

MULTIPLEX FIRE ALARM AND VOICE COMMUNICATION  
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**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22<sup>nd</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.1-12, Canadian Electrical Code, Part 1 (22<sup>nd</sup> Edition), Safety Standard for Electrical Installations. ESA OESC-2012, Ontario Electrical Safety Code, 25<sup>th</sup> Edition, Electrical Safety Authority 2012.
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S524-14, Standard for the Installation of Fire Alarm Systems.
  - .2 CAN/ULC-S525-07, Audible Signal Devices for Fire Alarm Systems, Including Accessories.
  - .3 CAN/ULC-S526-07, Visual Signal Devices for Fire Alarm Systems.
  - .4 CAN/ULC-S527-11, Standard for Control Units for Fire Alarm Systems.
  - .5 CAN/ULC-S528-14, Manual Pull Stations for Fire Alarm Systems.
  - .6 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.
  - .7 CAN/ULC-S530-91(R1999), Heat Actuated Fire Detectors.
  - .8 CAN/ULC-S536-13, Inspection and Testing of Fire Alarm Systems.
  - .9 CAN/ULC-S537-13, Verification of Fire Alarm Systems.
  - .10 CAN/ULC-S541-07, Speakers for Fire Alarm Systems, including accessories.
- .3 Canadian Forces Support Unit (CFSU) Ottawa Contractors Fire Orders.
- .4 Canadian Forces Fire Directive ADM(ie) Contractors Fire Orders June 2014
- .5 Canadian Forces Fire Marshal Directive FMD 4003 “Fire Protection and Life Safety Engineering Design”, September 2014.
- .6 Canadian Forces Fire Marshal Directive FMD 4005 “Partial Occupancy”, September 2009.
- .7 Canadian Forces Fire Marshal Directive FMD 4006 “Fire Protection System Impairments”, September 2009.
- .8 Canadian Forces Fire Marshal Directive FMD 4007, “Fire Alarm and Voice Communication Systems Installation Inspection Testing and Maintenance”, May 2011.
- .9 National Building Code (NBC) - 2010.
- .10 Ontario Building Code (OBC) – 2012.
- .11 National Fire Protection Association (NFPA)
  - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2013 Edition.

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- .12 The installation shall be in accordance to all applicable codes. If any requirements of these specifications are different, omitted, or contrary to the codes, then the code governs and overrides these specifications at no additional cost to this contract.
- .13 In no instance shall the standards established by the drawings and specifications be reduced by any of the codes referred to above.

**1.3 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 To Canadian Forces Fire Marshal (CFFM) approval and Authority Having Jurisdiction.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for multiplex fire alarm system and voice communication systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit the following shop drawings:
    - .1 all devices
    - .2 all control panels, transponders, annunciators and equipment
    - .3 zone schedules
    - .4 control matrix.
  - .2 Submit the following operational sequences:
    - .1 transponders
    - .2 Fire Command Centre CPU
    - .3 CRT and printer
    - .4 batteries
    - .5 signal, trouble, voice and control cards in control panels.
  - .3 Pictorial drawings of control equipment indicating the location of the components and parts, and their respective catalogue number and electrical characteristics.
  - .4 Internal schematic diagrams of control equipment.
  - .5 Interconnecting diagrams and cable manual.
  - .6 System descriptions of the actual installation.
  - .7 Maintenance instructions.
  - .8 Recommended spare parts list.
  - .9 Upon being awarded a contract the electrical contractor shall obtain ACAD files from the Departmental Representative and shall prepare and submit for final approval one complete set of installation drawings indicating:
    - .1 Equipment Room plans (1:50) and layouts.
    - .2 Floor plans (1:200) indicating all devices.
    - .3 System address of all devices.
    - .4 All control panels and annunciator panels.

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- .5 All interconnections to mechanical equipment.
- .6 All interconnections to ancillary equipment.
- .7 All conduit routing and sizes.
- .8 All wire sized, types, number.
- .9 A riser indicating all of the above

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 00 10 – General Instructions
- .2 Operation and Maintenance Data: submit operation and maintenance data for fire alarm and voice communication systems for incorporation into manual.
- .3 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.

**1.6 ABBREVIATIONS**

- .1 ACAD – Auto Computer Aided Design
- .2 AFF – Above Finished Floor
- .3 ASCII – American Standard Code for Information Interchange
- .4 CFAA - Canadian Fire Alarm Association
- .5 CCFM - Canadian Forces Fire Marshal
- .6 CCU - Central Control Unit
- .7 CPU – Central Processing Unit
- .8 CRT – Computer Printer Shelf
- .9 DC – Direct Current
- .10 DCLA – Data Communication Link Addressable Devices
- .11 DGP/TPR - Data Gathering Panels/ Transponder
- .12 EIP – Event Initiated Programs
- .13 EMI/RFI – Electro Magnetic Interference / Radio Frequency Interface
- .14 EPROM – Erasable Programmable Read-Only-Memory
- .15 EVAC – Emergency Evacuation
- .16 FCC - Fire Command Centre
- .17 HDMI - High-Definition Multimedia Interface
- .18 LED – Light Emitting Diode
- .19 MIC – Mineral Insulated Cable

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- .20 NFPA - National Fire Protection Association
- .21 PC – Personal Computer
- .22 RAM – Random Access Memory
- .23 SIM – Signal Circuit Isolation Module
- .24 ULC - Underwriters Laboratories of Canada
- .25 UPS - Uninterruptible Power Supply

**1.7 QUALITY ASSURANCE**

- .1 Inspection tests to conform to: CAN/ULC-S536.
- .2 Submit inspection report to Departmental Representative.

**1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove and dispose of all packaging materials.

**1.9 EXISTING FIRE ALARM SYSTEM AND MAINTENANCE**

- .1 The existing fire alarm system in building 250D is an Edwards EST Model FCC-IRC-3, two stage multi-zone multiplex addressable voice EVAC system. At the time of contract award, the Contractor will be provided with a copy of the existing fire alarm system function and sequence of operation. Presently the Departmental Representative has a maintenance contract with Chubb Edwards to maintain the system.
- .2 Upon award of contract for the replacement of the Fire Alarm System, the Contractor shall be responsible for ongoing maintenance and testing of the existing system in Building 250D in accordance with CAN/ULC-S536 throughout the duration of the project.
- .3 The remote buildings on the site are connected to the Fire Alarm Control panel in Building 250D to indicate alarm and trouble conditions. Maintenance on the Fire Alarm Systems in these building will be completed by the Departmental Representative on a monthly basis on every second Tuesday of each month. The Contractor shall accommodate the Departmental Representative's service provider for this testing and allow the technical staff access to the main fire alarm control panel at the entrance to 250D to confirm and verify reporting functions for alarm and trouble from these buildings.

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- .4 Departmental Representative will provide the Contractor with all recent test reports for the Fire Alarm System in Building 250D and all associated buildings onsite confirming all systems are in good operating condition and that all previously identified deficiencies have been repaired and addressed.
- .5 The existing building fire alarm system shall remain operational throughout the construction period. The new system or parts of the system shall be used as the building fire alarm system during construction. Interconnect the existing and new systems so that they operate as one system.
- .6 At an appropriate time in the construction stage, the Contractor shall interconnect the existing Fire Alarm system and the new system so that it functions as one system.

**1.10 EXISTING FIRE PROTECTION SYSTEMS**

- .1 Refer to additional requirements in Section 01 00 10 – General Instructions.
- .2 Reconnect existing building fire protection systems to the new fire alarm system to indicate all alarm and trouble conditions. Refer to fire alarm zone schedule on drawings for points list for these connections.

**1.11 DESIGNATED CONTRACTOR**

- .1 Hire the services of Chubb Edwards or its authorized representative to complete the following work:
  - .1 Isolation and/or bypassing of the existing Edwards EST Model FCC-IRC-3 Fire Alarm System in Building 250D as required to complete project implementation of the work. Refer to Section 01 00 10 – General Instructions, Article 8.3.
  - .2 To complete ongoing maintenance of the fire alarm system in Building 250D in accordance with CAN/ULC-S536. Refer to Section 01 00 10 - General Instructions, Article 8.4.
  - .3 To complete deprogramming of fire alarm initiate devices addresses from the existing fire alarm system. Refer to Article 3.7.2.7 of this section.

**1.12 QUALIFICATIONS**

- .1 All Contractors personnel performing testing and verification and installing fire alarm system including equipment, devices, wire termination and other components, and performing testing and verification shall be certified in accordance with the Ontario Fire Code.

**Part 2 Products****2.1 DESCRIPTION**

- .1 Fully supervised, microprocessor-based, fire alarm and voice communication system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.
- .2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.

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- .3 Zoned, non-coded single stage with voice communication dual channel.
- .4 Modular in design to allow for future expansion.
- .5 Operation of system shall not require personnel with special computer skills.
- .6 System to include:
  - .1 Central Control Unit (CCU) 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; microphone with necessary switches and controls.
  - .2 Data Gathering Panels/Transponders with stand-alone capabilities.
  - .3 Power supplies.
  - .4 Initiating/input circuits.
  - .5 Output circuits.
  - .6 Auxiliary circuits.
  - .7 Amplifiers.
  - .8 Wiring.
  - .9 Manual and automatic initiating devices.
  - .10 Audible and visual signalling devices.
  - .11 End-of-line resistors.
  - .12 Local annunciators and passive graphic displays.
  - .13 ULC listed laser printer.
  - .14 Historic event recorder.
- .7 Fire Command Centre (FCC) equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .8 Power supply: to CAN/ULC-S524.
- .9 Audible signal devices: to CAN/ULC-S525.
- .10 Control unit: to CAN/ULC-S527.
- .11 Manual pull stations: to CAN/ULC-S528.
- .12 Thermal detectors: to CAN/ULC-S530.
- .13 Smoke detectors: to CAN/ULC-S529.
- .14 Speakers: to CAN/ULC-S541.
- .15 Regulatory requirements:
  - .1 System:
    - .1 Subject to Fire Commissioner of Canada (FC) approval.
    - .2 Subject to FC inspection for final acceptance.
    - .3 To Canadian Forces Fire Marshal approval.
  - .2 System components: listed by ULC and comply with applicable provisions of NBC and Ontario Building Code (OBC), and meet requirements of local authority having jurisdiction.

**2.2 FIRE ALARM SYSTEM OPERATION COMPLETE WITH VOICE  
COMMUNICATION - SINGLE STAGE - MULTIPLE CHANNELS**

- .1 Actuation of any alarm initiating device to:
  - .1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.
  - .2 Indicate zone of alarm at central control unit and remote annunciator and display graphic.
    - .1 Cause speakers to sound evacuation tone throughout building.
    - .2 Transmit signal to central monitoring facility via central station.
    - .3 Cause air conditioning and ventilation fans to shut down.
    - .4 Cause fire doors and smoke control doors, if normally held open, to close automatically.
- .2 Possible to transmit voice message from central control unit to specific zones or group of zones, while maintaining EVAC tone to another zones, and alarm tone to yet another zones, by means of master microphone and speaker circuit selection switches. Activating push-to-talk switch on master microphone and specific switches for specific zones to silence tones in zones and allow one-way voice messages over system speakers. Releasing microphone 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 area-by-area basis.
- .3 Acknowledging alarm: indicated at central control unit.
- .4 Possible to silence tones by "alarm silence" switch at control unit, after silencing inhibit timer has timed out.
- .5 Subsequent alarm, received after previous alarm has been silenced, to re-activate tones on speakers.
- .6 Actuation of any supervisory device to:
  - .1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.
  - .2 Indicate respective supervisory zone at local graphic annunciator and computer graphic.
  - .3 Cause audible signal at central control unit to sound.
  - .4 Activate common supervisory sequence.
- .7 Resetting alarm and supervisory device will not return system indications/functions back to normal until complete control unit has been reset.
- .8 Trouble on system to:
  - .1 Indicate circuit in trouble on central control unit.
  - .2 Activate "system trouble" 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.

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- .9 Trouble on system to be suppressed during course of alarm.
- .10 Trouble condition on any circuit in system not to initiate alarm conditions.

**2.3 CONTROL PANEL**

- .1 Central Control Unit (CCU):
  - .1 Suitable for Data Communication Link Addressable Devices (DCLA) communication style: to CAN/ULC-S524.
  - .2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.
  - .3 Minimum capacity of 3000 addressable monitoring and 500 addressable control/signal points. Points may be divided between multiple communication channels in distributed system, each channel operating independently of other. Faults on one communication channel must not to affect operation of other.
  - .4 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.
  - .5 Integral power supply, battery charger and standby batteries.
  - .6 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 (i.e. zone labels, priorities) and changing of system operation software.
  - .7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.
  - .8 Communication between CCU and remote Data Gathering Panels (DGP's)/Transponders (TPR's) to be supervised, DCLA. Communications failure between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.
    - .1 Communication between nodes in networked system to be supervised, DCLA. Communication failure between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.
  - .9 Support up to 6 RS-232-C I/O ports. CCU 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 is 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 Full sized ULC listed laser remote printer controlled by EIA RS-232-C link from within CCU.



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- .13 Software to operate variable-sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.
- .2 One way voice communication system.
  - .1 ULC listed for use with fire alarm system. Provide intelligible, low-level, voice reproduction and incorporate one-way voice communication to speaker circuits in building.
  - .2 Integrated dual channel system for use in fire alarm and emergency paging. Capability to sound alarm in one part of building and voice message in yet another part, at same time.
  - .3 Manual control of building speaker circuits: via dedicated speaker circuit toggle switches at control panel.
  - .4 Master microphone: housed in CCU, push-to-talk, dynamic, noise-cancelling type, with frequency response of 200 to 4000 Hz. Any automatic alarm tone on system may be overridden (after initial inhibit period) by master microphone. Using microphone to enable authorized personnel to broadcast voice messages over system speakers. When such voice messages are completed, system to revert to previous state unless reset or manually controlled by authorized personnel.

**2.4 DATA GATHERING PANELS (DGP'S)/ TRANSPONDERS**

- .1 Fire control modules: distributed throughout building in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.
- .2 Modules: concentrated in single central location in modular central control panel.
- .3 Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.
- .4 Each DGP: circuitry with ability to detect failure in communication with CCU resulting from faults in communication wiring. In event of loss of communication with CCU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected input devices, and apply stand-alone programming to determine state of connected outputs.
  - .1 Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as, that of CCU.
- .5 Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.
- .6 Addressable DGP's:
  - .1 DGP's: addressable type, provide two-way data communication with up to 128 addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.
  - .2 Addressable DGP's: stand-alone capability.
  - .3 Interface modules: facilitate connection of non-addressable devices (i.e. flow switch) to addressable DGP; provided in different types for connection to

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monitoring devices (i.e. flow/tamper switch), signalling devices (i.e. bells, horns, speakers), and control functions (i.e. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).

- .4 Possible to connect all 3 types of addressable interface modules (monitoring, signal and control) to same addressable communication loop.
- .5 Addressable DGP's: self-contained, as specified.
- .6 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

**2.5 POWER SUPPLIES**

- .1 120 V, 60 Hz as primary source of power for system.
- .2 Voltage regulated, current limited distributed system power.
- .3 Primary power failure or power loss (less than 102 V) 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.

**2.6 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 central control unit and DGP's/transponders.
- .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 central control unit and DGP's/transponders.
- .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

**2.7 ALARM OUTPUT CIRCUITS**

- .1 Alarm output circuit: connected to speakers, wired in Class A configuration to central control unit and DGP's/transponders.
  - .1 Signal circuits' operation to follow system programming; capable of sounding temporal tone. Each signal circuit: rated at 2 A, 24 V DC; fuse-protected from overloading/overcurrent.

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- .2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.
- .3 Speaker circuits operation: follow system programming; capable of reproducing tones and voice fed by audio channels.
- .4 Audio channel available to each speaker circuit to be automatically and dynamically selected by system's microprocessor.
- .5 Manual selection and operation of alarm tones to be provided on area-by-area basis.
- .6 Manual selection for emergency paging to be provided on area-by-area basis.

**2.8 AUXILIARY CIRCUITS**

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

**2.9 AMPLIFIERS**

- .1 Modular in construction, solid state in design, with power output of 70 V 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 central control unit with visual indication.
- .3 Housed in DGP's/transponders. Integral power supply and supported by standby batteries in case of power failure.
- .4 Riser amplifiers: housed in central control unit, with outputs connected to voice communication risers.
- .5 Standby amplifiers: at every amplifier location; sized to meet requirements of largest amplifier in that location, with automatic transfer to be on priority basis.
- .6 Amplifiers: 25% spare capacity for future expansion.

**2.10 WIRING**

- .1 Copper conductors.
- .2 To initiating circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

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- .4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.
- .5 To control circuits: 19 AWG minimum, and in accordance with manufacturer's requirements.
- .6 Backbone: fibre optic cable and/or twisted, shielded pairs, configured to eliminate interference and cross-talk.

**2.11 FIBRE OPTICS**

- .1 Refer to Section 27 05 99 - Communication Cables.

**2.12 MANUAL ALARM STATIONS**

- .1 Addressable manual pull station:
  - .1 Pull lever, semi-flush in finished areas and surface mounted in Service Rooms, wall mounted type, single action, single stage, 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.

**2.13 AUTOMATIC ALARM INITIATING DEVICES**

- .1 Manual Alarm Stations
  - .1 Addressable manual pull station, pull lever, break glass rod, semi-flush wall mounted type, single action, single-stage, electronics to communicate station's status to addressable module/transponder over two (2) wires and to supply power to station. Station address to be set on station in field.
  - .2 Provide a locked set feature to permit the transmission of an alarm without breaking the glass for fire drills or tests.
  - .3 Finish the station in red with white bilingual lettering instructions.
  - .4 Manual stations flush mounted and equipped with a suitable terminal block and addressable electronics. Mount in two-gang outlet box, with suitable device skirt. Mount at 1200 mm AFF to top of device (barrier free height).
- .2 Thermal Fire Detectors
  - .1 Addressable thermal fire detectors, 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 or head in field.
    - .3 EMI/RFI shielded electronics.
    - .4 Sealed against rear air flow entry.
- .3 Smoke Detectors
  - .1 Addressable variable-sensitivity smoke detectors.
    - .1 Twist lock plug-in photo electric type with fixed base.

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- .2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay or alarm LED.
- .3 Ionization type.
- .4 Electronics to communicate detector's status to addressable module/transponder.
- .5 Detector address to be set on detector base or head in field.
- .6 Sensitivity settings: three (3) settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.
- .7 Ability to annunciate minimum of two (2) levels of detector contamination automatically with trouble condition at control panel.
- .8 Sealed against rear air flow entry. EMI/RFI shielded electronics. Device openings provide 360° smoke entry.
- .9 System to indicate when devices require cleaning. Annunciate zone and individual address of device.
- .2 Air Duct Detector
  - .1 Consisting of a photo electric type detector mounted in duct housing assembly with air sampling tubes.
  - .2 While the fans are operating, a continuous cross-sectional sampling of air from the ventilation duct shall flow through the ionization detector, after which the sampled air shall be returned to the duct.
  - .3 Rated for air velocities up to 1219.2 m/min.
  - .4 Smoke detector as described in 3.1 above. Mount detector duct housing directly to the outside of the duct in a readily accessible location, and to meet requirements of the smoke detector manufacturer.
  - .5 Provide remote LEDs for all devices which are not easily visible from the floor level.
  - .6 Provide access doors in duct work as required to complete installations and to facilitate smoke testing of duct mounted smoke detectors.
  - .7 Test all duct samples tubes for adequate air flow. Adjust and reposition as required.
- .4 Sprinkler Flow Switches
  - .1 Sprinkler flow switches are provided by Division 23.
  - .2 Provide addressable interface module for each device and hard wire to device terminals.
  - .3 Verify correct operation of flow switches and addressable interface.
- .5 Sprinkler Supervisory Valve Tamper Switches
  - .1 Supervisory switches are provided by Division 23.
  - .2 Provide addressable interface module for each device, and hard wire to device terminals.
  - .3 Verify correct operation of tamper switches and addressable interfaces.

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- .6 Addressable Interface Module
  - .1 For use in conjunction with local fire protection systems, sprinkler flow switches and supervisory valves.
  - .2 Addressable solid state device with wiring screw terminals and field addressing capability. Suitable for mount in 119 mm outlet box complete with surface cover. Module shall be capable of supervising wiring to device.
- .7 Remote Alarm Lamp
  - .1 LED type mounted on standard single gang switch box with brushed stainless steel faceplate, screw type terminals and wired to the detector for which it is to provide remote indication.
  - .2 During activation of the detector, the remote alarm lamp will identify the individual detector in alarm. Provide a remote alarm lamp for each concealed ceiling plenum surface mounted and duct mounted air duct detectors.

**2.14 PREACTION SPRINKLER SYSTEM**

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
  - .2 Flow switch type:
    - .1 With normally open and normally closed contacts and supervisory capability.
  - .3 Pressure alarm switch:
    - .1 With normally open and normally closed contacts and supervisory capability.

**2.15 AUDIBLE SIGNAL DEVICES**

- .1 Speakers:
  - .1 Cone type: surface square 200 mm, ceiling mounted.
    - .1 Fire-retardant, moistureproof.
    - .2 Multiple taps adjustable from 0.25 to 2 W.
    - .3 Frequency response: 400 to 4000 Hz.
    - .4 Output sound level: 89 db at 3 m with 1 W tap.
  - .2 Cone type: recessed square 200 mm ceiling mounted.
    - .1 Fire-retardant, moistureproof.
    - .2 Multiple taps adjustable from 0.25 to 2 W.
    - .3 Frequency response: 400 to 4000 Hz.
    - .4 Output sound level: 89 db at 3 m with 1 W tap.
  - .3 Cone type: recessed complete with integral visual alarm device, square 200 mm ceiling mounted.
    - .1 Fire-retardant, moistureproof.
    - .2 Multiple taps adjustable from 0.25 to 2 W.

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- .3 Frequency response: 400 to 4000 Hz.
  - .4 Output sound level: 89 db at 3 m with 1 W tap.
  - .5 Strobe type: flashing, 110 Candela output, 24 V dc.
- .4 Horn type with compression driver: surface or semi-flush mounted as indicated on drawings..
  - .1 Corrosion, vibration and vermin resistant.
  - .2 Taps: multiple, adjustable from .25 to 4 W.
  - .3 Frequency response: 400 to 4000 Hz.
- .2 Output sound level: 89 db at 3 m with 1 W tap. The following speaker tap settings are a guide and shall be adjusted on site as required to achieve audibility within each section of building:
  - .1 Offices or rooms up to 38 m2  $\frac{1}{4}$  W tap
  - .2 Rooms between 38 to 75 m2 in area  $\frac{1}{2}$  W tap
  - .3 Open office space or large rooms  $\frac{1}{2}$  or 1 W tap
  - .4 Corridors 1 W tap
  - .5 Stairwells  $\frac{1}{4}$  or  $\frac{1}{2}$  W tap
  - .6 Storage and Utility spaces 2 or 4 W tap
  - .7 Mechanical and Machine Rooms 2 or 4 W tap + visual strobe alarm

**2.16 VISUAL ALARM SIGNAL DEVICES**

- .1 Strobe type: flashing, 110 Candela output, 24 V dc.
- .2 Designed for surface mounting as indicated.

**2.17 END-OF-LINE DEVICES**

- .1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel.

**2.18 WAVEGUIDES**

- .1 Provide Waveguides at all shield penetrations for fibre optic connections between transponder cabinets.
- .2 Refer to drawings for locations and installation requirements.

**2.19 ADDRESSABLE SIGNAL CIRCUIT ISOLATION MODULE (SIM)**

- .1 Provide addressable isolation modules for signal circuits within the shielded area in Block A and B of Building 250D. Refer to drawings for exact location and quantities.
- .2 The signal circuit isolation module shall be placed in the signal circuit for each designated room to ensure that speakers and associated wiring cannot be tampered with to convert the speaker to microphones.
- .3 The isolation module shall allow the fire alarm system to maintain supervision of the signal circuit wiring to the EVAC speakers when the signals circuit zone is not active.

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**2.20 GRAPHIC DISPLAY**

- .1 Provide annunciator at main entrance control area to Building 250D, adjacent to the Central Control Unit (CCU).
- .2 Annunciator to be LED type and indicate all alarm conditions. Faceplate to be brushed stainless steel with hinged lockable door. All indicator lamps to have engraved identification ( white lettering). Arrange indicator lamps (LED) zones by floor and function.
- .3 In addition to the zones and functions indicated, the annunciator shall be equipped with the following:
  - .1 Power On Light (LED)
  - .2 Trouble Light & Buzzer
  - .3 Push button to test all lamps. Provide connection to nearest 15A 1 pole, 120 V separate circuit.
  - .4 Common lamp failure light.
- .4 Graphics shall include all of these functions as above and the following:
  - .1 ceiling level layout plan
  - .2 indicate all room names and numbers
  - .3 under raised floor level layout plan
  - .4 coloured LED indicating for zone of alarm
  - .5 coloured LED indicating a group of devices within each room
  - .6 the common red LED to annunciate and alarm originated outside the area.
  - .7 one sonalert (alarm and trouble)
  - .8 one signal silence switch with off-normal position indication and subsequent alarm capabilities. System cannot be reset with switch in the off position

**2.21 REMOTE PRINTER**

- .1 System printer: to give hard copy record of system events complete with features as follows:
  - .1 120 V ac, 60 Hz.
  - .2 Laser.
  - .3 Utilizes standard paper.
  - .4 Connected to RS-232 output at central control panel.

**2.22 REMOTE TERMINAL – FIRE COMMAND CENTRE**

- .1 The Fire Command Centre shall be located in the main control area at the main entrance to Building 250D.
- .2 Remote Terminal unit includes:
  - .1 Personal Computer (PC) with minimum 400 mHz, 586 microprocessor, (most recent version - past six months) and 64 Megabytes of RAM;
  - .2 One (1) Terabyte hard drive,
  - .3 DVD/CD-ROM burner;



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- .4 Keyboard;
- .5 Wireless Mouse;
- .6 600 mm wide screen LCD screen, 1080 P resolution with High Definition (HDMI or DVI) connection to PC;
- .7 Windows based - latest version.
- .3 Full screen viewing for: alarms, supervisory circuits, trouble alarms, and event history log. Manufacturer to include all operation software fully installed and setup. Software shall be a non-graphic type providing text based treed menu screens displaying all system activities, operational information, historical data and user interface.
- .4 Provide 1500 VA (ten (10) minutes) uninterruptible power supply (UPS) mounted on desk beside display unit.

**2.23 EMERGENCY POWER TRANSFER SWITCHES**

- .1 Connect the existing and new emergency power transfer switches to monitor status of switches when transferred to emergency power.
- .2 Provide monitor status of transfer switches in bypass mode (normal or emergency).
- .3 At each transfer switch provide the following:
  - .1 Voltage sensor and relay contact connected to emergency supply of transfer switch.
  - .2 Voltage sensor and relay contact connected to load side (output) of transfer switch.
  - .3 Connect sensor relay contacts in series and provide a status relay connected to fire alarm interface module to monitor transfer switch transferred to emergency power. Refer to drawing schematics.
  - .4 Interface module (dual input) wired to auxiliary contact of bypass switches.

**Part 3 Execution****3.1 SCHEDULING AND PLANNING**

- .1 Review strategy and planning carefully with the Departmental Representative. Provide a detailed construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule – Bar (GANTT) Chart.
- .2 Schedule a meeting with the Departmental Representative and the Canadian Forces Fire Marshall and review proposed procedures and schedule.

**3.2 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire alarm and communication systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.3 INSTALLATION**

- .1 Install systems to CAN/ULC-S524.
- .2 Refer to Article 3.7 Implementation Sequence Requirements for additional details.
- .3 Install central control unit and connect to ac power supply, ac standby power.
- .4 Install manual alarm stations and connect to alarm circuit wiring.
- .5 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from 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.
- .6 Connect alarm circuits to main control panel.
- .7 Install speakers to CAN/ULC-S525 and visual signal devices to CAN/ULC-S526 and connect to signalling circuits.
- .8 Connect signalling circuits to main control panel.
- .9 Install end-of-line devices at end of alarm and signalling circuits .
- .10 Install remote annunciator panels and connect to annunciator circuit wiring.
- .11 Install door releasing devices.
- .12 Install remote relay units to control fan shut down.
- .13 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .14 Room detection system:
  - .1 Install detectors. Make necessary connections between room detection panel and main fire alarm panel.
  - .2 Locate and install audible signals and visual alarms.
  - .3 Locate and install detectors facing downward under raised floor. Fasten to steel brackets approximately 300 mm above sub-floor level to clear cables and conduits.
- .15 Splices are not permitted.
- .16 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .17 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .18 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- .19 Install speakers and connect to speaker circuits.

**3.4 WIRING**

- .1 The normal power supply to the Fire Alarm system shall be 120 volt, 60 Hz, A-C.
- .2 Provide mineral insulated cable (MIC) for all connections between transponders in

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separate fire compartments as indicated on drawings.

- .3 **Provide complete new separate conduit and wiring systems for the fire alarm EVAC signalling appliances and visual signalling appliances throughout the building. All wiring and conduit shall be installed in accordance with all codes and standards and the manufacturers requirements.**
- .4 **Provide new addressable zone loop conduit and wiring systems from the transponder to each area to intercept existing initiate circuit/zone conduit system. Refer to drawings and associated details.**
- .5 **Provide new wiring for all initiate circuits and reuse existing conduits for interconnection of initiate devices as defined on the drawings. Provide new conduit and wiring from transponders to each initiate zone loop location and devices.**
- .6 All wiring shall be installed to conform to the requirements of the Canadian Electrical Code, Part I, and applicable Provincial Codes. Conductors shall be solid copper. Conductors shall conform to sizes indicated by manufacturer, but in any case, the minimum size of any conductor from transponder cabinet to devices shall be in accordance with Section 26 05 21 - Wires and Cables (0 – 1000 V) Article 3.3.3:
  - .1 All wiring shall be identified by coded markers at outlets and pull boxes. Joints shall only be made at device terminals.

### 3.5 ELECTROMAGNETIC SHIELDING

- .1 Provide fiber optic wave guide filters at all shield penetrations to meet manufacturers requirements.

### 3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and to CAN/ULC-S537.
- .2 Indicate all verification and testing activities and milestones in the project schedule. This includes:
  - .1 At completion of new system installation to CAN/ULC-S537.
  - .2 During the Commissioning stage verification to CAN/ULC-S536.
  - .3 Integrated systems testing and verification.
  - .4 System acceptance testing with Authorities Having Jurisdiction.
- .3 Provide complete verification, testing and certification of the fire alarm system as outlined herein.
- .4 Perform system verification in stages to suit construction implementation including:
  - .1 At completion of backbone and main transponder installation, risers and floor equipment rooms.
  - .2 Portions of system in areas and system loop as completed.
  - .3 Final acceptance testing with Authorities Having Jurisdiction prior to system cut-over from old to new.
- .5 Installation shall be in full compliance with the requirements of the CFFM and the Authority Having Jurisdiction.

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- .6 Provide testing and verification services of the manufacturer technical support and independent verification company.
- .7 Fire alarm system:
  - .1 Test and initiate all signalling devices and alarm circuit to ensure proper operation in accordance with CAN/ULC S537.
  - .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 Addressable circuits system style DCLA:
    - .1 Test each conductor on DCLA 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 3 signals. Correct imposed fault after completion of each series of tests.
    - .2 Test each conductor on DCLA 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 signals. Correct imposed fault after completion of each series of tests.
- .8 Provide final EPROM program re-burn for system Departmental Representative incorporating program changes made during construction.

**3.7 IMPLEMENTATION SEQUENCE REQUIREMENTS**

- .1 The installation of the new fire alarm system shall be performed in stages.
- .2 The stages of the work include:
  - .1 Install complete fire alarm system backbone including, distribution wiring, fibre optic cabling and conduit and associated transponders distributed throughout the complex. .  
 The Central Control Unit (CCU) shall be temporarily installed in the main entrance control room in 250D to allow for connection of the Fire Command Centre (FCC) computer.  
 Install and connect the following devices to each of the designated transponders to conduct a complete operational test of the programming and associated operating sequence for the new Fire Alarm System.

Fire Alarm Devices						Sprinkler			Fan Shutdown Relay
Trans-ponder	Horn/ Strobe	Speaker/ Strobe	Smoke Detector	Heat Detector	Pull Station	Flow Switch	Tamper Switch	Preaction Solenoid	
N2	2	2	4 (1)	-	2	2	2	1	1
N3	2	2	4	-	2	1	1	-	-
N4	2	2	4 (2)	-	2	-	-	-	-
N5	2	2	4 (2)	-	2	-	-	-	1
N6	2	2	4 (1)	-	2	-	-	-	-
N7	-	2	4 (1)	-	2	-	-	-	-
N8	-	1	2	-	1	-	-	-	-

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Fire Alarm Devices						Sprinkler			Fan Shutdown Relay
Trans- ponder	Horn/ Strobe	Speaker/ Strobe	Smoke Detector	Heat Detector	Pull Station	Flow Switch	Tamper Switch	Preaction Solenoid	
N9	-	1	2	-	1	-	-	-	-
N10	-	1	2	-	1	-	-	-	-
N11	-	4	4 (2)	-	2	-	-	-	-
N12	-	2	4 (1)	-	-	-	-	-	-
N13	-	2	4 (1)	-	-	-	-	-	-
N15	-	2	4 (1)	-	-	-	-	-	-
N17	-	2	4 (1)	-	-	-	-	-	-
N18	2	2	4	-	2	-	-	-	1
N19	2	2	2	2	2	2	2	2	1
N20	1	1	-	-	1	1	1	-	1

(1) Cross zoned detectors two (2) under-floor, two (2) ceiling detectors for computer room

(2) Two (2) ceiling detectors and two (2) under-floor detectors.

- .2 Complete cross-connection between the new and existing Fire Alarm System and confirm operation between systems.
- .3 Install new audible signaling devices, combination audible/visual signalling devices throughout the complex and connect to new transponder amplifiers.
- .4 Test and verify operation of all signalling devices throughout complex utilizing temporary initiate test devices described in .1 of this article. Signal circuits shall operate as **SINGLE STAGE** signalling throughout the complex in a temporal tone upon activation of any alarm initiate device.
- .5 Complete system cross connect between the existing fire alarm system and new system shall activate audible and visual signalling devices throughout the complex in **SINGLE STAGE** temporal tone. Test and activate initiate devices in each and every zone on the existing fire alarm to ensure that signalling devices are activated.
- .6 Complete replacement of each and every initiate device and installation of new wiring for the complete system, one addressable fire alarm loop at a time. Devices and wiring replacement shall be limited to the number of devices and wiring that can be replaced and certified during a single working shift. The fire alarm system shall be returned to normal operation at the end of each and every shift.
- .7 Upon completion of replacing 100 initiate devices from the existing fire alarm system, the Contractor shall have Chubb Edwards deprogram the device addresses that have been removed from the existing Fire Alarm System to eliminate excessive system troubles.
- .8 As areas are completed (including verification) coordinate and schedule interim acceptance test with authorities having jurisdiction.
- .9 At each stage where devices are transferred to the new system, ensure building operators and commissionaires are fully trained in operating the new/existing system.

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- .10 At the completion of the new system, perform a system test and inspection in accordance with ULC S536. Arrange with authorities having jurisdiction and perform a final acceptance test of the completed system.
- .11 Decommission and remove existing fire alarm system including all transponders and backbone conduit and wire from site.

**3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 - General Instructions.
- .3 Waste Management: separate waste materials and dispose of.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.9 DEMONSTRATION AND TRAINING**

- .1 The Fire Alarm equipment manufacturer shall develop and deliver onsite lectures to demonstrate the operation of the Fire Alarm System and associated components and train operational personnel in use and maintenance of fire alarm system. All training shall be completed in both official languages in separate sessions.
- .2 Provide training as outlined in Section 01 79 00 - Demonstration and Training and submit two copies of training plan to the Departmental Representative for review. Include a listing of training topics and a proposed training schedule. Amend the plan as instructed by the Departmental Representative and resubmit for approval prior to training commencement. All training and demonstration to be completed in both official languages.
- .3 Training shall include on-site lectures, seminars, equipment demonstration and hands-on staff training by qualified fire alarm system equipment representatives in use and maintenance of fire alarm system.
- .4 Training shall include all aspects of the fire alarm system operation under normal and alarm conditions and system test procedures.
- .5 Training shall be provided by qualified manufacturer's technical representatives at various stages of system completion, including:
  - .1 During each stage of implementation of equipment.
  - .2 Substantial completion of the fire alarm system.
  - .3 At completion of new installation and de-commissioning of existing system.
  - .4 Four (4) months after final acceptance and commissioning of the entire fire alarm system, provide six (6) hours additional training.
- .6 Provide fire alarm system instructional training and operations tutorial (in French and English) on DVD. Submit two copies of DVD to Departmental Representative for review and as directed incorporate any revisions or modifications to the DVDs.

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- .7 All training sessions, demonstrations and seminars shall be scheduled during working weekdays between the hours 08:30 hrs to 11:30 hrs and 13:00 to 16:00, or as directed by the Departmental Representative.

**3.10 VERIFICATION FORMS AND CHECKLISTS**

- .1 Provide all required tools, materials, labour to complete verification forms and checklists for each new fire alarm system component throughout the building.
- .2 Provide sample verification forms to be used. Make all modifications as directed by the Departmental Representative.
- .3 Zone identification and description, device address and description shall be submitted to the Departmental Representative for review and acceptance prior to commissioning of devices and system. Provide English and French text to be displayed or printed.
- .4 Complete all forms and submit to Departmental Representative for review prior to commissioning each portion of the new system

**3.11 TESTING AND VERIFICATION**

- .1 Refer to **3.7- IMPLEMENTATION SEQUENCE REQUIREMENTS.**
- .2 The testing schedule as approved by the Departmental Representative shall occur weekday evenings going no later than 24:00 hours (midnight) daily. Approved testing on week-ends shall be no longer than ten (10) hours per day. Commissioning activities shall not be scheduled on week-ends.
- .3 The Contractor shall provide the necessary qualified personnel to assist with all testing and verification.
- .4 At each stage of completion of the new system equipment and devices test and verify the system using the supervisory services of the manufacturer. Perform verification to ULC-S537 and submit reports.
- .5 After completion of system verification, perform commissioning to ULC-S536 and submit reports..
- .6 Only after the testing, verification and commissioning tasks are completed, and all deficiencies rectified, notify the Departmental Representative, the representatives of the City of Ottawa Building Inspection, the CFFM and authority having jurisdiction and perform acceptance testing. This includes in their presence demonstrate the proper functioning of the entire system.
- .7 The purpose of a verification procedure for the system is to make certain that all equipment operates as intended. Upon completion of the verification procedures, an approved certificate of verification shall be provided to the Departmental Representative. One copy shall be displayed near the control panel, and a copy shall be kept with the system documentation. An equipment schedule listing each device and showing confirmation that was verified shall be provided.
- .8 The verification shall be performed by manufacturers' field technicians registered with the Canadian Fire Alarm Association (C.F.A.A.).
- .9 The system verification, and inspection and testing shall be conducted in accordance with the latest revisions of the ULC Standard 537, "Standard for Verification of Fire Alarm

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Systems" and 536 "Standard for the Inspection and testing of fire alarm systems" and as described herewith.

- .10 Simulate grounds and breaks on initiate and signal circuits to demonstrate and ensure proper operation of trouble signals. Simulate capability of subsequent alarm signals during each imposed open circuit and ground fault conditions. Trouble signals shall be verified to operate an open circuit, short circuit, ground fault or the removal of any plug-in component. Wiring shall be inspected to ensure that individual terminations have been provided for all conductors, and that applicable correct polarities have been observed.
- .11 All equipment installed as part of the system shall be inspected for visible damage or tampering which might interfere with its intended operation.
- .12 Any device which is field adjustable shall be tested to ensure that its setting is acceptable under ambient conditions at the location of installation.
- .13 Each and every manual initiating device shall be operated to verify their proper operation.
- .14 Each and every heat detector, resettable or self-restoring: a heat source shall be used to test the device operation.
- .15 Each and every heat detector, non-resettable: simulate the detectors operation by shorting terminals on the detector base.
- .16 Each and every smoke detector, duct and area type: detector sensitivity shall be tested according to the manufacturer's recommendations. Detector operation shall be tested by introducing "smoke" into the detector.
- .17 Review location of smoke detector device with manufacturer prior to installation and adjust as required. Install sampling tubes and verify air flow through tubes and smoke detector housing. Relocate as necessary if insufficient air flow due to duct air turbulence or installation method. Test all completed duct mounted smoke detectors by means of smoke bomb/generator in position upstream (return air duct) of device at nearest duct opening. Provide new access door in existing duct work as required to achieve testing.
- .18 All audible signal appliances shall be tested for acceptable operation. Tests shall be made to determine that the signal is audible throughout the building above normal ambient noise. Tests shall be made to verify that adequate power is available from both normal and standby sources under the maximum system load. Provide field measure sound pressure levels (dBA) for each room or area and record results on a floor plan which shall be submitted with the verification report.
- .19 Alert and evaluation signals shall not be transmitted to stairwell speaker. Provide paging only in these areas.
- .20 Installation of additional signals or revisions to power sources shall be made to ensure audibility prior to completion of the inspection before a certificate of verification can be issued.
- .21 Annunciators shall be tested to ensure proper operation, correct voltage, correct zoning and visibility of all legends.
- .22 The system normal power supply shall be inspected to ensure that is properly fused, locked away from unauthorized interruption, adequate to meet system requirements and separated from auxiliary device power source such that a fault in such circuit cannot affect fire alarm system control unit power.



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- .23 Battery units shall be inspected for protection from accidental damage and for adequate ventilation. Batteries shall be permanently connected to a properly fused charging circuit dedicated to the alarm system batteries.
- .24 The batteries shall have sufficient capacity to operate the fire alarm system for 24 hours with the charger input disconnected, followed by 120 minutes of full evacuation alarm operation.
- .25 All control equipment shall be tested for acceptable operation. An inspection and test shall be made of all cable terminals, plug connectors, plug-in circuits, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable, and where applicable, to confirm their electrical supervision.
- .26 All field wiring shall be verified to be terminated on a single conductor per terminal basis.
- .27 All lamps and indicators shall be tested for acceptable operation. All control functions shall be operated to verify correct response. Simulation of open circuits, short circuits and ground faults shall be performed on all relevant components to confirm proper trouble circuit response.
- .28 Ancillary equipment connections shall be tested for proper operation. Such equipment shall be inspected to ensure that faults in it will not interfere with alarm system operation.
- .29 The remote central station connection shall be tested for acceptable operation.
- .30 All fan shutdown systems to be tested for acceptable operation
- .31 All sprinkler flow switches, supervisory valves and pressure switches shall be tested for acceptable operation.
- .32 All interconnections between control panels and annunciators.
- .33 Upon completion of all tests and verification provide the Departmental Representative with final certificates of test and verification and complete proof of liability insurance for this work.
- .34 Only when testing is completed in accordance with the ULC verification standards and as noted herewith, the ULC label shall be affixed to each control panel and the certificate of verification issued

**3.12 INTEGRATED SYSTEMS TESTING**

- .1 At the completion of the project, after completion of testing, verification and commissioning of the new fire alarm system, mechanical systems and removal of the existing fire alarm system, perform integrated systems testing.

**3.13 EXISTING SYSTEM REMOVAL**

- .1 Remove existing fire alarm system only after new system is complete, including final verification, testing and acceptance by authority having jurisdiction. Existing system removals include but are not limited to:
  - .1 EVAC panel.
  - .2 Amplifiers and main control panels.
  - .3 Fire alarm signal devices, and speaker recessed in back boxes shall be removed.
  - .4 Remove all existing devices.

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- .5 Remove and dispose hazardous material in detectors as required by Code and Authority Having Jurisdiction.
- .6 After removal of existing equipment, patch and make good all surfaces to match existing surfaces. All work to the satisfaction of the Departmental Representative.

**END OF SECTION**