in their officially published literature/documentation, design/application manuals, or other authoritative sources such as SANS, BS, NFPA, etc. shall be used as the basis for shop drawings. The specific source shall be identified at submission stage.

6 SHOP DRAWINGS SUBMISSIONS

Shop drawings shall indicate all equipment, distribution systems, testing / inspection / instrumentation positions, access requirements and builder's work requirements.

Builder's work requirements shall include all work to be provided by others (holes in concrete and / or masonry walls / floors, etc) as well as the sizes, capacities and positions of service connections.

shop drawings shall be based on the Engineer's design concept shown on the tender drawings, approved equipment selections and samples. The shop drawings shall be checked and passed by the contractor's chief draughtsman and project Engineer/manager. The shop drawings shall be stamped to confirm that co-ordination with architects, structural and other affected Contractor's drawings, has taken place.

Three (3) copies of shop drawings in PDF and DWG (AutoCad) of all parts of the subcontract works shall be submitted to the Engineer for approval within **30 working days of appointment.**

The contractor may, if he so desires, obtain "electronic / e-mail" copies of the Engineer's drawings for modifications and updating if required. These drawings shall be re-titled in accordance with the contractor's system and shall thereafter be submitted as the sub contractor's shop drawings. **No portion of the sub contractor's works shall be commenced until the shop drawing has been approved by the Engineer.**

Detail design: As part of the detail design phase of the project, it is required that the contractor review the Engineer's drawings and make any recommendations to ensure shop drawings are compliant to SANS 10139. The contractor will be responsible for co-signing a SANS 10139 Design certificate as there are various aspects of the design (detection zoning, positioning of loop isolators, device numbering, battery loop calculations etc.) that forms part of the Shop drawing process and which is the responsibility of the contractor.

7 DESIGN CALCULATIONS

The successful Contractor shall submit for perusal by the Engineer copies of his detailed design calculations within the time period specified in the specification. These shall include at least the following:

- Loop isolator positions, battery calculations, detection zoning, alarm zoning etc. (all to comply with SANS 10139)

7.1 ASPIRATING DETECTION

The installation contractor shall be responsible for the design, supply and commissioning of a fully supervised Aspirating Fire & Smoke Detection System as specified herein and indicated on the relevant drawings.

Where necessary the installation contractor shall employ the services of the relevant supplier to assist with any or all aspects of the system design, supply, commissioning and maintenance to ensure the completed system meets the requirements for the project.

The completed aspirating fire and smoke detection system shall comply fully with all the requirements of:

- (UK) - FIA Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems – Issue 3 February 2012.
- South African National Standard SANS 10139 - Fire detection and alarm systems for buildings

The proposed sampling system design is generally as described within the FIA Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems 2012 and as such is defined as:

- A 'Primary Sampling System' that utilises the airflow created by the air conditioning and ventilation system to carry the sampled air to the sampling point.
- A 'Secondary Sampling System' where the sampling points are sited and spaced as if they are point type smoke detectors.

The installation contractor shall ensure that the proposed air sampling system design for the area*(s)* to be protected, complies with the recommendations and product approvals, with regard to the maximum number of sample points, maximum lengths of sampling pipes and the maximum area of coverage per sampling point and/or detector.

The sampling pipe network design for each installation must be approved by the fire Engineer. The design details given to the Engineer shall indicate materials of construction, sampling pipe type, size and lengths together with 'Sampling Point' and 'Capillary Sampling Point' hole spacing and size.

Any significant design deviation may alter the operation of the system and therefore any adjustment of the air sampling network design must be approved by the relevant supplier as well as the Engineer.

The installation contractor shall ensure that the aspirating system sampling pipe work configuration is confirmed as acceptable using the applicable supplier's sampling pipe calculation program. The calculation program shall determine the transport times, airflow and balance details for each individual sampling pipe and sampling point.

The maximum 'transport time' must not exceed 120 seconds or 60 seconds (Class A response time) from the furthest sampling point on the pipe work system to the aspirating detector.

Where appropriate the installation contractor shall include within their design / installation sampling pipe 'test points'. These will be installed at the end of each sampling pipe run after the last sampling point. These test points are provided for future system servicing and to test the integrity of the sampling pipe from the furthest point back to the aspirating detector. Test points should be located within accessible and secure areas to prevent tampering by unauthorised personnel.
Please note that it is not a requirement for the sampling pipe test point to comply with the maximum transport time of 120 seconds or 60 seconds (Class A response time).

The contractor shall submit a certificate of compliance on his company letterhead stipulating that the system has been installed in accordance with the design and complies with all relevant standards and manufacturers requirements.

8 "AS-BUILT" DRAWINGS

As built" drawings are the shop drawings embodying all modifications made during construction. They shall include floor- and ceiling layout drawings indicating all equipment.

Copies of "as built" drawings shall be submitted to the Engineer for approval in PDF and DWG (AutoCad).

9 EQUIPMENT SECTION SUBMISSION

The contractor shall select equipment which complies with these specifications. These selections shall be submitted to the Engineer for approval.

No equipment shall be installed until the equipment selection submission has been approved by the Engineer if the selected equipment deviates from the design concept and/or deviates from the accepted equipment offered.

10 SAMPLE SUBMISSION

Samples are any samples required by the Engineer. Samples shall be physical examples to illustrate materials, equipment or workmanship, and to establish standards by which the works may be judged. Such samples, after approval, will be retained by the Engineer for a period sufficient to ascertain that the relevant component is actually provided as per such sample, but will then be returned to the contractor for incorporation in the works.

11 SUBMISSION PROCEDURES

Submission for approval will consist of the following activities executed by the contractor and other parties involved:

The contractor shall review, stamp, date and sign to signify his approval and submit in the manner required by the Engineer and with reasonable promptness and in orderly sequence so as to cause no delay in the work, all contractor's drawings, equipment selections and/or samples required by the subcontract documents or subsequently by the Engineer. Contractor's drawings, equipment selections and samples shall be properly identified as specified or as the Engineer may require.

At the time of submission, the contractor shall inform the Engineer in writing of any deviation in the contractor's drawings, equipment selection or samples from the requirements of the subcontract documents.

Each individual equipment selection submission shall be accompanied by a copy of the applicable detailed technical specification. Each clause of this specification shall be marked "complies" or "does not comply", complete with reason stated and countersigned by the contractor's project Engineer/manager.

The drawings and equipment selections shall be submitted in a number of copies and along the channels agreed.

By submitting drawings, equipment selections and/or samples, the contractor represents that he has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and coordinated each contractor's drawing and sample with the requirements of the works and of the subcontract documents.

The Engineer, on behalf of the contractor, will review contractor's drawings, equipment selections and samples with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the subcontract works and with the information given in the subcontract documents. The Engineer's approval of a separate item shall not indicate approval of an assembly in which the item functions.

the contractor shall make any corrections required by the Engineer and shall re-submit the required number of corrected copies of the contractor's drawings, equipment selections or new samples until approved. The contractor shall direct specified attention in writing on resubmitted drawings to revisions other than the corrections required by the Engineer on previous submissions.

12 WORK PROVIDED BY OTHERS

12.1 GENERAL

The following related work to the Detection and Alarm Systems ***(DAS)*** contract will be provided by others. The Detection and Alarm Systems **(DAS)** Contractor shall be responsible for the detailing, checking and ensuring that the work as listed in the schedules and shown in principle on the drawings is provided as per his detailed builder's work and related services drawings.

Instructions for **DAS** Contractor's exact requirements shall be transmitted to the Contractor timeously in the form of builder's and associated services drawings in accordance with an agreed Contractor's programme. Should these instructions be issued after the completion of the relevant areas, then this work will be carried out at the expense of the **DAS** Contractor.

12.2 ELECTRICIAN AND DAS CONTRACTOR

Item	Contract Documents	
	Electrician	**DAS**
Provision of single phase 20A A power supplies as per plan – must be fed from emergency section in distribution board or a UPS and have its own circuit breaker.		X
Supply and installation of conduits, related fittings, elbows and electrical reticulation to all gas control panels, Addressable Control Panels, Beam Detectors and any other detection equipment that would require high voltage electrical supply.		X
Fire detection and alarm system work.		X
Electrical connections to Distribution Boards and relevant circuit breakers.		X

12.3 HVAC SUBCONTRACTOR AND DAS CONTRACTOR

Item	Contract Documents	
	HVAC	**DAS**
Low voltage relay for isolating any fresh air supply units, operating of smoke vents and any other services as per design.		X

12.4 OTHER SUB-CONTRACTORS AND DAS CONTRACTOR

Item	Contract Documents	
	Others	DAS
Holes through structure and brickwork – Pressure relief dampers		X
Access routes, holes for equipment		X
Maintenance space for equipment		X
Access to shafts		X
Cut openings in plaster board ceiling for devices		X
Access to outlets and control		X

13 COMPLIANCE WITH REGULATIONS AND STANDARDS

13.1 GENERAL

The contractor shall comply with all acts of parliament and all regulations and bylaws of local and or other authorities having jurisdiction regarding the execution of the n/s works in particular the following:

- SANS 10142 Code of Practice, as amended, for the Wiring of Premises.
- SANS 10139 Code of Practice, Fire Detection and Alarm Systems for Buildings
  - System Design, Installation and Servicing.

  SANS 7240 -16 & 19 Code of Practice, Fire Detection and Alarm Systems for Buildings - System Design, Installation, commissioning and service of sound system for evacuation purposes.
- EN 54 16 Code of Practice.
- National Building Regulations and Building Act (Act 103 of 1977).

- The contractor is to comply with all requirements of the Occupational Health and Safety Act (Act 85 of 1993) and all subsequent revisions thereof. Further, the contractor undertakes to employ only people who have been duly authorised in terms thereof and who have received sufficient health and safety training to ensure that they can comply therewith. In addition, the Contractor warrants that it shall enforce the terms of this clause on any sub- Contractor employed by the contractor in connection with the contract.

- Government, provincial and local authorities ordinances, regulations, by-laws, rules and other statutory requirements.

- Specifications and codes of practice issued by the South African Bureau of Standards and British Standards Institute. The former shall have precedence over the latter where both bodies have issued conflicting specifications or codes of practice.

13.2 AUTOMATIC SYSTEMS

Control and indicating equipment from automatic fire alarm systems shall comply with SANS EN 54 - Part 2.

13.3 MANUAL SYSTEM (TYPED M)

Control and indicating equipment from manual fire alarm systems shall comply with SANS EN 54-2 or SANS EN 54-4.

14 APPROVALS

The contractor shall, before building starts, submit the following to the consulting Engineer:

(a) the application for the approval of the design;
(b) a signed declaration that the installation has been designed in accordance with this specification by a competent person;
(c) a signed undertaking that the installation will be installed by an approved installer, in accordance with the appropriate plans and drawings, and as specified in this specification and relevant standards.
(d) appropriate plans, drawings, details and information required in terms of this specification.
(e) particulars of the power supplies; and
(f) a statement that the installation will comply with this standard, together with details of any deviation(s), and

The consulting Engineer shall be provided with a summarized schedule that contains all the relevant information relating to the system.

15 PROTECTION AGAINST DAMAGE

Special care shall be taken in transport, delivery, storage on site and installation to ensure that the entire system is in 'as new' condition at start-up.

Packaging material shall be of sufficient strength and/or temporarily reinforced during transport to - and handling on site, until installed in its final position, to ensure that the equipment "packed" retains its structural and dimensional integrity during these phases of the contract.

The contractor shall remain responsible for equipment in 'as new condition' and is not allowed to install equipment in areas or spaces where it can be subjected to damage through weather or trades for which it has not been designed.

16 ACCESS TO EQUIPMENT AND SYSTEMS

The contractor shall familiarise himself with the proposed location of the equipment and shall be responsible for ensuring that sufficient access is available on site to allow the largest component parts to be brought into position.

The required unobstructed space shall be left around the equipment for access, maintenance and service of the equipment in accordance with the manufacturer's instructions.

Equipment shall be installed to be readily accessible for testing, operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this, but changes of magnitude or which involve extra costs shall not be made without approval of the Engineer.

17 TESTING, COMMISSIONING, OPERATING OF PLANT AND HANDOVER

1. Concurrent with equipment submissions the contractor shall submit full testing and commissioning procedures for each item of equipment.

2. Prior to the pre-start inspection the contractor shall submit and have obtained approval of a fully detailed commissioning programme.
   The programme shall include but may not be limited to the following:
   - checking of earth containing and earth loops impendence to ensure compliance with SANS 10142
   - the alarm devices comply with the requirements,
   - all detectors and manual call points function correctly and initiate the correct operation,
   - any connection to the fire brigade or remote manned centre operates correctly,
   - any radio links have adequate signal strength, and
   - any signals to ancillary equipment are given correctly.

3. After physical completion of the subcontract works the contractor shall carry out all preliminary tests necessary to satisfy himself that the plant, materials and equipment comply with the provisions of the subcontract and are in a state suitable to satisfy the requirements of the acceptance tests by the Engineer. The preliminary tests shall then be completed satisfactorily before the contractor, through the contractor, requests the Engineer to witness the acceptance tests.

4. The Engineer may request the contractor to replace any portion of the subcontract work which does not conform to the requirements of the subcontract documents.

5. In the event of the installation not conforming to the requirements of the subcontract documents, the employer shall be at liberty to either recover from the contractor or to deduct from the subcontract price all reasonable expenses incurred by himself or his agents attending the repeated test.
6. After physical completion has been reported and all defects made good, "programming" shall take place.

7. Prior to the carrying out of acceptance tests the contractor shall operate the entire system for as long a period as may be required to provide satisfactory performance as specified in this specification and SANS 10139 code of practice at all times for 24 hours a day continuously.

   The contractor's operator(s) shall be fully conversant with the plant operation and experienced in running similar installations. The contractor shall train the employer's operator(s) to enable them to be responsible for the capable of operating the plant. Logging of the plant operation (alarm, dirt, etc. History) shall commence once plant has been commissioned and the contractor shall continue logging until the acceptance tests have been carried out and the plant handover.

18 GUARANTEE

The contractor shall guarantee that the systems are installed and commissioned in such a manner that they will function to the true intent and meaning of the sub-contract documents.

19 CERTIFICATIONS

19.1 BACKGROUND

In order to obtain a fire clearance certificate on completion of the project, it will be necessary to prove to the local authority that the systems specified and

as installed under this contract have been correctly installed and are fully operational.

19.2 CERTIFICATION REQUIRED FROM CONTRACTOR

Upon completion of the installation of an system contained in this document, the contractor shall provide to the Engineer (Plantech) a signed written statement, substantially in form as follows:

> *"The undersigned, having installed the Fire Detection and Voice Evacuation System at Armscor Head Office Building, Pretoria confirms that the above-mentioned systems were installed in accordance with the specification, instructions and directions provided to us by the manufacturers."*

In addition, the certificates as prescribed by SANS 10139 Code of Practice must be completed in full with no qualifications or amendments.

20 OPERATING AND MAINTENANCE MANUALS

The contractor shall supply four (4) comprehensively indexed operating and maintenance manuals, bound in loose leaf plastic covers, as well as an identical "soft" cope on CD or flash drive.

The manuals shall be arranged in two parts:

20.1 OPERATING AND MAINTENANCE MANUALS

The contractor shall supply two comprehensively indexed operating and maintenance manuals, bound in loose leaf plastic covers, as well as an identical "soft" cope on CD or flash drive.

The manuals shall be arranged in two parts:

20.2 OPERATION MANUAL

This manual should consist of two parts.

Part I - Operation Instruction
Contains information a qualified operator needs

1) to start and stop equipment
2) to control and monitor the performance of the equipment in normal modes of operation
3) to change from one mode of operation to another and
4) to operate equipment in emergency situations.

Operation procedures with proper flow charts for all integrated systems are also required. The system function should be represented pictorially and in writing.
Full trouble analysis procedures shall also be included.

Part II - Performance Verification Procedures
Contains all the information a qualified operator needs to verify equipment and overall system performance at the. Any design calculations needed for performance verification shall be included in this manual.

20.3 MAINTENANCE MANUAL

This manual should also consist of two parts.

20.3.1 Part I – Inventory

Contains a listing of all systems and pieces of equipment to be maintained as well as all the technical information needed to order spare parts. Manufacturers' catalogues are considered useful adjuncts only.

The full names, addresses and contact details of all suppliers of equipment shall be included.

20.3.2 Part II - Maintenance Programme

Contains the information necessary to perform breakdown, preventative, and predicative maintenance. These programmes include written information regarding when or how often to perform maintenance in the most efficient and economical fashion to satisfy tenant needs.

21 ONE YEAR'S MAINTENANCE

The contractor shall furnish free of charge all maintenance on the entire subcontract works for a period of twelve months after completion of subcontract works. Maintenance shall include systematic examination and adjustment of equipment as set out in the schedules below:

	Description	Daily	Weekly	Monthly	Three-Monthly	Six-	Annuall
1	Maintained in Accordance to SANS 10139	At All Times					
2	Clear space of at least 500mm radius below detectors maintained at all times				✓		

	Description	Daily	Weekly	Monthly	Three-Monthly	Six-	Annuall
3	Check that manual call points are accessible and conspicuous				✓		
4	Review logbook and automatic alarm log			✓			
5	Repair / reinstate after activation of fire (within 24 hours)	At All Times					
6	Check that panel is in Normal mode (no faults)			✓			
7	Record any faults in log			✓			
8	Repair any faults identified	Within 8 Hours of Discovery					
9	Test communication with Fire Department				✓		
10	Visual inspection of backup batteries			✓			
11	Full test of backup batteries				✓		
12	Test each zone of detection system				✓		
13	Test each individual detector						✓
14	Visual inspection of cables						✓
15	Complete certificate as per SANS 10139 on completion of testing						✓
16	Check the following after a fire: o All radioactive detectors are handled as per Occupational Health and Safety Act requirements; o Each detector and break glass unit in fire area is tested; o Visual inspection of all other parts of the system; o Batteries and battery charger; and o Issue certificate as per Annex	Immediately Following a Fire					

	Description	Daily	Weekly	Monthly	Three-Monthly	Six-	Annuall
17	After any false alarm check: o Which device caused the false alarm; o If device not faulty, identify cause of device trigger (e.g. Someone smoking, etc.)	Immediately Following a False Alarm					

The contractor shall in the course of such maintenance or on call during the maintenance period, repair or replace defective parts, and shall use only genuine parts produced by the manufacturer of the original part.

The contractor shall supply all replacement parts, as required at no cost where work is of a routine nature (i.e. not maliciously damaged).

22 TRAINING

The contractor will at no additional cost train the staff selected by the client.

The training shall be continued until the contractor is satisfied that the selected staff is capable in the operation and maintenance requirements of the system(s).

23 COMPLETION OF SUBCONTRACT WORKS

Completion of the works will occur after the following procedure has been certified by the Engineer as having been carried out in accordance with the specification:

- After the defects are made good and approval of the Engineer is obtained, physical completion has been reported to the Engineer by the contractor and the Engineer has given approval for "start-up".
- "start-up" has taken place.
- Commissioning and testing has taken place as specified and test results have been witnessed (where required), recorded and finally approved by the architect.
- Four copies of Operations and Maintenance Manuals have been received.

24 QUALITY

24.1 GENERAL

All aspects of the installation (e.g. setting out, alignment, levels, positions, etc.) must be checked on site and the installation installed correctly within the parameters of the SANS 10139 and EN 54 Codes of Practice.

24.2 VISUAL APPEARANCE

The visual appearance of installation is important and the Contractor must ensure that the lines and levels followed by the equipment are correct not only within the tolerances specified but also look aesthetically correct to the satisfaction of the Client and Engineer..

24.3 CLAIMS AND CERTIFICATION.

At the end of each month, the Detection contractor will be responsible to provide the Engineer with a claim representing the works performed during the month. The date and format on which this claim is to be provided will be communicate to the successful Contractor after appointment.

That being said, the contractor will ensure that the claims represent the following maximum amounts in terms of percentages, based on the work completed at the time of the claim.

Should at any point the Engineer be of the opinion that the contractor is over claiming, will the Engineer deem the claim to be invalid and will stop certifying any works until the claim has been resolved. If the contractor has any objection to the draw down as stipulated below, it should be brought to the attention of the consulting Engineer as part of the tender submission pack. If not, it will be taken that the contractor is in agreement with the percentages stipulated below.

Description	% Claimed
Shop drawings produced and approved	20%
Materials on site in lockable room	50%
First fix complete (cabling and containment)	75%
Final Fixes installed	85%
System life and Commissioned	95%
Building Tuning Complete and training complete	98%
Client Acceptance Sign-off	100%

PART II: GENERAL TECHNICAL SPECIFICATION

1. MATERIALS

Only equipment and components specifically designed for the proposed use may be used. To this end, all equipment shall be either listed / approved by an approved testing laboratory / authority. Proof of such compliance shall be provided for each item.

Under normal conditions of use, all materials shall be free from defects, which are liable to cause undue deterioration or failure. Materials shall not shrink, warp or cause mould or odours and shall be resistant to attack by local vermin and destructive pests.

Materials shall be stored in areas allocated by the Employer. Stored materials shall not overload the floor construction beyond design limits.

2. COMPATIBILITY

All the components of a fire alarm system shall be mutually compatible.

Compliance of an individual component with any standard or approval does not necessarily guarantee that it will work satisfactorily in conjunction with another component that complies with another standard.

The contractor shall consider the subjects below, and the data provided with each item shall provide the information necessary for the consideration of its compatibility with other items. All specifications and details are to be forwarded to the Engineer for approval.

In relation to a given control and indicating panel, such consideration shall include at least the following:

a) for all devices:
- the requirements of the system in order to satisfy electrical safety requirements;
- any provision for earthing;
- the earth insulation resistance;
- the method of adjustment where adjustment is required to ensure compatibility;
- any preferred method(s) for monitoring line continuity;
- whether the current taken or delivered has an appreciable reactive component;
- the characteristics of any signals that pass between components;

- the ability of the control and indicating equipment to operate in conjunction with the number of devices to which it will be connected;
- any software provided for programming the system or its components, and the compatibility of other components with the software; and
- any limitations on the numbers, types, sizes or other parameters (such as impedance) of wires that can be connected.

b) for fire detectors:
- the form of output;
- the operating voltage, including tolerances;
- the quiescent current;
- the alarm current or maximum permissible alarm current rating;
- the method of resetting the device after an alarm;
- the states of the detector that indicate normal conditions, fault conditions and fire conditions;
- any requirements for indications of operation to be provided in the vicinity of a detector, together with any resultant changes in system conditions, e.g. Reliability or power consumption; and
- the number of conductors required.

c) for alarm devices:
- whether polarized connection is required;
- whether precautions might be required in order to suppress any interference generated by the device;
- what methods for monitoring the interconnections can be used;
- whether the power supply arrangements can provide sufficient power;
- whether a high starting current is required.

d) for manual call points:
- whether they are of open or closed circuit operation;
- whether they are of polarized operation;
- the method of discrimination between alarm and fault conditions;
- the method of resetting the device after an alarm.

e) for power supplies:
- the correct voltage for the type of battery used (i.e. Lead-acid or alkaline types);
- the correct charging characteristics for the type of battery (i.e. Constant current or constant voltage);
- the relationship between polarity and earth, or whether the potential is earth-free;
- the current rating in relation to calculated maximum demand;
- the permissible limits of ripple;

- the degree of stabilization;
- the formula for power capacity for the system, including the storage capacity of the standby supplies and the required standby duration;
- the permissible range for the supply voltage; and
- whether the standby power supplies are able to provide the necessary current for the specified duration.

3 IDENTIFICATION

A label shall be provided under each device, detector, relay, controller and panel identifying the equipment controlled and/or performance indication by such items.

The labels shall consist of a non-corroding material with a non-glossy appearance, engraved with black, lettering on a white background.

A battery room or cabinet should be secured against unauthorized admission and should display notices indicating its purpose, the importance of not smoking, and the need to use insulated tools and to remove metallic personal adornment to avoid accidental short-circuits.

In additional to the warning and information labels that should be provided in accordance with SANS 10142, a label should be provided on any isolating protective device that affects the fire alarm system and should read as follows:

"Warning: this switch also controls the supply to the fire alarm system"
"DO NOT SWITCH OFF"

4 POWER

4.1 GENERAL

Provision is made for a normal power supply and a standby power supply, each shall be capable of supplying the largest load to be placed on it under normal, fire and fault conditions.

Transition between supplies shall not cause momentary interruptions. Where devices such as fuses are fitted in order to protect power supplies, the operation of a single protective device shall not interrupt both power supplies and cause the system to fail.

The condition of the normal supply shall be indicated by a green pilot light, which lights up when the normal supply is on.

The largest alarm load is the maximum load imposed by the fire alarm system on a power supply under fire conditions. It will include the power required to operate the sounders, detectors, fault warning devices, the illumination and any ancillary services powered by the fire alarm system etc.
Any power required for a display should be derived from the fire alarm system power supply and should be taken into account when assessing the capacity of the power supply.
The load imposed on the power supply by the simultaneous operation of detectors or manual call point (or both) shall not cause an existing fire alarm to cease. In systems using microprocessors or stored programs, the imposition of the maximum alarm load should not cause incorrect operation.

4.2 NORMAL POWER SUPPLY

The normal supply for the fire detection and alarm system shall be derived from the public supply system, transformed or modified as necessary.

4.3 STANDBY POWER SUPPLY – SECONDARY BATTERIES

Where secondary batteries with an automatic charger are used they should be of a type that has a life of at least 4 years under the conditions of use likely to be experienced in the fire alarm system. Automotive lead-acid batteries (e.g. the type normally used for starting cars) are not acceptable.

Because the life of the battery frequently depends on its charging conditions, care should be taken that the battery charger satisfies any requirement specified by the battery supplier. Where replacement batteries or battery chargers are used, similar care should be taken to ensure charging compatibility. Replacement cells shall be compatible with the existing cells in both charge and discharge characteristics. The supplier of the system shall specify a method of test that is likely to predict failure of the battery in the interval between routine tests.

The charging rate of the battery shall be such that, having been discharged to its final voltage, the battery can be charged sufficiently to comply with the recommendations after a charging period of 24 hours.

A battery calculation sheet is to be completed and approved by the Engineer prior to the commencement of installation activities.

5 CIRCUIT DESIGN

5.1 GENERAL

Note: The tender drawings are intended to show the principle layout of the system. As specified elsewhere in this document, it will be the

responsibility of the contractor to complete the circuit design in terms of the guidelines provided and the SANS 10139 Code of Practice.

Care should be taken to ensure compatibility of all components that are part of the fire alarm system or connected with it in any way.

Circuits should be so arranged that an indication is given at the control and indicating equipment within 100 seconds of the occurrence of any disconnection, open or short circuit in a cable that would disable one or more detectors or call points (or both), or of a failure of any other interconnection, and this should be done without giving a false alarm.

Even where the wiring of a system is monitored, regular routine testing is important and should be considered during installation.

The contractor shall provide a method of manually testing of circuits.

5.2 CIRCUITS THAT CONTAIN FIRE DETECTORS

The wiring arrangement of the system shall be such that:

a) if separate circuits are used for each zone, a fault or faults on one circuit shall not affect any other circuit,
b) if any circuit is used for more than one zone, a fault or faults on one circuit shall not affect any other circuit,
c) if a circuit is used for more than one zone and multiple faults within one fire compartment could remove protection from an area greater than that allowed for a zone, the circuit within that division is suitably protected, and
d) two simultaneous faults shall not remove protection from an area greater than 10 000 m².

If the system is such that the removal of a detector or call point from the circuit could affect the operation of other detectors or call points

i. removal of a detector or call point shall cause a 'fault' signal to be generated at the control equipment, indicating the need to replace the missing detector or call point as soon as possible, and
ii. the operating instructions shall draw the users attention to any adverse effects on the remainder of the system due to the removal of one or more detectors or call points (or a combination of these).

5.3 CIRCUITS THAT CONTAIN FIRE ALARM SOUNDERS

If alarm sounders use the same wiring as detectors, no alarm sounder shall be affected by the removal of any detector. Any sounder that is necessary in order to reach the audibility levels recommended shall only be removable by

the use of a special tool, and removal shall generate a fault warning at the control and indicating equipment.

The wiring of sounder circuits shall be so arranged that, should a short circuit develop in any part of the wiring of sounder circuits during a fire, at least one alarm sounder will continue to sound. This minimum provision shall ensure that a general alarm can be given at the start of a fire and for a significant period thereafter and that, in the event of the fire's burning through a sounder cable, the alarm will be maintained at, at least one point in the building, usually near the control equipment.

5.4 RING SYSTEMS

If devices such as detectors, call points or sounders are connected to control equipment by a ring circuit, then, provided that the devices can receive or send signals in either direction, they will continue to operate even with a single open circuit or high series resistance in the ring. Such faults shall be indicated at the control and indicating equipment within 60 seconds of their occurrence. A simple ring circuit, however, cannot give protection against short-circuit faults and hence such faults have to be indicated, without giving a false fire alarm, within 100 seconds. Where sounders are used on simple ring circuits, the distribution wiring to each sounder circuit should be protected against overload owing to a short circuit by a fuse or similar device.

5.5 CIRCUITS PROTECTED AGAINST CABLE FAULTS

In some ring systems (usually those using computer techniques with addressable devices) short-circuit isolating devices can be provided such that a short circuit will only affect the section between the isolators. The isolators could be independent devices or could be contained within other devices on the circuit. In such a system a single fault, whether to open-circuit or to short-circuit conditions, can affect at most the section of the loop between the nearest isolators. (other circuit arrangements that have the same general effect are possible). Where the effect of the fault is to reduce to one the number of signal paths to any detector or call point, the control equipment should indicate the fault within 60 seconds of its occurrence and should preferably indicate the position of the fault. It is essential that action be taken to repair such faults since, if a fault is left unprepared, the system has no protection against further faults. However, if, because of redundancy in the circuit design, at least two signal paths to each detector and to each call point remain, it is necessary to ensure the indication of the fault only within 24 hours of its occurrence.

5.6 ZONES

When a signal of fire is given it is vital that there should be no confusion about the zone from which it is received. To facilitate response by people who provide

assistance, the zone should be small enough for a fire to be located quickly. It is often important that there should be adequate fire separation between the zones; this is particularly so if the initial evacuation procedures in the building usually entail movement from the zone of the fire to one of temporary refuge.

On larger premises in particular, the fire alarm system should therefore be so designed and arranged that it is both fully compatible with the emergency procedures and provides at some central or convenient point, or points, an indication of the zone in which an alarm has originated. In the case of two-stage alarms, clear and unambiguous signals should indicate the emergency procedure to be adopted throughout each zone.

In general the signals used in different zones on the same premises should be the same unless the background noise in one or more zones is such as to require different sounders.

If the system has been installed for purposes of safety of life (type I or m), each zone should be readily accessible from the point(s) where the indication of the location of fire is provided. In general, access to any zone should be by normal circulation routes; however, where small areas of the building are defined as zones for specific purposes (such as the existence of a special risk) it might be permissible for access in the immediate vicinity of that zone to be by another route, for example through another room.

Note: In systems other than addressable systems, signals coming from individual detectors or groups of detectors cannot be separately identified. In these systems, therefore, to allow zone identification, it is usual for each zone to be fed by a separate circuit. It has thus become common for the concepts of 'zones' and 'circuits' to be used interchangeably. In addressable systems, however, several zones (defined as subdivisions of the premises) can be fed from a single circuit while retaining zone identification. It is therefore important that in such systems the concepts of 'zones' and 'circuits' be treated separately.

5.7 LOOPS

It shall be possible to connect the following detectors/devices to the control unit addressable loop.

- multisensors – optical / thermal type
- optical smoke sensors – analogue type
- ionization smoke sensors – analogue type
- heat sensors – analogue type
- manual call point "break-glass" units
- open-area smoke imaging detection (OSID)/beam detectors– loop/address interface

- wireless radio-based analogue multisensors – optical/thermal (with loop interface)
- wireless radio-based analogue sensors – heat type (with loop interface)
- wireless radio – based call points (with loop interface)
- addressable relays i.e. Output devices
- addressable sounders (loop powered)
- sounder circuit controllers
- addressable remote led indicators
- gas discharge control units
- line isolators

Note: Detectors within any area protected by a gaseous suppression system shall be connected to at least two loops.

6 CABLES AND CONDUCTORS

6.1 CABLES

It is essential that connections between detectors or call points and the control equipment should be able to maintain the alarm without a continued signal from the detector or call point, i.e. Destruction of the connection after the initial operation shall not affect the sounding of the alarm.

Where multi-core cable, flexible cable, or flexible cords are used for interconnections in fire alarm circuits, none of the conductors shall be used for circuits other than those of fire alarms.

Electric cables should

a. be suitable in the opinion of the authority that has jurisdiction for a particular application and comply with approved standards where relevant,
b. be selected, handled and installed in accordance with SANS 10198-2; SANS 10198-4 and SANS 10198-8,
c. be protected from direct exposure to fire, and
d. be appropriately insulated and armoured, be enclosed in appropriate conduit, or be mineral-insulated and copper-sheathed.

Note the following types of cable are normally deemed to be suitable, subject to the restrictions on their use and the recommendations for further protection:

I. impregnated-paper-insulated metal-sheathed cables that comply with SANS 97;
II. cables designed for the detection of heat that comply with SANS 529;
III. polymeric or rubber insulated cables that comply with SANS 1268;

IV. cross-linked polyethylene (XPLE)-insulated electric cables that comply with the requirements of SANS 1339; and
V. cables with solid dielectric insulation that comply with SANS 1507.

Note: FR-20 cable is not considered acceptable.

Item	Area	Cable Requirements
1.	Block 1 to Block 5 (All floor levels)	PH120
2.	Block 7 (All floor levels)	PH30

Cable is to be colour-coded as follows:

- **Red:** Fire detection system;
- **Blue:** Voice evacuation system – loop 1;
- **Green:** Voice evacuation system – loop 2; and
- **Yellow:** Emergency voice communication / fireman's telephone system.

6.2 APPLICATIONS

6.2.1 General

A wide variety of different cables can be used in various parts of a fire alarm system. However, because of their varying abilities to resist both fire and electrical or mechanical damage, many of these cables might be restricted in their suitability for specific applications. The applications are classified according to the need for fire protection.

6.2.2 Applications in Which Prolonged Operation During A Fire Is Required

Cables used for the interconnection of components of a fire alarm system are required to continue operating after a fire is first discovered (e.g. Sounders, control and indicating equipment and power supplies) unless they are protected against cable failure. Cables used within protected premises for the transmission of the alarm to a remote centre should also be protected against cable failure. In general, it may be assumed that interconnections between sounders, control and indicating equipment and power supplies that can resist fire for at least 0,5 hours will be satisfactory. In special cases, however, longer periods might be required (for example, in buildings with a two-stage alarm system).

6.2.3 Applications in Which Prolonged Operation During A Fire Is Not Required

Cables that are not required to continue operating for appreciable periods after the fire is discovered or after they are attacked by fire will usually be only

those to detectors or call points but might also include those to ancillary devices (such as door holders), in which case a failure of the cable due to a fire will not lead to a dangerous condition.

6.2.4 Protection from Fire

i. Applications that do not require prolonged operation during a fire
Where prolonged operation during a fire is not required, any of the cables listed may be used without additional fire protection.
Cables designed for the detection of heat, or coaxial cable, may be used for the interconnection of detectors within a zone, provided that the system is such that it gives a fire alarm in response to the occurrence of fire at such a cable.

ii. Applications requiring prolonged operation during a fire
Cables that are required to continue operating during exposure to fire should be protected against exposure to the fire by either:
   a. burial in the structure of the building and protection by the equivalent of at least 12 mm of plaster, or
   b. separation from any significant fire risk by a wall, partition or floor that will resist a fire for at least 0,5 hours.

Note: the mechanical protection of cables by conduit, ducting or trunking should not be considered as giving protection against fire.

iii. Reduced protection
Where possible, cables should be routed through areas of low fire risk. Where cables pass through areas of very low fire risk or where cables are protected by an automatic extinguishing system or sprinkler installation, a reduction in the degree of fire protection recommended might be acceptable following consultation with interested parties.

6.2.5 Protection of Cables From Electrical Or Mechanical Damage

i. Electrical protection
Cables designed for the detection of heat should be used within the manufacturer's ratings.

ii. Mechanical protection
Some types of cable are not sufficiently robust to withstand the mechanical hazards that they might be exposed to in practice, such as impact, abrasion, or attack by rodents. In order to protect such cables from damage both during and after installation, it will be necessary to provide mechanical protection by installation in conduit, ducting or trunking or by laying the cable in a channel.

Cables should be given mechanical protection when appropriate if
   a. they are not monitored,
   b. they are less than 2,25 m above the floor, or
   c. physical damage or rodent attack is likely.

The above recommendations for resistance to mechanical damage would be expected to be sufficient for most applications. However, where particularly severe conditions might be experienced (such as impact by forklift trucks), it might be necessary to provide additional protection designed to withstand the expected hazards. Armoured cable should be used where appropriate.

6.3 JOINTS

Unless specifically approved otherwise by the Engineer, all connections shall be made at the devices (so-called loop-in, loop-out arrangement). No other joints shall be allowed.

6.4 SEGREGATION OF WIRING

Conductors that carry fire alarm power or signals should be separated from conductors that are used for other systems. The separation may be by one or more of the following methods:

a. installation in conduit, ducting, trunking or a channel reserved for fire alarm conductors;
b. a mechanically strong, rigid and continuous partition of non-combustible material;
c. mounting at a distance of at least 300 mm from conductors of other systems; or
d. wiring in mineral-insulated copper-sheathed cable with an insulating sheath or barrier.

If a cable that should be segregated from cables of other services is not enclosed in ducting, trunking or a channel reserved for fire alarm circuits, it should be suitably marked or labelled at intervals not exceeding 2 metres to indicate its function and the need for segregation. Ducting, trunking or a channel reserved for fire alarm circuits should be marked to indicate this reservation. The fire alarm cable should be completely enclosed when the cover of the ducting, trunking or channel is in place, and all covers should be securely fixed.

Segregation of the fire alarm power supply cables need not be applied on the supply side of the isolating protective device. Cables carrying power in excess of extra-low voltage should be separated from other fire alarm cables. In particular, the mains supply cable should not be brought in through the same cable entry as cables carrying extra-low voltage power or signals.

6.5 TELECOMMUNICATION CABLES

Public telecommunication operator lines used for the transmission of alarms to the fire brigade should be mechanically protected and should be considered as required to give prolonged operation during a fire.

6.6 ALTERNATIVE CABLES

Types of cable or cable system other than those described above may be used only if it can be shown that, in the application in which they are to be used

a. their resistance to heat and fire is suitable for the application,
b. their resistance to ambient conditions, including resistance to mechanical impact and abrasion, is suitable for the application,
c. they are not prone to faulty assembly or installation,
d. their electrical properties under both normal and fault conditions are suitable for the application, and
e. they are operated within their manufacturers ratings.

Where possible, alternative types of cable should be certified or approved under a recognized certification or approval scheme as satisfactory for their application.

6.7 DAMP, CORROSIVE OR UNDERGROUND LOCATIONS

Cables intended for installation in damp, corrosive or underground locations, or in plasters or cements that have corrosive effects on metallic sheathing, should be pvc-sheathed overall. Where the environment can attack pvc, a suitable alternative sheath should be adopted. In some locations further protection might be necessary.

6.8 CONDUCTORS

6.8.1 General

Conductors should

a. be suitable in the opinion of the authority that has jurisdiction for a particular application and comply with approved standards, where relevant, and
b. have an appropriate temperature rating for their intended use.

Note: the following are normally deemed to be suitable (depending on the particular application):

I. heat-resisting wiring cables complying with SANS 529; and
II. single-core, PVC insulated, annealed copper conductors of 600 V grade in accordance with SANS 1507.

6.8.2 Conductor Sizes

In selecting conductor sizes, physical strength and limitations imposed by voltage drop should be taken into account. Voltage drop in a cable should not be such as to prevent devices from operating within their specification limits, even under minimum supply and maximum load conditions. Consideration should be given to any possible extensions to the system.

Unless otherwise recommended, conductors should be of copper, each with a cross-sectional area of **not less than 1.0mm²**.

6.8.3 Ambient Temperatures

Care should be taken that the combination of ambient temperature and temperature rise caused by load current does not result in a conductor temperature that exceeds the limit for the insulation.

Subject to any overruling consideration, safety factors and consultation with the relevant authority, the fire alarm system may be so designed that detectors or call points (or both), in addition to giving an alarm and calling the fire brigade, will close or open circuits of ancillary services by means of relays or similar devices.

Note: examples of ancillary services include the

a. actuation of fixed fire-extinguishing systems,
b. closing of windows, smoke and fire doors,
c. control of ventilating systems, and
d. covering of tanks that contain flammable liquids and controlling their valves to isolate the contents from direct contact with the fire.

Means to temporarily disable an item or items of ancillary equipment for routine servicing or maintenance of that equipment may be provided if it does not affect the operation of the fire alarm system.

If operation of the fire alarm system during servicing or testing can have undesirable effects on ancillary equipment, means should be provided for disabling the automatic operation of the ancillary equipment. The disablement may take the form of a transfer from automatic to manual operation. A visual indication of disablement should be provided.

Power supplies to ancillary services should be such that the power supply to the fire alarm system is not prejudiced. Indications of both the state of ancillary systems and that of ancillary systems that take power only when there is a fire may be operated from the fire alarm supply, but ancillary systems that take power (other than for indicators) in the non-fire state should not be operated from the fire alarm supply. Any additional loads taken by ancillary systems should be taken into account in the calculations of power supply capacity.

6.9 CONDUIT AND TRUNKING

All conduit, trunking, sleeves and associated provisions will be provided by the electrician.

7 DEVICES – GENERAL

7.1 SYSTEM

7.1.1 Device Address

Each device on line must be uniquely identifiable by the control unit. This must be achieved by pre-setting the address of each device.

Removal of a detector head from its base must extend a fault condition to the control unit.

7.1.2 Device Identification

The identification of each type of address unit and each type of sensor (i.e multi-sensor, ionisation detector, heat detector, sprinkler switch, etc.) must be transmitted to the panel on each polling scan.

7.1.3 Device Status

The condition of each line device, including circuit, calibration and contamination, must be transmitted to the panel on each polling scan.

7.2 LOOP DEVICES - GENERAL REQUIREMENTS

Sensors shall have complete electromagnetic and electrostatic protection against externally generated noise and the effects of devices such as fluorescent light fixtures, variable frequency motor controllers, cellular telephones, and electrical surges from other sources. Protection must meet the European directive CE 336/89, and must comply with the following standards:

a. IEC 801-1 : general surge protection requirements
b. IEC 801-2 : electrostatic discharge
c. IEC 801-3 : radiated electro magnetic interference
d. IEC 801-4 : voltage transients – fast transient bursts
e. IEC 801-5 : process equipment: surge immunity requirements
f. in addition, sensors must be fully resistant to RFI interference to a signal strength of 10 V/m over a frequency range of 1mHz to 1000 mHz, and a signal strength of 50 V/m over 50v/m over cellular telephone signal ranges 450-466 mHz, and 890 – 960 mHz.

An indicator led shall be provided on the detector which illuminates when the detector is in an alarm condition. The indicator shall be operated independently of the detector from the central point panel.

Provision shall be made from an output from the detector suitable for operation of a remote indicator led. The output shall be operated independently of the smoke detector from the central point panel.

The unique address of the detector shall be set by the installer using high integrity sealed dipswitches.

8 ADDRESSABLE POINT SENSORS

Sensors shall have an aesthetically pleasing design and shall be available in black or white (with matching bases) as standard. Painting or spray-painting of sensor exteriors shall not be acceptable.

Sensors shall have complete electromagnetic and electrostatic protection against externally generated noise and the effects of devices such as fluorescent light fixtures, variable frequency motor controllers, cellular telephones, and electrical surges from other sources. All sensors must be CE certified and meet the relevant requirements of the EN61000 standard.

The electronic components must be of the surface-mounted type, and the board assembly must be protected with a conformal coating stable to 100 degrees C. The coating shall be applied to both sides of the board, affording protection against moisture, fungus, and dirt.

The sensor housing shall be manufactured from durable ABS plastic.

Each detector shall incorporate dual LED's which shall allow the detector status to be visible through 360 degrees at ground level. These LED's shall flash GREEN when the detector is healthy every time that it is polled. It shall be possible to disable this flash GREEN on healthy, if required. When a detector is in alarm the LED's shall indicate steady RED.

Sensors must plug into separate mounting bases with a twist-lock action. The bases shall be fitted with corrosion resistant connector springs and terminal screws with captive clamping plates.

All bases shall incorporate a concealed security lock to prevent unauthorised removal or tampering with sensors. It shall be possible to activate the security lock in areas where required. With the security lock activated, it must only be possible to remove a sensor from its base using a special tool.

9 LINE ISOLATORS

It shall be possible to fit loop isolators at a maximum spacing of one per 20 devices. The isolators shall protect against short circuits, and partial short

circuits, on the loop by isolating that section of the loop where the short circuit occurred, thus maintaining the integrity of the remainder of the system.

10 MANUAL CALL POINTS

All manual call points shall include an integral short circuit isolator. Manual call points shall be clearly identifiable and simple to use without the need for instructions regarding their method of operation. The method of operation of all manual call points in an installation shall be identical unless. If necessary, a striker shall be provided adjacent to the call point to facilitate breaking the cover. The delay between operation of a call point and the giving of the general alarm shall therefore not exceed 3 seconds.

Call points shall be fixed at a height of 1.4 metres above the floor, at points as indicated on the drawings. Manual call points shall be sited against a contrasting background to assist in easy recognition. They may be flush mounted in locations where they will be seen readily, but where they will be viewed from the side (e.g. In corridors) they should be surface mounted or semi-recessed in order to present a side-profile area of not less than 750mm.

11 INTERFACE WITH OTHER SYSTEMS

The system must be capable of interfacing with other systems via Input / Output units, relays and similar equipment. All relays and equipment beyond the Input / Output units will be provided by others. The systems to be interfaced include:

System	Action
Sprinkler System	Receive a signal from the sprinkler system flow switch when activated.
Sprinkler System	Receive a signal from the monitored valves (3 per Installation Control Valve assembly).
Voice Evacuation System	Initiate voice evacuation procedure.
Lifts	To ground the lifts on ground floor.
Stair Ventilation	To engage pressurisation to stair.
HVAC Fresh Air Supply	To shut down the fresh air supply.
Windows / Doors / Turnstiles	To open/close

Note: Final connections between the fire detection system and associated equipment to be carried out by the fire detection contractor.

PART III: DETAILED SPECIFCATION

1 DESCRIPTION OF THE SYSTEM

1.1 THE BUILDING

The project involves the refurbishment of an old office building and associated basement parking level at Armscor Head Office Building, Pretoria

The building is made up of the following occupancy classification in terms of Regulation A20 of the *National Building Regulations and Building Standards Act (Act 103 of 1977)*:

Class of Occupancy	Occupancy
G1	**Offices** Occupancy comprising offices, banks, consulting rooms and other similar usage.
D4	**Plant Room** Occupancy comprising usually unattended mechanical and electrical services necessary for the running of building.
J4	**Parking Garage** Occupancy used for storing or parking of more than 10 motor vehicles.

1.2 SCOPE OF CONTRACT

Scopes of works contain detail design, supply, procurement, delivery, erection, testing, commissioning and handover of a complete Fire Detection & Alarm System, Emergency Voice Evacuation System in accordance to SANS 10139, SANS 7240, SANS 10142-1 AND SANS 10400-T operational to the Employer and the guarantee and comprehensive maintenance thereof for a further period of 12 months.

1.3 FIRE PROTECTION BY OTHERS

The following fire protection measures will be provided by others:

- Automatic sprinkler system;
- Hand-held fire equipment, including hydrants, hose reels and fire extinguishers;
- Passive fire protection measures including emergency escape provision, statutory emergency signage, etc.

1.3.1 Classification of System

The fire alarm system shall comply with the requirements for a "L1" type system (with type "M" system included) as defined by SANS 10139 Code of Practice summarised below:

- **Type L1 : systems installed throughout all areas of the building except the following areas;**
    - **Toilets**
    - **Toilet Lobbies**
    - **Any room or cabinet smaller than 1m²**
    - **Ceiling voids smaller than 800m in depth**
- **Type M : manual alarm system.**

2 CONTROL PANEL

2.1 PANEL DESCRIPTION

The fire alarm panel shall be a 24 volt **analogue addressable unit**, designed to communicate with the sensors and field devices. **The fire alarm panel must be capable to be networked with other fire alarms panels in the facility**. It shall be a microprocessor based unit and shall incorporate all hardware and software to enable it to make decisions based upon information received from sensors, and operate appropriate outputs to initiate required alarms and signals.

The panel shall comply fully with standard EN54: Part 2.

The control unit shall continuously monitor the analogue status of all sensing devices, and initiate action when a fire or smoke condition is present.

The alarm management shall be field configurable from the control panel via a keypad to enable the system to be tailored to suite the protected building, and to permit future changes. This configuration shall be maintained under power failure conditions.

The control unit shall have a front panel comprising of indicating LED's, control keyboard, and LCD display, as described in detail later.

The system will comprise **13** panel having **four** loops. The zones must be fully field programmable to permit sensors to be allocated to any zone. The zoning must be manually configured on system start-up, or on request by an authorised operator.

The panel must provide facilities for the operator to inspect the zoning configuration, and inhibit, or activate devices. Facilities must be provided for identifying all active and inhibited addressed, and all connected device types.

Note: While this specification is based on the preferred **Protec 6500 4 Loop Stand Alone Fire Panel**, there is nothing preventing the Contractor from offering equipment which performs equal to or better than the equipment specified.

2.2 NETWORKING

It shall be possible to network multiple panels, each panel shall consist of a network card and shall be a Class A redundant network as per the latest revision of SANS 10139

2.3 PANEL OPERATION

Four levels of access into the system menu via the keypad are to be provided.

These are to be as follows:

- Level 1 : Operating (no access code required)
- Level 2 : Maintenance Technician (access code required)
- Level 3 : Commissioning (access code plus key)
- Level 4 : Access Code Changes (access code plus key)

Facilities for "locking-off" controls are to be provided.

The panel is to incorporate a keyboard and push-button with the following functions:

Facilities for "locking-off" controls are to be provided.
The panel is to incorporate a keyboard and push-button with the following functions:

- numeric keyboard
- system reset button
- alarm accept button/silence alarm button
- alarm sound button
- panel buzzer "mute" button
- lamp test function
- control buttons as required for system operation
- menu functions for maintenance and commissioning

2.4 POLLING

The system is to incorporate a polling system which polls each sensors individually and reads information at regular intervals to the control unit. The idle value shall be continuously updated in order to compensate for ageing and atmospheric conditions. The panel shall make decisions based upon the number of devices attached to the loop.

All communication shall be under the control of the panel, which shall sequentially poll each device in turn and authorise communication. No device shall communicate with the control panel without authority.

The control panel must be able to read information from a device or send instructions to a device.

The panel shall monitor each device on every scan, and give a fault signal for any of the following conditions, within 30 seconds:

a) detector removed
b) address unit removed
c) incorrect device type
d) faulty calibration or sensitivity

2.5 CALIBRATION

The system must check the calibration of each analogue line device and record changes caused by environmental contamination.

When maximum calibration adjustment is reached the panel must indicate a "maintenance" signal. This must be a dedicated signal, and must be separate from the pre-alarm" signal.
The build-up of dirt or similar contamination on the optical surface will cause the output signal from the detector to gradually change. The control panel shall be capable of monitoring this slow change in signal and at a predetermined level indicate that the detector is in need of servicing.

2.6 PANEL DISPLAY

All display and indicators shall be LCD for text, and LED for lamp indication.
The type, calibration, sensitivity and status of each device must be able to be displayed at the control panel.

The control panel shall be able to physically identify the zone in which each sensor or device address resides, and shall give a "configuration-fault" signal if a sensor or device address is located in the incorrect zone.

Fire indication shall be by zone, displayed on LED indicators, and on the LCD text display.

Fault, maintenance, pre-alarm, and device/zone disabled signals shall be indicated visually by LCD text display, and audibly, in the control unit.

The top portion of the LCD text display shall always show the first alarm received. The lower portion of the LCD text display shall show the last alarm received. It must be possible to manually scroll through all alarms on the lower portion of the screen, using "up" and "down" scroll buttons.

The display must show the total number of alarm events currently in the system.

Fire alarm shall take priority when displaying. However, it must be possible to view all events currently in the system, displayed devices, and other events.

It shall be possible to view the devices, by address, that initiated the alarm on the LCD text display, on manual request. When viewing the device, a 40 character location message specific to each device shall be displayed.

The visual indications must be arranged so that the different warnings are clearly distinguished. (i.e. amber for fault, red for alarm).

The internal audible signal device may be the same for all alarms, but either tone variation or time switching shall be used to differentiate the signals.

Outputs shall be provided for audible alarms, control functions, remote mimics and connection for computers and printers.

The LCD text display must be able to simultaneously display a minimum of the following information in each display mode.

One display mode:

- type of alarm
- 2 zones (first and last)
- alarm count
- total number of alarms
- 40 character zone location message for each zone
- time and date

Device display mode:

- type of alarm
- 2 zones (first and last)
- alarm count
- total number of alarms
- 40 character zone location message for each zone
- time and date

Device display mode:

- loop number, zone number, detector address
- alarm count
- detector in alarm
- alarm type
- active or accepted
- time and date

The LCD must be at least a 160-character display.

2.7 SOFTWARE ALGORITHMS

The data from which sensor must be evaluated by intelligent software algorithms to identify the presence of fire or smoke, and any possible faults present.

The system must support a number of software different algorithms, each tailored to suit the profile of a different hazard or protected area. These algorithms must be specifically matched to provide the optimum protection for each type of area. It must be possible to allocate selected algorithms independently to each sensor in the system. In addition, different algorithms must be automatically allocated to the same sensor at different times.

It must be possible to customise algorithms to take into account special conditions that may exist in certain specific hazards. This customisation should incorporate the features below.

Alarm sensitivity relative to each analogue detector is to be individually adjustable, device by device, by the control panel. Not less than four levels of sensitivity adjustment are required for each device, as follows:

-	smoke sensors	(1)	1.5%/m obs
		(2)	2.5%/m obs
		(3)	3.5%/m obs
		(4)	5.0%/m obs
-	heat sensors	(1)	42 °C
		(2)	58 °C
		(3)	70 °C
		(4)	82 °C

2.8 ALARMS

There shall be no limit to the number of devices which may be in alarm simultaneously.

Every analogue detector must have the facility for verifying the validity of an alarm signal over a 20 second period, before initiating an alarm. This alarm

verification function must be able to be enable or disable, on a device by device basis, from the control panel.

2.8.1 Alarm Outputs

The panel must incorporate two monitored audible alarm outputs for the switching-on of bells of electronic sounders.

These outputs must be continuously monitored for open and short circuit. Each output must be rated at 0.75 A at 24V dc.

It shall be possible to independently display either of the alarm bell output by means of a control push button.

A test facility shall be provided in order to test each of the alarm bell out outputs. When the test is initiated the selected alarm bell will operate intermittently.

Both the alarm bells will have a delay facility which is selected by controls on the front panel. Manual call points will override this delay.

2.8.2 Alarm Contacts

One voltage free change-over contact must be provided. This must operate on a "fire" condition, and is to remain "on" until the system is reset.

The contacts are to be rated 2 A at 24 V dc.

2.8.3 Double-Knock (Coincidence) Operation

It shall be possible to programme any of the control outputs or addressable relays to operate upon an alarm from any two sensors in the programmed group.

2.8.4 Silencing Operation

It shall be possible to programme any of the control outputs or addressable relays to operate in either "silencing" mode or "non-silencing" mode.

In "silencing" mode the relay or outputs shall de-activate when the "alarm accept" button is pressed, or when the "reset" button is pressed, or when the "reset" button is pressed.

In "non-silencing" mode, the relay or output shall be de-activated only when the "reset" button is pressed.

2.9 ACTIVATION DELAY

It shall be possible to programme any of the control outputs or addressable relays to activate after a delay period from receipt of the control signal.

This delay shall be 0-16 minutes, in one second increments.

2.10 DISCRIMINATION

The alarm sound shall be distinct from background noise or any other sounders likely to be heard, and in particular should be distinct from the audible fault warning signal given in the control panel. All fire alarm sounders (including high powered sounders) withing a building should have similar sound characteristics.

If appointed Contractor cannot obtain high powered sounders with the same characteristics as normal the sounder/strobes, then only the sounder/strobes should be installed as indicated in the construction drawing.

2.11 INTERFACING TO DETECTION SYSTEM

Sounder/strobes shall normally be loop powered and comply with the abovementioned specifications. Where high volume, high powered sounder/strobes are specified, these devices shall be complete with power supply, relay unit for activating the sounder/strobe and shall be red in colour.

2.12 SOFTWARE CONTROL

All the above functions, shall be under software control, and programmed through the panels keyboards or by means of a computer.

It must be possible, as an option, to programme the panel off-line on a computer, and download the programme into the panel.

It must be possible to save the programme to disk for future reference.

2.13 REMOTE PANEL OUTPUTS

An optional serial port shall be provided for connecting to remote panels and computers.

The remote units must have the following display and controls:

Remote 160 character LCD text display which repeats all events being displayed on the panel display.

- numeric keyboard
- system reset button
- alarm accept button/silence alarm button
- alarm sound button
- panel buzzer "mute" button
- lamp test function
- "help" button
- control buttons as required for system operation
- menu functions for maintenance and commissioning

2.14 PROCESSOR MONITORING

The panel must be provided with fault tolerance enabling monitoring and resetting of the microprocessor in the event of microprocessor failure. For diagnostic purposes, a counter must allow the viewing of the incidents that the processor has been reset by the system. This information must be stored in non-volatile memory, enabling it to be viewed even if the panel has been turned off. The counter must only be able to be reset by an authorised Engineer, under a level 3 access code.

The microprocessor must perform full diagnostic tests on all memory devices on start-up, as follows:

RAM Test	(running data)
EPROM Checksum Verification	(programme storage)
EEPROM Checksum Verification	(site configuration storage)

Should any test fail an audible and visual fault indication must be given, and the LCD display must indicate the nature of the fault.

The control unit shall perform periodic checksum tests, at intervals not exceeding 60 minutes, on the RAM, EPROM, EEPROM memories, and give and audible, visual, and LCD text fault indication in the event of a discrepancy.

It must be possible to view the original and current checksums for all memories on the panel LCD display, as a maintenance (Level 2) function.

In the event of a fault condition where the processor will not restart within 20 seconds, the panel must give an audible and visual alarm indication.

2.15 SYSTEM MAINTENANCE

The control panel shall keep statistics for each of the system sensors. These statistics shall be able to be displayed on demand by a level 2 operator.

The following statistics shall be displayed:

- maximum value attained by the sensor as well as the date and time.
- the minimum value attained by the sensor as well as the data and time.
- the average idle value attained by the sensor.
- communication error rate

It shall be possible to put up to 1 Zone (20 detectors) in soak test mode. Sensors in soak test mode will log their conditions in the vent buffer without raising fire alarms. It shall be possible to display or printout the result of the soak-test.

3 DETECTOR BASES

Sensors must plug into separate mounting bases with a twit-lock action. The bases shall be fitted with corrosion resistant connector springs and terminal screws with captive clamping plates.

All bases shall incorporate a concealed security lock to prevent unauthorised removal of tampering with sensors. It shall be possible to activate the security lock in areas where required. With the security lock activated, it must only be possible to remove a sensor from its base using a special tool.

There shall be a facility on the base for attaching a label indicating the address of that detector. A similar facility shall be available on the detector, enabling the fitting of a label indicating its address. When the detector is fitted to its base, both the detector and base address labels shall be visible, and aligned adjacent to each other.

4 REPEATER PANELS

Repeaters shall be available for monitoring the status of the fire panel from another location, like a gate house or entrance of a building. One type of repeater panel shall be available:

- Network Repeater that can be connected to a network of control panels to view multiple panels

It shall be possible to connect the network repeater using the following:

- Dual serial RS422 connection with copper cable.
- Dual TCP-IP connection. The TCP-IP network card shall ideally have on-board Wi-Fi and Bluetooth technology to enhance connectivity.
- Dual fibre-optic connection. The fibre-optic network card shall support both single mode and multi-mode fibre-optic cable.

The above cards shall be from the same manufacturer as the control panels and repeaters and shall form an integral part of the panel and repeater when installed. Third party type convertors shall not be acceptable.

All panel networking and repeater connections shall be as per manufacturers' recommendations.

5 ANALOGUE ADDRESSABLE DETECTORS

5.1 HIGH SENSITIVITY 'OPTICAL' SMOKE DETECTION

High sensitivity LED Optical '**Scatter Chamber Detectors'** (SCD's) shall be provided within **the Pro-Point Plus** detector to each of the connected sampling ports, providing high sensitivity smoke detection per pipe. Each SCD smoke sensor shall identify the visible smoke particles generated as material over-heats.

The optical measurement scale is %obscuration per meter (%obs/m) and provides the 'Smoke' detection element of the **Pro-Point Plus** detector.

5.1.1 Submittals

Product data and site drawings shall be submitted and shall include pipe layout, operational calculations and performance criteria.

A copy of the manufacturer's installation, operation and maintenance manuals shall be supplied upon completion of the installation.

System commissioning data shall be supplied (in a format recommended by the manufacturer and per the instructions provided by the manufacturer) within 30 days of completion of the installation.

5.1.2 Quality Assurance

Qualifications

Manufacturer

- The manufacturer shall have a minimum of 15 years production experience in the manufacture and design of high sensitivity air sampling smoke detection systems.
- The manufacturer shall be certified as meeting ISO 9001:2008 for manufacturing.

Technology

The Laser Detection Chamber shall be of the mass Light Scattering type and capable of detecting a wide range of smoke particle types of varying size.

A smoke-hours method shall be used for the purpose of monitoring contamination of the filter (dust & dirt etc.) to automatically notify when maintenance is required.

The Laser Detection Chamber shall incorporate a separate secondary clean air feed from the filter; providing clean air barriers across critical detector optics to eliminate internal detector contamination.

The detector shall not use adaptive algorithms to adjust the sensitivity from that set during commissioning. A learning tool shall be provided to ensure the best selection of appropriate alarm thresholds during the commissioning process.

Equipment Supplier

The equipment supplier shall be authorized and trained by the manufacturer to calculate/design, install, test and maintain the air sampling system and shall be able to produce a certificate stating such on request.

5.1.3 Detector Assembly

The Detector, Filter, Aspirator and Relay Outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk area and a sample passed through the Dual Stage Filter and Detector by the Aspirator.

The Detector shall be laser-based type and shall have an obscuration sensitivity range of 0.0025-20% obs/m.

The Detector shall have four independent field programmable smoke alarm thresholds across its sensitivity range with adjustable time delays for each threshold between 0-60 seconds.

The detector shall also incorporate the facility to transmit a fault either via a relay.

The detector shall have a single pipe inlet that must contain an ultrasonic flow sensor. High flow fault (urgent and non-urgent) and low flow fault (urgent and non-urgent) can be reported.

The filter must be a two-stage disposable filter cartridge. The first stage shall be capable of filtering particles in excess of 20 microns from the air sample. The second stage shall be ultra-fine, removing more than 99% of contaminant particles of 0.3 microns or larger, to provide a clean air barrier around the detector's optics to prevent contamination and increase service life.

The aspirator shall be a purpose-designed aspirator assembly.

When using pre-engineered sampling pipe networks shall be capable of supporting combined sampling pipe length up to 100m with a transport time per applicable local codes. Custom sampling pipe network designs shall be supported using calculation software.

The assembly must contain relays for basic alarm and fault conditions. The relays shall be software programmable (latching or non-latching). The relays must be rated at 1A at 30 VDC.

The assembly shall have built-in event and smoke logging. It shall have separate event log storage for smoke levels, alarm conditions, operator actions and faults.

The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 128 events on a First In First out (FIFO) basis.

5.1.4 Displays

- The detector will be provided with LED indicators and Touchscreen display.
- Each Detector shall provide the following features at a minimum:
  - Alert, Action, Fire 1 and Fire 2 corresponding to the alarm thresholds of the detector.
  - Circular Smoke Dial display to represent the level of smoke present in protected area.
  - Fault indicator.
  - Power indicator.
  - Disabled indicator.
  - Buttons supporting the following features shall be accessible to authorized personnel:
    - Reset – (press and release) un-latches all latched alarm and faults.
    - Disable – (press and release) disables the fire relay outputs from actuating and indicates a fault.
    - Test – (press and release) simulates a Fire 1 condition.

5.1.5 Digital Communication Port

- An RS485 compatible serial port will be provided on the detector for configuration, status monitoring, command input, event log extraction and software upgrades. It shall comply with EIA RS485Protocol.
- The unit shall support an Open Detector Control Protocol (ODCP) for connection to 3rd party embedded devices. The ODCP shall provide the following:
  - Alarm Status for all VLF alarm levels
  - Current smoke level
  - Current flow level (% flow and litres/min)
  - Detector state (Running, Disable & Standby)
  - Fault Status
  - Remaining Days for Filter Life
  - Smoke Threshold levels

- Detector's product ID (serial number)
- Reset
- Disable
- Standby
- Normalise

5.1.6 Application

Detection Alarm Levels

The standard laser based air sampling detection system is supplied with two alarm relay outputs (Alert and Fire 1). For four-relay alarm levels use the optional relay interface card.

The standard alarm outputs may be used as follows:

- Alert (Alarm Level 1)

Activate a visual and audible alarm in the fire risk area.

- Action (Alarm Level 2)

Activates the electrical/electronic equipment shutdown relay and activates visual and audible alarms in the Security Office or other appropriate location.

The additional alarm outputs, with the optional relay interface card may be used as follows:

- Fire 1 (Alarm Level 3)

Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.

- Fire 2 (Alarm Level 4)

Activate a suppression system and / or other suitable countermeasures (e.g. evacuation action or shutdown of systems).

5.1.7 Initial Detection Alarm Settings

Initial settings for the alarm levels shall be determined by the requirements of the fire zone. Default settings of the unit shall be:

- Alarm Level 1 (Alert) 0.08% obs/m (0.0025% obs/ft)
- Alarm Level 2 (Action) 0.14% obs/m (0.0448% obs/ft)
- Alarm Level 3 (Fire 1) 0.20% obs/m (0.0625% obs/ft)
- Alarm Level 4 (Fire 2) 2.0% obs/m (0.625% obs/ft)

Initial (Factory Default) Alarm Delay Thresholds

Initial (factory default) settings for the alarm delay threshold shall be:

- Alarm Level 1 (Alert) 10 seconds
- Alarm Level 2 (Action) 10 seconds
- Alarm Level 3 (Fire 1) 10 seconds
- Alarm Level 4 (Fire 2) 10 seconds
- Fault Alarm 5 seconds

5.1.8 Fault Alarms

The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The fault relay shall also be connected to the appropriate control system.

5.1.9 Power Supply And Batteries

The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition in accordance with EN 54: Part 4.

5.1.10 Sampling Pipe Design

Sampling Pipe

The installation contractor shall ensure that the proposed air sampling system design for the area(s) to be protected, complies with the recommendations and product approvals, with regard to the maximum number of sample points, maximum lengths of sampling pipes and the maximum area of coverage per sampling point and / or detector.

The sampling pipe network design for each installation must be approved by the Engineer. The design details given to the aspirating system designer shall indicate materials of construction, sampling pipe type, size and lengths together with 'Sampling Point' and 'Capillary Sampling Point' hole spacing and size.

Any significant design deviation may alter the operation of the system and therefore any adjustment of the air sampling network design must be approved by the fire Engineer.

The installation contractor shall ensure that the aspirating system sampling pipe work configuration is confirmed as acceptable using the applicable sampling pipe calculation program. The calculation program shall determine the transport times, airflow and balance details for each individual sampling pipe and sampling point.

The maximum 'transport time' must not exceed 120 seconds or 60 seconds (Class A response time) from the furthest sampling point on the pipe work system to the aspirating detector.

Where appropriate the installation contractor shall include within their design / installation sampling pipe 'test points'. These will be installed at the end of each sampling pipe run after the last sampling point. These test points are provided for future system servicing and to test the integrity of the sampling pipe from the furthest point back to the aspirating detector. Test points should be located within accessible and secure areas to prevent tampering by unauthorised personnel. Please note that it is not a requirement for the sampling pipe test point to comply with the maximum transport time of 120 seconds or 60 seconds (Class A response time).

The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm and internal diameter (ID) of 21mm shall be used.

The pipe material should be suitable for the environment in which it is installed, or should be the material as required by the specifying body (UL 1887 Plenum rated CPVC).

All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.

The pipe shall be identified as Air Sampling / Aspirating Smoke Detector Pipe (or similar wording) along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.

All pipes should be supported at not less than 1.5m centres, or that of the local codes or standards.

The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on detailed calculations.

All sampling pipes shall be red in colour.

5.1.11 Sampling Holes

Sampling holes shall not be separated by more than the maximum distance allowed for conventional point detectors as specified in the local codes and standards. Intervals may vary according to calculations.

Each sampling point port shall be identified.

Consideration shall be given to the manufacturer's recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.

Sample port size shall be as specified by detailed calculations.

5.1.12 Installation

The Detection system

The contractor shall install the system in accordance with the manufacturer's System Design Manual.

The Capillary Sampling Network

Where false ceilings are installed, the sampling pipe shall be installed above the ceiling, and Capillary Sampling Points shall be installed on the ceiling and connected by means of a capillary tube.

The typical internal diameter of the capillary tube shall be 5mm, the maximum length of the capillary tube shall be 8m unless the manufacturer in consultation with the Engineer have specified otherwise.

The Capillary tube shall terminate at a Ceiling Sampling Point specifically designed and approved by the manufacturer. The performance characteristics of the Sampling Points shall be taken into account during the system design.

Air Sampling Pipe Network Calculations

For specific performance requirements that fall outside the pre-engineered designs, a sampling pipe aspiration-modelling program shall provide air sampling pipe network calculations. Pipe calculations shall be supplied with the proposed pipe layout design to indicate the following performance criteria:

- **Transport Time**

Wherever possible the transport time (i.e. the time taken by smoke sampled to reach the detector) for the least favourable sampling point shall be less than 60 seconds for open hole sampling and less than 90 seconds for capillary tubes.

- **Balance %**

The sample point balance for the pipe shall not be less than 70%. That is, the volume of air drawn from the last sampling point shall not be less than 70% of the average volume of air through the other holes.

5.1.13 Commissioning Tests

The contractor shall allow for the manufacturer's representative to attend commissioning of the entire installation in the presence of the owner and/or its representative.

All necessary instrumentation, equipment, materials and labour shall be provided by the Contractor.

The Contractor shall record all tests and system calibrations and a copy of these results shall be retained on site in the System Log Book.

A wire burn test would be required during the commissioning and handing-over of the HSSD systems and should be demonstrated to the Engineer and client.

System Checks

Visually check all pipes to ensure that all joints, fittings, bends, sampling points, etc., comply with the Specification.

Check the system to ensure the following features are operational and programmed in accordance with the specification.

- Alarm threshold levels (for both day and night settings),
- Detector address,
- Time and date,
- Time delays,
- Air flow fault thresholds,
- External buttons operable (Reset / Disable / Test / Instant Fault Finder, AutoLearn Smoke and AutoLearn Flow),
- Referencing (if VESDAnet card is used)
- Units set to U.S./S.I. (for US only) or metric for other regions

Check to ensure that all ancillary warning devices operate as specified.

Check interconnection with Fire Alarm Control Panel to ensure correct operation.

Set smoke thresholds

5.2 POINT-TYPE OPTICAL SMOKE DETECTORS

Optical smoke sensors must comply with standard EN 54.

Optical smoke sensors will be suitable for detecting invisible products of combustion as well as visible smoke and be of the dual chamber source type to provide good stability in changing environmental conditions.

The detector shall be capable of operating within the following environmental limits:

Description	Value
Temperature operating range	–20°C to +60°C
Humidity operating range	0% to 95% RH

Description	Value
	(excluding condensation)
Wind	Up to 10 m/s

The detector shall be capable of protecting an area up to 100m² at a height of up to 12m. The installation and siting of the sensors must conform to the latest revision of SANS 10139

5.2.1 Key features

- Optical technology - responds quickly to slow smouldering fires
- CE marked
- Designed for use with the Firewatch single and two loop fire alarm panels
- Self- extinguishing white polycarbonate case
- Unaffected by wind or atmospheric pressure
- Supply voltage: 17 to 28 Volts dc
- Operating temperature: -20°C to +60°C
- IP23D rating

5.2.2 Approvals / Certifications

- Certified to EN54 – 7 by the LPCB
- Loss Prevention Certification Board (LPCB) and VdS approved.

5.3 ANALOGUE ADDRESSABLE HEAT DETECTORS

Heat sensors shall comply with standard EN 54-5 (1996).
The heat detector shall be electronic in operation and shall monitor ambient temperature by means of a NTC thermistor.

The detector shall be capable of operating within the following environmental limits.

Description	Value
Temperature operating range	–20°C to +60°C.
Humidity operating range	0% to 95% RH (excluding condensation)
Wind	Not affected

Each detector shall be suitable for protecting an area up to 50m² at a height of up to 7.5m. The installation and siting of the sensors shall be carried out on accordance with SABS 0139.

5.4 OEPN AREA SMOKE IMAGING DETECTORS (OSID ONLY)

Open Area Smoke Imaging Detectors (OSID) are to comply with EN 54 and meet the following performance criteria:

Description	Value
Maximum detection range	Up to 150 meters
Status LEDs	Fire, trouble and power
Interrogation	Dust and intrusive solid-object rejection
Alignment	Easy alignment with large adjustment and viewing angles
Configuration	DIP switch configuration
Alarm thresholds	Configurable

5.4.1 Key Features

- High tolerance to building flex and vibration.
- Dual wavelength LED-based smoke detection. (UV and IR Wavelengths Spectrums)
- Limited maintenance requirements.
- Configurable alarm thresholds

6 LOOP POWERED SOUNDER/STROBE

Every warning device shall be a combined siren/strobe unit and installed in accordance with the attached drawing.

The loop sounder/strobe shall connect directly to the analogue addressable loop with its own unique address. The sounder shall be able to be operated in a continuous or pulsed mode. It shall be possible to connect 32 sounders to an analogue addressable loop. The loop sounder shall have an output of 85 dB (A) at 1 metre at a current consumption of only 3 mA. The unit shall be able to be

supplied as a sounder base, or a sounder base with cap, for use as a standalone sounder.

7 INTERFACE WITH OTHER SYSTEMS

The loop shall be capable of receiving information from third-party systems, e.g. operation of Sprinkler flow switch, by means of standard interface units. The source of this information shall be identified by its own unique address. In addition, the interface unit shall indicate to the panel the type of alarm, e.g."sprinkler activated", etc.

The system must be able to support optional relays. Each relay must be software programmable and must be able to be allocated to a loop device, a zone, fire alarm, fault or coincide operation.

The operation relays must be able to be allocated in a different grouping or the same grouping as the zones. Each optional relay shall have a change-over-free contact rated at 2A at 24V DC

8 INPUT/OUTPUT

The input/output unit shall provide a programmable voltage-free, single pole, change-over relay output; a single, monitored switch input and an unmonitored, non-polarised opto-coupled input. The unit shall be loop-powered and operate at between 14-28 VDC.

9 MANUAL CALL POINT

Manual call points shall be installed at all exits and stairwell exits from each floor and every exit to fresh air on the ground floor as indicated in the drawing.

All manual call points shall be red in colour and mounted at 1400mm from the floor and one should not walk more than 45 meters without finding a manual call point.

9.1 Key Features

- Anti-Tamper facility
- Integral Short Circuit
- Re-settable Break Glass Element
- Backward Compatibility
- Fully Approved to the latest Standards

10 REVIEW OF ELECTRICAL COMPONENTS

(a) All wiring systems shall be properly installed in compliance with the appropriate national standard and the system drawings. AC and DC wiring shall not be combined in a common conduit unless property shielded and grounded.

(b) All field circuitry shall be tested for ground fault and short circuit condition. When testing field circuitry, all electronic components (such as smoke and flame detectors or special electronic equipment for other detectors, or their mounting bases) shall be removed and jumpers properly installed to prevent the possibility of damage within these devices. Replace components after testing the circuits.

(c) Adequate and reliable primary standby sources of energy which comply with 6.4 shall be used to provide for operation of the detection, signalling, control and actuation requirements of the system.

(d) All auxiliary functions (such as alarm sounding or displaying devices, remote annunciators, air handling shutdown, power shutdown, etc.) shall be checked for proper operation in accordance with system requirements and design specifications.

Alarm devices shall be installed so that they are audible and visible under normal operating and environmental conditions.

Where possible, all air-handling and power cut-off controls should be of the type that once interrupted require manual restart to restore power.

(e) Check that for systems using alarm silencing, this function does not affect other auxiliary functions such as air handling or power cut-off where they are required in the design specification.

(f) Check the detection devices to ensure that the types and locations are as specified in the system drawings and are in accordance with the manufacturer's requirements.

(g) Check the manual release devices are properly installed, and are readily accessible, accurately identified and properly protected to prevent damage.

(h) Check that all manual released devices used to release extinguishants require two separate and distinct actions for operation. They shall be properly identified. Particular care shall be taken where manual release devices for more than one system are in close proximity and could be confused or the wrong system actuated. Manual release devices in this instanced shall be clearly identified as to which hazard enclosure they protect.

(i) Check that for systems with a main/reserve capability, the main/reserve switch is properly installed, readily accessible and clearly identified.

(j) Check that for systems using hold switches requiring constant manual force, these are properly installed, readily accessible within the hazard area and clearly identified.

(k) Check that the control panel is properly installed and readily accessible.

10.1.1 Preliminary Functional Test

(a) Where a system is connected to a remote central alarm station, notify the station that the fire system test is to be conducted and that an emergency response by the fire department or alarm station personnel is not required. Notify all concerned personnel at the end-user's facility that a test is to be conducted and instruct them as to the sequence of operation.

(b) Disable or remove each extinguishant storage container release mechanism and selector valves, where fitted, so that activation of the release circuit will not release extinguishant. Reconnect the release circuit with a functional device in lieu of each extinguishant storage container release mechanism.

For electrically actuated release mechanisms, these devices may include suitable lamps, flash bulbs or circuit breakers. Pneumatically actuated release mechanisms may include pressure gauges. Refer to the manufacturer's recommendations in all cases.

(c) Check each resettable detector for proper response.

(d) Check that polarity has been observed on all polarized alarm devices and auxiliary relays.

(e) Check that all required end-of-line devices have been installed.

(f) Check all supervised circuits for correct fault response.

10.1.2 System Functional Operation Test

(a) Operate the detection initiating circuit(s). All alarm functions shall occur according to the design specification.

(b) Operate the necessary circuit to initiate a second alarm circuit if present. Verify that all second alarm functions occur according to design specifications.

(c) Operate the manual release device. Verify that manual release functions occur according to design specifications

(d) Where appropriate, operate the hold switch. Verify that functions occur according to the design specifications. Confirm that visual and audible supervisory signals are received at the control panel.

(e) Check the functional all resettable valves and activators, unless testing the valve will release extinguishant.

"One-Shot" valves, such as those incorporating frangible discs, should not be tested.

(f) Check pneumatic equipment, where fitted, for integrity to ensure proper operation.

10.1.3 Remote Monitoring Operations (If Applicable)

(a) Disconnect the primary power supply, then operate one of each type of input device while on standby power. Verify that an alarm signal is received at the remote panel after the device is operated. Reconnect the primary power supply.

(b) Operate each type of alarm condition and verify receipt of fault condition at the remote station.

10.1.4 Control Panel Primary Power Source

(a) Verify that the control panel is connected to a dedicated unswitched circuit and is labelled properly. This panel shall be readily accessible, but access shall be restricted to authorized personnel only.

(b) Test a primary power failure in accordance with the manufacturer's specification, with the system fully operated on standby power.

10.1.5 Completion of Functional Test

When all functional tests are completed, reconnect each storage container so that activation of the release circuit will release the extinguishant. Return the system to its fully operational design condition. Notify the central alarm station and all concerned personnel at the end-user's facility that the fire system test is complete and that the system has been returned to full service condition by following the procedures specified in the manufacturer's specifications.

11 COMPLETION CERTIFICATE AND DOCUMENTATION

The installer shall provide to the end user a completion certificate, a complete set of instructions, calculations and drawings showing the system as-installed, and a statement that the system complies with all the appropriate requirements of this part of ISO 14520, and giving details of any departure from appropriate recommendations. The certificate shall give the design concentrations and, if carried out, reports of any additional test including the door fan test.

11.1 PROGRAMME

By completing the tender documents, the Contractor confirms that he is able to meet the dates set out in the Preliminaries. Any uncertainty should be resolved with the Engineer prior to tender submission.

11.2 SUBMISSION OPTIONS

All equipment and installation by Contractors are to comply fully with the following standards:

- SANS 10139; and
- Applicable EN 54 standard

12 VOICE EVACUATION SYSTEM

Note: The quoted system shall comply with the following standards: SANS 7240 parts: 4 and 16 (ISO 7240-4, -16, 24); EN 54 parts: 4, 16 and 24; and/or BS 5839 part 8, whichever one applies, as specified below. Certification to be provided, where indicated.

Further, the standards SANS 10139 and SANS 10400-T: 2020 Edition 4 shall be adhered to.

Note: While this specification is based on the preferred **TOA voice evacuation system**, there is nothing preventing the Contractor from offering equipment which performs equal to or better than the equipment specified.

12.1 STANDARD OF COMPLIANCE - KEY ELEMENTS

The quoted system shall comply to the EN 54 standard, as specified below:

- All-call emergency evacuation. Includes all zones.
- Automated emergency evacuation per individual zone.
- Built-in voice/tone alarms from pre-recorded messages.
- 2-phased voice alarm message broadcasting (alert and evacuation), but not simultaneously.

12.1.1 Relevant Safety Elements and Features of the System:

- All-call emergency evacuation. Includes all zones
- Automated emergency evacuation per individual zone
- Built-in voice/tone alarms from pre-recorded messages
- 2-phased voice alarm message broadcasting (VM-3000),
- (signal and voice) per channel, and two message channels sequentially (alert and evacuation)
- Fireman's Microphone, built into the master amplifier (VM-3000)

- Remote fireman's microphone
- Remote and built-in fireman's microphones capsule fault detection
- the fireman microphones' capsule is included in the signal path's fault detection
- Critical signal path fault detection
- from microphone capsule to the last speaker on any speaker line
- Continuous speaker line monitoring
- without interruption of BGM distribution or paging announcements
- Automatic log-bookkeeping, internal, review via LAN connection on external PC
- Power Supply and Battery backup
- with automatic and seamless switch over between AC and DC, according to EN 54 part 4
- VRLA (vent regulated lead acid) batteries
- Flame retardant according to UL94V-0 or UL94HB, and compliant to EN 50272-2, EN 60896-2
- Speaker cable supplied having been tested in accordance with EN 50200, class PH30. I.e. having a fire duration of survival of 30 minutes at 830°C surrounding temperature
- Standby amplifier(s)
- Speakers equipped with thermal fuse (72°C or higher)
- Speakers equipped with fire resistant terminal block
- Speakers equipped with steel fire dome
- Separate zone for stairways

The various components are fully integrated into one system, from where the main processor head end device surveys and controls the entire setup, reporting to the internal data logbook all occurrences within the system as well as indicating on the front panel via LEDs. The system shall be connected to an external fire panel for receiving alarm signals and respond accordingly. The voice alarm system (VAS) to understand simultaneous triggers from the fire panel and relate them to the respective zones, regarding evacuation and/or alert.

The various components are to be fully integrated into one system, from where the main processor headend device surveys and controls the entire system, reporting to the internal data logbook and touch screen console all occurrences within the system as well as indicating on the front panel via LEDs. The system is to be connected to an external fire panel, for receiving alarm signals and reacting accordingly.

12.2 DESIGN CRITERIA

The system is to be designed for "Automated Voice Emergency Evacuation", paging included, BGM possible. Fully integrated system, according to key element schedule, as listed earlier on.

Fully compliant with EN 54.

The "Automated Emergency Voice Evacuation System" shall:

- be a fully integrated voice evacuation system,
- contain all components and features within one manufacturers system,
- not rely other vendors' or manufacturers' devices,
- in order to analyse and report on all safety standard features build-in as listed above,
- be interconnected to a fire panel for receiving alarm signals relating to fire and evacuation signalling.
- has to be interconnected to a fire panel for receiving alarm signals relating to fire and evacuation signalling.

A build-in protocol is to be available to access the internally stored data from an external personal computer, such as status and system information, as well as control of the outputs and reading of the inputs.

12.2.1 Sound Pressure Level

The Sound Pressure Level (SPL) of the alarm message(s) in each zone shall be of good coverage. The emergency message signal shall broadcast at 10dB SPL above ambient noise, as per ISO/SANS 7240-19 or BS 5839-8 Standard.

12.2.2 Number of zones

The Voice Alarm System VAS (Emergency Voice Evacuation System) is designed for **(12) zones.**

12.3 SYSTEM DESCRIPTION

12.3.1 Sound Pressure levels of speakers

The following sound pressure levels shall be obtainable from the proposed loudspeakers at the following parameters.

SPL at 1m distance, power input as specified.

Voice alarm system:

- Ceiling speakers: [6W, 1m]: 102dB SPL
- Wall mount speakers: [6W, 1m]: 102dB SPL

- Horn speaker: [15W, 1m]: 121dB SPL
  Sound reinforcement systems:

12.3.2 Speakers and Cabling

Above speakers to be compliant, tested and certified in accordance to the relevant Standard, i.e. EN 54-24 and/or BS 5839-8, as per schedule on pages 1 and 2. Certification has to be presented in the tender document.

If the speakers are assembled in accordance to above standards but not certified, the Contractor has to make the consultant aware of this fact, so it can be considered during the material and information equipment data review.

Speaker wiring has to be chosen such that not more than 10% power loss occurs over the cable in total, in order to conduct as much amplifier power to the speakers for full sound volume and minimal loss of sound pressure level. The speaker cable has to adhere to the Standard BS EN 50200.

The Sound Pressure Level (SPL) in each zone shall be of good coverage and between +6 and +10 dB SPL above ambient noise.

12.3.3 Amplifier wattage

The Voice Alarm System VAS (Emergency Voice Evacuation System) is designed for (12) zones, of which its power requirements are to be satisfied by the respective amplifier(s) quoted in the technical specification list at the end of this document, and leaving enough headroom for more speakers to come in the future, without exhausting the existing amplifier capacity.

Please consider in your calculations the sensitivity of the speakers you propose (please see above), as well as the necessary sound pressure level (SPL in decibel) required per respective area and zone (please see above Design Criteria – Sound Pressure Level).

12.3.4 Microphones

Fireman's Microphone integrated into the front panel of the master amplifier (VM-3000)

The Remote Paging Microphone (incorporating 10 extension buttons), with 10-button extension keypad, shall be desk mounted as per instruction by the Consulting Engineer.

12.3.5 Emergency Broadcasting

Broadcasting automatically (pre-recorded messages) or manually. Individually per zone, group of zones or all call.

Broadcasting of pre-recorded emergency messages to occur not simultaneously but sequentially, first the evacuation message in the emergency zone(s), then following the alert message in the neighbouring zone(s).

Additionally, each broadcast may contain two or more messages, or an attention drawing signal first and then followed by an announcement, etc.

12.3.6 Standby Amplifier(s)

The standby amplifiers to take over the respective failing amplifier/s in the system.

Per each group of maximum ten operating amplifiers, one standby amplifier has to be provided, with the same or more signal power then the largest operational amplifier out of the ten.

12.3.7 Speaker/Amplifier Wiring

Each operational amplifier for PA/EVAC to provide single line output speaker connection.
The loudspeaker lines to utilise impedance matching between the amplifier's transformer output and the group of parallel switched loudspeaker transformer inputs. The high impedance speaker line shall utilise a 100V system.

12.3.8 Battery Backup

The following rating has to be sufficed:

- 24 hours system standby time, plus
- 30 minutes evacuation period under full speaker load.

The battery capacity provided has to be sufficient for the chosen system to stay operational for the above periods of time. Calculation of the battery capacity to be in compliance with Standards BS 5839 part 8.

Above battery backup is required for the 'Automated Emergency Voice Evacuation System', including the fireman microphone(s) and remote paging microphone(s). Further, the emergency power supply itself, including battery backup, is powered via the general power grid. Correct circuit breaker rating to be considered and supplied.

Those components of the system that are not directly part of the emergency evacuation system are to be supplied with electrical power via the general power grid, and backed up by UPS and/or emergency generator.

Accessories:

Equipment rack(s) with accessories, complete, to be provided, containing all head-end equipment, battery backup, etc.

12.3.9 Warranty and Support

Local warranty valid in South Africa to be considered, when sourcing all items.

Commercial and technical support has to be available within South African borders.

Warranty has to be maintained for at least two(2) years after handover, plus technical support from the manufacturer to be available for at least the following ten (10) years.
The equipment and individual components shall be available from the manufacturer for at least ten (10) years, and spares and spare parts shall be available for at least seven (7) years after discontinuance of the product range.

12.3.10 Rack building, setup, test and commissioning

The rack(s) and system to be factory build, configured, setup and tested. Test certificate to be supplied.

Commissioning to happen on site, handover and commissioning certificate to be supplied.

12.3.11 Certification

The complete system has to be compliant and certified in accordance to EN 54 parts 4, 16 and 24, and all other relevant Standards, as previously mentioned.

Certification has to be presented in the tender document.

If certification does not exist, the Contractor has to make the consultant aware of this fact, so it can be considered during the material and equipment data review.

In addition to the system proposed, the Letter of Authority (LOA) supplied by the National Regulator for Compulsory Specifications (NRCS) of South Africa must be provided, thereby proving that the product is authorised to be imported into South Africa and be connected to the electrical mains grid of the local electricity supplier. Submissions, without the relevant LOA certificate included with the tender proposal, will not be considered and deemed disqualified.

13 EMERGENCY VOICE COMMUNICATION SYSTEM

13.1 Description

The Emergency Voice Communications System is designed to fully comply with BS5839 - Part 9: 2003 for use as a Disabled Refuge Call system.

The Emergency Voice Communications System is fixed, secure, bi-directional, full duplex voice communication system to assist fire fighters in an emergency in high rise buildings or large sites where Radio communication may not work and covers the operation of disabled refuge systems.

The Emergency Voice Communications System comprises of three functional blocks, the master handset, the nine-line Exchanges and outstations, with the quantities of these basic units being adjusted to suit the application. Using network communications combined with subscriber line telephone techniques, The Emergency Voice Communications System provides large-scale cable savings, while not requiring a dedicated rack room to house a central exchange.

13.2 Cable Requirements

Any system with Fire Fighting Telephone (Normally Type A Outstation) must have all wiring to the outstations and any necessary network cables interconnecting parts of the system in Enhanced fire rated cables.

14 SYSTEM OPERATION AND EVACUATION STRATEGY

14.1 Detection Strategy

The entire building/precinct will be protected and monitored by a networked analogue fire detection system which will be integrated with an emergency voice evacuation system. The proposed fire detection system will consist of a number of addressable fire detection control panels networked together throughout the building that would provide the required detection protection and will control the required triggers to the emergency voice evacuation system to each block.

14.2 Fire Alarm Control Panel

There shall be addressable analogue fire control panel provided for each block. These fire control panels shall be interconnected by a network which will serve as a data highway. Some sub-panels will simply act as data gathering panels and provide no indication whiles others will be fully functional control and

indicating panels, configured so as to "**stand-alone"** and continue to operate normally in the event of a failure of the communication link between sub-panels. The network shall be via a fibre cable in which the operation of the panels will be peer-to-peer feeding all information data to the panel located in Block 4 inside the control room. Networked panels which the communication link forms a critical signal path will comprise of a loop or ring system for more resiliency to network failure.

14.3 Evacuation Strategy

A **Phased Evacuation Strategy** will be utilised. In order to achieve this, it will be necessary to break the building down into detection zones and alarm zones.

14.4 Fire Detection Zones

To direct those responding to a fire alarm signal to the affected area, particularly the emergency fire services, the building will be divided into **detection zones per block**. This is also done in order to make it easier for the operator/user to identify any faults in the system quicker. Each zone has been limited to a floor area of **2000m²** as specified in SANS 10139: 2021.

Also, all automatic fire detectors installed within enclosed stairwell will be considered as separate detection zones.

14.5 Alarm Zones

A separate evacuate signal shall be provided for each alarm zone. On operation of manual call point or automatic fire detectors, the emergency voice evacuation system will operate in sequence as per the configured phased evacuation strategy. Because this is a large complex building all the staircases are not sized to accommodate a simultaneous evacuation, the '**Evacuate Signal'** will first be sent on the effected zone whiles other areas such as the floor above and below or the other block will receive an '**Alert Signal'**.