

**ENGINEERING SPECIFICATION**

***VESDA-E VEP & VEU Range***

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# Scope

This document provides general specification details for the installation and commissioning of an Aspirating Smoke Detection (ASD) System. This scope of works has been put together using a base line to form part of the minimal requirements as detailed below.

ASD systems which are equivalent and meet the base requirements will be accepted in this scope of works.

Note: The system shall be designed and installed in accordance with the manufacturer’s design guidelines and applicable codes and standards.

# System Information

## Overview

A Very Early Warning Smoke Detection System shall be installed throughout the areas as nominated on the project drawings or as detailed herein. It shall consist of a highly sensitive LASER-based Smoke Detector/s complete with an aspirator and 2-stage filtration. The ASD system must provide absolute detection.

The sampling method to be adopted will or may include both sampling from a series of 21 mm ID PVC pipe networks and Capillary sampling tubes attached to these pipe networks.

Reference should be made to the manufacturer’s relevant design guides and application notes. Assistance should be sought through the local ASD “Channel Partners”.

## General

The systems must be able to be configured on site and programming achieved with a single PC for the entire system via a dedicated configuration management program.

Any pipe layouts detailed on the drawings are indicative only and show the minimum requirement. Some alterations to the design may be necessary to accommodate the building structure. Any proposed alterations must be detailed and submitted to the client or their representative for approval before being undertaken.

As part of the “As Installed” documentation prepared by the contractor, pipe lengths shall be accurately determined and the system performance modelled using ActivFire approved “ASPIRE” software. After the installation of the pipe network, actual measurements shall be taken and correlated against ASPIRE calculations. These results shall be incorporated within the commissioning documentation. Only an ActivFire approved pipe network modelling software will be accepted.

Pipe lengths, sampling point spacing (spacing has to be compliant to AS1670.1:2015) and sampling point hole size shall be in accordance with manufacturer’s recommendations. Pipe pressure and flow levels shall be calculated to cater for the installation of water traps (if required) or possible future installation of in-line filters.

## Certification and Listing

The Very Early Smoke Detection System must be of a type designed, manufactured and tested to comply with AS1603.8 and AS7240.20, Multi Point Aspirated Smoke Detectors and must be Certified and Listed by:

* UL (Underwriters Laboratories Inc), USA
* FM (Factory Mutual), and FM approved for Hazardous Locations,
* LPCB (Loss Prevention Certification Board), UK
* CSIRO and ActivFire, Australia
* VdS (Verband der Sachversicherer e. V.), Germany

## Codes, Standards or Regulations

The entire installation shall comply with (unless directed otherwise):

* AS1670.1-2015

## Submittals

Submit product data and site drawings that include pipe network layout, operational calculations and performance criteria. Supply one copy of the manufacturer’s installation, operation and maintenance manuals immediately upon completion of installation. Supply completed system commissioning documentation (manufacturer’s commissioning sheets) within 60 days of completion of the installation.

## Quality Assurance

### Manufacturer

* The manufacturer shall have a minimum of 30 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.

### System

The system shall:

* Consist of a highly sensitive, short wavelength LASER-based, particle imaging and light scattering smoke detector, aspirator, & monitored filter and shall be enclosed in a single mounting box
* Provide “Absolute” Detection - relatively or drift calibrated detection systems “shall not” be considered.
* Allow sub-sampling of the air sample - full flow detection systems “shall not” be considered
* Use a clean air barrier to keep optics free of contamination.
* Provide sensitivity range 0.005-20 %Obs/m or 0.001-20 %Obs/m.
* Provide freely adjustable programmable thresholds across the entire detectors sensitivity range.
* Systems which do not meet the above minimum system requirements, will not be accepted.

### Detection Method

The detection sensing method shall use both a two-dimensional image sensing array and at least 5 photodiodes spaced inside the chamber to detect various scattering angles. The output data from the sensing method shall include particle size and mass scattering measures. A particle counting method shall be employed for the purposes of:

Minimising the effect of large dust particles on the true smoke obscuration.

Monitoring contamination of the filter (dust & dirt, etc.) to automatically notify when maintenance is required.

### Analytics

The detector shall be capable of applying analytics algorithms based on output data from the sensing method to determine the nature of sampled airborne material. Such algorithms shall provide probabilities of sampled air containing dust, diesel particulate and smoke from overheating PVC wire.

### Equipment Supplier

The equipment supplier shall be an authorized Xtralis “Channel Partner”, trained by the manufacturer to model/design, configure, commission, and technically support the air sampling system and shall be able to produce a certificate stating such on request.

### Installation Contractor

The installing technician/individual shall be experienced and have obtained a current “Accreditation Certificate” issued by or on behalf of the manufacturer, in the installation of high sensitivity aspirated smoke detection systems. The company must utilize technical staff that have also undertaken a current and approved “Accreditation Training” course. Installing and commissioning technicians must also be able to demonstrate experience in the installation of such systems in similar applications.

Successful tenders are to supply current accreditation certificates with their submission. Contractors who cannot provide a current “Accreditation Certificate” from the manufacturer or channel partner will not be accepted for this Scope of works.

Note: No work is to be subcontracted unless prior approval is received.

# Products

## Detector Assembly

The detector shall be modular in design where the chamber, filter, aspirator, sampling module and relay outputs shall be enclosed in a single mounting box and shall be installed approximately where shown on the drawings. The detector assembly shall be mounted directly on the wall or on the manufacturer supplied mounting plate. Where applicable and to suit the environmental conditions the detector shall be contained in approved IP enclosure. Configure the installation to allow for the potential future installation of in-line filters.

The detector shall have a display with indicator LEDs and a reset control button and/or optionally with a LCD Display showing detector status including fault categories and smoke level.

Provide 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 0.005-20 %Obs/m or 0.001-20 %Obs/m.

Systems which adjust smoke thresholds with the use of DIP switches or the changing of chambers will not be accepted in this scope of works.

The detector shall incorporate facilities to transmit two levels of fault condition (i.e. Minor and Major) to the Fire Indicating Panel. The Detector shall have the capabilities to log internally four (4) airflow fault conditions per pipe. This information shall be downloadable to a PC and viewable via a smart handheld device.

The filter unit contained within the detector housing must be at least a single stage, disposable filter unit, capable of filtering particles in excess of 20 microns from the air sample. The filter shall be accessible by opening the cover to the field wiring terminal area. Once accessible, the filter shall be removable and replaceable by hand without the need of a tool. The filter shall incorporate an electronic circuit which identifies it uniquely and maintains status information such as the percent of filter life remaining. ASD systems which use external filtration as their primary filter, will not be accepted.

A second filter must be provided to remove all contaminants from the sampled air such that it provides a clean air barrier which continually keeps all optical surfaces clean to reduce the maintenance requirements of the detector and maintain its absolute calibration.

The aspirator shall be a purpose-designed impeller air pump. It shall be capable of allowing for branched pipe networks up to 130m and 560m/800m in total for single pipe and four pipe detector respectively, with a transport time per applicable local codes.

The detector assembly must contain an appropriate number of programmable relays to annunciate alarm and fault/isolate conditions.

The detectors shall be surface mounted in the most suitable and appropriate locations. If required the inlet ports shall be orientated downwards to prevent condensation from entering the Detector.

Each detector shall have two RS-485 communications ports, each being configurable to allow for “Redundant” loop communication

The detectors shall provide inbuilt secondary communications for monitoring and configuration using USB, 10/100 BaseT Ethernet and WiFi (802.11b/g)

The detector shall have an AutoConfig facility to allow airflow normalisation, Autolearn Smoke and Flow using a single button.

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 20,000 events and does not require the presence of a display in order to do so.

The detector shall incorporate a galvanically isolated General Purpose Input (GPI) which activates in the event of an applied voltage of 5 to 50VDC and can be assigned by configuration to activate one of several functions (Reset, Disable, Reset/Disable, Stand-by, Mains OK, Day/Night).

The detector shall incorporate a monitored voltage-free input, to be used with isolated relay contacts, which is supervised using a 10k Ohm terminating resistor.

The detector shall allow future hardware expansion via stackable modules placed either on top or below the detector.

The Detector shall also incorporate facilities to transmit the following fault categories: Detector, Air flow, Filter, System, Zone, Network, Power, Chamber, Module

The pipe inlets must contain a flow sensor each and shall use ultrasonic flow sensing technology.

The detector shall allow airflow thresholds configuration for each pipe inlet.

The detector shall have the facilities for referencing with time dilution and smoke obscuration offset between detectors for external smoke contamination. System’s which do not have the ability to use referencing detection for external smoke contamination will not be accepted in this scope of work

The detector shall use the following security measures:

* Connectivity via wireless access shall support WPA2 encryption with encryption key.
* Access to a detector via Ethernet or WiFi shall be protected using a detector password specific to the detector and in addition to the WiFi encryption key.
* All software connecting to a detector or peripheral shall support an authentication protocol to verify that it has been supplied by the manufacturer of the system.

The selections of Detectors suitable for these sites are:

* VEU – VESDA-E VEU
* VEP – VESDA-E Four Pipe VEP
* VEP-1 - VESDA-E Single Pipe VEP

## Device Networking Requirements

If required by the client, all detectors on site shall communicate to each other via an RS-485 “Daisy Chain” loop configuration.

A manufacturer approved shielded twisted pair RS-485 Data Cable or equivalent shall be used and the communications shall comply with the RS-485 Protocol:

## System Configuration

### Detection Alarm Levels

The four alarm levels shall be used as follows:

Alarm Level 1 (Alert) As advised on site.

Alarm Level 2 (Action) As advised on site

Alarm Level 3 (Fire 1) Activate an Alarm Zone Facility (AZF) in

The Fire Alarm Control Panel (Fire detection control and indicating equipment (FDCIE))

Alarm Level 4 (Fire 2) As advised on site

Note: Subject to direction from the client or their representative the system may be required to:

* Call the Fire Brigade
* Activate all local warning devices/systems
* Activate via the security system to a manned monitoring station
* A combination of the above

### Detection Alarm Settings

Each detector shall be programmed to achieve a sensitivity of the individual sampling points as determined by the system design and modelling software and according to local code requirements

The setting for Fire 1 shall always appear as 100% on the bar-graph scale on the Display module. The Alert and Action alarm levels shall be determined on site.

### Alarm Thresholds Delays

Settings for the alarm threshold delays shall be:

* Alarm Level 1 (Alert): 10 seconds (default) or as determined on site
* Alarm Level 2 (Action): 10 seconds (default) or as determined on site
* Alarm Level 3 (Fire 1): 10 seconds (default) or as determined on site
* Alarm Level 4 (Fire 2): 10 seconds (default) or as determined on site
* Fault: 60 seconds

### Fault/Isolation Relays

The Detector Fault/Isolation relays shall be connected to the appropriate alarm zone on the FDCIE (Fire Detection Control and Indicating Equipment).

## Management System

Optional equipment required by the client may include intelligent remote displays and/or a high level interface to a building management systems or a dedicated fire system management software package (VSM4).

* The ASD system must have the ability to be managed and controlled by a dedicated Colour Graphics Interface (CGI), which is completely independent of the Fire Alarm system. ASD systems which do not have this ability will not be accepted in the scope of works.
* As an option by the client intelligent remote displays and/or a high level interface to a building management systems or a dedicated fire system management software package (VSM4) may be used.

System commissioning and maintenance shall be aided by a dedicated configuration and maintenance software package (VSC) available as a free download from the manufacturer’s website.

## Power Supply and Batteries

The system shall be powered from separate power supplies or from a separate fused output within FDCIE to comply with AS1670.1:2015.

## Sampling Pipe Network Design

The sampling pipe network shall be arranged to provide optimum efficiency and shall be designed to protect all nominated areas.

The transport time for the least favourable sampling point in the system shall not exceed the requirements of the applicable standards and the system shall be adequately balanced such that it shall not be less than 70%.

Air Sampling Network Calculations shall be provided from a modelling program software tool - ASPIRE™.

### Capillary Tube

Where a false ceiling is installed and subject to the client’s requirements the sampling pipe shall be installed above the ceiling. All sampling points installed on the ceiling are to be connected by means of a capillary tube and secured so as NO damage or disruption to airflow is caused.

The requirements of the capillary tube in terms of diameter and length shall be in accordance with the pipe network modelling software (ASPIRE).

### Sampling Points

The sampling point holes shall be of the size as determined by the ASPIRE modelling calculation tool. New drill bits of the exact size shall be used. The last sampling point in each pipe shall be deemed the “end cap” and shall comply with the ASPIRE design tool.

### Sampling Pipe Network

All piping shall be supplied and installed in accordance with relevant standards. The sampling pipes shall be PVC electrical conduit and comply with Australian Standards, and be of 25 mm OD nominal diameter. These pipes shall be identified as a “FIRE DETECTION SAMPLING - DO NOT PAINT” at intervals not exceeding 2 metres for the entire length.

Changes of direction shall be made with long radius ‘lazy’ bends. Purpose-made branching pieces are acceptable. The far end of each trunk or branch pipe shall be fitted with an end cap.

All joints shall be airtight and made by using solvent cement as required by the pipe manufacturer. Sample pipe entering the detector shall not be glued. All sampling pipes shall be supported at spacing’s not exceeding 1m centres.

The pipe network shall be installed to allow for the “expansion and contraction” of the building. Methods of installation shall be approved for achieving this requirement. The method of achieving this requirement shall be detailed in the tender submission.

Note: The Tenderer shall submit with the tender details of the pipe network design “ASPIRE” IDP (Installation Data Pack) document showing the proposed layout. The design shall be supported by computer-generated calculations showing transport times, sensitivity, suction pressures and balance details of each sampling point.

There shall be no deviation from the specified layout without prior approval from the client or their representative.

# Installation

## Commissioning

### Requirements

The Contractor shall allow for the “Manufacturer’s Representative” or “Channel Partner” to be present and assist with the commissioning tests. The contractor shall allow for any costs associated with this requirement.

The Contractor shall provide all necessary instrumentation, equipment, materials and labour.

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

Commissioning documentation shall be properly completed with three (3) copies supplied to the client. ASD manufacturer’s commissioning sheets shall be used.

### System Checks

Visually check the pipe network to ensure all joints, fixing, bends, sampling points, etc. comply with the specification. Check the system to ensure the following items are operational and programmed in accordance with the specification:

* Alarm threshold levels (for both day and night settings)
* Pipes in use
* Detector address
* Time and date
* Time delays
* Airflow fault thresholds
* Display button operable (Isolate, Reset)
* Referencing
* Units set to S.I.

Check all ancillary warning devices are operating as specified.

Check interconnections with the FDCIE to ensure correct operation of all fault and alarm inputs.

Check alarm levels and indicators, set clock function to local time, time delays and airflow fault indicators.

### Tests, Programming & Compliance

Introduce smoke into the least favourable sampling point in each sampling pipe to provide a Go/No-Go test. Transport time shall not exceed the relevant standards or specific client requirements. Conduct additional tests as may be required using smoke emitters or equivalent at locations determined by the Consultant.

Activate the appropriate FDCIE zones and advise all concerned that the system is fully operational.

The entire system shall be signed off by the installation contractor as being compliant with the requirements of this specification and applicable Australian Standards.

The system shall be programmed to suit the various activities and environments located within this building.

## Drawings

Three (3) copies of the latest sampling pipe configurations shall be supplied to the client.

## Training

Train nominated client representatives in the operation and basic fault finding of the system.

## Maintenance

The system shall be maintained in accordance with current Australian Standard AS 1851 and the manufacturer’s recommendations.

## Upgrading

There shall be provision for field upgrading the firmware in the system using a USB memory key connected directly to the detector, avoiding the need for a separate PC for this function.