SECTION 2831[XX] – AIR SAMPLING SMOKE DETECTION SYSTEMS

THE A/E SHALL EDIT THE INFORMATION IN THIS DOCUMENT, REMOVE BRACKETS AND CHANGE THE RED TEXT TO AUTOMATIC TEXT TO MATCH THE SENTENCE.

THE A/E SHALL VERIFY THAT SECTION TITLES REFERENCED IN THIS SECTION ARE CORRECT FOR THIS PROJECT'S SPECIFICATIONS; SECTION TITLES MAY HAVE CHANGED.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

REVISE SECTION AND ASSOCIATED NUMBERS IN SUBPARAGRAPHS BELOW TO MEET PROJECT REQUIREMENTS.

A. Related Sections include the following:

1. Section [XXX000].

B. [X.XX] Template Drawings.

1.02 SUMMARY

A. This Section Includes the following:

ADJUST LIST BELOW TO MEET PROJECT REQUIREMENTS

1. Air Sampling Smoke Detection (ASSD).
2. Air Sampling smoke detection network management system.
3. 24Vdc power supply.
4. Air Sampling smoke detection pipe distribution network.

B. Provide Air Sampling Smoke Detection (ASSD) system(s) as indicated in this Specification and on the Drawings.

REVISE DRAWING NUMBERS IN SUBPARAGRAPH BELOW BASED ON ACTUAL DRAWING NUMBERS OF PROJECT.

C. Reference the drawings for connectivity, interaction and function between other systems and devices as indicated on drawing [X.XX].

D. All fees and permits specifically required for the Air Sampling Detection system shall be applied for and paid for by Air Sampling Detection system Contractor.

E. The Contractor shall be responsible for obtaining and meeting the requirements as imposed by the AHJ. Any costs as a result of these requirements shall be the Air Sampling Detection system Contractor(s) responsibility.

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F. This Specification outlines the requirements for furnishing, installation, connection, commissioning and testing of Air Sampling Detection system(s). The work described in this Specification includes all design, engineering, labor, materials, equipment and services necessary and required, to form a complete operative and coordinated system.

1.03 DEFINITIONS

A. AHJ Authority Having Jurisdiction.

B. ASSD Air Sampling Smoke Detection.

C. BMS Building Management System.

D. EWFD Early Warning Fire Detection.

E. FACU Fire Alarm Control Unit.

F. FM Factory Mutual.

G. PE Professional Engineer.

H. FPE Fire Protection Engineer.

I. HLI High Level Integration.

J. NICET National Institute for Certification in Engineering Technologies.

K. NRTL Nationally Recognized Testing Laboratory.

L. FSCP Fire Suppression Control Panel.

M. SFD Standard Fire Detection.

N. UL Underwriters Laboratory.

O. VEWFD Very Early Warning Fire Detection.

1.04 SYSTEM DESCRIPTION

A. System shall consist of an ASSD assembly housing an integral aspiration fan, flow sensor(s), filter, laser based detection chamber, and control, output and supervision circuitry.

B. System shall consist of a regulated 24Vdc power source provided with backup rechargeable batteries.

C. System shall consist of an air sampling pipe distribution network which shall include piping, tubing, fittings and fasteners as specified herein. Piping shall originate from each ASSD apparatus and extend to the protected area(s). Sampling points shall be placed along the air

sampling pipe distribution network in accordance with this Specification and the Drawings. The air sampling pipe distribution network shall be supported by calculations from the Manufacturer's computer-based design modeling tool.

D. In operation, the aspiration fan in the ASSD apparatus draws air from the protected area(s) through sampling points in the air sampling pipe distribution network then to the ASSD detector assembly where it is analyzed for concentration of fire products.

E. ASSD apparatus shall include independent configurable alarm and trouble relay outputs for interface to other systems in accordance with this Specification and the Drawings.

F. ASSD apparatus shall communicate on a Class A bidirectional RS485 network with each device incorporating an integral repeater and loop isolator. Network cabling shall be as required by the ASSD system manufacturer's published instructions.

G. Networked ASSD apparatuses shall communicate to a graphical workstation installed where designated on the Drawings via a direct fiber optic communication loop. Provide compatible serial to fiber converters as necessary and as recommended by the ASSD system manufacturer.

H. Graphical workstation PC shall be loaded with ASSD system manufacturer's system management software (VSM4 or equivalent).

I. ASSD apparatus shall be capable of communicating to FACU through a UL listed High Level Interface (HLI) or by relay connectivity where HLI integration is not available with a particular manufacturer's control panel.

J. The system shall be considered a complete system when Division 21, Division 28, Division 23, and this Section are combined and designed to function as one system.

1.05 PERFORMANCE REQUIREMENTS

REVISE SUBPARAGRAPHS BELOW AND ASSOCIATED NUMBERS TO MEET PROJECT REQUIREMENTS.

A. System shall be complete in all ways. It shall include all engineering, and electrical installation, all detection and control equipment, auxiliary devices and controls, alarm interface, functional checkout and testing, training and all other operations necessary for a functional ASSD system.

B. System design, installation, commissioning and testing shall be in accordance with this Specification, the Manufacturer's guidelines and per all applicable codes and requirements of the local Authorities Having Jurisdiction (AHJ).

C. All equipment and associated components shall be new, standard products or the Manufacturer's latest design and suitable to perform the functions intended.

D. All fire protection related wiring shall be in conduit – no exceptions. Refer to the drawings for additional requirements or use.

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E. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, switches and devices necessary for a sound, secure and complete installation in full compliance with all applicable codes and requirements of the local Authorities Having Jurisdiction.

F. For detection of smoke concentration within ceiling void(s), where indicated in the drawings or where required to meet local jurisdictional requirements:

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated area(s).
2. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted to the underside of the structural ceiling or below beams where the ceiling is classified as being smooth.
3. Sampling points shall be drilled directly into the air sampling pipe distribution network, be oriented downward and be within 4 inches (101mm) below the underside of the structural ceiling or beam as indicated in drawing detail **[X.X]**.
4. For ceilings with beam depths exceeding smooth ceiling criteria, air sampling pipe distribution networks shall mount to the underside of structural beams with stanchions having sampling point extending up into each beam pocket, placed within 4 inches below the ceiling at locations where sampling points are required as indicated in drawing detail **[X.X]**.
5. Where the ceiling void is used as an air plenum, sampling points shall be oriented downward 20° to 45° towards the incoming airflow.
6. Maximum coverage per sampling point shall not exceed 200 sq ft (18.5 sq m).
7. Sampling points shall be installed in an area on the ceiling that is free from obstructions for a minimum of 18 inches (457mm) on all sides.
8. Placement of sampling points nearest to walls shall be greater than 12 inches (304mm) and not exceed 7ft (2m).

G. For detection of smoke concentration within open areas, where indicated in the drawings:

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated area(s).

DELETE THE FOLLOWING IF CROSS-ZONING IS NOT A PROJECT REQUIREMENT

2. [For preaction cross zoning and for source location purposes ASSD apparatuses shall be addressable with each pipe being a zone or sector.]
3. [For preaction release initiation sampling points from one ASSD pipe sector or detection zone serving open areas shall cross zone with one or more adjacent ASSD pipe sectors or detection zones.]
4. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted to the underside of the structural ceiling.
5. Sampling points shall be drilled directly into the air sampling pipe distribution network, be oriented downward and be within 4 inches (101mm) below the underside of the structural ceiling as indicated on drawing detail [X.X].
6. For structural ceilings that have beams, girders, solid joist or a waffle-like construction, etc., and that meet the special provisions of NFPA-72, air sampling pipe distribution networks shall mount to the underside of structural beams with stanchions having sampling point extend up into each beam pocket at locations where sampling points are required as indicated on drawing detail [X.X].

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7. Where accessible ceilings are present sampling points shall be remotely mounted to the underside of the accessible ceiling, be oriented downward and be within 4 inches (101mm) below the underside of the accessible ceiling. Remote sampling points shall interconnect with air sampling pipe distribution network located above the accessible ceiling via use of flexible "capillary" tubing as indicated on drawing detail [X.X].

   a. For efficiency, air sampling pipe distribution networks located above the accessible ceiling shall have "capillary" tubing running either side of each sampling pipe run to the corresponding remote sampling point as indicated in drawing detail **[X.X]**.

8. Maximum coverage per sampling point shall not exceed 200 sq ft (18.5 sq m), exception being where obstructions such as air supply diffusers would otherwise prevent this spacing objective from being met, in which case placement shall be just outside perimeter of obstruction.
9. Sampling points shall be a minimum of 3ft (1m) away from air supply diffusers.
10. Sampling points shall be installed in an area on the ceiling that is free from obstructions for a minimum of 18 inches (457mm) on all sides.
11. Placement of sampling points nearest to walls shall be greater than 12 inches (304mm) and not exceed 7ft (2m).

H. For detection of smoke concentration within accessible floors, where indicated in the drawings or where required to meet local jurisdictional requirements:

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated area(s).
2. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted and secured to raised floor support posts as close to the underside of floor tiles as possible.
3. Sampling points shall be drilled directly into the air sampling pipe distribution network and be oriented downward towards the slab.
4. Where the floor void is used as an air plenum, sampling points shall be oriented downward 20° to 45° towards the incoming airflow.
5. Maximum coverage per sampling point shall not exceed 200 sq ft (18.5 sq m).
6. Sampling points shall be free from obstructions for a minimum of 18 inches (457mm) on all sides.
7. Placement of sampling points nearest to perimeter walls extending to the slab shall be greater than 12 inches (304mm) and not exceed 7ft (2m).
8. Refer to drawing detail **[X.X]**.

I. For detection of smoke concentration within contained hot aisles, where indicated in the drawings:

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated area(s).

DELETE THE FOLLOWING IF CROSS-ZONING IS NOT A PROJECT REQUIREMENT

2. [For preaction cross zoning and source location purposes ASSD apparatuses shall be addressable with each pipe being a zone or sector.]

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3. [For suppression release initiation sampling points from one ASSD pipe sector or detection zone serving open areas shall cross zone with one or more adjacent ASSD pipe sectors or detection zones.]
4. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted at a point just before mechanical forced air leaves the contained hot aisle.
5. Sampling points shall be drilled directly into the air sampling pipe distribution network and be oriented 20-45° downward towards the incoming airflow.
6. Sampling point spacing shall be based upon sampling point distribution of minimum one (1) sampling point per 6ft (1.8m) of linear distance.
7. Each hot aisle shall be served by an individual ASSD pipe zone or sector (eg. four pipes on a four zone ASSD apparatus with each pipe serving an individual hot aisle).
8. Refer to drawing detail [X.X]

J. For detection of smoke concentration at return air paths where indicated in the drawings:

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated return air paths.
2. Sampling at return air grilles:

    a. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted to face of return air grilles prior to filtration in accordance with Manufacturer's guidelines, this Specification and the drawings.
    b. Sampling points shall be drilled directly into the air sampling pipe distribution network, be oriented downward 20° to 45° towards the incoming airflow and shall not be placed outside of grille area.
    c. Sample point spacing for return air grille detection shall be based upon sampling point distribution of a minimum of one (1) sample point per every four (4) square feet of grille area.
    d. Sampling points covering return air grilles shall standoff 3 to 6 inches from the grille in order to avoid the low or negative pressure point directly at the grille surface.
    e. A means to disconnect the sampling pipe from return air grilles shall be provided and based on Manufacturer's guidelines.
    f. Mechanical standoff fasteners used to support the sampling pipe network shall be fit for purpose. Plastic zip ties are not permitted.
    g. Refer to drawing detail [X.X]

3. Sampling within return air ducts:

    a. ASSD apparatus serving a return air duct shall be dedicated to the duct in which it is monitoring.
    b. Air sampling pipe distribution networks shall be constructed using rigid pipe with sampling to occur within return air duct prior to entry into HVAC unit(s).
    c. The exhaust port of each ASSD apparatus shall be returned within the duct in which it is monitoring so as to maintain an equal pressure across ASSD inlet and exhaust port.
    d. Sampling port spacing within return air ducts shall be spaced in accordance with Manufacturer's guidelines and be oriented 20° to 45° towards the incoming airflow and shall not be placed outside of the duct.

e. Application shall be in accordance with the Manufacturer's published in-duct sampling guidelines, this Specification and the drawings.
f. ASSD apparatuses serving return air duct(s) shall be listed and approved for duct application.
g. Refer to drawing detail [X.X].

K. For detection of smoke concentration at supply side of HVAC system(s):

1. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover supply side of designated HVAC unit(s).
2. Air sampling pipe distribution networks shall be constructed using rigid pipe with sampling to occur at a common point at the supply side of the HVAC unit(s).
3. Sampling points shall be drilled directly into the air sampling pipe distribution network, be oriented downward 20° to 45° towards the incoming airflow and shall not be placed outside of the HVAC supply side discharge area.
4. Sample point spacing for HVAC supply side monitoring shall be based upon a sampling point distribution of a minimum of one (1) sample point per every four (4) square feet of HVAC supply side discharge area.
5. The exhaust port of each ASSD apparatus shall be placed within same environment as the inlet so as to maintain an equal pressure across the inlet and exhaust ports.
6. Precautions shall be taken to ensure ASSD apparatuses operate within their UL listed temperature range and that condensation is prevented from entering the apparatus following Manufacturer's guidelines.
7. Mechanical standoff fasteners and pipe hangers used to support the sampling pipe network shall be fit for purpose.
8. Maximum transport time from furthest sampling point on each pipe run shall not exceed 60 seconds.
9. Provide detailed drawing of proposed installation for approval to the Architect/Engineer project manager prior to installation.
10. Refer to drawing detail [X.X]

L. For detection of smoke concentration at outside air intakes:

1. Where indicated on drawings, outside air intakes shall each be monitored by sampling points of a VEWFD ASSD system prior to filtration to monitor incoming air for smoke.
2. Provide appropriate number of ASSD apparatuses to efficiently and adequately cover designated outside air intakes.
3. The air sampling pipe distribution network shall not be directly exposed to the outside environment.
4. Precautions shall be taken to ensure ASSD apparatuses operate within their UL listed temperature range and that condensation is prevented from entering the apparatus (refer to Drawing for details).
5. ASSD apparatuses deploying ultrasonic flow supervision shall be exclusively utilized for this application.
6. Sampling at outside air intake openings:

    a. Air sampling pipe distribution networks shall be constructed using rigid pipe mounted to face of outside air intake openings in accordance with Manufacturer's guidelines, this Specification and the Drawings.

b. The exhaust port of each ASSD apparatus shall be placed within same environment as the inlet so as to maintain an equal pressure across ASSD inlet and exhaust port.
c. Sample point spacing for outside air intake opening detection shall be based upon sampling point distribution of a maximum of one (1) sample point per every four (4) square feet of intake opening.
d. Sampling points covering outside air intake openings shall standoff 3 to 6 inches from the surface of the opening in order to avoid the low or negative pressure point directly at the opening surface.
e. Sampling points covering outside air intake openings shall be oriented downward 20° to 45° towards the incoming airflow and shall not be placed outside of intake opening.
f. A means to disconnect the sampling pipe from outside air intake openings shall be provided and based on Manufacturer's guidelines.
g. Mechanical standoff fasteners used to support the sampling pipe network shall be fit for purpose. Plastic zip ties are not permitted.

7. Sampling within outside air intake ducts:

a. ASSD apparatus serving an outside air intake duct shall be dedicated to the duct in which it is monitoring.
b. The exhaust port of each ASSD apparatus shall be returned within the duct in which it is monitoring so as to maintain an equal pressure across ASSD inlet and exhaust port.
c. Air sampling pipe distribution networks shall be constructed using rigid pipe with sampling to occur within outside air intake duct prior to entry into HVAC unit(s) as indicated on the Drawings.
d. Sampling port spacing within outside air intake ducts shall be spaced in accordance with Manufacturer's guidelines and be oriented 20° to 45° towards the incoming airflow and shall not be placed outside of the duct.
e. Application shall be in accordance with the Manufacturer's published in-duct sampling guidelines, this Specification and the Drawings.
f. ASSD apparatuses serving outside air duct(s) shall be listed and approved for duct application.

8. ASSD apparatuses monitoring outside air intakes are supervisory inputs to the FACP or BMS only and do not alarm the building causing evacuation.
9. Provide detailed drawing of proposed installation for approval to the Architect/Engineer project manager prior to installation.
10. Refer to drawing detail [X.X]

M. ASSD apparatuses shall exhaust into an equal or lessor pressure and in no case shall the Δp between ASSD apparatuses sampling pipes and between sampling pipes and detector exhaust exceed 100 Pa (0.4 inches of water).

N. Manufacturer's specific software modeling tool which uses air sampling pipe distribution network parameters shall be used to predict performance of pipe network design(s). Each of the following performance requirements shall be met:

1. Maximum Fire 1 sensitivity at each sample point for ASSD shall not exceed 1% obs/ft (3% obs/m) and shall be within 30 percent of this target.
2. Smoke transport time shall not exceed 60 seconds measured from the furthest sampling point (excluding Benchmark Test Point) on each pipe run back to the ASSD apparatus. A minimum 5% buffer shall be maintained to account for field variations that may occur but in no case shall exceed the 60 second objective.

O. Where local codes and standards dictate placement and spacing of sampling points that is more stringent than those specified herein, local codes and standards shall prevail.

P. All sampling points shall be marked with the Manufacturer's standard identification labels as specified herein.

Q. ASSD apparatus shall be installed in an accessible location and at an accessible height not to exceed 6ft (1.82m) as indicated in this Specification and on the Drawings.

R. A Benchmark Test Point shall be provided at the furthest end of each pipe run, opposite end of the ASSD apparatus. Provisions shall be made so that this test point can be located maximum 6ft (1.82m) above finished floor. The test point shall be constructed using a normally closed industrial quick connect fitting with an orifice of nominal 1/8 inch (3.2mm) when open to facilitate benchmark performance verification as indicated in this Specification and on the Drawings. This remote test point is intended to benchmark system performance at time of initial commissioning and during routine test and inspection. The test point shall be labeled documenting benchmark system performance at time of commissioning using Manufacturer supplied labels intended for this purpose. Benchmark labels shall be placed just above test points and be positioned so that they are visible without obstruction. Refer to drawing detail [X.X].

S. Installation and materials shall be in accordance with Manufacturer's guidelines, this Specification and as indicated on the Drawings.

1.06 SUBMITTALS

A. Submittals shall be in full compliance with the requirements of NFPA 72, Chapter 7, 2016 Edition.

B. It is imperative that the Manufacturer be included in the early stages of project work to ensure all designs are in compliance with regulatory code, and Manufacturer's criteria.

1. Installing Contractor: Prior to submittal, ordering of equipment or commencement of any installation work, the ASSD system Manufacturer shall review all designs for new ASSD systems;

    a. A set of prints (AutoCAD) shall be sent to manufacturer complete with all ASSD piping layouts, detector placement, ASPIRE calculations, and a copy of ASSD project specifications. Upon receipt of this complete package, manufacturer will review and comment within 5-7 working days.

C. Product Data:

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1. Submit Manufacturer's technical product data as a minimum, but not limited to, for the following:

    a. Air Sampling Smoke Detector(s).
    b. Display unit(s).
    c. Programming device(s).
    d. Sampling pipe.
    e. Input/output and monitoring devices.
    f. Devices such as relays if needed, etc.
    g. Wiring diagrams.
    h. Equipment ratings.
    i. System management software.
    j. Description of system operation for each product and that the system meets or exceeds specified requirements.

D. Shop Drawings:

1. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by Manufacturer in Air Sampling Detection system design.
    b. NICET certified fire alarm technician, Level III minimum or equivalent.
    c. Where required, licensed or certified by the authorities having jurisdiction.

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2. Information shall be submitted on [1/8" = 1'-0"] scale building floor plans. Reproduction of contract drawing will not be acceptable. The following information shall be included in the shop drawings:

    a. Provide mounting details of ASSD apparatuses, displays, programmers, power supplies and other boxes to building structure, showing fastener type, sizes, material, and embedded depth where applicable.
    b. Air sampling pipe, fittings and pipe details including pipe routing and support.

3. The following Calculations and Wiring Diagrams shall also be included on the shop drawings:

    a. Provide calculations for the battery stand-by power supply taking into consideration the power requirements of all auxiliary components under full load conditions. Include battery size calculations.
    b. Show system components, including detectors and cabinets, locations, quantities, and full schematic of system wiring showing conductor size, routings, quantities and connection details.

4. Reflected Ceiling Plans: Show ceiling penetrations, ceiling-mounted items, and method of attaching hangers to building structure.

5. System Performance Calculations:

    a. Submit report generated from Manufacturer's system performance calculation program illustrating performance criteria such as transport time to the detector. The

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system transport time shall not exceed 60 seconds from the furthest sampling point back to the detector.

6. A complete sequence of operation.

E. Permit Approved Drawings: Working plans, prepared according to local codes and standards, that have been approved by Authorities Having Jurisdiction. Include design calculations.

F. Maintenance data

G. Warranty information.

1.07 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of Air Sampling Smoke Detection systems of types, sizes, and electrical characteristics required, and whose products have been in satisfactory use in similar service for not less than fifteen years.
2. The name of the manufacturer, part numbers and serial numbers shall appear on all major components.

B. Designers and Technicians Qualifications:

1. Trained and certified by Manufacturer in Air Sampling Detection system design.
2. NICET certified fire alarm technician, Level III minimum or equivalent.
3. Where required, licensed or certified by the authorities having jurisdiction.
4. Final construction drawings shall be signed and stamped/sealed and issued by a PE registered in the jurisdiction where the installation is to be made either by the System Designer or Engineer Consultant.

C. Contractor Qualifications:

1. All contractors involved with the design and installation of ASSD systems shall be very experienced with the systems that they are designing / installing per the occupancy use. A minimum of 5 years experience in the installation of ASSD systems and a NICET level III fire alarm technician or equivalent on staff to supervise the design and installation is required.
2. The installing contractor shall have successfully passed advanced certification training and be listed by the ASSD system Manufacturer as an accredited contractor, trained and certified to model, design, install, program, test and maintain the ASSD system and shall be able to produce a certificate stating such upon request.
3. The installing contractor shall maintain appropriate licensing and certifications from the jurisdiction in which the work occurs.

D. Testing Technicians Qualifications:

1. Testing technicians of ASSD systems shall be trained and qualified by the ASSD system Manufacturer in the proper operation of the system per the occupancy use.

2. System testing technicians or others conducting system programming, certification, power up, and system commissioning shall have had advanced certification training, be listed by the ASSD system Manufacturer as an accredited contractor and shall be able to produce a certificate stating such upon request.
3. Testing technicians shall be an accredited NICET Level II (or greater) or equivalent fire alarm technician to perform such work.

E. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

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1. [NFPA 70: National Electrical Code.]
2. [NFPA 72: National Fire Alarm Code.]
3. [NFPA 75: Standard for the Fire Protection of Information Technology Equipment.]
4. [NFPA 76: Standard for the Fire Protection of Telecommunication Facilities.]
5. [NRTL: Nationally Recognized Testing Laboratory]
6. [FM Global: Property Loss Prevention Data Sheet 5-32]
7. Standards listed, as well as all other applicable codes and standards shall be used as "minimum" design standards. Also, to be considered are the requirements of the "Authority Having Jurisdiction" and good engineering practices.

1.08 CLOSEOUT SUBMITTALS AND DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Requirements and recommendations related to maintenance.
2. Manufacturer's user training manuals.
3. Provide all information required for shop drawing and product data review.

B. Record Drawings:

1. Equipment installation, operation and programming manuals.
2. Manufacturer's required maintenance related to system warranty requirements.
3. Include name, telephone number, address, and contact information for the local fire alarm installing contractor.
4. Record drawings to show as-built conditions to include, but not limited to the following:

    a. Parts list.
    b. Circuit drawings, point-to-point wiring diagram, riser diagram and control diagrams.
    c. Sequence of Operation which includes detailed operation and control of each item of equipment and a control sequence.
    d. Final location of all devices related to the ASSD system.
    e. Show size and route of all conduits related to the ASSD system.

C. Field quality-control test reports.

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1. Record all tests and system calibration using the Manufacturer's standard commissioning form for each and every ASSD system provided. A copy of these results shall be included in close-out submittals and a copy made available to be left on site.

1.09 DELIVERY, STORAGE, AND HANDLING

A. It is the Contractor's responsibility to ensure on-time delivery of all materials and equipment required for the Project. All materials furnished or incorporated in the Work shall be new, unused, of best quality, and especially adapted for the service required; whenever the characteristics of any material are not particularly specified, such material shall be utilized as is customary in first class work of a nature for which the material is employed.

B. Contractor shall provide necessary means to properly stage and store all materials and equipment until time of use or installation on the Project. Contractor shall be solely responsible for materials and equipment stored on the Site; type and extent of security provided to be at Contractor's discretion. Coordinate all requirements with Owner.

C. Contractor shall be responsible for proper handling, rigging, and installing of all materials and equipment for the Project.

D. Owner reserves the right to reject any materials or equipment that are not properly stored in accordance with these specifications or the Manufacturers' requirements.

1.10 WARRANTY

A. All ASSD system components furnished and installed under this contract, shall be guaranteed against defects in design, materials and workmanship for the full warranty period which is standard with the Manufacturer, but in no case less than one (1) years from the date of system acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers – Basis of Design Bid: Subject to compliance with requirements, provide products by Xtralis Inc. Base bid shall include the Basis of Design. Substitutions will be considered for products by other manufacturers, but are not required in advance of bid. When substitution requests are submitted, the Architect / Engineer will be the sole judge of equivalency.

B. Manufacturer's Approved Products:

1. VESDA VLF (LaserFOCUS)
2. VESDA VES (SCANNER)
3. VESDA VEP (one pipe and 4 pipe versions)
4. VESDA VEU

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C. All devices and equipment shall be listed by a Nationally Recognized Testing Laboratory.

2.02 MATERIALS AND EQUIPMENT

A. Air Sampling Smoke Detection (ASSD) Apparatus shall:

1. Be aspirated laser-based type.
2. Be of the mass light scattering type and capable of detecting a wide range of smoke particle types of varying size. A particle counting method shall be employed for the purposes of:

    a. Preventing large particles from affecting the true smoke reading.
    b. Monitoring contamination of the filter (dust & dirt etc.) to automatically notify when maintenance is required. The particle counting method shall not be used for the purpose of smoke density measurement.

3. Be equipped with an integral 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 across critical detector optics to eliminate internal detector contamination.
4. Be self monitoring for filter contamination and provide indication through system fault when replacement is necessary. Detectors which allow automatic reset of filter status upon removal and reinsertion are not permitted.
5. Contain relays for alarm and fault conditions. The relays shall be software programmable to the required functions.
6. Be network capable, each with its own integral bus isolator and repeater.
7. Be equipped with a general purpose input to allow either: Remote Reset, Isolate or Standby.

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8. [Be modular, with each detector monitored by an integral or externally mounted Display Unit featuring indicator LED's. For addressable detectors, indicators shall identify which pipe is carrying smoke. Remote Display units shall incorporate integral control buttons for Reset and Isolate.]
9. Permit configuration by programmers that are either integral to the system, portable or PC based.
10. Allow configuration of:

    a. Smoke threshold alarm levels.
    b. Time and date.
    c. Time delays.
    d. Faults, including airflow, detector, power, filter and network as well as an indication of the urgency of the fault.
    e. Relay outputs for remote indication of alarm and fault conditions.
    f. General purpose input functionality.
    g. Simulated electronic testing of relays.

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11. Provide a minimum of four alarm output levels corresponding to Alert, Action, Fire 1 and Fire 2. Alarm levels shall be programmable and able to be set within listed limits at absolute sensitivities meeting sensitivity objectives specified herein. Setting and adjustment of sensitivities by means of adaptive algorithms is not permitted.
12. Incorporate a flow sensor in each pipe inlet and provide staged airflow faults. Detector units which permit unsupervised disabling of flow sensors is not permitted.
13. Incorporate facilities to transmit the following faults:

    a. Detector
    b. Airflow
    c. Filter
    d. System
    e. Zone
    f. Network
    g. Power
    h. Urgent and Minor faults

14. Store internally a minimum of 18,000 events in its history buffer for future extraction and analysis of events and operational status.
15. Addressable detectors shall have four pipe inlets fitted with an integral scanning valve mechanism to identify which sampling pipe is carrying smoke. The valve mechanism shall:

    a. Begin to sample each pipe individually upon detection of smoke.
    b. Be used to identify the level of smoke in each pipe.
    c. Be used to indicate in which pipe an alarm was first detected.

B. ASSD System Management Workstation.

1. Microsoft Windows 32-bit 7 Professional or Windows 7 Enterprise operating system, 2.8 GHz CPU (or Core 2 Duo 2.1 GHz CPU), 2 GB RAM, 40 GB minimum hard drive; two Serial ports, one Parallel port, two USB ports, dual Gigabit LAN, one PS/2 mouse port, one PS2 mouse and keyboard adapter cables; SVGA video output with 16 MB VRAM, CD/DVD R/W, 101 keyboard, PS/2 mouse, PCI and ISA slots (as required), integral audio and amplified speakers.
2. Power: 120VAC with 6-foot plug and cord.
3. ASSD software provided by the ASSD system manufacturer (VSM4 or equivalent).
4. ASSD software features to include:

    a. All system programming.
    b. Remote management capabilities.
    c. Comprehensive configuration and commissioning of all ASSD devices.
    d. Automatic detection of network devices.
    e. Smoke trend charts.
    f. Real-time active event listings.
    g. Sorting and filtering of system events.
    h. Customizable software views.
    i. Caching of smoke trend data.
    j. Graphical floor plans.
    k. Must be compatible with the Workstation PC.

C. Power Supply and Batteries:

1. System shall be powered by from a listed and approved regulated supply of nominally 24Vdc.
2. Power supply shall be provided with appropriately sized/rated batteries to accommodate the system's power requirements for a duration of time required by the local AHJ in the event main AC power is interrupted.

D. Sampling Pipe, Capillary Tubing, Remote Sampling Points, Fittings and Mounting Hardware:

1. Sampling pipe, capillary tubing, remote sampling points and associated fittings shall be as provided by the ASSD Manufacturer.
2. Material for sampling pipe, capillary tubing, remote sampling points and associated fittings shall be in accordance with the ASSD Manufacturer's published guidelines, local codes and standards.
3. Pipe and tubing inside diameter shall be in accordance with Manufacturer's guidelines and as specified in air sampling pipe distribution software modeling tool.
4. Pipe and tubing interior shall be smooth bore.
5. Pipe and tubing shall be permanently imprinted with listing information and marking requirements as per local codes and standards. Adhesive labels applied to the pipe containing code required identification is not acceptable.
6. All fittings shall be made with compatible pre-formed elbows, tees, couplings, end caps and unions.
7. All joints in the sampling pipe must be air tight and made by using compatible solvent cement, except at entry to the detector.
8. Mechanical pipe fasteners and hangers shall be approved for use with the pipe material in which it is supporting. Fasteners and hangars shall allow pipe to freely slide in and out to facilitate expansion and contraction of the material.
9. It shall be the installing contractor's responsibility to confirm pipe and tubing material and mounting methods selected meets this Specification, requirements of the local AHJ and Manufacturer's guidelines.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with local codes and standards, and in accordance with the Manufacturer's written instructions for installation of Air Sampling Detection systems.

B. Air Sampling Smoke Detector (ASSD) Apparatus:

1. ASSD apparatuses shall be installed in accordance with this Specification and the Manufacturer's written installation and instruction manuals.
2. Detector assembly shall be mounted to a wall in the protected room at a height of approximately 48 inches (1.2m) to 60 inches (1.5m) to top of detector measured above finished floor.
3. Mounting location shall be a fully accessible and visible location.

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4. Mounting or attachment to site equipment, cable trays, movable walls, other equipment or equipment supports is not permitted without express written approval.
5. Piping network insertion into the detector inlet shall not be glued.
6. Flexible tubing for termination of the sampling pipe network into detector inlet is not permitted.
7. In seismic zones, installation techniques shall be in compliance with the geographical seismic zone requirements per the AHJ.

C. Pipe Mounting:

1. The air sampling pipe network shall be mounted in accordance with the Manufacturer's written installation and instruction manuals, and local codes and standards. The hardware used for mounting will depend upon the design and site requirements.
2. To minimize flexing the pipes shall be secured every 5ft (1.5m).
3. When installing a pipe network in areas subject to high temperature fluctuations allow for the contraction and expansion of pipes.
4. Where expansion or contraction of pipes is likely either after installation or on a continuous basis, do not place pipe clips adjacent to couplings and socket unions as these may interfere with the movement of the pipe.
5. No bends are permitted within the first 20 inches (508mm) from the detector inlet.
6. Piping shall be mounted as close to the ceiling as possible.
7. The routing of the piping network shall be coordinated with potential obstructions, including cable trays, grounding bars, and HVAC ductwork.
8. All changes in direction shall be made with standard elbows or tees.
9. All joints shall be air-tight and made by using solvent cement, except at the entry to the detector assembly. Refer to ASTM F402-88 standard practice for safe handling of solvent cements, primers and cleaners used for joining thermoplastic pipe and fittings.
10. Flexible tubing for termination of the sampling pipe network into detector inlet is not permitted.
11. All pipes shall be supported by mechanical hangers attached to the structure of the building. Not more than one foot of pipe shall extend beyond the last hanger of each sampling pipe. The final installation shall result in no noticeable deflection in the piping network.
12. Attachment of air sampling pipe networks to cable trays is prohibited.
13. Air sampling pipe network shall be permanently imprinted with the ASSD apparatus Manufacturer's standard identification marking at least 20ft (6m) intervals.
14. Placement of the air sampling pipe network shall take into consideration appropriate sampling point locations and spacing.
15. All air sampling pipe network penetrations of fire-rated partitions shall be sealed with a listed and/or approved through-penetration firestop material.
16. Debris accumulated in air sampling pipe network during installation and assembly shall be removed by negative airflow prior to connection to the ASSD apparatus.

D. Capillary Sampling Network:

1. In areas with an accessible ceiling the sampling pipe network shall be installed above the ceiling with remote sampling points extending through the accessible ceiling using appropriate lengths of 0.375 inch (10mm) inside diameter capillary tubing attached to remote sampling points. Remote sampling point locations shall align in center of

acoustical ceiling tiles where possible provided spacing meets the requirements of this Specification. Appearance shall be uniform in terms of sampling point row alignment. Coordinate layout with T-Bar grid.

2. The maximum length of the capillary tube shall be 26ft (8m).
3. An additional 2ft (60cm) of capillary tubing shall be provided for each drop to permit future relocation of remote sampling points (not to exceed 26ft (8m) limitation).
4. Remote sampling points shall be labeled with the Manufacturer's standard identification marking.
5. Capillary tube and attachment to sampling pipe network shall be that required by the Manufacturer.

E. Combined Detection Coverage:

1. It is permissible for an air sampling pipe network to protect adjacencies provided a branched or separate air sampling pipe networks are deployed, sensitivity objectives and ambient background levels are equal, and that the ASSD apparatus exhaust is in an equal or negative pressure, not to exceed 100 Pascal's (0.4 inches of water), in relationship to where sampling points are located. Strict compliance with the Manufacturer's system design manual shall be given when applying a system in this fashion.

3.02 ELECTRICAL POWER AND WIRING

A. General: All power and distribution shall meet the requirements of the Manufacturer, applicable codes and standards.

3.03 IDENTIFICATION

A. Install framed instructions in a location visible from each ASSD apparatus.

B. Identification shall include corresponding detector zone number, associated power supply number.

C. ASSD apparatus identification to be consistent with BAS identification. This requires coordination between ASSD system contractor and BAS contractor.

3.04 INITIAL COMMISSIONING SETTINGS

A. Initial Commissioning Settings for ASSD Apparatus.

1. Alarm threshold settings for air sampling smoke detection apparatuses shall be configured to achieve target port sensitivities above recorded average ambient peak level of 0.20% obs/ft for Alert, 0.6% obs/ft for Action, 1.0% obs/ft for Fire 1, and 2.5% obs/ft for Fire 2. Data review and analysis shall consider the normal base line or ambient pollutant level recorded, as well as all deviations from the established base line as recorded by the apparatuses event log. The recorded data shall then be used in conjunction with the following formulas to calculate alarm thresholds:

a. Fire 2 – Divide target sampling port sensitivity of 2.5% obs/ft by number of holes in overall system pipe network then add the recorded average ambient peak level to derive at the Fire 2 alarm threshold.
b. Fire 1 – Divide target sampling port sensitivity of 1% obs/ft by number of holes in overall system pipe network then add the recorded average ambient peak level to derive at the Fire 1 alarm threshold.
c. Action – Divide target sampling port sensitivity of 0.60% obs/ft by number of holes in overall system pipe network then add the recorded average ambient peak level to derive at the Action threshold.
d. Alert – Divide target sampling port sensitivity of 0.20% obs/ft by number of holes in overall system pipe network then add the recorded average ambient peak level to derive at the Alert threshold.

2. Air sampling detection apparatuses which permit scheduling of sensitivity thresholds by date and/or time shall be programmed to use the same sensitivity thresholds specified herein 24 hours a day, 7 days a week.
3. Time delays are intended to mitigate nuisance signals as a result of transient conditions. The following time delays shall be programmed into each detector apparatus:

a. Fire 2: 30 seconds.
b. Fire 1: 15 seconds.
c. Action: 30 seconds.
d. Alert: 30 seconds.
e. Airflow fault delay: 60 seconds.
f. Scan Delay (four zone air sampling detector apparatuses): 3 seconds.
g. Sector Delay (four zone air sampling detector apparatuses): 15 seconds.
h. Filter Fault: 1825 days.

3.05 SIGNALS

REVISE SUBPARAGRAPHS BELOW TO MEET PROJECT REQUIREMENTS.

A. Air Sampling Smoke Detection (ASSD) Apparatus Signals.

1. Fire 2:

a. Discrete visual indicator at ASSD apparatus.
b. Fire 2 alarm to FACU.
c. Audible/visual alarm at FACU.
d. Fire 2 alarm signal to the monitoring station.

2. Fire 1:

a. Discrete visual indicator at ASSD apparatus.
b. Fire alarm signal to FACU.
c. Audible/visual alarm at FACU.
d. Fire alarm signal to the monitoring station.

3. Action:

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a. Discrete visual indicator at ASSD apparatus.
b. Action supervisory signal to FACU.
c. Audible/visual alarm at FACU.

4. Alert:

a. Discrete visual indicator at ASSD apparatus.
b. Alert supervisory signal to FACU.
c. Audible/visual alarm at FACU.

5. Sector Pipe Identification (four zone ASSD apparatus):

a. Sector pipe identification signal to FACU.

6. Fault:

a. Discrete visual indicator at ASSD apparatus.
b. Trouble indication at FACU.
c. Trouble to the monitoring station.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. The ASSD system Contractor shall draft and submit, to the Architect / Engineer and the Owner's Representative, for approval, a detailed Method of Procedure (MOP) commissioning plan, per area, which outlines all commissioning activities and identifies each activity and test, zone specific, necessary for a complete verification of the design and operation prior to start of testing.

ADJUST DURATION BELOW TO MEET PROJECT REQUIREMENTS.

C. The complete system shall be functionally tested in the presence of Architect / Engineer and/or Owner's Representative and all functions must be operational at least [five (5)] days prior to the final acceptance tests.

D. Tests and Inspections:

1. General testing:

a. All system and equipment devices shall function as required and designed.
b. Each detector unit circuit shall be tested for trouble by inducing a trouble condition into the system.
c. Test wiring runs for continuity, short circuits, and grounds before system is energized. Test and record resistance, current, and voltage readings as work progresses.
d. Field tests shall be performed for all devices and functions of the ASSD system (100%) prior to the performing a final test to be witnessed and accepted by the local AHJ. All testing shall be coordinated with the Architect / Engineer and the Owner's Representative

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2. Visual Inspection: Conduct visual inspection prior to testing.
3. Correct malfunctioning equipment, and then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
4. Report test results promptly and in writing to Architect / Engineer, the Owner's Representative and Authorities Having Jurisdiction.

E. Acceptance Tests:

1. Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals as indicated in this Specification Part 1, Closeout Submittals and Documents. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.
2. Final Acceptance Test shall begin only when the Preliminary Test Report has been approved.
3. As-Built Drawings and previous test results shall be available at the time of testing.
4. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

F. Prepare test and inspection reports.

1. Upon completion of a successful test, the ASSD system Contractor shall so certify the system in writing to Owner's Representative.
2. Submit copy of test results in duplicate, after signed off by the AHJ, to the Architect / Engineer and the Owner's Representative.

G. Upon acceptance by the Architect / Engineer and the Owner's Representative, the completed system(s) shall be placed into service.

3.07 DEMONSTRATION AND TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain ASSD systems.

B. Prior to final acceptance, the installing contractor shall provide operational training to each shift of Owner's personnel. Each training session shall include ASSD system operation, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

ADJUST DURATION BELOW TO MEET PROJECT REQUIREMENTS.

1. Furnish training for a minimum of [four (4)] Owner designated employees of the system user:

   a. Training in the receipt, handling, and acknowledgement of alarms.

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b. Training in the system operation including manual control of output functions from the system.
c. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
d. The total training requirement shall be sufficient to cover all items specified.

END OF SECTION 2831[XX]