VESDA VLI

Engineering Specification

FAST
FIRE & SECURITY TECHNOLOGY

Singapore +65 6757 7045 Indonesia +62 21 8778 2069

VESDA® by xtralis

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1. Scope

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

2. System Information

2.1 General

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

The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port.

2.2 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 (Underwriters Laboratories Inc), USA
- ULC (Underwriters Laboratories Canada), Canada
- FM (Factory Mutual), USA
- FM approved for Hazardous Locations, Class 1, Div.2, Groups A, B, C, D (3020906), USA
- CSFM (California State Fire Marshall), USA
- LPCB (Loss Prevention Certification Board), UK
- ActivFire, Australia

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.

2.3 Codes, Standards or Regulations

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

- AS 1670.1-2004, AS1603.8 – 1996, 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

2.4 System Description

2.4.1 Design Requirements

1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
2. It shall be tested and approved to cover up to 2,000m^2 (20,000 sq.ft).
3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
4. It shall provide absolute smoke detection.
5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft).
6. The detector shall be specifically designed for industrial applications.
7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.
8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
9. It shall have four pipe inlets for sample air.
10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.
11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:
    - Dilute the sampled air for prolonged detector life.
    - Combine sample air from all pipe inlets.
    - Divide sampled air into filtered clean air and unfiltered air before mixing them together.
    - Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
    - Use a mesh/screen for the unfiltered air for protection against lint type of particles.
    - Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
    - Maintain consistent detector sensitivity over time.
    - Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.
13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.

15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.
23. It shall be self-monitoring for filter contamination.
24. It shall be configured via local USB port with Ethernet port for remote monitoring.
25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
26. It shall have at least one general purpose input (GPI).
27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
28. Optional equipment may include a dedicated Xtralis VSM graphics package.
29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
30. The detector shall have built-in event and smoke logging. It shall store 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 18,000 events.

2.4.2 Programming Requirements

Using either USB or Ethernet port the detector shall allow programming of:

- IP address and related fields to support Ethernet based networking
- Four smoke threshold alarm levels
- Time delays
- Configurable relay outputs for remote indication of detector conditions
- Holidays and day/night changeover times
- Major and minor airflow fault limits
- Aspirator speed
- General purpose input function
- Alarm and fault latching

2.5 Sampling Pipe Design

2.5.1 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.
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 (e.g. in the US, VESDA pipe material shall be UL 1887 Plenum rated CPVC).
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) centres, 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 ASPIRE2 calculations.

2.5.2 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 port size shall be as specified by ASPIRE2 calculations.

2.6 Submittals

Product data and site drawings shall be submitted and shall include pipe layout, operational calculations (ASPIRE2) 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.

2.7 Quality Assurance

2.7.1 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.

2. 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 employed for the purpose monitoring contamination of the filters to automatically notify when replacement is required.

The Laser Detection Chamber shall incorporate a secondary clean air feed separate to all the other filters; providing clean air barriers across critical detector optics to eliminate internal detector contamination. The Laser Detection Chamber shall incorporate a clean air zero system consisting of a separate fan and a clean air HEPA filter.

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.

3. 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.

3. Products

3.1 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

3.2 Manufactured Units(s)

The VESDA VLI ASD system: Part Number VLI-800

Part numbers for spares:

Spare Part Number	Description
VSP-030	VLI Intelligent Filter
VSP-031	VLI Secondary Foam Filter
VSP-032	VLI Aspirator
VSP-033	VLI Chamber Assembly

3.3 Application

3.3.1 Detection Alarm Levels

The laser based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:

- Alarm Level 1 (Alert)
  Activate a visual and audible alarm in the fire risk area.
- Alarm Level 2 (Action)
  Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
- Alarm Level 3 (Fire 1)

  Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.
- Alarm Level 4 (Fire 2)
  Activate a suppression system and/or other suitable countermeasures.

Note: 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).

Note: When used within the EU, alarm thresholds shall be configured to achieve the required sensitivity class (A, B or C).

3.3.2 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) 0.2% obs/m (0.064% obs/ft)
- Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft)
- Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft)
- Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft)

3.3.3 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

3.3.4 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 Minor Fault and Isolate relays 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).

3.3.5 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.

4. Installation

4.1 The Detection system

The contractor shall install the system in accordance with the manufacturer's instructions.

4.2 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.

4.3 Air Sampling Pipe Network Calculations

Air Sampling Pipe Network Calculations shall be provided by Air Sampling Pipe Network modelling program such as ASPIRE2. Pipe network calculations shall be supplied with the proposed pipe layout design to indicate the following performance criteria:

4.3.1 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 90 seconds. Longer transport times may be tolerated where long pipe runs are required and where local codes and standards or performance based designs 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

When used within the EU the maximum transport times shall be in accordance with the limits approved under EN54-20.

4.3.2 Balance %

The sample point balance for the pipe shall not be less than 50% as indicated by ASPIRE2. That is, the volume of air drawn from the last sampling point shall not be less than 50% of the average volume of air through the other holes.

4.4 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 configuration and a copy of these results shall be retained on site in the System Log Book.

4.5 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),
   - Pipes in use,
   - Detector location and address,
   - Detector IP address, subnet mask and default gateway (if required)
   - Clock and date,
   - Time delays,
   - Air flow fault thresholds,
   - Units set to U.S./S.I. (for US only) or metric for other regions
3. Check to ensure that all ancillary warning devices operate as specified.
4. Check interconnection with Fire Alarm Control Panel to ensure correct operation.

4.6 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.