

PART 1 - GENERAL

- 1.1 SUBMITTALS .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
- .3 Shop drawings to show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify current model production.
.5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
.2 Operation and maintenance manual approved by, and final copies deposited with, Departmental representative before final inspection.
.3 Operation data to include:
.1 Control schematics for systems including environmental controls.

- .2 Description of systems and their controls.
- .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental representative for approval. Submission of individual data will not be accepted unless directed by Departmental representative.
 - .2 Make changes as required and re-submit as directed by Departmental representative.

- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Sets of white prints will be provided, as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Record information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC; finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: -
"AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED"
(Signature of Contractor)
(Date).
 - .3 Submit to Departmental representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

<u>1.2 QUALITY ASSURANCE</u>	.1	Quality Assurance: in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
<u>1.3 MAINTENANCE</u>	.1	Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows: <ul style="list-style-type: none"> .1 One casing joint gasket for each size pump. .2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set. .3 Spare belts for each piece of equipment.
	.2	Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
	.3	Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.
<u>1.4 DELIVERY, STORAGE, AND HANDLING</u>	.1	Waste Management and Disposal: <ul style="list-style-type: none"> .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management & Disposal.
<u>PART 2 - PRODUCTS</u>	.1	Not Used
<u>PART 3 - EXECUTION</u>		
<u>3.1 PAINTING REPAIRS AND RESTORATION</u>	.1	Do painting in accordance with Section 09 91 23 - Interior Painting.
	.2	Prime and touch up marred finished paintwork to match original.
	.3	Restore to new condition, finishes which have been damaged.

- 3.2 CLEANING .1 Clean interior and exterior of all systems including strainers. Clean interior of all new ductwork and air handling units, including the exhaust fan, in accordance with NADCA ACR 2006.
- 3.3 FIELD QUALITY CONTROL .1 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- 3.4 DEMONSTRATION .1 Departmental representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Pumps
 - .2 HVAC System
 - .3 Terminal Units
 - .4 Controls
 - .5 Plumbing Fixtures and Systems
 - .6 Liquid Heat System
 - .7 HVAC System
 - .8 Refrigeration System
 - .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 PROTECTION .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.6 COMMISSIONING .1 All contractors shall assist the Commissioning Agent in the following:

- .1 Provide documentation on all equipment being removed or added to the site. The commissioning agent shall provide forms, which must be filled and returned to the Commissioning Agent.
- .2 Assist the Commissioning Agent in maintaining the Computerized Maintenance Management System (CMMS). The following procedure must be adhered to.
 - .1 The inventory of the equipment in the building was updated in 2011 and a list of items can be shared with the General Contractor to help with this tracking. All we ask is that the contractor use the list provided and cross off the items as they are removed. Or the contractor can just keep a log of the items and submit this log. All items should have a 25mm by 50mm white label affixed to it with a number that will start with 2520133.
 - .2 For items to be added, the contractor will be responsible to fill out a CMMS equipment information form provided by SNC-Lavalin for each new piece of equipment. With this information, SNC-Lavalin will generate a new inventory number and label.

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- .3 Halocarbons shall be removed in accordance with information noted in Section 23 23 00 - Refrigerant Piping.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ASHRAE Standard 90.1-[01], Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B 209M-[04], Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
 - .2 ASTM C 335-[04], Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411-[04], Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449/C 449M-[00], Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 533-[2004], Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C 547-[2003], Mineral Fiber Pipe Insulation.
 - .7 ASTM C 795-[03], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C 921-[03a], Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-[95], Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts

- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-[03], Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-[1997], Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-[03], Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 02 81 01 - Hazardous Materials.

- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 33 00 - Submittal Procedures.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management & Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental representative.

PART 2 - PRODUCTS

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| <u>2.1 FIRE AND SMOKE
RATING</u> | .1 In accordance with CAN/ULC-S102. <ul style="list-style-type: none"> .1 Maximum flame spread rating: 25. .2 Maximum smoke developed rating: 50. |
| <u>2.2 INSULATION</u> | .1 Mineral fibre specified includes glass fibre, rock wool, slag wool. <ul style="list-style-type: none"> .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335. .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket. <ul style="list-style-type: none"> .1 Mineral fibre: to CAN/ULC-S702 ASTM C 547. .2 Maximum "k" factor: to CAN/ULC-S702. |

- .3 Acceptable materials: Fiberglass 850 with all service jacket and double sure closure system, Knauf, Mansville, Manson.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C 547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C 547.
 - .4 Acceptable materials: Fiberglass 850 with all service double sure closure system, vapour barrier jacket and facing material, Knauf, Mansville, Manson.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C 547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C 547.
 - .4 Acceptable materials: Fiberglass faced flexible piping insulation Type II with reinforced foil and flame retardant craft facing, Knauf, Mansville, Manson.
- .6 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: To CAN/CGBS-51.40 with vapour retarder jacket.
 - .2 Jacket: To CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: To CAN/CGSB 51.40.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.
 - .5 Thermal conductivity: 0.039 W/m·°K at 24°C mean temperature per ASTM C 177 or C 518
 - .6 Water vapour permeability: 1.16x10⁻¹⁵ kg/(s·m·Pa) as per ASTM E96.
 - .7 Water absorbtion: 0.2% per volume per ASTM C209.

- .8 Flame spread and smoke development:
25/50 per ASTM E84.
- .9 Temperature range: -57 to 105°C.
- .10 Acceptable materials: AP Armaflex Pipe
Insulation or approved equal.
- .7 Radiant Panel Insulation
 - .1 Radiant panel shall be insulated with
50 mm thick flexible foil faced batt
insulation.
 - .2 Insulation shall be installed on the
back of radiant panels with foil
backing facing down.
 - .3 Acceptable products: Owen-Corning,
Manville, Manson, CertainTeed.
- 2.3 INSULATION SECUREMENT
 - .1 Tape: self-adhesive, aluminum, reinforced,
50 mm wide minimum.
 - .2 Contact adhesive: quick setting.
 - .3 Canvas adhesive: washable.
 - .4 Tie wire: 1.5 mm diameter stainless steel.
 - .5 Bands: stainless steel, 19 mm wide, 0.5 mm
thick.
- 2.4 CEMENT
 - .1 Thermal insulating and finishing cement:
.1 To CAN/CGSB-51.12.
- 2.5 VAPOUR RETARDER LAP ADHESIVE
 - .1 Water based, fire retardant type, compatible
with insulation.
- 2.6 INDOOR VAPOUR RETARDER FINISH
 - .1 Vinyl emulsion type acrylic, compatible with
insulation.
- 2.7 JACKETS
 - .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to
CAN/CGSB-51.53 with pre-formed shapes
as required.
 - .2 Colours: White.
 - .3 Minimum service temperatures: -20
degrees C.
 - .4 Maximum service temperature: 65
degrees C.
 - .5 Thickness: 0.15 mm.

- .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks (must not affect vapour barrier).
 - .3 Pressure sensitive vinyl tape of matching colour.
- .7 Acceptable material: ITW, Zeston, Proto.
- .2 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50mm sheet.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints with 50mm laps.
 - .5 Fittings: 0.5mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: Stainless steel, 19mm wide, 0.5mm thick at 300mm spacing.
- .3 Jackets: Venture Clad
Provide a 5-ply laminate, zero permeability, absolute vapor barrier, stucco embossed Venture Clad 1577CW-E, as manufactured by Venture Tape Group, or equal. The jacket shall have high puncture and tear resistance and be a self-adhesive material exceed UL723 requirements. The jacket shall be installed in strict accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

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| 3.1 MANUFACTURER'S
<u>INSTRUCTIONS</u> | .1 | Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet. |
| 3.2 PRE-INSTALLATION
<u>REQUIREMENT</u> | .1 | Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified. |

- .2 Surfaces clean, dry, free from foreign material.

- 3.3 INSTALLATION .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- 3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES .1 Application: at expansion joints, valves, primary flow measuring elements, flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation. Provide sample of each method proposed.
- .3 Insulation:
- .1 Insulation, fastenings and finishes: same as system.
- .2 Jacket: aluminum or PVC.
- 3.5 INSTALLATION OF ELASTOMERIC INSULATION .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.
- 3.6 PIPING INSULATION SCHEDULES .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

- .2 TIAC Code: A-1.
 - .1 Securements: SS wire. Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS wire. Tape at 300mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: ss wire, tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .5 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Pipe Sizes (NPS) and insulation thickness (mm)					Jacket
			1¼ to 2	2½ to 4	5 to 6	8 & over		
Hot water heating	60 - 94	A-1	25	38	38	38		PVC
Heating domestic HWS		A-1	25	25	25	38		PVC
Chilled water		A-3	25	25	25	25		VC
Chilled water pump casing		A-3	25	25	25	25		VC
Refrigeration Inside		A-6	38	38				PVC
Refrigeration Outside		A-6	38	38				Aluminum
Domestic CWS		A-3	25	25	25	25		VC
Trap Primer		A-3	25	25	25	25		PVC
Cooling coil cond. Drain		C-2	25	25	25	25		VC

- .6 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Use Venture Clad jacket on TIAC code A-3 insulation compatible with insulation.
 - .4 Installation: to appropriate TIAC code CRF/1 through CPF/5.
 - .5 Outdoors - Aluminum.

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| 3.7 FIELD QUALITY
CONTROL | .1 | Verification requirements in accordance with Section 01 33 00 - Submittal Procedures:
Contractor's Verification, include: <ul style="list-style-type: none">.1 Materials and resources..2 Storage and collection of recyclables..3 Construction waste management..4 Resource reuse..5 Recycled content..6 Local/regional materials..7 Certified wood..8 Low-emitting materials. |
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| 3.8 CLEANING | .1 | Proceed in accordance with Section 01 74 11 - Cleaning. |
| | .2 | Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment. |

END OF SECTION

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PART 1 - GENERAL

<u>1.1 REFERENCES</u>	.1	American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
	.1	ANSI/NFPA 13-[2002], Installation of Sprinkler Systems.
	.2	ANSI/NFPA 24-[2002], Installation of Private Fire Service Mains and Their Appurtenances.
	.3	ANSI/NFPA 25-[2002], Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
	.2	Health Canada/Workplace Hazardous Materials Information System (WHMIS)
	.1	Material Safety Data Sheets (MSDS).
	.3	Underwriter's Laboratories of Canada (ULC)
	.1	CAN4 S543-[M984], Standard for Internal Lug Quick Connect Couplings for Fire Hose.
<u>1.2 SAMPLES</u>	.1	Submit samples of following:
	.1	Each type of sprinkler head.
	.2	Signs.
<u>1.3 DESIGN REQUIREMENTS</u>	.1	Modify existing automatic wet pipe fire suppression sprinkler systems as dictated by floor plan changes and in accordance with NFPA 13, latest edition, light hazard, hydraulic calculations for existing sprinkler shop drawings and expand with calculations to verify design.
	.2	Replace all existing sprinkler heads with new quick-response sprinkler heads.
	.3	Include with each system materials, accessories, and equipment to provide each system complete and ready for use.
	.4	Modify system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

- .5 Locate sprinkler heads as required to address plan change, ceiling heights, light and diffuser locations.
- .6 Install an new ULC Listed double check.
- .7 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .8 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for light.
- .9 Water Supply:
 - .1 Contractor shall perform a flow test and base all hydraulic calculations on flow determined.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 02 81 01 - Hazardous Materials.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
 - .2 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.

- .6 Reinforcement.
- .7 Assembly details.
- .8 Accessories.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .2 Manufacturer's Field Reports: manufacturer's field reports specified.
- .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
 - .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Sprinkler heads.
 - .3 Pipe hangers and supports.
 - .4 Mechanical couplings.
 - .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".

- .2 Show data essential for proper installation of each system.
- .3 Show details, plan view, elevations, and sections of systems supply and piping.
- .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
- .4 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports:
 - .1 Preliminary tests on piping system.
- .6 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit drawings on reproducible Mylar film with title block similar to full size contract drawings.

1.5 QUALITY ASSURANCE .1

Qualifications:

- .1 Installer: must be certified with the Apprenticeship And Occupational Certification Act, Section 17(2).
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

- 1.6 MAINTENANCE .1 Extra Materials:
.1 Provide spare sprinklers and tools as required by ANSI/NFPA 13.
- 1.7 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 33 00 - Submittal Procedures.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
.1 Store materials indoors.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management & Disposal.

PART 2 - PRODUCTS

- 2.1 ABOVE GROUND PIPING SYSTEMS .1 Provide fittings for changes in direction of piping and for connections.
.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

- 2.2 PIPE, FITTINGS AND VALVES .1 All steel piping shall be manufactured in Canada or the United States. All piping shall be ULC listed and stamped accordingly. Pipe fittings are not required to be manufactured in Canada or the United States. All pipe fittings shall be ULC listed and stamped accordingly. Piping or fittings that are not stamped shall not be accepted.
- .2 Mains 2½" and larger shall be Schedule 10. Branch lines of 2" and smaller shall be Schedule 40.
- .3 All steel piping shall meet ASTM A53, ASTM A795 and ASTM A135.
- .4 Fittings and joints to ANSI/NFPA 13, ULC listed.
- .1 Ferrous: screwed, welded, flanged or cut grooved.
- .2 All fittings and joints by one manufacturer.
- .3 Acceptable manufacturers: Victaulic, Gruvlock, National, Shurjoint.
- .5 All pipe and fittings shall be inspected by the Departmental representative and PWGSC, before installation. Required labeling must be visible for inspection.
- .4 Pipe hangers:
- .1 ULC listed for fire protection services in accordance with NFPA.
- 2.3 SPRINKLER HEADS .1 General: To ANSI/NFPA 13 and ULC Listed for fire services.
- .2 Type and locations of sprinkler heads shall be in accordance with drawings.
- .3 Sprinkler heads shall be quick response except for extra hazard.
- .4 All sprinkler heads shall be by one manufacturer.
- .5 Acceptable manufacturers: Viking, Victaulic, Reliable, Tyco.

- .6 Refer to drawings for head types:
- .1 Upright bronze, glass bulb type.
 - .2 Sidewall chrome, link and lever type.
 - .3 Semi-recessed chrome pendant glass bulb with two-piece ring and cup.
- 2.4 DOUBLE CHECK BACKFLOW PREVENTER
- .1 Modular double check valve assembly with centre stem guiding. Each check module shall have a captured spring and be accessible through a bolted cover plate.
 - .2 Replaceable seats.
 - .3 Complete with tight closing, resilient seated shut off valves, test locks and strainer.
 - .4 CSA and UL Listed.
 - .5 Acceptable manufacturers: Watts, Wilkens, Combraco.
- 2.5 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS
- .1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labeled for A, B and C, Class protection.

CLASS "A" HAZARDS				
Hazard	Rating	Size (kg)	Max Area (m ²)	Max travel (m)
Light	2A	4.5	287	22.8
Ordinary	2A	4.5	139	22.8
CAP	2B	4.5	139	9.1

- 2.6 CABINETS
- .1 Semi-recessed type, constructed of 1.6 mm thick steel, 180 degree opening door of 2.5 mm thick steel and latching device.
 - .2 Cabinet to maintain fire resistive rating of construction in which they occur.
 - .3 Cabinet door with injection molded crystal clear shatterproof panel.
 - .4 Finish:
 - .1 Tub: prime coated; finish coat: white.
 - .2 Door & Frame: Red baked enamel finish.

PART 3 - EXECUTION

- | | | |
|--|----|---|
| <u>3.1 MANUFACTURER'S INSTRUCTIONS</u> | .1 | Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet. |
| <u>3.2 INSTALLATION</u> | .1 | Install, inspect and test to acceptance in accordance with ANSI/NFPA 13 and ANSI/NFPA 25. |
| <u>3.3 PIPE INSTALLATION</u> | .1 | Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings. |
| | .2 | Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter. |
| | .3 | Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. |
| | .4 | Inspect piping before placing into position. |
| <u>3.4 FIELD QUALITY CONTROL</u> | .1 | Site Test, Inspection:
.1 Perform test to determine compliance with specified requirements in presence of Departmental representative.
.2 Test, inspect, and approve piping before covering or concealing.
.3 Preliminary Tests:
.1 Hydrostatically test each system at 1378 kPag for a 2 hour period with no leakage or reduction in pressure.
.2 Flush piping with potable water in accordance with NFPA 13.
.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings. |

- .4 Confirm operation of alarms and flow switches through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish equipment for tests.
 - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

- 3.5 CLEANING .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 33 00 - Submittal Procedures. |
| | .2 | Section 01 74 21 - Construction/Demolition Waste Management & Disposal. |
| <u>1.2 REFERENCES</u> | .1 | American National Standards Institute (ANSI) |
| | .1 | ANSI/ASME B1.20.1-[83(R2001)], Standard for Pipe Threads, General Purpose. |
| | .2 | ANSI/ASME B16.3-[98], Malleable Iron Threaded Fittings Class 300. |
| | .3 | ANSI/ASME B16.9-[93], Factory Made Wrought Steel Buttwelding Fittings. |
| | .4 | ANSI/ASME Section IX, Welding and Brazing Qualifications. |
| | .2 | American Society of Mechanical Engineers (ASME) |
| | .1 | ASME B31.1-[01], Power Piping Code. |
| | .3 | American Society for Testing and Materials (ASTM International) |
| | .1 | ASTM A 53/A 53M-[01], Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless. |
| | .2 | ASTM A 106-[99e1], Seamless Carbon Steel Pipe for High-Temperature Service. |
| | .3 | ASTM A 197/A 197M-[00], Specification for Cupola Malleable Iron. |
| | .4 | ASTM A 234/A 234M-[02], Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures. |
| | .4 | Factory Mutual - FM Approval Guide. |
| | .5 | National Fire Protection Association (NFPA) |
| | .1 | NFPA 2001-[00]: Standard on Clean Agent Fire Extinguishing Systems. |
| | .2 | NFPA 70-[02], National Electrical Code. |
| | .6 | Underwriters' Laboratories Inc. (UL) - Fire Protection Equipment Directory-2002 |
| | .1 | UL 1058-[95], Halogenated Agent Extinguishing System Units. |
| | .2 | UL 2166-[99], Halocarbon Clean Agent Extinguishing Systems Units. |

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- .7 U.S. Department of Transportation (DOT) - Title 49 Code of Federal Regulations Parts 100 to 199, Transportation of Hazardous Material.
- 1.3 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings indicating:
 - .1 Detailed layout of system.
 - .2 Component descriptions and locations.
 - .3 Control diagrams.
 - .4 Wiring diagrams.
 - .5 Written sequence of operations.
- .3 Submit electrical schematics and piping diagrams describing complete suppression system.
- .4 Submit product data for the following:
 - .1 Storage cylinders.
 - .2 Control valves and pilot controls.
 - .3 Control panels.
 - .4 Nozzles.
 - .5 Push button stations.
 - .6 Detectors.
 - .7 Alarm bells or horns.
 - .8 Switches.
 - .9 Annunciators.
- .5 Submit test reports for the following:
 - .1 Room integrity test[s].
 - .2 Pressure test.
 - .3 Flow test.
- 1.4 SAMPLES .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples of following:
 - .1 Nozzle.
 - .2 Signs and valve tags.
- 1.5 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management & Disposal.
- .2 Deposit packaging materials in appropriate containers on site for recycling or reuse.

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- .3 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .4 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- 1.6 COMMISSIONING .1 Upon acceptance, system shall be commissioned and placed in operation.
- 1.7 OPERATION AND MAINTENANCE DATA .1 Provide complete operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance data to include:
 - .1 Electrical schematic of circuits.
 - .2 Written description of system design.
 - .3 Drawings illustrating control logic and equipment location.
 - .4 Written documentation for:
 - .1 Emergency procedures.
 - .2 Abort functions.
 - .3 System control panel operation.
 - .4 Trouble procedures.
 - .5 Safety requirements.
- 1.8 OPERATION AND MAINTENANCE MANUAL .1 Supply a standardized Maintenance & Operation manual in accordance with Section 01 78 00 - Closeout Submittals.
- .2 The manual shall include all necessary instructions to operate and maintain the system, and be explicit regarding the interaction between the clean agent suppression system, the Preaction sprinkler system and the controls and detection portion. Emergency procedures must form an integral part of the manual.
- .3 Supply separate user manual specific to the release control panel.
- 1.9 EXTRA MATERIALS .1 Provide maintenance data for system and components for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide spare parts as follows:
 - .1 Two (2) nozzles.

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| 1.10 RELATED WORK IN
OTHER SECTIONS | .1 | The work listed below shall be shall be provided by others, or under other sections. |
| | .2 | Supply and install one dedicated 110VAC, 60Hz branch circuit to power the release control panel. Circuit breaker shall be well identified and locked. |
| | .3 | Supply 110VAC, 60Hz branch circuit to power the air compressor. Circuit breaker shall be well identified |
| | .4 | Supply and install interlock wiring & conduit for shutdown of HVAC, damper, electrical power supplies, or shunt trip breaker. |
| 1.11 SYSTEM
DESCRIPTION | .1 | Self-contained unit, combining Preaction system with clean agent, including: <ul style="list-style-type: none"> .1 Integrated cabinet .2 Clean agent suppression system .3 Preaction Single Interlocked system .4 Dual Agent Releasing Control Panel |
| | .2 | The integrated unit shall include a clean agent system and an approved single interlocked preaction system in a cabinet enclosure. |
| 1.12 CLEAN AGENT
SYSTEM DESIGN | .1 | The system shall be a 3445 kPa pre-engineered type system. It shall have a minimum design of 4.5% volumetric concentration for Class A hazard and a minimum of 5.85% volumetric concentration for Class B hazard, minimum concentration of 4.7% for Class C hazard low-voltage at the minimum anticipated temperature with the protected area. |
| | .2 | System design shall not exceed 10% for normally occupied spaces, adjusted for maximum space temperature anticipated altitude and with provisions for room evacuation before agent release. |
| | .3 | System shall provide total flooding clean agent concentration in maximum 10 seconds for a 10 minutes holding time. |
| 1.13 PREACTION SYSTEM
DESIGN | .1 | The system must be designed for: <ul style="list-style-type: none"> .1 Occupancy hazard: Light .2 Density: 4.07 L/min./m²) |

- .3 Area of sprinkler operation 26.3 m².
- .4 Water Supply Location: Room 162
- .5 The sprinkler contractor shall do a flow test and pre-action design shall be based on recorded flow.

1.14 DRAWINGS AND .1
HYDRAULIC CALCULATIONS

The fire protection contractor must prepare and submit for approval all installation drawings and hydraulic calculations as required by NFPA.

1.15 TECHNICAL DATA .1

Submit for approval a set of equipment data sheets which will include all technical data for each essential component of the system such as integrated unit and options, clean agent cylinder, control system, etc.

PART 2 - PRODUCTS

2.1 CLEAN AGENT CABINET.1

The integrated cabinet with clean agent and single interlocked, electric release Preaction systems containing all hydraulic, pneumatic, fire extinguishing fluid and devices, and electrical components required for the control of an integrated system. A releasing control panel shall be integrated within the cabinet. System shall include the following:

- .1 Self-contained unit in sturdy free-standing 2.0mm steel cabinet, measuring:
 - .1 91mm cabinet: 35¾" x 25" x 77⅞" (91 x 64 x 196 cm)
- .2 The cabinet shall have a textured rust proof coating, inside and outside, fire red, oven baked polyester powder on phosphate base.
- .3 Two locked access doors shall reduce front area required for opening and shall be easily removable without tools to allow easy installation & servicing. They shall be provided with a neoprene gasket to avoid vibrations.

- .4 Integrated Clean Agent System:
 - .1 Clean agent storage cylinder assembly steel pressure vessel c/w pressure supervisory switch manufactured, tested and stamped in accordance with applicable DOT and Transport Canada markings. The agent storage cylinder shall be pressurized with 3445 kPa of nitrogen at the factory. Cylinder of 74 kg capacity should also be provided with a liquid level indicator. Fire protection fluid (also known as FK-5-1-12). Agent shall not contain any hydro-fluorocarbons (HFCs).
 - .2 SEVO Discharge Valve Assembly shall be of brass construction and designed as per the pressure differential concept. It shall be complete with piston, seal, siphon tube, pressure gauge and releasing controls including electric actuator.
 - .3 A Pressure Supervisory Switch shall be provided on the SEVO cylinders to monitor the pressure within the cylinder should a loss of nitrogen occur. The low pressure switch shall be wired to a supervisory circuit to provide a Supervisory indication upon activation.
- .5 Integrated Preaction System
 - .1 Deluge Valve, complete with releasing trim rated at 1722 kPa and all the necessary accessories. Trim shall include a mechanical latching device to prevent system from resetting in case of loss of power to the release solenoid. Systems provided with solenoid only, without this mechanical latching device, shall not be accepted. Every valve shall be clearly identified as to its operation with arrows indicating all positions to facilitate system operation.
 - .2 Pressure gauges shall indicate water supply, priming water and air pressures of the system. Each pressure gauge must be provided with its own three-way valve and shall be clearly identified on the outside of the cabinet front door.

- .3 Release trim with solenoid valve and every supervisory and alarm device required shall be Schedule 40 galvanized steel. Black pipe will not be accepted.
- .4 Schedule 40 steel pipe header shall be painted fire red, with grooved ends to be connected to supply water from the left-hand side of the cabinet.
- .5 Schedule 40 steel pipe drain manifold of 2" diameter shall be painted fire red, with grooved ends for drain connections from the left-hand side of the cabinet.

.6 Trim shall include properly identified contractor test ports factory mounted into the trim piping to facilitate system testing and commissioning.

.7 Shut-off valve & Sight-glass assembly: Provide a Listed and Approved butterfly isolation valve installed on the system riser inside the cabinet for full flow test purposes. The valve shall be supervised by the same supervisory circuit as the system main water supply valve tamper and wired at the factory. An integrated sight glass shall be part of this arrangement for visually confirming water flow through the main drain upon system actuation. A detailed instructions placard must be provided inside the cabinet door for easy reference.

2.2 INTEGRATED RELEASE.1 CONTROL PANEL

dual agent integrated control panel with emergency *batteries*, factory-assembled within the enclosure. Field wiring terminal strips integrated with the cabinet for connection of field wiring.

2.3 STANDARD OF ACCEPTANCE

.1 The Dual Agent cabinet assembly be pre-assembled, pre-wired and factory tested under ISO-9001 conditions, as a **FireFlex® DUAL** System, by FireFlex Systems Inc. It shall also be **cULus Listed and FM Approved** as an assembled unit and it shall be complete in all ways. The system shall incorporate all components required for complete system operation.

2.4 INTEGRATED CONTROL.1 PANEL

The release control panel shall be integrated into the cabinet. This panel shall include two Class A or B, programmable detection zones; four Class B supervisory zones and four Class A or B, programmable output circuits.

- .2 Programming of the control panel made by the vendor and password protected. The panel shall be compatible with many types of fire alarm & supervisory devices such as linear heat detectors, spot-type heat and smoke detectors, water flow and release indicators, low and high air pressure switches, manual pull stations.
- .3 The control panel shall include an alphanumeric display with 2 lines of 40 characters describing all the system conditions, as well as a set of red and yellow LED lamps individually indicating the alarm and trouble conditions of the system
- .4 Easy to operate control buttons are also provided to activate and operate the system's various functions.
- .5 Standard of Acceptance: Notifier Model NFS-320

2.5 AUTOMATIC AND MANUAL DETECTION DEVICES

- .1 A complete electrical detection system including conduit, wiring, heat and/or smoke detectors, manual pull stations and connections to auxiliary functions.
- .2 Heat and/or smoke detectors shall be wired on either Zones 1 or 2. Where more than the allowable quantity of detectors are required on a same detection zone, use the recommended 4-wire type detector base for that detector. Spacing and type of detectors shall meet the requirements of the applicable standards and the manufacturer's recommendations.
- .3 Manual pull stations shall be connected on a dedicated detection circuit.
- .4 The Abort stations shall be "dead man" type.

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|---|----|---|
| 2.6 NOTIFICATION
DEVICES AND SIGNS | .1 | Supply and install a complete notification system including:
.1 Conduit, wiring, notification devices. |
| | .2 | The NAC devices must be compatible with the release control panel. |
| | .3 | Audible & visual pre-discharge alarms shall be provided within the protected area to give positive warning of impending discharge. |
| 2.7 CAUTION AND
ADVISORY SIGNS | .1 | Warning and instruction signs at entrance to and inside protected areas shall be provided. |
| | .2 | A manual discharge sign is required at each manual release station and clearly indicate which hazard is controlled by the station. |
| | .3 | The safety signs format, color and the letter style of the signal words shall be in accordance with ANSI Z535. |
| 2.8 SEQUENCE OF
OPERATION - AUTOMATIC
RELEASE | .1 | Actuation of a detector from one detection zone:
.1 "ZONE 1" (or "ZONE 2") message appears on the display.
.2 "FIRE ALARM" lamp flashes until acknowledged.
.3 "ALARM" audible devices activate.
.4 "ALARM" contacts activate.
.5 Preaction solenoid valve activates.
.6 Deluge valve opens.

Note: Preaction piping network will fill with water.

.7 "WATERFLOW PREACTION" message appears on the display.
.8 "WATERFLOW PREACTION" contact activates. |
| | .2 | Actuation of a detector from the other detection zone for crossed- zone configuration:
.1 "ZONE 2" (or "ZONE 1") message appears on the display. |

- .3 Clean agent discharge sequence occurs:
 - .1 "PRE-DISCHARGE" and "DISCHARGE" lamps illuminate steady.
 - .2 "PRE-DISCHARGE" contacts activate.
 - .3 Pre-discharge delay starts (not exceeding 60 sec).
 - .4 "SECOND STAGE ALARM" audible devices activate.
- .4 After pre-discharge delay is completed:
 - .1 "PRE-DISCHARGE" lamp turns off.
 - .2 Clean agent electric actuator (C) activates.
 - .3 "DISCHARGE CLEAN AGENT" contact activates.

If **NOVEC 1230** discharge switch option is selected:

- .4 "CLEAN AGENT" message appears on the display.
- .5 After a preaction sprinkler head fuses:
 - .1 Water will flow into sprinkler piping network and out of sprinklers and any openings on the system.
- .6 If Manual Release
 - .1 Operation of the emergency manual release of the sprinkler system will:
 - .1 Drain the priming chamber of the deluge valve, causing the system to immediately fill the piping network with water, and activate alarm and water flow contacts connected to the building fire alarm panel. The opening of an automatic sprinkler OR damage to system piping without electrical detection will initiate the sounding of a warning device and the activation of a supervisory contact but will not cause the system to fill.

2.9 CLEAN AGENT SYSTEM.1 PIPING

Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA 2001, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations

- .2 The piping between the storage cylinders and nozzles should be the shortest route with the minimum elbows and fittings allowable. Use schedule 40 seamless ASTM A53 or A 106. Cast iron pipe, steel pipe conforming to ASTM A 120, or non-metallic pipe shall not be used.
- .3 All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
- .4 All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only. All fittings shall be 300 lb Class and installed per manufacturer's specifications.
- .5 All piping must be rigidly supported. All supports and parts shall conform to the requirements for pressure piping ANSI B31.1 and U.L. Listed. All drops using 180 degree nozzles require back bracing in the opposite direction of the discharge.

2.10 CLEAN AGENT .1 NOZZLES

Nozzles shall be SEVO Engineered Nozzles. 360° (central) and 180° (sidewall) nozzles shall be installed as per the manufacturer's recommendation in the design manual.

2.11 SPRINKLER SYSTEM .1 PIPING

System piping and fittings shall be as recommended by NFPA 13.

2.12 AUTOMATIC .1 SPRINKLERS

Supply and install all required automatic sprinklers. They will be VIKING glass bulb type, UL/ULC listed and FM approved.

- .2 Applicable specifications of automatic sprinklers shall be determined as per the manufacturer recommendations, based on the project conditions.

- 2.13 AIR SUPPLY .1 The automatic sprinkler piping is supervised by compressed air from a source installed inside the preaction cabinet.
- .2 The air compressor must be of the proper size in order to be able to restore normal system air pressure within 30 minutes.
- 2.14 SPRINKLER SYSTEM DRAIN .1 The single drain collector of the DUAL System shall be connected to an open drain (open end pipe with an air gap around the drain pipe or equivalent).
- .2 The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector. It shall also be arranged to avoid back-pressurizing the drain trim.
- .3 Multiple drain collectors and open drain cups inside the cabinet will not be accepted.
- .4 Open drain should be outside the protected area, if installed inside protected area, drain should have traps to avoid gas leakage on discharge.
- .5 Manifolding of multiple units is permitted provided the manufacturer's recommendations are carefully followed and complied with.

PART 3 - EXECUTION

- 3.1 INSTALLERS .1 System components and accessories shall be installed by personnel trained and certified by clean agent specified manufacturer.
- .2 Install, inspect and test to acceptance in accordance with NFPA Standard 2001 [NFPA 70].
- 3.2 INSTALLATION .1 General: to NFPA Standard 2001.
- .2 In accordance with clean agent manufacturer's written instructions.
- .3 Install cylinders to allow a service aisle for cylinder removal and cylinder weighing.
- 3.3 PIPING .1 Ream pipe after cutting to remove burrs and sharp edges.

- .2 Thoroughly clean pipe before installation to remove foreign matter and oil from pipe.
 - .1 Pull a wire brush through pipe lengths several times.
 - .2 Follow with clean cloth rags treated with a noncombustible metal cleaner designed for the purpose.

.3 Blow nitrogen through piping prior to installation of nozzles.

.4 Install piping in accordance with layout design to provide maximum flow and to avoid possible mechanical, chemical or other damage.

.5 Report deviations from pipe routing design to Engineer.

.6 Pipe reductions: install reductions to permit full flow. Entrance holes from the main pipe run to the fitting to be of proper size and free of sharp edges, ridges or burrs.

3.4 PIPE HANGERS AND SUPPORTS

.1 Securely fasten piping near nozzles to prevent pipe movement due to reaction force during discharge.

.2 Install piping supports to prevent disengagement of supports by movement of supported pipe.

.3 Solidly anchor pipe to structural members where longitudinal or lateral movements is possible.

.4 Install rigid hangers wherever a change in direction or change in elevation in the piping system occurs.

.5 Every other hanger shall be rigid on long straight runs.

.6 Attach piping to rigid hangers by means of U-bolts locked with double nuts, one on each side of hanger.

.7 Allow for longitudinal movement of pipe within the U-bolt except where piping design requires pipe to be anchored.

.8 Do not support pipe using other pipeline.

.9 Arrange piping supports to prevent bending stresses from concentrated loads between supports.

3.5 TESTS AND VERIFICATIONS

.1 The verification of the fire alarm system must be done in accordance with the NFPA 72

.2 The verification of the clean agent system must be done in accordance with the NFPA 2001

.3 The general contractor shall be responsible for sealing and securing the protected spaces against agent loss and/or leakage during the 10-minutes "hold" period.

.4 The clean agent system piping shall be pneumatically tested in a close circuit for a period of 10 minutes at 275 kPa (2.8 bars). At the end of the 10 minutes, the pressure drop shall not exceed 20% of the test pressure. The pressure test can be omitted in the case where the total piping contains no more than one change in direction fitting between the storage cylinder and the discharge nozzle, and where all piping is physically checked for tightness.

.5 A room pressurization test shall be conducted by the installing contractor in each protected space to determine the presence of openings which would affect the agent concentration levels. All testing shall be made in accordance with NFPA 2001, Annex C.

.6 If the room pressurization testing indicates that openings exist which would result in leaks and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor, sub-contractor or agent. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed.

.7 Hydrostatic tests must be performed on the entire sprinkler piping system, as required by NFPA 13.

- .8 In addition to the standard hydrostatic test, an air pressure leakage test at 275 kPa (2.8 bars) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 10.3 kPa (0.1 bar) during the 24 hours shall be corrected.
- .9 A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to verify that the water supply is adequate and to make sure that no back pressure in drain piping exists, which could affect the proper operation of the preaction system.
- .10 An air supply test must be performed, to confirm that normal air pressure in the sprinkler system can be restored within 30 minutes.

3.6 REPORT AND CERTIFICATE

- .1 An inspection report and a certificate must be supplied by the fire protection contractor to the departmental representative, owner or owner's representative at the completion of the project. All tests results shall be duly registered in a booklet to be included with the inspection report.

3.7 DEMONSTRATION

- .1 Upon completion of installation provide a 'hand-on' site review of system components and operation.
- .2 Functionally test the system to demonstrate system components, system functions and recommended procedures for building maintenance personnel, Owner's representatives.
- .3 Training to include but not necessarily limited to training for emergency procedures, abort functions, system control panel operation, trouble procedures and safety requirements.
- .4 Duration of training: 4 hours, with time to be approved by user and be signed off by attendees.

END OF SECTION