

Capital Projects Group

Clean Agent Fire Suppression System Specification

Specification 21 22 00

Revision 1

Date: September 2018

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Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
Various	Sept. 20, 2018	Revised to coordinate with corresponding specifications.

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1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Provide clean agent Fire Suppression System (FSS) as required, scheduled and specified herein.

1.2. DESIGN REQUIREMENTS

1.2.1. System is to be designed by a professional engineer registered and licensed in jurisdiction of the work and in the employ of the system manufacturer. Design engineer is to sign and stamp all shop drawings (not product data sheets) and design calculations.

1.2.2. Fire suppression system is to utilize 3M "NOVEC 1230" or approved equivalent, gas and is to be in accordance with requirements of NFPA 2001.

1.2.3. System is to be a permanent, piped, fixed discharge nozzle type system designed for total flooding of the gas to provide a sufficient amount of fire suppression agent to obtain a uniform (minimum) design concentration throughout protected area while taking into account such factors as un-closable openings, "rundown" time of fans, time required for dampers to close, and any other feature of the facility that could affect gas concentration. Design concentration is to be achieved within 10 seconds of start of gas discharge.

1.2.4. The cylinder storage area, system electronics and piping header shall include provisions to install a minimum of 10% additional clean agent volume to account for site conditions and other unknowns, in addition to the design factors indicated in NFPA 2001.

1.2.5. One complete system (panel, cylinder(s), etc.) for each protected space.

1.2.6. Cylinder(s) located either inside protected space or very close to it. Ensure space is available.

1.2.7. Special consideration regarding prevention of agent migration through building ventilation system.

1.2.8. System is to include but not be limited to following main components:

- a) agent release control panel with addressable input and output modules;
- b) smoke detectors, located at maximum 37 m² (400 ft.²) intervals and connected in cross-zoned circuits;
- c) manual pull station and manual abort station at each protected area exit;
- d) audible alarm signals;
- e) visual alarm signal(s);

- f) charged cylinder(s) of "NOVEC 1230" with manifold if required, cylinder bracket(s), valve actuator(s), discharge hose/check valve assemblies, and orifice union/nipple assembly;
- g) motorized dampers;
- h) gas distribution piping system with discharge nozzles;
- i) regulations.

1.2.9. Description of System Operation

- a) Following describes general sequence of operation. Final sequence to be in accordance with requirements of local fire authority and Owner.
- b) Automatic Activation Sequence
 - 1) Activation of any single detector in any detection zone is to:
 - i) transmit trouble alarm from releasing panel to main building fire alarm panel and remote annunciators;
 - ii) energize strobe and audible device to signal first alarm;
 - iii) flash alarm lamp and corresponding zone lamp on agent release panel;
 - iv) display detection message on agent release panel screen;
 - v) energize lamp on activated detector.
 - 2) Activation of a second detector in different detection zone is to:
 - i) transmit "System Discharge" alarm signal from agent release panel to main building fire alarm panel and remote annunciators;
 - ii) energize strobe and audible device to signal second alarm;
 - iii) energize auxiliary contacts for ventilation equipment shutdown and closure of motorized dampers;
 - iv) flash "Pre-Discharge" lamp on agent release panel;
 - v) initiate a programmable agent release time delay (30 seconds) in agent release panel.
 - 3) Activation of an abort station is to:
 - i) flash a system trouble and "Abort" lamp on agent release panel;

- ii) display abort message on agent release panel screen;
 - iii) hold pre-discharge timer at 10 seconds (programmable).
 - 4) If abort station is released/deactivated, pre-discharge timer is to continue countdown starting at 10 seconds. If abort station is activated again before countdown reaches zero, time is to reset to 10 seconds. Time is programmable.
 - 5) Upon completion of release panel time delay, system is to:
 - i) illuminate steady "Discharging" lamp on agent release panel;
 - ii) display releasing message on agent release panel screen;
 - iii) energize electronic actuator for cylinder(s), thereby releasing extinguishing agent into room;
 - iv) continue audible/visual alarms for duration of system operation.
- c) Manual Activation Sequence
 - 1) In addition to automatic operation, provide manual release stations at each exit point of protected space. Operation of manual release is to bypass time delay but in all other respects, control system is to operate as if two detectors had activated.
- d) System is to be electrically supervised and monitored for integrity of conductors, and is to be complete with:
 - 1) addressable interface between agent release control panel and fire alarm system control panel;
 - 2) output signals and devices to shutdown associated room ventilation equipment;
 - 3) addressable communication techniques for local data acquisition and control;
 - 4) active/interrogative features whereby each system device is repetitively scanned, causing a signal to be transmitted to agent release panel to indicate that initiating devices and signalling appliance circuit wiring is functional, with loss of signal at agent release panel resulting in a trouble indication as specified herein for the particular input.

- e) If building Fire Protection System (FPS) requires additional sprinkler heads installed in areas that are protected by FSS, due to local Code or Code Consultant Report requirement, include for following requirements to be incorporated in FSS operation:
 - 1) interconnection between clean agent FSS and building sprinkler protection system and/ or main building fire alarm system to suit design requirements;
 - 2) pre-action clean agent FSS initiating devices to initiate activation of fire suppression system only in required areas of coverage;
 - 3) base building sprinkler system to delay initiation of sprinklers in clean agent FSS activated zones based on clean agent FSS activation and base building sprinkler sequence of operation, typically of interconnected cross zone detectors.
- f) System components are to be CSA certified and ULC listed.

1.3. RELATED WORKS

- 1.3.1. Section 20 05 05 - Mechanical Work General Instructions.
- 1.3.2. Section 20 05 10 - Basic Mechanical Materials and Methods.
- 1.3.3. Section 20 05 40 - Mechanical Work Commissioning.
- 1.3.4. Section 21 13 00 - Fire Protection Sprinkler System.
- 1.3.5. Section 25 05 10 - BAS Performance Specification.

1.4. REFERENCE STANDARDS

- 1.4.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.
- 1.4.2. ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
- 1.4.3. ANSI B16.3, Malleable Iron Threaded Fittings.
- 1.4.4. ANSI B16.11, Forged Steel Fittings, Socket Welding and Threaded.
- 1.4.5. CAN/ULC S524, Installation of Fire Alarm Systems.
- 1.4.6. CSA C22.1, Canadian Electrical Code.
- 1.4.7. OESC - Ontario Electrical Safety Code.
- 1.4.8. NFPA 2001, Clean Agent Fire Extinguishing System.

1.5. TRAINING

- 1.5.1. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.
- 1.5.2. Include for 2 training sessions of maximum 7 hours duration per session for 6 Metrolinx people per session.
- 1.5.3. Refer to Section 20 05 05 for additional general requirements.

1.6. WARRANTY

- 1.6.1. Products to be guaranteed by manufacturer, for a minimum of 2 years after acceptance by Metrolinx.
- 1.6.2. Refer to requirements within Section to any extended warranties.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Handle and store products in accordance with manufacturer's instructions, in locations approved by Metrolinx. Include one copy of these instructions with product at time of shipment.

1.8. SUBMITTALS

- 1.8.1. Refer to submittal requirements in Section 20 05 05.
- 1.8.2. Submit shop drawings/product data sheets for products specified in this Section except pipes and fittings.
- 1.8.3. Submit complete CAD layout drawings indicating "head-end" equipment, piping schematic, pipe routing and sizing, zones, activation devices, and wiring schematics, all signed and stamped by a professional engineer registered and licensed in jurisdiction of the work.
- 1.8.4. Submit copies of calculations and a listing of design data used in preparing the calculations, system layout and sizing, signed and stamped by the design engineer as specified above.
- 1.8.5. Submit weekly inspection reports by system design engineer as specified below in the article entitled Quality Assurance.
- 1.8.6. Submit an inspection and test report and certification by system manufacturer's design engineer confirming the system is properly installed, has been tested, and is in proper operating condition, all as specified in Part 3 of this Section.
- 1.8.7. Submit 3 identified keys for fire suppression agent release panel door prior to Substantial Performance of the Work.

1.8.8. Product Data

- a) Submit product data sheets indicating:
 - 1) technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;
 - 2) performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol;
 - 3) product transportation, storage, handling, and installation requirements;
 - 4) product identification in accordance with Metrolinx requirements.

1.8.9. Shop Drawings

- a) Submit shop drawings for products indicating:
 - 1) type, capacity and ratings;
 - 2) mounting details to suit locations shown, indicating methods and hardware to be used;
 - 3) control components and control wiring schematic.

1.8.10. Commissioning Package

- a) Submit the following in accordance with Metrolinx Station Services Commissioning and Handover protocol typical, and Sections 20 05 05 and 20 05 40:
 - 1) Commissioning Plan;
 - 2) Commissioning Procedures;
 - 3) Certificate of Readiness;
 - 4) complete test sheets specified in Section 20 05 40 and attach them to the Certificate of Readiness;
 - 5) Source Quality Control Inspection and test results and attach to the Certificate of Readiness.

1.8.11. Commissioning Closeout Package

- a) Submit the following in accordance with Section 20 05 05:
 - 1) Deficiency Report;
 - 2) Commissioning Closeout Report;

- 3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals in accordance with Section 20 05 05:
 - i) Identification: manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems;
 - ii) functional description detailing operation and control of components;
 - iii) performance criteria and maintenance data;
 - iv) safety precautions;
 - v) operating instructions and precautions;
 - vi) component parts availability, including names and addresses of spare part suppliers;
 - vii) maintenance and troubleshooting guidelines/protocol;
 - viii) product storage, preparation, handling, and installation requirements;
 - ix) Commissioning Report.

1.9. QUALITY ASSURANCE

- 1.9.1. System installation personnel are to be licensed journeyman pipe fitters in the employ of the system manufacturer and under constant on-site supervision of a competent supervisor.
- 1.9.2. System manufacturer's design engineer is to conduct weekly inspections during the course of the work, and submit an inspection report after each site visit. Design engineer is also to perform final inspection/start-up/programming and submit certification as specified in Part 3 of this Section.
- 1.9.3. Manufacturers Qualifications
 - a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced similar product for a minimum period of thirty years. When requested by Consultant, an acceptable list of installations with similar product shall be provided demonstrating compliance with this requirement.
 - b) Where manufacturers provide after installation onsite inspection of product installations, include for manufacturer's authorized representative to perform onsite inspection and certificate of approvals.

1.9.4. Installers Qualifications

- a) Installers for work to be performed by or work under licensed Mechanical Contractor.
- b) Installers of equipment, systems and associated work are to be fully qualified and experienced installers of respective products and work in which they are installing.
- c) Where manufacturers provide training sessions to installers and certificates upon successful completion, installers to have obtained such certificates and submit copies with shop drawings.

1.9.5. Regulatory Requirements

- a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.
- b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. PIPE, FITTINGS AND JOINTS

- 2.1.1. Schedule 40 black iron or galvanized steel pipe, conforming to either ASTM A53 or ASTM A106, and complying with NFPA 2001 requirements.
- 2.1.2. Threaded fittings are to comply with NFPA 2001 and be a minimum Class 300 malleable iron or Class 300 ductile iron, or have a minimum rated working pressure of 3450 kPa (500 psi) at 21 °C (70 °F).
- 2.1.3. Grooved fittings and couplings are to comply with NFPA 2001 and have a minimum rated working pressure of 3450 kPa (500 psi) at 21 °C (70 °F). Piping is to be rolled or cut grooved in accordance with fittings or coupling manufacturer's guidelines.

2.2. PIPE HANGERS AND SUPPORTS

- 2.2.1. ULC listed pipe hangers and supports as specified in Section entitled Basic Mechanical Materials and Methods.

2.3. DISCHARGE HOSE/CHECK VALVE

- 2.3.1. Flexible reinforced discharge hose and check valve at cylinder for connection to manifold inlet.

2.4. FIRE SUPPRESSION AGENT

- 2.4.1. 3M NOVEC 1230.

2.5. STORAGE CYLINDERS

- 2.5.1. DOT and Transport Canada tested and stamped steel cylinders, factory filled with clean agent and pressurized with nitrogen, painted red and properly labelled, and complete with a pressure relief device and all required mounting hardware.

2.6. DISCHARGE VALVE ASSEMBLY

- 2.6.1. Backpressure type valve constructed of brass, sized to suit size of storage cylinder, and complete with following:
- a) copolymer seal;
 - b) piston;
 - c) siphon tube;
 - d) pressure gauge with integrated low pressure switch;
 - e) 24 VDC electronic actuator compatible in all respects for clean agent system.

2.7. MANUAL ACTUATOR

- 2.7.1. Mechanical activation device causing clean agent to discharge through valve outlet, mounted on top of electric actuator allowing for both electrical and manual system activation.

2.8. LIQUID LEVEL INDICATOR

- 2.8.1. For cylinders with a maximum storage capacity greater than 59 kg (130 lbs), manually operated device providing means to determine liquid level in a vertically mounted tank without need to remove cylinder from bracketing and piping for weighing.

2.9. MAINTENANCE LOCK-OUT SWITCH

- 2.9.1. Key operated and used to disable electronic actuator, preventing discharge during maintenance/inspection. Switch assembly is to include a red indicator lamp to be illuminated when switch is in lock-out position. Agent release panel is to indicate a trouble condition when switch is in lock-out position.

2.10. MAIN/RESERVE SWITCH

- 2.10.1. Key operated main/reserve switch that allows selecting of agent release on either main or reserve cylinder.

2.11. DISCHARGE NOZZLES

- 2.11.1. Permanently identified discharge nozzles, each sized for flow rates in accordance with system design flow calculations, and threaded directly to discharge piping without the use of special adaptors.

2.12. AGENT RELEASE PANEL

- 2.12.1. Surface wall mounting, microprocessor-based control and annunciation panel with a NEMA 4 enamelled steel enclosure with lockable hinged door and glass or transparent opening. Agent release panel is to communicate with and control following:

- a) detectors;
- b) addressable modules;
- c) remote annunciator;
- d) all other controlled devices.

- 2.12.2. Programming and editing of initial system program is to be achieved without special equipment and without interrupting alarm monitoring functions of panel.

- 2.12.3. Control panel to:

- a) communicate with, monitor and control all external interfaces, and is to include an EPROM for system program storage, non-volatile memory for building specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure;
- b) contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by system, and such control-by-event programs are to be held in non-volatile programmable memory and are not to be lost, even if system primary and secondary power failures occur;
- c) be complete with a real time clock for time annotation of system displays and history file, and time-of-day and date which is not to be lost if primary and secondary power supplies fail, and the real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

- 2.12.4. Display to include:

- a) status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones;
- b) LED backlight alphanumeric liquid crystal display with QWERTY programming and control keypad;

- c) touchpad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming;
- d) two different password levels to prevent unauthorized system control or programming.

2.12.5. Signalling line circuit (SLC) to include:

- a) SLC interface to provide power to and communicate with up to 159 intelligent detectors and 159 intelligent modules for a system capacity of 318 devices per loop, accomplished over a single SLC loop;
- b) loop interface board to receive analog information from all intelligent detectors to determine whether normal, alarm, or trouble condition exists;
- c) software to automatically maintain detector's desired sensitivity level by adjusting for effects of environmental factors, including accumulation of dust;
- d) detector software to be ULC certified as a calibrated sensitivity test instrument, allowing for manual or automatic sensitivity adjustment.

2.12.6. Panel to be complete with ground fault detection and indication.

2.12.7. Panel to include battery back-up power complete with:

- a) 12 volt, maintenance-free sealed battery of sufficient capacity to power system for a minimum of 24 hours plus 5 minutes of alarms (including operation of all ancillary relays) upon failure of normal AC power;
- b) battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge;
- c) protection to prevent battery discharge through charger;
- d) meters to indicate battery voltage and charging current.

2.12.8. Operator controls to include following:

- a) acknowledge switch;
- b) signal silence switch;
- c) system reset switch;
- d) drill (evacuate) switch.

2.12.9. Specific system operations to include following:

- a) smoke detector sensitivity adjustment;

- b) alarm verification;
- c) point disable;
- d) point read;
- e) system status report;
- f) system history recording and report;
- g) automatic detector maintenance alert;
- h) pre-alarm function;
- i) software zones.

2.13. ADDRESSABLE DEVICES

- 2.13.1. Detectors are to be intelligent and addressable and connect with two wires to releasing control panel signalling circuits.
- 2.13.2. Addressable detectors are to provide dual alarm and power LEDs. Both LEDs are to flash under normal conditions indicating detector is operational and in regular communication with control panel. Both LEDs are to be placed into steady illumination by control panel when an alarm condition has been detected. An output connection is to be provided in base to connect an external remote alarm LED.
- 2.13.3. Smoke detector sensitivity is to be set through control panel and adjustable through field programming. Sensitivity may be automatically adjusted by control panel on a time-of-day basis.
- 2.13.4. Using software in control panel, detectors are to automatically adjust for dust accumulation and other slow environmental changes that may affect performance. Detectors are to be ULC listed as meeting the calibrated sensitivity test requirements.
- 2.13.5. Equip detectors with a dust cover, to be removed at time of verification to prevent dust and dirt entering smoke chamber during construction work.
- 2.13.6. Detectors are to have internal identifying type code for agent release panel or fire alarm panel to use to identify type of detector (smoke, thermal, etc.).
- 2.13.7. Detectors are to be ceiling mounted and include a separate twist-lock base with tamperproof feature.
- 2.13.8. Detectors are to provide test whereby detectors will simulate an alarm condition and report that condition to agent release panel, with test initiated at detector itself or initiated remotely on command from agent release panel.

2.13.9. Analog Addressable Smoke Detectors

- a) Photoelectric type, compatible in all respects for clean agent system, with ability to measure products of combustion and, on command from agent release panel, send data to panel representing analog level of products of combustion.

2.13.10. Analog Addressable Heat Detectors

- a) Analog addressable devices rated at 57 °C (135 °F) with a rate-of-rise element rated at 9.4 °C (15 °F) per minute, and able to connect to control panel signalling line circuit through 2 wires and utilize electronic sensor to measure thermal conditions caused by a fire and, on command from control panel, send data to panel representing analog level of thermal measurements.

2.13.11. Analog Addressable Duct Smoke Detector

- a) In-duct smoke detector housing utilizing an intelligent photoelectric sensor which provides continuous analog monitoring and alarm verification from control panel.

2.13.12. Addressable Manual Pull Stations

- a) Positive, visual indication of operation with a key-type reset, clearly visible operating instructions provided on cover with word "AGENT" appearing on front and both sides of station, operation requiring two actions, and ability to send data to control panel regarding state of manual switch.

2.13.13. Addressable Dry Contact Monitor Module

- a) Provided to connect one supervised initiating device circuit (IDC) zone of conventional alarm initiating devices to one control panel SLC loop and is to include LED operational status indication.

2.13.14. Addressable Two-Wire Detector Monitor Module

- a) Provided to connect one supervised IDC zone of conventional two-wire smoke detectors or alarm initiating devices and is to include LED operational status indication.

2.13.15. Addressable Control Module

- a) Provided to supervise and control operation of one conventional notification appliance circuit (NAC) of compatible, 24 VDC powered, polarized audio/visual notification appliances, and include LED operational status indication.
- b) For fan shutdown and other auxiliary control functions, control module may be set to operate as a dry contact relay.

- c) Audio/visual power to be provided by a separate supervised power loop from main control power or from supervised ULC listed remote power supply.
- d) Provide address-setting means and store internal identifying code that control panel can use to identify type of device.
- e) Magnetic test switch to be provided to test module without opening or shorting its NAC wiring.
- f) To be suitable for pilot duty application and rated for a minimum of 0.6 amps at 30 VDC.

2.14. ISOLATOR MODULE

- 2.14.1. Provided to automatically isolate wire-to-wire short circuits on an SLC loop and limit number of modules or detectors that may be rendered inoperative by a short circuit fault on SLC loop.
- 2.14.2. Does not require any address-setting and its operations are to be totally automatic, not requiring to be replaced or reset after its normal operation.
- 2.14.3. LED to provide operational status indication.

2.15. REMOTE LAMP UNITS

- 2.15.1. Single gang stainless steel faceplate with LED indicating lamp and suitable identification labelling, suitable for mounting on standard wall box. Unit to be remotely connected to any smoke detector located in position where detector activated LED cannot be seen, such as under raised floors, in drop ceilings, above or in ductwork, etc. Smoke detectors to include auxiliary connections to suit connection requirements in accordance with system manufacturer's recommendations.

2.16. AUDIBLE/VISUAL DEVICES

- 2.16.1. Devices include horns, strobes and combination units. Devices to mount on wall back boxes. Back boxes to be supplied by system manufacturer to suit specific devices and type of installation. Devices are to be in accordance with requirements of local building code and local fire authority.
- 2.16.2. Visual Alarm Strobe Lights
 - a) 24 VDC strobe light fixture, compatible in all respects for clean agent system, complete with a red Lexan housing and white translucent lens identified "FIRE".

2.16.3. Audible Alarm Horn

- a) 24 VDC alarm horn, compatible in all respects for clean agent system, with electronic sounder capable of generating minimum 2 different distinctive sounds upon receiving a signal from agent release panel, minimum 94 dBA at 3 m (10') at low setting, and complete with required mounting and connection hardware and accessories.

2.16.4. In finished areas, devices to mount to a 100 mm (4") square, 60 mm (2-1/8") deep, back box. Where devices are to be surface mounted, provide a red finished surface back box with no knockouts.

2.16.5. Devices mounted to building exterior to be complete with weather-proof box.

2.17. REMOTE ANNUNCIATOR

2.17.1. Supervised, remotely located, back-lit, colour, LCD touchscreen display containing minimum 80 characters for alarm annunciation in clear English text and compatible in all respects with agent release panel. Annunciator to display all alarm and trouble conditions in system and include system functions such as acknowledge, signal silence, and reset.

2.18. ABORT STATION

2.18.1. Wall mounting "dead man" type mushroom head pushbutton abort switch requiring constant pressure on pushbutton to transfer a set of contacts, compatible in all respects with clean agent system, and consisting of a suitably sized back box, a red front faceplate with device identification and clear operating instructions.

2.19. PRESSURE/FLOW SWITCH

2.19.1. Pressure type flow switch complete with required mounting hardware and pipe fittings, and designed to interface with agent release panel to facilitate annunciation of agent discharge.

2.20. END-OF-LINE RESISTORS

2.20.1. End-of-line resistors for standard alarm and signalling circuits, sized to ensure correct supervisory current flows in each circuit.

2.20.2. Mount end-of-line resistors on a stainless steel plate suitable for mounting on a standard single gang wall box.

2.21. WIRING

2.21.1. CSA approved and ULC listed wire and cable, approved for fire alarm circuits, with colour coded, insulated solid copper conductors, of type in accordance with local governing electrical code and local governing fire authority requirements, and sized and installed in accordance with system manufacturer's instructions.

3. EXECUTION

3.1. ROOM INTEGRITY TEST

- 3.1.1. Before installation of clean agent system, perform room integrity testing in protected space in accordance with NFPA 2001.
- 3.1.2. Suppression system installing contractor is to inspect work to ascertain that protected space has been adequately and properly sealed.
- 3.1.3. If room integrity test indicates openings exist which would result in leakage and/or loss of extinguishing agent, coordinate and direct General Contractor to determine and correct cause of test failure.
- 3.1.4. Retest and correct deficiencies until successful test result is obtained, at no additional cost to Owner. Submit copy of successful test result in O&M manual.

3.2. INSTALLATION

- 3.2.1. Provide a complete clean agent fire suppression system to protect area(s) indicated on drawings.
- 3.2.2. Install system in accordance with reviewed shop drawings, system manufacturer's instructions, requirements of NFPA 2001, CAN/ULC S524, CAN/ULC S527, CSA C22.1, any additional requirements of local governing authorities including local fire authority, and following requirements:
 - a) install piping in accordance with reviewed shop drawings, securely supported, and arranged with close attention to design layout since deviations may alter design flow of fire suppression agent;
 - b) bracket piping within 300 mm (12") of all discharge nozzles;
 - c) ream piping prior to erection, blow clear and swab with appropriate solvent to remove mill varnish and cutting oils;
 - d) assemble threaded joints using Teflon tape applied to male threads only.
- 3.2.3. Provide required number of cylinders. Mount cylinder bracket assemblies to wall to accommodate single row arrangement with supplied fasteners. Locate and position cylinders to permit easy removal for service and refilling.
- 3.2.4. Install pressure/flow switch in manifold/discharge piping at cylinder(s) to facilitate detection of agent discharge.
- 3.2.5. Carefully coordinate installation of nozzles and detectors with location of other ceiling mounted items, and with location of equipment in room. Secure detector bases to outlet boxes and plug-in detector heads when finishing work is complete.

- 3.2.6. Provide remote annunciators and locate generally where indicated on drawings but review exact location with Consultant prior to roughing-in.
- 3.2.7. Provide required alarm horns and strobes. Ensure sound levels and light intensity levels are in accordance with requirements of local governing code and local governing authorities.
- 3.2.8. Strobe lights within protected area are to be placed 2 m (8') above highest floor level, or 150 mm (6") below ceiling, whichever is lower. Strobe lights outside protected area are to be located above entering door frame(s).
- 3.2.9. Review exact location of components and devices with Consultant prior to roughing-in. Where applicable, review component finishes with Consultant prior to ordering.

3.3. WIRING

- 3.3.1. Power wiring to agent release control panel will be done as part of the electrical work. Control wiring between agent release panel and fire alarm system control panel will be done as part of the electrical work.
 - a) Perform wiring work between agent release panel and system components, and wiring between agent release panel, fire alarm control panel and mechanical equipment (i.e. integration with ventilation units for unit shut-down or with dampers to close/open). Provide relays, contacts, and related components. Install wiring in metallic conduit in accordance with electrical work wiring requirements. Initiating device circuits are to be wired Class A. Indicating appliance circuits are to be wired Class B. Power for initiating devices is to be from agent release panel only.
 - b) Run alarm signalling circuits (horns and strobes) and initiating circuits (pull stations and detectors) in separate conduits from each other.
 - c) Provide liquid-tight flexible conduit for final connections at flow switch and electronic actuator.
 - d) Wiring materials, boxes, etc., unless otherwise specified, are to be in accordance with system manufacturer's recommendations.
 - e) Provide end-of-line resistors to electrically supervise wiring as required. Generally, locate end-of-line resistors at ceiling lines above a pull station location. Provide isolators and install in accordance with ULC standards. Properly label and identify. Do not locate end-of-line resistors and isolators in concealed locations.

3.4. INSPECTION, TESTING, AND CERTIFICATION

- 3.4.1. System design engineer is to conduct weekly site inspections of work and submit inspection reports to Consultant after each site visit. After installation and testing is complete, obtain and submit to Consultant, a letter from system design engineer stating he/she has visited site and reviewed system installation and operation and system is in accordance with engineered submittals including reviewed shop drawings and is in proper operating condition. Include copy of letter in O&M manual.
- 3.4.2. Test piping in accordance with requirements specified in Section entitled Basic Mechanical Materials and Methods.
- 3.4.3. Refer to Section entitled Basic Mechanical Materials and Methods for equipment and system start-up requirements. After system installation is complete, system is to be inspected and functionally tested by manufacturer's qualified personnel in accordance with manufacturer's recommended procedures and NFPA standards. Manufacturer's personnel to inspect and test following items:
- a) cylinders and distribution piping is inspected for proper mounting and installation;
 - b) electrical wiring is inspected and tested for proper connection, continuity and resistance to ground;
 - c) each detector is tested in accordance with manufacturer's recommended procedures;
 - d) system and equipment interlocks, such as audible and visual devices, equipment shutdowns, local and remote alarms, etc., are functioning properly;
 - e) each agent release panel circuit is tested for trouble by inducing a trouble condition into system.
- 3.4.4. Refer to Section entitled Basic Mechanical Materials and Methods for manufacturer certification requirements. Obtain and submit to Consultant, a letter from manufacturer's personnel who performed system inspection and testing stating he/she has visited site and reviewed system installation and operation and system is in accordance with reviewed shop drawings and in proper operating condition. Include copy of letter in O&M manual.
- 3.4.5. If applicable, submit to Consultant copy of approval certificate(s) from local fire authority and include in O&M manual.

END OF SECTION