Honeywell

Engineering Specification Guide

VESDA-E VEP

29712_07
November 2018

Contents

1 GENERAL 3

1.1 Scope 3
1.2 ASD System Information 3
1.3 Approvals and Standards 3
1.4 Codes, Standards or Regulations 3
1.5 Quality Assurance 4
1.5.1 Manufacturer 4
1.5.2 Equipment Supplier 4
1.5.3 Installer 4
1.5.4 Warranty 4
1.5.5 Training 4
1.6 Documentation 4

2 SYSTEM DESCRIPTION 6

2.1 ASD System Features 6
2.2 Detection Technology 6
2.2.1 Light Source 6
2.2.2 Detection Method 6
2.2.3 Absolute Calibration 7
2.3 Peer-to-Peer Communications Networking 7
2.4 Secondary Communications 7

3 PRODUCTS 8

3.1 Manufacturer 8
3.2 Manufactured Units(s) 8
3.3 Detector Features 8
3.4 Displays 9
3.5 Monitoring 10
3.6 Configuration and Programming 10
3.7 Security 10
3.8 Upgrading 11

4 APPLICATION 12

4.1 Detection Alarm Levels 12
4.2 Initial Detection Alarm Settings 12
4.3 Initial (factory default) settings for the alarm/fault delays 12

4.4 Faults 12
4.5 Power Supply and Batteries 13
4.6 Sampling Pipe Design 13
4.6.1 Sampling Pipe 13
4.6.2 Sampling Holes 13

5 EXECUTION 15

5.1 System Installation 15
5.1.1 ASD Detector Mounting 15
5.1.2 The Capillary Sampling Network 15
5.1.3 Air Sampling Pipe Network Calculations 15
5.2 System Commissioning 16
5.2.1 Detector commissioning 16
5.2.2 Commissioning Tests 16
5.2.3 System Checks 16
5.2.4 Final Tests 17
5.3 Maintenance and Service 17
5.3.1 Sample Filter 17
5.3.2 Spare Parts 17

1 GENERAL

1.1 Scope

This document provides specification details of the VESDA-E VEP Air-sampling Smoke Detection (ASD) products to assist in their installation and commissioning. VESDA-E VEP range provides a single pipe and four pipe products. VESDA VEP ASD is referred to as ASD throughout this document.

1.2 ASD System Information

1. A Very Early Warning Fire Detection System like the VESDA-E VEP System shall be installed throughout the areas nominated on the drawings.
2. The ASD system shall consist of highly sensitive short wavelength LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes.
3. When required, an optional Display unit may be provided to monitor each ASD detector.

1.3 Approvals and Standards

The ASD must be of a type submitted to, tested, approved, and/or listed to the Standards mentioned below by a Nationally Recognized Testing Laboratory (NRTL):

1. UL268 and UL268A: UL (Underwriters Laboratories Inc), USA
2. UL268: ULC (Underwriters Laboratories Canada), Canada
3. EN54-20: VdS, Germany
4. FM3230 (Factory Mutual), FM 3611-3810-3600 Class I, Division 2, Groups A, B, C, D (3020906), USA
5. AS1603.8 / AS-7240.20: CSIRO with ActivFire Listing, Australia
6. Category 7259: CSFM (California State Fire Marshal), USA
7. CSFM (California State Fire Marshall, USA)
8. LPCB (Loss Prevention Certification Board), UK
9. ActivFire, Australia
10. VdS (Verband der Sachversicherer e. V.), Germany
11. AFNOR, France
12. VNIIPO, Russia
13. CCCF, China
14. KFI, Korea

1.4 Codes, Standards or Regulations

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

1. AS 1670.1-2004, AS1603.8 – 1996, ASNZS 3000
2. Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems

3. NFPA Standards, US
4. NEC Standards, US
5. NZS 4512: 2003
6. When used within the EU, the system shall be declared to the Construction Products Regulation (CPR) 305/2011 by a notified body such as VdS when tested to the EN54-20 standard
7. Local codes and standards

1.5 Quality Assurance

1.5.1 Manufacturer

1. The manufacturer shall have a minimum of 35 years production experience in the design and manufacture of high sensitivity air sampling smoke detection systems.
2. The manufacturer shall be certified as meeting ISO 9001:2008 for manufacturing.

1.5.2 Equipment Supplier

1. The equipment supplier shall be authorized trained by the manufacturer to calculate/design, install, test and maintain the ASD system.
2. The equipment supplier shall be able to produce a certificate of training from the manufacturer.

1.5.3 Installer

1. The equipment installer shall be authorized and trained by the manufacturer and shall have the ability to design a system based on code requirements.
2. The installer shall be capable of providing calculations, design, and testing documents upon request.

1.5.4 Warranty

1. The manufacturer shall guarantee the product by warranty for a period of two years.
2. Any damage to the ASD due to poor handling or operating outside its operation limits will void its warranty.
3. The installation and programming of the ASD shall be completed by a factory-trained installer.

1.5.5 Training

1. The manufacturer and their representatives shall make available adequate accreditation training to all personnel involved in the supply, installation, commissioning, operation and maintenance of the ASD system.

1.6 Documentation

The following documentation shall be supplied.

1. Product data and site drawings shall be submitted and shall include pipe layout, operational calculations and performance criteria. Tools such as ASPIRE may be used to

generate this material.

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

2.1 ASD System Features

The ASD system shall:

1. Consist of a highly sensitive, short wavelength LASER-based, particle imaging and light scattering smoke detector, aspirator, and filter.
2. Be modular, with each detector having 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.
3. Consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modelling tool.
4. Support optional equipment which may include intelligent remote displays and/or a high level interface (HLI) with the building fire alarm system, or a dedicated graphics package such as VSM.
5. Be tested and approved to cover up to 1,000 sq. m. (10,760 sq. ft.) for the single pipe VEP, or up to 2,000 sq. m. (21,520 sq. ft.) for four pipe VEP.
6. Be approved to provide Very Early Warning Fire Detection (VEWFD) / Class A, Early Warning Fire Detection (EWFD) / Class B and Standard Fire Detection (SFD) / Class C.
7. 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 (0.0016–6.25% obs/ft) with a resolution of 0.0002% obs/m (0.00006%obs/ft).
8. Report any fault on the detector by using configurable fault relay outputs, via a peer-to-peer network or by communications to a monitoring software tool running on a PC or hand-held device such as a tablet or smart phone.
9. Be self-monitoring for filter contamination.
10. Incorporate a flow sensor in each pipe inlet and provide staged airflow faults against flow fault thresholds that may be determined and set for each pipe individually.

2.2 Detection Technology

2.2.1 Light Source

The Detection Chamber shall employ a highly sensitive, short wavelength LASER light source.

2.2.2 Detection Method

The detection sensing method shall use both a two-dimensional image sensing array and at least five (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:

1. Minimizing the effect of large dust particles on the true smoke obscuration.
2. Monitoring contamination of the filter (dust & dirt, etc.) to automatically notify the user when maintenance is required.

2.2.3 Absolute Calibration

The detection chamber shall be factory calibrated and shall not use adaptive algorithms or drift compensation techniques to adjust the sensitivity or detector output from that established during commissioning.

2.3 Peer-to-Peer Communications Networking

A peer-to-peer networking facility shall be provided for the purposes of reporting alarms, faults and monitoring status, history and for configuration of devices.

The peer-to-peer network shall:

1. Comprise a physical layer that shall:
   a) comply with the ANSI/TIA/EIA-485-A-1998 electrical specifications
   b) employ asynchronous serial data transfer
   c) operate at a baud rate no less than 19.2 kBaud.
   d) detect communications errors due to interference, open and short circuit
   e) detect ground faults
2. Be able to support up to 200 devices (detectors, displays and programmers), of which 100 detectors can be supported.
3. Be capable of being configured in a fault tolerant loop for short circuit, open circuit and ground fault. Any communication faults shall be reported unambiguously and shall be clearly attributable to an individual device or wire link in the fault messages.
4. Be configurable by PC based configuration tools that are available to configure and manage the network of detectors.

2.4 Secondary Communications

Detectors shall provide inbuilt secondary communications for monitoring and configuration using the following physical media:

1. USB
2. 10/100 BaseT Ethernet
3. WiFi (802.11b/g)

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

3.2 Manufactured Units(s)

The VESDA-E VEP ASD system can be supplied in the following configurations:

Part Number	Description
VEP-A00-1P	VESDA-E VEP with LEDs, 1 pipe, coverage area 1,000 sq. m. (10,760 sq. ft.)
VEP-A00-P	VESDA-E VEP with LEDs, 4 pipes, coverage area 2,000 sq. m. (21,520 sq. ft.)
VEP-A10-P	VESDA-E VEP with LEDs and 3.5" LCD, coverage area 2,000 sq. m. (21,520 sq. ft.)

3.3 Detector Features

The detector shall incorporate the following features.

1. The Detector, Filter, Aspirator and Relay Outputs shall be housed in a plastic enclosure and shall be arranged in such a way that air is drawn from the fire risk area by an aspirator and a sample passed through a sample filter and detection chamber.
2. The Detector shall employ a short wavelength LASER light source and incorporate particle imaging and light scattering using a two-dimensional image sensing array and scatter pattern measurement using photodiodes.
3. The detector shall have an obscuration sensitivity range of 0.005-20% obs/m (0.0016–6.25% obs/ft) with a resolution of 0.0002%obs/m (0.00006%obs/ft).
4. 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.
5. The detector shall employ modular construction allowing field replacement of the filter, chamber and aspirator.
6. The detector shall allow future hardware expansion via stackable modules placed either on top or below the detector.
7. The Detector shall also incorporate facilities to transmit the following fault categories:
    a) Detector
    b) Air flow
    c) Filter
    d) System
    e) Zone
    f) Network

g) Power

h) Chamber

i) Module

8. The detector shall support the generation and transmission of urgent and minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.
9. The single and four pipe VEP shall include one and four sample pipe inlets respectively, and must contain a flow sensor for each pipe inlet. Both Minor and Urgent flow faults can be reported
10. The flow sensors in each pipe shall use ultrasonic flow sensing technology.
11. The filter shall be a disposable filter cartridge and shall be capable of filtering particles in excess of 20 microns from the air sample.
12. A second filter shall be ultrafine, removing more than 99% of contaminant particles of 0.3microns or larger, to provide a clean air barrier around the detector's optics to prevent contamination and increased service life.
13. The aspirator shall be a purpose-designed impeller air pump. With applicable transport time as per the local codes:
    a) The single pipe VEP shall allow a linear pipe length of up to 100m (328ft) and branched pipe networks with a total length of up to 130m (427ft).
    b) The four pipe VEP shall allow a linear pipe length of up to 280m (919ft) and branched pipe networks with a total length of up to 560m (1,837ft).
14. The Assembly must contain seven (7) or more relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The relays must be rated 2 Amp at 30 VDC. Remote relays shall be offered as an option and either configured to replicate those on the detector or programmed differently.
15. 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 allow storage of up to 20,000 events and does not require the presence of a display in order to do so.
16. 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).
17. 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.

3.4 Displays

Both single and four pipe VEP detectors shall provide an LED user interface with a button to support RESET and DISABLE commands; four LEDs to indicate Alert, Action, Fire 1 and Fire2 alarm events; one trouble LED; one disable / standby LED; and power On / Off indication. All LEDs shall have appropriate symbols without any text.

The VEP detector shall optionally have a display module located in a remote mounting box or a 19 inch remote rack.

In addition to the LED user interface, the four pipe VEP detector shall optionally provide an LCD user interface with following characteristics:

1. Color LCD touch screen user interface with a bar graph display.
2. Alarm threshold indicators for Alert, Action and Fire 1.

3. Fault icons indicating these fault categories: detector, chamber, filter, flow, aspirator, network, power and external module where applicable.
4. A remotely mounted Display may be optionally equipped with 7 configurable relays for signaling alarm and fault conditions.
5. A touch screen interface to allow scrolling through status screens on the LCD.

3.5 Monitoring

The system shall have available software to monitor all devices connected to a system. Such software shall be provided to run on:

1. PC-based, Android-based or iOS-based hardware
2. A dedicated monitoring device mounted remotely from any detector

3.6 Configuration and Programming

Configuration and programming may be performed using a Windows® application such as VSC running on a PC connected through a High Level Interfacing unit (PC-Link HLI) or by direct connection to a detector or through Ethernet network.

Configuration and programming tool shall support the following features at a minimum:

1. Programming of any device on the VESDAnet system.
2. Viewing of the status of any device in the system.
3. Adjustment of the alarm thresholds of a nominated detector.
4. Setting of Day/Night, weekend and holiday sensitivity threshold settings.
5. Initiation of AutoLearn™, to automatically configure the detector's smoke and flow threshold settings to suit the environment.
6. Multi-level password control.
7. Programmable latching or non-latching relay operation.
8. Programmable energized or de-energized relays.
9. Programmable high and low flow settings for airflow supervision.
10. Programmable aspirator speed control for the four pipe VEP.
11. Programmable maintenance intervals.
12. Facilities for referencing with time dilution compensation.
13. Testing of relays assigned to a specific zone to aid commissioning.

3.7 Security

The following security measures shall be provided.

1. Connectivity via wireless access shall support WPA2 encryption with an encryption key.
2. 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.
3. 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.

3.8 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.

4 APPLICATION

4.1 Detection Alarm Levels

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

1 Alarm Level 1 (Alert) - Activate a visual and audible alarm in the fire risk area.

2 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.

3 Alarm Level 3 (Fire 1) - Initiate an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.

4 Alarm Level 4 (Fire 2) - Activate a suppression system and/or other suitable countermeasures.



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).

4.2 Initial Detection Alarm Settings

Initial settings for the alarm levels shall be determined by the requirements of the protected environment. However, the setting for Fire 1 (Alarm Level 3) shall always appear as 100% on the bar graph scale. Default settings of the unit shall be:

1. Alarm Level 1 (Alert) 0.08% obs/m (0.025% obs/ft)
2. Alarm Level 2 (Action) 0.14% obs/m (0.0448% obs/ft)
3. Alarm Level 3 (Fire 1) 0.20% obs/m (0.0625% obs/ft)
4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.625% obs/ft)

4.3 Initial (factory default) settings for the alarm/fault delays

1. Alarm Level 1 (Alert) 10 seconds
2. Alarm Level 2 (Action) 10 seconds
3. Alarm Level 3 (Fire 1) 10 seconds
4. Alarm Level 4 (Fire 2) 10 seconds
5. Air Flow Fault 5 seconds

4.4 Faults

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).

4.5 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:

1. UL 1481 Listed - provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
2. 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.
3. EN 54-4 approved power supply for use in Europe.
4. In accordance with AS 1670.1-2004 and NZS4512: 2003.

4.6 Sampling Pipe Design

4.6.1 Sampling Pipe

The sampling pipe shall comply with the following requirements.

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 piping should be supported at centers of the lesser of 1.5m (5ft) apart or that specified by local codes or standards.
6. The end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of a hole in the end-cap will be dependent on the network design (see ASPIRE calculations).

4.6.2 Sampling Holes

The sampling holes shall comply with the following requirements.

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 hole 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 holes and the distance of the sampling holes 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.

5 EXECUTION

5.1 System Installation

The contractor shall install the entire detection system in accordance with the national and local codes and manufacturer's System Design Manual.

5.1.1 ASD Detector Mounting

1 The detector shall be capable of vertical mounting with sample air inlet port(s) directed up toward the ceiling (normal mounting) or down towards the floor (inverted mounting).

2 The detector shall be capable of mounting directly to a wall using screw fasteners or by using a stainless steel mounting bracket such as the VSP-960.

3 Where a mounting bracket is used, it shall be marked or engraved with the correct locations of inlet port sample pipe(s) and cutting guide and electrical conduit locations.

5.1.2 The Capillary Sampling Network

The capillary sampling network shall comply with the following requirements:

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 otherwise specified in consultation with the manufacturer.
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.

5.1.3 Air Sampling Pipe Network Calculations

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

5.1.3.1 Transport Time

Wherever possible the transport time (i.e. the time taken by smoke sampled to reach the detector) for the least favorable 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 local codes and standards permit.

Local codes and standards may also apply. For example:

1.	AS1670, Part 1	Australia	90 Seconds
2.	FIA Code of Practice	UK	120 Seconds
3.	NFPA 72	The Americas	120 Seconds
4.	NFPA 76	The Americas	60 Second

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

5.1.3.2 Balance %

1. The balance is the ratio of lowest sampling hole flow rate to the highest, expressed as a percentage. The sampling hole balance for the pipe shall not be less than 70% as indicated by ASPIRE.
2. Tools such as ASPIRE calculate the balance for a protected area as part of the outputs for modelled pipe sampling network.

5.2 System Commissioning

5.2.1 Detector commissioning

The detector shall incorporate a push button to invoke self-learning modes to simplify commissioning including:

1. A learning mode that ensures the best selection of appropriate alarm thresholds during the commissioning process
2. A learning mode that determines the optimum flow fault thresholds based on environmentally induced flow changes during the commissioning process.

Additionally, there shall be a provision for a PC software tool to configure all user modifiable parameters of the all system devices.

5.2.2 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 their 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.

5.2.3 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.

1. Alarm threshold levels (for both day and night settings),
2. Time delays,
3. Pipes in use for the four pipe VEP,
4. Detector address,
5. Display address where applicable,
6. Clock time and date,
7. Air flow fault thresholds,
8. Reset / Disable button operable,
9. Touch screen operable where applicable,
10. Referencing

11. Units set to U.S./S.I. (for US only) or metric for other regions
12. Check to ensure that all ancillary warning devices operate as specified.
13. Check interconnection with Fire Alarm Control Panel to ensure correct operation.

5.2.4 Final Tests

The contractor shall:

1. Introduce smoke into the detector assembly to provide a basic Go / No-Go functional test.
2. Verify that the transport time from the farthest sampling hole does not exceed the local code requirements using a smoke signal rise displayed in VSC / VSM or the LCD display.
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.

5.3 Maintenance and Service

5.3.1 Sample Filter

1. The detector shall incorporate a replaceable cartridge-style filter such as the VSP-962 to remove large contaminants from the sampled air.
2. The filter shall be accessible by opening the cover for the field wiring terminal area.
3. Once accessible, the filter shall be removable and replaceable by hand without the need of a tool.
4. The filter shall incorporate an electronic circuit which identifies it uniquely and maintains status information such as the filter remaining life.

5.3.2 Spare Parts

1. The detector shall incorporate a replaceable Aspirator such as the VSP-963. The manufacturer's instructions for replacing the Aspirator shall be followed.
2. The detector shall incorporate a replaceable Chamber Assembly such as the VSP-964. The manufacturer's instructions for replacing the Chamber Assembly shall be followed.
3. The detector shall incorporate a replaceable Sampling Module such as the VSP-965. The manufacturer's instructions for replacing the Sampling Module shall be followed.
4. The detector shall incorporate replaceable Front Covers such as the VSP-968 (VEP Front Cover with LEDs) and VSP-969 (VEP Front Cover with LCD). The manufacturer's instructions for replacing the Front Cover shall be followed.