VESDA VLF-500 ENGINEERING SPECIFICATIONS



VLF-500

May 2023

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# Scope

This document provides specification details of the VESDA VLF-500 Air sampling Smoke Detection (ASD) products to assist in their installation and commissioning.

# System Information

## General

A Very Early Warning Smoke Detection System similar to the VESDA VLF-500 System shall be installed throughout the areas nominated on the drawings.

The system consists of highly sensitive laser-based smoke detector using aspirated air sampling and is connected to sampling pipes. It shall be provided with a single sample pipe inlet, internal flow monitoring, smoke detection and a facility for exhaust pipe connection. Reset, disable, test and fault determination functions will be available via the field service access door. System configuration will be provided through AutoLearn Smoke and Flow functions, also available via the field service access door.

The system shall support pre-engineered sampling pipe network designs with verified calculations in addition to custom sampling pipe network designs using a computer-based design modelling tool. Sampling pipe material shall be UL 1887 approved for use in air sampling smoke detection systems

## Approvals

The Very Early Warning Smoke Detection System must be of a type submitted to, tested, approved, and/or listed by a Nationally Recognized Testing Laboratory (NRTL) as follows:

* UL
* ULC
* CCC
* FM Class I Div II
* ActiveFire (ISO/AS 7240-20)
* CE
* UKCA
* LPCB
* VdS
* VNIIPO
* NF
* EN 54-20

When used within the EU, the system shall be formally approved by a notified body (such as VdS or LPCB) to EN54-20 Class A, B and C and shall carry appropriate CE marking to confirm this approval.

## Codes, Standards or Regulations

The VLF-500 smoke detector shall be installed to comply with one or more of the following codes or standards:

* AS 1670.1-2004, ASNZS 3000
* Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems
* NFPA Standards, US
* NEC Standards, US
* NZS 4512: 2003
* Local codes and standards

## System Description

### Design Requirements

1. The detector shall consist of a highly sensitive laser-based smoke detector, an aspirator, and a dual-stage filter cartridge.
2. The detector shall have control switches for Reset, Disable, Test and restricted access switches for Alarm Setup and Flow Setup.
3. The detector shall have individual illuminated indicators for:

* Four alarm levels (Alert, Action, Fire1 & Fire 2).
* Fault, Power & Disabled.
* Alarm Setup and Flow Setup.

1. The detector shall have a front-panel, 10 segment, illuminated, yellow-colored circular smoke dial for the purpose of indicating current smoke level and detector status.
2. The detector shall have individual relay outputs for Fault, Action, and Fire 1.
3. The detector shall have an RS232-compatible serial control port for the purpose of configuration, control, status monitoring, event log extraction and upgrade.
4. The detector shall provide for the addition of one interface card.
5. The detector shall provide a general-purpose input to allow either: Reset, Disable, Reset & Disable, Standby, External and Night Time Thresholds.
6. The detector may also be configured by a PC and allow programming of four smoke threshold alarm levels, time delays, faults including airflow, detector, power, and filter as well as an indication of the urgency of the fault and three relay outputs for remote indication of alarm and fault.
7. The detector shall consist of an air sampling pipe network to transport air to the detection system and support pre-engineered designs. Complex designs are supported by calculations from a computer-based design-modeling tool.
8. The detector shall incorporate an ultrasonic flow sensor in the pipe inlet port for airflow monitoring purposes.

### Performance Requirements

* The detector shall be NRTL listed and approved to cover up to 500m2 (5,380 sq.ft).
* The detector shall be approved to provide very early warning smoke detection and provide up to four output levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.025-20% obs/m (0.008–6.25% obs/ft).
* The detector shall provide fault indication on the unit using the Instant Fault Finder function.
* The detector shall be self-monitoring for filter contamination.
* The detector shall provide staged airflow faults via the use of an ultrasonic flow sensor in the pipe inlet port.

## Submittals

Product data and site drawings shall be submitted and shall include pipe layout, operational calculations   
(refer to the Product Guide for simple pre-engineered designs, or use ASPIRE) 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.

## Quality Assurance

### Qualifications

1. Manufacturer

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

1. 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 and 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.

1. 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.

# Products

## Manufacturer

Air Sampling Smoke Detection System: Acceptable Manufacturer:

Xtralis

4 North Drive

236 – 262 East Boundary Road

East Bentleigh VIC 3165

Australia

Telephone: +61 3 9936 7000

Fax: +61 3 9936 7200

## Manufactured Unit(s)

The VESDA VLF-500 ASD system (Part Number VLF-500-XX).

Many configurations are possible; typical configurations are:

|  |  |
| --- | --- |
| Part Number | Description |
| VLF-500-00 | VLF-500 English Display and Euro language set |
| VLF-500-01 | VLF-500 International Display and Euro language set |
| VLF-500-02 | VLF-500 International Display and Asian language set |
| VLF-500-03 | VLF-500 International Display and Scandinavian language set |
| VLF-500-04 | VLF-500 International Display and Russian language set |
| VLF-500-05 | VLF-500 International Display and Eastern Euro language set |
| VIC-010 | VESDAnet Interface Card |
| VIC-020 | Multifunction Control Card (MCC) |
| VIC-030 | Multifunction Control Card (MCC) with Monitored Powered Output (MPO) |
| VSP-005 | Filter Cartridge |
| VSP-715 | Aspirator for VESDA VLF-500 |

## Detector Assembly

1. 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.
2. The detector shall be Laser-based type and shall have an obscuration sensitivity range of   
   0.025-20% obs/m (0.008–6.25% obs/ft).
3. The detector shall have four independent field programmable smoke alarm thresholds across its sensitivity range with a configurable time delays for each threshold between 0-60 seconds.
4. The detector shall also incorporate the facility to transmit a fault either via a relay or via a VESDAnet card as an option.
5. 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.
6. 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.
7. The aspirator shall be a purpose-designed aspirator assembly.
8. VESDA VLF-500 when using pre-engineered sampling pipe networks shall be capable of supporting   
   a single pipe run of 50m (150ft), or two pipe runs of 30m (90ft), with a transport time per applicable local codes. Custom sampling pipe network designs shall be supported using ASPIRE calculation software.
9. 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 2 A at 30 VDC. Remote relays shall be offered as an option with a VESDAnet interface card and either configured to replicate those on the detector or programmed differently.
10. 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 shall be capable of storing up to 18,000 events.

## Displays

1. The detector will be provided with LED indicators.
2. Each detector shall provide the following features at a minimum:

* Indication of Adaptive Scan Threshold
* Indication of smoke an alarms levels (Alert, Action, Fire 1, Fire 2)
* 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.

## Device Networking Requirements (VESDAnet Card Required)

1. The devices in the smoke detection system shall be capable of communicating with each other via twisted pair RS485 cable with the addition of a VESDAnet interface card (VIC-010). The network shall be able to support up to 200 devices (detectors, displays and programmers), of which 100 detectors can be supported.
2. Backward compatibility with VESDA Laser Product via VESDAnet card.
3. The unit shall be capable of being configured in a fault tolerant loop for both short circuit and open circuit.
4. PC based configuration tools shall be available to configure and manage the network of detectors.

## Digital Communication Port

1. An RS 232 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 RS232 Protocol.
2. 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)
* VLF 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
* Set smoke thresholds

## 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 (VIC-020 or VIC-030).

The standard alarm outputs may be used as follows:

* **Alert** (Alarm Level 1)

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

* **Fire 1** (Alarm Level 3)

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

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

* **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.

* **Fire 2** (Alarm Level 4)

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

|  |  |
| --- | --- |
| Beschreibung: Hinweis-i2_8 | Notes!   * The alarm level functions as listed are possible scenarios. Consideration should be given to the best utilization of these facilities for each application and the requirements of local authorities (e.g. Authorities Having Jurisdiction in the US). * When used within the EU, alarm thresholds shall be configured to achieve the required sensitivity class (A, B or C). |

### 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 (0.025% 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

### Fault Alarms

The Detector Fault relay shall be connected to the appropriate alarm zone on the 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.

Check local Codes, Standards or Regulations to determine whether compliance with this set up is required.

### 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.

Local Power Supply Standards that may apply:

* UL 1481 Listed - provided the power supply and standby batteries have been appropriately sized/rated to accommodate the system’s power requirements.
* US Telecommunication Central Office Power Supply - the system shall operate on negative 48 VDC (provided continuously from the telephone central office power source) converted to 24VDC.
* EN 54-4 approved power supply for use in Europe.
* In accordance with AS 1670.1-2004 and NZS4512: 2003.

## Sampling Pipe Design

### Sampling Pipe

1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05” and internal diameter (ID) of 21mm or ¾” should be used. It should be marked along its length with “Xtralis Aspirating Smoke Detection Pipe”, while for American pipes, it should be marked “VESDA Smoke Detector Sampling Tube”.
2. 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. For example, in the US, VESDA pipe material shall be UL 1887 Plenum rated CPVC). In the UK/most of Europe, the pipe material shall be ABS Grade SD-0150, tested to BS EN 61386-1:2004.
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
4. 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.
5. All pipes should be supported at not less than 1.5m (5ft) centers, or that of the local codes or standards.
6. 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 ASPIRE calculations.

### Sampling Holes

1. 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. For AS1670.1 -2004 the maximum allowable distance is 10.2m. For FIA the maximum allowable distance is 10.6m. For NFPA, the maximum allowable distance is 30ft.
2. Each sampling point port shall be identified in accordance with codes or standards.
3. 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.
4. Sample point size and indeed the entire pipe design and installation design shall be supported by ASPIRE calculations.

# Installation

## The Detection System

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

## The Capillary Sampling Network

1. 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.
2. The typical internal diameter of the capillary tube shall be 5mm or 3/8”, the maximum length of the capillary tube shall be 8m (26 ft) unless the manufacturer in consultation with the engineer have specified otherwise.
3. 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

Pre-engineered pipe network setups are provided in the VESDA VLF-500 Product Guide. For specific performance requirements that fall outside the pre-engineered designs, a sampling pipe aspiration-modeling program such as ASPIRE 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. Longer transport times may be tolerated where long pipe runs are required and where local codes and standards permit.

Local codes and standards may also apply. For example:

* AS1670, Part 1 Australia 90 Seconds
* FIA Code of Practice UK 120 Seconds
* NFPA 72 The Americas 120 Seconds
* NFPA 76 The Americas 60 Seconds

When used within the EU the maximum transport times shall be in accordance with the limits approved under EN54-20; i.e. VLF = 90 seconds for Class A, 90 seconds for Class B and 90 seconds for Class C.

### Balance %

The sample point balance for the pipe shall not be less than 70% as indicated by ASPIRE. 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.

## Commissioning Tests

1. 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.
2. All necessary instrumentation, equipment, materials and labor shall be provided by the Contractor.
3. 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.

## System Checks

1. Visually check all pipes to ensure that all joints, fittings, bends, sampling points, etc., comply with the specification.
2. 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

1. Check to ensure that all ancillary warning devices operate as specified.
2. Check interconnection with the FACP to ensure correct operation.

## Tests

1. Introduce smoke into the detector assembly to provide a basic Go/No-Go functional test.
2. Verify that transport time from farthest sampling port does not exceed the local code requirements.
3. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the logbook and commissioning report accordingly.