

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 00 10 - General Instructions.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 Canadian Electrical Code.
- .2 National Research Council of Canada
 - .1 NRCC NBCC-2015, National Building Code of Canada.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 72, National Fire Alarm and Signaling Code, 2019 Edition.
 - .2 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN-ULC-S524-2019, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN-ULC-S525-16-REV1, Audible Signal Devices for Fire Alarm Systems, Including Accessories.
 - .3 CAN-ULC-S527-19, Standard Laboratory Guide for Control Units for Fire Alarm Systems.
 - .4 CAN-ULC-S528-14-REV1, Standard for Manual Pull Stations for Fire Alarm Systems, Including Accessories.
 - .5 CAN-ULC-S529-16-REV2, Standard for Smoke Detectors for Fire Alarm Systems.
 - .6 CAN-ULC-S530-M91-R2018, Standard for Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .7 CAN-ULC-S531-19, Standard for Smoke Alarms.
 - .8 CAN-ULC-S537-2019, Standard for Verification of Fire Alarm Systems.
 - .9 ULC-S541-16-REV1, Speakers for Fire Alarm and signaling Systems, Including Accessories.
 - .10 CAN-ULC-S561-13-R2018, Standard for Installation and Services for Fire Signal Receiving Centres and Systems.
 - .11 CAN-UC-S1001-11-Rev1, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 SYSTEM DESCRIPTION

- .1 Fully supervised addressable, microprocessor- based, fire alarm utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission. System to be 1-stage type, Class A wired. Wiring from main control panel to DGP's for communications, to be 'DCLC' configuration.
- .2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating alert signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency and fire department.
- .3 Modular in design to allow for future expansion.
- .4 Operation of system shall not require personnel with special computer skills.

- .5 System to include:
 - .1 Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/ display, and program control/signalling; master telephone with necessary switches and controls.
 - .2 Data Gathering Panels/Transponders with stand-alone capabilities as required.
 - .3 Power supplies.
 - .4 Initiating/input circuits.
 - .5 Output circuits.
 - .6 Telephone circuits.
 - .7 Auxiliary circuits.
 - .8 Amplifiers.
 - .9 Wiring.
 - .10 Manual and automatic initiating devices.
 - .11 Audible and visual signalling devices with voice reproducing capability.
 - .12 Local and Remote displays.
 - .13 Printer & Event log memory chip.
 - .14 Historic event recorder.
 - .15 Network command centre.
 - .16 End of line resistor.
 - .17 Line fault isolators as required by CAN-ULC-S524. To be installed at all stairwells, between floors, fire separation and for each 2000 metre square of a building area.
- .6 Provide line isolators at all stairwells, between floors, between fire compartments and for each 2000 m² of floor space as per ULC and NBC requirements. Indicate the location of all line isolators on as-built drawings.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System components: listed by ULC and comply with applicable provisions of National Building Code, and meet requirements of Departmental Fire Coordinator, Fire Protection Engineering Services.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Detail assembly and internal wiring diagrams for control units, Consoles Auxiliary cabinets.
 - .2 Overall system riser wiring diagram identifying control equipment, initiating zones, signalling circuits; identifying terminations, terminal numbers, conductors and raceways.
 - .3 Details for devices.
 - .4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
 - .5 Step-by-step operating sequence, cross referenced to logic flow diagram.

1.6 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 26 05 00 - Common Work Results for Electrical.
- .2 Include:
 - .1 Instructions for complete fire alarm system to permit effective operation and maintenance.

- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
- .4 List of recommended spare parts for system.
- .5 Updated "As-Constructed" riser diagram.
- .6 Verification forms and final certificate.

1.7 MAINTENANCE MATERIALS

- .1 Include:
 - .1 Four (4) spare smoke detectors of each type.
 - .2 Four (4) spare heat detectors each type.
 - .3 Four (4) spare horns of each type.
 - .4 Four (4) fire alarm pull stations.
 - .5 Four (4) spare strobe lights.
 - .6 Four (4) line isolators.
 - .7 Four (4) flame detectors.

1.8 TRAINING

- .1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel and security personnel in use and maintenance of fire alarm system, to the Departmental Representative's satisfaction, in both official languages.
- .2 Contractor to coordinate with local responding fire fighters to be present during training.
- .3 Refer to Section 01 79 00 - Demonstration and Training, Part 1.2.5.1.

PART 2 - PRODUCT

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Power supply: to N.E.S.A./NBBC.
- .3 Audible signal devices: to CAN-ULC-S525.
- .4 Control unit: to CAN-ULC-S527.
- .5 Control panel: to CAN-ULC-S527.
- .6 Manual pull stations: to CAN-ULC-S528.
- .7 Thermal detectors: to CAN-ULC-S530.
- .8 Smoke detectors: to CAN-ULC-S529.
- .9 Smoke alarms: to CAN-ULC-S531.

- .10 Speakers: to ULC-S541.
- .11 Communication cable for monitoring: to CAN-ULC-S561.
- .12 Imaging smoke detection: ULC listed.
- .13 Line fault isolators.

2.2 SYSTEM OPERATION: VOICE COMMUNICATION - SINGLE STAGE

- .1 Actuation of alarm initiating device of manual station, fire detector and water flow switch:
 - .1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.
 - .2 Indicate address of alarm at control unit and remote annunciator display and remote printer and terminal.
 - .3 Operation:
 - .1 Cause audible and visual signalling devices to operate on all floors.
 - .4 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.
 - .5 Cause fire doors, if normally held open, to close automatically.
 - .6 Cause elevators to return to main floor, or to 2nd floor (alternate floor), as required.
 - .7 Cause powered door operator to be disabled.
 - .8 Cause signal to be transmitted to all audible devices.
 - .9 Cause magnetic locks to release.
 - .10 Cause turnstiles to release.
- .2 Possible to transmit voice message from control unit to specific floor, group of floors, area, zone, group of zones. Activating push-to-talk switch on master and specific switches for specific zones to silence tones in zones and allow one-way voice messages over system speakers. Releasing master switch and returning switches back to original position to re-activate tones on speakers in zones unless tones have been silenced. Audio channel available to each speaker circuit to be automatically and dynamically selected by microprocessor. Manual selection and operation of evacuation tones/emergency paging to be provided on floor-by-floor, area-by-area basis.
- .3 Possible to transmit voice message from control unit to each stairwell. Stairwell speakers are to be dedicated to voice message only.
- .4 Acknowledging alarm: indicated at control unit.
- .5 Possible to silence signals by "alarm silence" switch at control unit, after silencing after the initial signal has sounded for a minimum of 60 seconds.
- .6 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals, to the state they were in at the time of the alarm silencing and timer should not be reset.
- .7 Actuation of supervisory device to:
 - .1 Cause electronic latch to lock-in supervisory state at control unit.
 - .2 Indicate respective supervisory zone at control unit and remote display. annunciator
 - .3 Cause audible and visual signal at control unit and annunciators to sound.
 - .4 Activate common supervisory sequence.
- .8 Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit has been reset.

- .9 Trouble on system to:
 - .1 Indicate circuit in trouble on control unit.
 - .2 Activate "system trouble" visual indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.
- .10 Trouble on system to be suppressed during course of alarm.
- .11 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

- .1 Control unit (C.U.):
 - .1 DCLC style for communications links between control panels and annunciators.
 - .2 Suitable for DCLC communication style: to CAN-ULC-S524.
 - .3 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.
 - .4 System capacity shall be as required for indicated system plus 25% additional devices.
 - .5 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.
 - .6 Integral power supply, battery charger and standby batteries.
 - .7 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions e.g. address labels, priorities, and changing of system operation software.
 - .8 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.
 - .9 Support up to 4 RS-232-C I/O ports. C.U. output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.
 - .10 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.
 - .11 Software and hardware to maintain time of day, day of week, day of month, month and year.
 - .12 Software to operate variable-sensitivity addressable smoke detectors and announce their status and sensitivity settings at control panel.
 - .13 The total system one-way response time shall not exceed 2.5 seconds at system maximum capacity.
 - .14 Addressable loops shall have no more than 75% devices connected per loop based on manufacturers recommended maximum.
 - .15 System shall automatically re-initialize after a total system power down. Battery backed up devices are unacceptable.
 - .16 History log, up to 800 events.
 - .17 The panel must be capable of measuring the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors.
 - .1 The measurements shall be discrete voltage readings, accurate to 0.01 VD. The readings shall be dynamic, providing a constant display of voltage shifts when in the sensitivity voltage list mode.
 - .2 The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing.
 - .3 When programmed, any system connected, ionization or light refraction style smoke detector shall be capable of automatic sensitivity drift compensation up or down. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant throughout the life of the detector to prevent false indications or failure to alarm in the presence of smoke.

- .4 The control panel shall place each detector in the system in an alarm condition, transparent to the system operator, every 24 hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pre-test state.
- .5 The system shall be capable of monitoring the state of detectors and display a message when a detector is approaching the limits of adjustment (80% of alarm threshold) as a result of contaminants. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminants.
- .6 The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.
- .18 The system shall recognize initiating of an alarm and indicate the alarm condition in a degrade mode of operation, in the even of processor failure or the loss of system communications to the circuit interface panels.
 - .1 Degraded Mode: Refer to CAN-ULC-S524, 4.3.3.
 - .2 The system shall indicate a trouble condition during degrade mode operation and shall give a visual indication of an alarm condition.
 - .3 Detector operation in the degrade mode shall continue at the alarm threshold previously programmed. Systems returning detectors to a common default value in degrade mode shall not be acceptable.
- .19 The system shall provide a one (1) person field test of either the complete system or a specified area, maintaining full function of areas not under test.
 - .1 Field test shall be usable in a silent or audible mode. When in the audible mode, the signals shall audibly annunciate alarms, troubles and device types.
 - .2 All field test activity shall be logged to the system printer and historical memory.
- .20 The system shall be provided with eight (8) levels of password protection with up to forty (40) passwords.
- .21 Provide a cost savings software verification Compare program. The program shall instruct the technician as to what software changes have been made from one (1) software revision to another and what points require verification.
- .22 The system must be capable of reading and displaying at the control panel the sensitivity of remote intelligent/analog ionization and photoelectric detection devices. Individual intelligent/analog detection device alarm threshold must be adjustable from the control panel.
- .23 The detection system must remain 100% operational and capable of responding to an alarm condition while in either routine operator maintenance mode or during programming by the manufacturer.
- .24 Dynamic supervision of system electronics, wiring, detection devices and software must be provided by the control system. Failure of system hardware or wiring must be indicated by type and location on the alphanumeric display.
- .25 The control mode must permit the arming and disarming of individual detection or output devices. Status of these devices must be displayed upon command from the control panel.
- .26 The address, type of device and sensitivity setting of each addressable device must be field settable by a simple programming device and stored in the addressable device in non-volatile memory. Loss of both A/C power and batteries in the control panel will not affect the system device programming.
- .27 The system must be programmed in the field only via laptop computer. Burning of EPROM's is not acceptable. System programming must be password protected. The final system program must be available on hardcopy and included in the Departmental Representative
- .28 The printer or alphanumeric display must be capable of listing upon request:
 - .1 Alarms with time, date and location.
 - .2 Status of out put functions.
 - .3 Sensitivity of intelligent/analog smoke detectors.
 - .4 Detection device number, type and location.
 - .5 Status of remote relays.
 - .6 Acknowledgement time and date.
 - .7 Signal silence time and date.

- .8 Reset time and date.
- .9 Battery voltage, A/C voltage and battery charge current.
- .29 The system must be capable of:
 - .1 Counting the number of intelligent/analog devices within a "zone" which are in alarm.
 - .2 Counting "zones" which are in alarm.
 - .3 Counting the number of intelligent/analog detectors that are in alarm on the system.
 - .4 Differentiating among types of intelligent/analog detectors such as smoke detectors, manual stations, water-flow switches, thermal detectors, cross zoning, etc.
- .30 System LCD screen to be bilingual.
- .2 Lockable covers on sprinklerproof enclosure c/w full viewing window, 2 keys.
- .3 Auxiliary plug-in relays.
- .4 Provide drip shield on panel.

2.4 POWER SUPPLIES

- .1 120 V, 60 Hz as primary source of power for system. Connected to existing emergency power. 24V DC output standby power via gel cell batteries.
- .2 Voltage regulated, current limited distributed system power, c/w surge suppression, rectifiers, regulators and filters.
- .3 Primary power failure or power loss (less than 102V) will activate common trouble sequence.
- .4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.
- .5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.
- .6 Standby batteries: sealed, maintenance free.
- .7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.
- .8 Battery to be capable of 24 hours of full supervision followed by two (2) hours of full alarm functions.

2.5 INITIATING/ INPUT CIRCUITS

- .1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to control unit.
- .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.
- .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
- .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to control unit.
- .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

- .6 Circuit loading not to exceed 75% capacity.
- .7 Provide two (2) spare alarm initiating/input circuits per panel transponder.

2.6 ALARM OUTPUT CIRCUITS

- .1 Alarm output circuit: connected to speakers, wired in Class A configuration to control unit.
 - .1 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.
 - .2 Speaker circuits operation: follow system programming; capable of reproducing tones and voice fed by audio channels.
 - .3 Audio channel available to each speaker circuit to be automatically and dynamically selected by system's microprocessor.
 - .4 Manual selection and operation of alarm tones to be provided on zone by zone / floor by floor basis.
 - .5 Manual selection for emergency paging to be provided on floor-by-floor.
 - .6 Proprietary evacuation control switch to be provided to shunt out automatic system programming once manual control of system has been assumed by authorized personnel.
 - .7 Zoning of system shall be per stairwell, floor, fire zone, elevator shaft. Refer to plans for fire zones.
 - .8 Circuit loading not to exceed 75% capacity.
 - .9 Provide two (2) spare alarm output circuits per panel/transformer.

2.7 AUXILIARY CIRCUITS

- .1 Auxiliary contacts for control functions.
- .2 Actual status indication (positive feedback) from controlled device.
- .3 Alarm and/or supervisory, trouble on system to cause operation of programmed auxiliary output circuits.
- .4 Two sets of separate contacts for elevator capture (to ground floor of egress and to alternate 2nd floor), for each elevator.
- .5 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
- .6 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by EMCS.
- .7 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

2.8 AMPLIFIERS

- .1 Modular in construction, solid state in design, with power output of 25V RMS, for constant voltage distribution to speaker circuits.
- .2 Continuously supervised for proper operation. Loss of power, open or short circuit on input or output of amplifier, or total amplifier failure, to activate trouble sequence at control unit with visual indication.
- .3 Housed in control unit. Powered through system power supply, and supported by standby batteries in case of power failure.
- .4 Riser amplifiers: housed in control unit, with outputs connected to voice communication risers.

- .5 Standby amplifiers: at control unit; sized to meet requirements of largest amplifier in that location, with automatic transfer to be on priority basis.
- .6 Amplifiers: to be sized to accommodate 1 watt per speakers including 25% spare capacity for future expansion.
- .7 Audible circuit amplifiers shall not be loaded above 75% capacity.
- .8 Provide at least one spare amplifier in each panel.

2.9 WIRING

- .1 Copper conductors.
- .2 To initiating circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.
- .5 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
- .6 Risers: MI cables.

2.10 MANUAL ALARM STATIONS

- .1 Addressable manual pull station:
 - .1 Pull lever, semi-flush wall mounted type, single action, 1-stage, with key switch, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.
 - .2 Note: All pull stations to have integral aux. contacts to de-energize & release magnetic lock immediately.
 - .3 Signage on fire alarm pull stations to be bilingual.
 - .4 Red colour.
 - .5 Explosion proof, pull lever, semi-flush wall mounted type, single action, 1 stage, with key switch, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field, as shown on drawings.

2.11 AUTOMATIC ALARM INITIATING DEVICES

- .1 Addressable thermal fire detectors, plug in type, twist lock, low profile, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C, rate of rise 8.3°C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector base in field.
- .2 Addressable variable sensitivity smoke detector: ionization type and air duct type with sampling tubes with protective housing.
 - .1 Twistlock Plug-in type with fixed base.
 - .2 Wire-in base assembly with integral red alarm LED, and terminals for relay remote or alarm LED.
 - .3 Low profile type.

- .4 Electronics to transmit status to control panel.
- .5 Sensitivity settings variable from the control panel.
- .6 Able to annunciate detector contamination automatically with trouble induction at panel.
- .7 Detectors to be programmable for application specific operation, with a no false alarm guarantee.
- .8 Smoke detectors to have 'no false alarm guarantee' provided in writing.
- .3 Addressable smoke detector:
 - .1 Ionization type.
 - .2 Electronics to communicate detector's status to addressable module/transponder
 - .3 Detector address to be set on detector base in field.
 - .4 Low profile .
- .4 Intelligent interface modules:
 - .1 To interface with water flow devices, tamper switches, other direct contact monitoring devices.
- .5 Addressable variable sensitivity explosion proof smoke detector: ionization type:
 - .1 High performance optical smoke detection.
 - .2 Built-in 0-20 mA output for easy Distributed Control System (DCS) integration.
 - .3 Self-diagnostics for reliable operation.
 - .4 Alarm, auxiliary, and trouble relays for annunciator and control panel connection.
 - .5 On-board LED.
 - .6 Non-latching operation.
 - .7 Magnetic switch for manual testing.
 - .8 FM approved for smoke detection in Class I, Division 1 hazardous locations.
 - .9 IECEx Zone approved.

2.12 AUDIBLE SIGNAL DEVICES

- .1 Horns, red colour, refer to drawings for quantities:
 - .1 Mini horn 24V dc.
 - .1 Corrosion, vibration and vermin resistant, weatherproof.
 - .2 Horns 24V dc.
- .2 Explosion proof horns, red colour, refer to drawings for quantities and location:
 - .1 Mini horn 24V dc.
 - .1 Corrosion, vibration and vermin resistant, weatherproof.
 - .2 Horns 24V dc.

2.13 VISUAL ALARM SIGNAL DEVICES

- .1 Strobe type: flashing, red, 24 V dc. Xenon flash tube.

2.14 REMOTE PRINTER

- .1 System printer to be located in security office - main entrance. To provide a hard copy record of system events c/w following features:
 - .1 120 V ac, 60 Hz.
 - .2 80 columns.
 - .3 160 cps.
 - .4 Utilizes fan fold paper.
 - .5 Connected to RS-232 output at central control panel.

2.15 ANCILLARY DEVICES

- .1 Remote double voltage relay units to initiate fan shutdown, door closure etc. as required.

2.16 REMOTE ANNUNCIATORS

- .1 Provide an 80-character backlit LCD display remote Annunciator to annunciate all zones and system conditions same as the main control panel. Annunciation to include type of alarm, type of device, time and date, total number of alarms as well as general status system indicators. Annunciator will include "next" and "first" scroll keys. All indicators must be in English and French. Remote annunciators as indicated on drawings.

2.17 INTELLIGENT INTERFACE MODULES

- .1 Provide intelligent interface modules incorporating a custom microprocessor based integrated circuit for connection of normally open or normally closed contact type devices such as water flow switches, tamper switches and other direct contact monitoring functions as required. These modules shall be available in single zone, dual zone or single zone with programmable relay and have LED to indicate status.

2.18 FAULT ISOLATION MODULE

- .1 Provide Isolation Module:
 - .1 Provide fault isolation module to conform to ULC standard and:
 - .1 Enable part of the data loop to continue operating should a short circuit occurs.
 - .2 Cut power to all devices beyond the isolator on the loop as follows:
 - .1 A short on the line causes all isolators to open within 23 msec.
 - .2 At 10 msec. intervals, beginning on one side of the Class A circuit nearest the loop controller, the isolators close to provide the next isolator down the line with power.
 - .3 When the isolator next to the short closes, it reopens within 10 msec.
 - .3 Continuously checks the faulted side of the loop to determine if the short still exists. When the fault is removed, the module automatically restores the entire data loop to the normal condition.

2.19 AUTOMATIC ALARM INITIATING DEVICES (ANALOGUE)

- .1 Heat detectors: provide heat detectors designed for detection of fire by combination fixed temperature rate-of-rise, line-type fixed temperature principle.
- .2 Rate Compensating Detector (Spot Type): designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.
 - .1 Detectors: hermetically sealed and automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise.
 - .2 Detector operation: not be subject to thermal time lag.
- .3 Line-Type Fixed Temperature Detectors: provide thermostatic line-type heat detection cable with weather-resistant outer covering where indicated.
- .4 Smoke detectors designed for detection of abnormal smoke densities by ionization principle.
 - .1 Detectors: 4-wire, 2-wire type.

- .5 Ionization Detectors: multiple chamber type responsive to both invisible and visible particles of combustion.
 - .1 Detectors: not susceptible to operation by changes in relative humidity.
- .6 Photoelectric Detectors: operate on light scattering principle using LED light source.
 - .1 Detector: respond to both flaming and smoldering fires.
- .7 Temperature rating of detectors: in accordance with NFPA (Fire) 72.
- .8 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.
- .9 Flame Detector to be explosion proof flame detectors: Ultraviolet only, type, c/w fire alarm module:
 - .1 General:
 - .1 Multi spectrum design - for long distance detection and high false alarm immunity.
 - .2 Sensitivity selection - to ensure no zone crossover detection.
 - .3 Automatic and Manual Built-In-Test (BIT) - to assure continued reliable operation.
 - .4 Heated window - for operation in harsh weather conditions (snow, ice, condensation).
 - .5 Multiple output options for maximum flexibility and compatibility:
 - .1 Relays (3) for Alarm, Fault and Auxiliary.
 - .2 0-20mA (stepped).
 - .3 HART Protocol for maintenance and asset management.
 - .4 RS-485, Modbus Compatible.
 - .6 High Reliability - MTBF - minimum 150,000 hours.
 - .7 Approved to Safety Integrity Level 2 (SIL2 - TUV).
 - .8 User Programmable via HART or RS-485.
 - .9 Hazardous area zones:
 - .1 Zones 1 & 2 with IIC gas group vapours present.
 - .2 Zones 21 & 22 with IIIC dust type present.
 - .10 Ex approved to:
 - .1 ATEX & IECEx
 - .2 FM/FMC/CSA
 - .3 TR CU (EAC)
 - .11 3rd party performance tested:
 - .1 EN54-10 (VdS)
 - .2 FM3260
 - .12 Spectral Response = Three IR Bands.
 - .13 Detection Range (at highest Sensitivity Setting for 1 ft.² (0.1 m²) pan fire):

FUEL	FT. / M
n-Heptane	215 / 65
Gasoline	215 / 65
Diesel Fuel	150 / 45
JP5	150 / 45
Kerosene	150 / 45
Ethanol 95%	135 / 40
Methanol	115 / 35
IPA (Isopropyl Alcohol)	135 / 40
Methane (30" (0.75 m) high, 10" (0.25 m) width plume fire)	150 / 45
LPG (30" (0.75 m) high, 10" (0.25 m) width plume fire)	150 / 45
Polypropylene Pellets	115 / 35
Office Paper	83 / 25
 - .14 Response Time = 5 seconds
 - .15 Adjustable Time Delay = Up to 30 seconds
 - .16 Sensitivity Ranges = 4 Sensitive ranges for 1 ft.² (0.1 m²) n-heptane pan fire from 50 ft. (15 m) to 215 ft. (65 m)

- .17 Field of View = Horizontal 100°; Vertical 95°
- .18 Built-in-Test (BIT) = Automatic (and Manual)
- .19 Temperature Range =
 - .1 Operating: -67°F to +167°F (-55°C to +75°C)
 - .2 Option: -67°F to +185°F (-55°C to +85°C)
 - .3 Storage: -67°F to +185°F (-55°C to +85°C)
- .20 Heated Optics = To eliminate condensation and icing on the window
- .2 Electrical:
 - .1 Operating Voltage = 24 VDC nominal (18-32 VDC)
 - .2 Power Consumption =
 - .1 Standby: Max. 90 mA (110 mA with heated window)
 - .2 Alarm = Max. 130 mA (160 mA with heated window)
 - .3 Cable Entries = 2 x 3/4" - 14 NPT conduits or 2 x M25 x 1.5 mm ISO
 - .4 Wiring = 12 - 22 AWG (0.3 mm² - 2.5 mm²)
 - .5 Electrical Input Protection = According to MIL-STD-1275B
 - .6 Electromagnetic Compatibility = EMI/RFI protected to EN61326-3 and EN61000-6-3
 - .7 Electrical Interface = The detector includes twelve (12) terminals with five (5) wiring options (factory set)
- .3 Outputs:
 - .1 Relays = Alarm, Fault and Auxiliary, SPST volt-free contacts rated 2A at 30V DC
 - .2 0-20 mA (stepped) = Sink (source option) configuration:
 - .1 Fault: 0 +1 mA
 - .2 BIT Fault: 2 mA 10%
 - .3 Normal: 4 mA ±10%
 - .4 Warning: 16 mA ±5%
 - .5 Alarm: 20 mA ±5%
 - .6 Resistance Loop: 100-600 Ohm
 - .3 HART Protocol:
 - .1 Optional HART communications on the 0-20 mA analog current (FSK) - used for maintenance, configuration changes and asset management, available in mA source output wiring options.
 - .2 RS-485: RS-485 Modbus compatible communication link that can be used in computer-controlled installations
- .4 Mechanical:
 - .1 Materials = Stainless Steel 316L with electro polish finish
 - .2 Mounting = Stainless Steel 316L with electro polish finish
 - .3 Dimensions = Detector 4" x 4.6" x 6.18" (101.6 x 117 x 157 mm)
 - .4 Weight = Detector (St.St.) 6.1 lbs. (2.8 kg), Tilt mount 2.2 lbs. (1.0 kg)
 - .5 Environmental Standards = Meets MIL-STD-810C for Humidity, Salt & Fog, Vibration, Mechanical Shock, High Temp, Low Temp.
 - .6 Water and Dust = IP66 and IP67 per EN60529, NEMA 250 6P
- .5 Approvals:
 - .1 Hazardous Area:
 - .1 ATEX and IECEx Ex II 2 G D
Ex db eb op is IIC T4 Gb
Ex db eb op is IIC T4 Gb
Ex tb op is IIIC T96°C Db (-55°C < Ta < +75°C)
K
Ex tb op is IIIC T106°C Db (-55°C < Ta < +85°C)
K
 - .2 Performance = EN54-10 (VdS), FM3260
 - .3 Reliability = IEC61508 - SIL2 (TUV)

- .10 Explosion proof, heat detectors: provide explosion proof heat detectors designed for detection of fire by combination fixed temperature, as shown on drawings rate-of-rise, line-type fixed temperature principle, as shown on drawings.
- .11 Flame detectors: Ultraviolet only. Type, c/w fire alarm module.

2.20 DUCT SMOKE DETECTORS

- .1 Provide detectors installed in ducts of ionization type and listed by ULC duct installation.
- .2 Provide integral control and power modules required for operation with main control panel.
- .3 Ensure detectors and associated modules are compatible with main control panel and suitable for use in supervised circuit.
- .4 Detector circuits: 4-wire type where detector operating power is transmitted over conductors separate from initiating circuit. Malfunction of electrical circuits to detector or its control or power modules to cause operation of system trouble signals.
- .5 Provide duct detectors in accordance with NFPA (Fire) 90A.
- .6 Provide duct detectors with approved duct housing, mounted exterior to duct, with perforated sampling tubes extending across width of duct.
- .7 Provide detectors with visible indicator lamp that flashes when detector is in normal standby mode and glows continuously when detector is activated.
- .8 Provide remote indicator lamp for each detector.
- .9 Permanently label remote indicator with description, number of associated air handling unit(s).
- .10 Provide each detector with remote test switch. Mount switch not more than 1.8 m above finished floor.
- .11 Permanently label test switch with description, number of associated air handling unit(s).

2.21 FOAM SYSTEM CONTROL PANEL (FSCP)

- .1 All control systems shall be UL Listed or FM approved and be utilized with listed or approved compatible operating devices and shall be capable of the following functions:
 - .1 Ground fault indication
 - .2 Supervised alarm circuit
 - .3 Supervised primary power circuit
 - .4 Remote Trouble Alarm
 - .5 Battery standby
 - .6 Front panel indicating lamps (LEDs) or (LCD) display
 - .7 Key lock steel enclosure
 - .8 Control Panel
- .2 The control panel shall be a ULC Listed and FM approved addressable, fully programmable, microprocessor controlled control panel.

- .3 The door shall provide a key lock and include a glass or other transparent opening for viewing of all indicators.
- .4 All interfaces and associated equipment are to be protected so they will not be affected by voltage surges or line transients.
- .5 The control panel shall receive one (1) 120 volt dedicated power feed.
- .6 The foam system control panel (FSCP) and the fire alarm control unit (FACU) shall be compatible and from the same manufacturer.
- .7 All high expansion foam system supervisory inputs, associated hangar wet sprinkler flow switches, manual release stations, manual over ride stations, flame sensors, diesel fire pump, and deluge valve foam release controls shall be wired directly to the FSCP, FSCP shall be able to control the entire high expansion, foam system even if the main fire alarm control panel is offline.
- .8 Installation shall meet latest releasing panel requirements of CAN/ULC-S524.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install systems in accordance with CAN-ULC-S524.
- .2 Install control unit and connect to emergency ac power supply, dc standby power.
- .3 Install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts, and coordinate with contractor and manufacturers, recommendations.
- .5 Install flame detector and connect to alarm circuit wiring.
- .6 Connect alarm circuits to main control panel.
- .7 Install signal and visual signal devices and connect to signalling circuits.
- .8 Connect signalling circuits to main control panel.
- .9 Install end of line resistors and line isolation devices as required.
- .10 Install remote relay units to control fan shut-down/start-up.
- .11 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .12 Connect fire suppression systems to control panel.
- .13 Splices are not permitted.
- .14 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and C.U., as required by equipment manufacturer.

- .15 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .16 Identify circuits and other related wiring at control unit, annunciators, and terminal boxes.
- .17 Install horns and connect to horn circuits.
- .18 Provide connection to the following systems
 - .1 Security panel - alarm & trouble.
 - .2 Generator - common generator trouble.
 - .3 Generator - ON.
 - .4 Elevator controls - automatic recall & alternate floor feature.
 - .5 Fire pump - 4 points.
- .19 Coordinate location of duct smoke detectors with humidifiers, air flow, etc. to manufacturers recommendations.
- .20 All Fire Alarm devices shall have both the device and it's base labelled with p-touch to indicate building, floor, column line, device type and device address. i.e. device labelled as BB-5-F3-SD/0108126 would indicate Building 'BB', floor 5, column F3, smoke detector, address 0108126. This description should also be indicated at the annunciator and control panel.
- .21 All fire alarm work is to be logged in at the main security station by the contractor, and shall indicate the location of the work, a description of the work, and the name of the contractor performing the work.
- .22 The installing contractor shall notify the Departmental Representative of verification times, so the Departmental Representative can include their maintenance contractor in review.
- .23 Install fault isolation module before and after fire rated compartment to conform to ULC standard.
- .24 Complete network control wiring and programming for entire system.
- .25 Communication cable for remote monitoring to be installed in conduit from fire control panel to main telephone room.

3.2 FIELD QUALITY CONTROL

- .1 Manufacturer perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537. Submit Technicians Report of individual device tests and recommendations, with Final Certification of Verification.
- .2 Fire alarm system:
 - .1 Test such device and alarm circuit to ensure manual stations, thermal and smoke detectors, area smoke detection systems, sprinkler system transmit alarm to control panel and actuate first stage alarm, ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Test each device for physical operation as intended including flow switches, tamper devices, fire shutters, fans and associated EMCS HVAC equipment sequencing.

- .3 Addressable circuits system style DCLA and/or DCLC:
 - .1 Test each conductor on all DCLA/DCLC addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
 - .2 Test each conductor on all DCLA/DCLC addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
- .4 Provide final programming for system incorporating program changes made during construction.
- .5 Measure audibility/intelligibility of alarm signalling and document any areas falling below 65 dB sound pressure level. Adjust speaker taps to attain Code required audible levels. If audible levels or intelligibility cannot be achieved by modifying speaker taps, notify Departmental Representative of specific area for direction. Include dB levels on verification report for all areas of the building.

3.3 CERTIFICATION AND VERIFICATION

- .1 Verify system to "CAN-ULC-S537".
- .2 Verification is the responsibility of the manufacturer for testing the wiring in relation to field devices operation.
- .3 To avoid unnecessary alarms during testing, the system's program shall be capable of being temporarily disabled to disconnect only the audible signals that are being tested. Reenable the zones after the testing is performed at the end of the day.
- .4 Inspect and test wiring to every device to verify the removal of the device or breaking the wire will cause a trouble condition at the Control Panel.
- .5 Inspect all equipment installed as part of the system for visible damage or tempering which may be a potential problem with its intended operation.
- .6 Activate each manual initiating device to verify and ensure their proper operation.
- .7 Test each self-restoring heat detector utilizing a heat source to test the device operation.
- .8 Test each ionization smoke detector. Detector operation shall be tested by introducing "smoke" into the detector head.
- .9 Test area smoke detection systems and calibrate as required.
- .10 Test all audible signals for proper operation. Tests shall be made to determine that the signal is audible throughout the area and above the normal ambient noise level.
- .11 Verify all field wiring and terminate on a single conductor per terminals basis.
- .12 Test system annunciators to ensure proper operation correct zoning and visibility of window inscriptions. All lamps and indicators shall be tested for proper operation.
- .13 Test all control equipment for proper operation. Inspect and test all cable terminals, plug connectors, plug-in modules circuitry, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable to confirm their electrical supervision.

- .14 Test ancillary equipment connections. Inspect such equipment to ensure that faults and malfunctions will not interfere with the alarm system.
- .15 Test the following control functions for proper supervision, operation and annunciation.
 - .1 Main control station for PA system.
 - .2 Smoke exhaust system.
 - .3 Sprinkler devices.
- .16 Only make changes to the system program or zone identifications as approved by authorized personnel.
- .17 Notify and demonstrate the complete system to Departmental Representative, a representative of Fire Coordinators representative Fire Protection Engineering Services and Building Inspection's representatives only after testing and verification performances has been completed and all deficiencies rectified. In their presence, demonstrate the proper functioning of the system. Have system manufacturer's certified technician present.
- .18 Upon completion of the inspection and when all of the above conditions have been performed and complied with, the manufacturer shall issue to the Departmental Representative the following:
 - .1 A copy of the inspection report identifying the location of each device and certifying the test results of each device.
 - .2 A certificate of verification confirming that the inspection has been completed and outlining the conditions upon which such an inspection and certification have been rendered.
 - .3 Proof of liability insurance for the inspection.
- .19 All costs involved in this inspection for both the manufacturer's and the Contractor's work shall be included in the overall tender price.

3.4 VERIFICATION RECORDS

- .1 Complete accurate records of the verification shall be maintained with the following requirements but not limited to:
 - .1 Show the date on which each device and equipment has been verified.
 - .2 Show the date of all deficiencies encountered in the control system equipment, wiring and field devices.
 - .3 Show the date when the deficiencies have been corrected and re-verified.
 - .4 Show dB levels measured during verification for all areas of the building.

3.5 MONITORING

- .1 Reconnect new fire alarm system to existing system remote monitoring agency.

3.6 TRAINING

- .1 Provide training as per Section 01 79 00 - Demonstration and Training.

END OF SECTION