



Federal Building Arviat, Nunavut

Project No. 1408-00
Date: April 07, 2015
Issued: For Bid

VOLUME 2

Bid Set No. _____

DOCUMENT/SECTION NAME

NO. OF PAGES

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION

DOCUMENT 00 00 01 - PROJECT TITLE PAGE	1
DOCUMENT 00 01 10 - TABLE OF CONTENTS	5
REFER TO VOLUME 1	

PROCUREMENT REQUIREMENTS

REFER TO VOLUME 1

CONTRACTING REQUIREMENTS

REFER TO VOLUME 1

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01 - GENERAL REQUIREMENTS

REFER TO VOLUME 1

DIVISION 02 - EXISTING CONDITIONS (NOT USED)

DIVISION 03- CONCRETE

REFER TO VOLUME 1

DIVISION 04 - MASONRY (NOT USED)

DIVISION 05 - METALS

REFER TO VOLUME 1

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

REFER TO VOLUME 1

DOCUMENT/SECTION NAME

NO. OF PAGES

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

REFER TO VOLUME 1

DIVISION 08 - OPENINGS

REFER TO VOLUME 1

DIVISION 09 - FINISHES

SECTION 09 21 16 - GYPSUM BOARD	27
SECTION 09 30 13 - CERAMIC TILE	19
SECTION 09 51 00 - ACOUSTIC TILE CEILINGS	10
SECTION 09 57 53 - METAL SECURITY CEILINGS	9
SECTION 09 65 16 - RESILIENT VINYL SHEET FLOORING	11
SECTION 09 65 17 - RESILIENT VINYL SHEET SAFETY FLOORING	11
SECTION 09 65 30 - RESILIENT BASE AND ACCESSORIES	8
SECTION 09 66 23 - EPOXY SEAMLESS FLOORING (TROWEL APPLIED)	14
SECTION 09 77 13 - ACOUSTIC CEILING PANELS	7
SECTION 09 91 00 - PAINTING	29
SECTION 09 96 56 - HIGH PERFORMANCE INTERIOR COATINGS	9

DIVISION 10 - SPECIALTIES

SECTION 10 11 00 - VISUAL DISPLAY BOARDS	5
SECTION 10 22 13 - WIRE MESH PARTITIONS	8
SECTION 10 22 26 - FOLDING PANEL OPERABLE PARTITIONS	9
SECTION 10 26 00 - WALL PROTECTION	7
SECTION 10 28 00 - ACCESSORIES	10
SECTION 10 51 00 - METAL LOCKERS	7
SECTION 10 51 10 - EVIDENCE AND GUN LOCKERS	5
SECTION 10 75 00 - FLAGPOLES	6
SECTION 10 95 00 - MISCELLANEOUS SPECIALTIES	6

DIVISION 11 - EQUIPMENT

SECTION 11 24 24 - FALL ARREST ANCHOR SYSTEM	7
--	---

DIVISION 12 - FURNISHINGS

DOCUMENT/SECTION NAME	NO. OF PAGES
SECTION 12 23 14 - MANUAL ROLLER WINDOW SHADES	10
SECTION 12 35 71 - STAINLESS STEEL CASEWORK	11
DIVISION 13 - SPECIAL CONSTRUCTION (NOT USED)	
DIVISION 14 - CONVEYING EQUIPMENT (NOT USED)	
DIVISION 21 - FIRE SUPPRESSION	
DIVISION 22 - PLUMBING	
*SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING	5
*SECTION 22 10 10 - PLUMBING PUMPS	6
*SECTION 22 11 16 - DOMESTIC WATER PIPING	7
*SECTION 22 13 18 - DRAINAGE WASTE AND VENT PIPING - PLASTIC	3
*SECTION 22 30 05 - DOMESTIC WATER HEATERS	4
*SECTION 22 42 01 - PLUMBING SPECIALTIES AND ACCESSORIES	7
*SECTION 22 42 01A - APPENDEX PLUMBING FIXTURES	8
DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING	
*SECTION 23 01 31 - AIR DUCT CLEANING FOR HVAC SYSTEMS	9
*SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC	5
*SECTION 23 05 05 - INSTALLATION OF PIPEWORK	6
*SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	5
*SECTION 23 05 17 - PIPE WELDING	4
*SECTION 23 05 19.01 - THERMOMETERS & PRESSURE GAUGES-PIPING SYSTEMS	4
*SECTION 23 05 23.01 - VALVES - BRONZE	4
*SECTION 23 05 23.05 - BUTTERFLY VALVES	5
*SECTION 23 05 29 - HANGERS & SUPPORTS FOR HVAC PIPING AND EQUIPMENT	8
*SECTION 23 05 48 - VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT	5
*SECTION 23 05 53.01 - MECHANICAL IDENTIFICATION	7
*SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC	7
*SECTION 23 07 13 - DUCT INSULATION	6
*SECTION 23 07 15 - THERMAL INSULATION FOR PIPING	8
*SECTION 23 08 01 - PERFORMANCE VERIFICATION MECH PIPING SYSTEMS	4
*SECTION 23 08 02 - CLEANING AND START-UP OF MECH PIPING SYSTEMS	4
*SECTION 23 09 33 - ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC	6

DOCUMENT/SECTION NAME	NO. OF PAGES
*SECTION 23 11 13 - FACILITY FUEL-OIL PIPING	7
*SECTION 23 21 13.02 - HYDRONIC SYSTEMS: STEEL	5
*SECTION 23 21 14 - HYDRONIC SPECIALTIES	6
*SECTION 23 21 23 - HYDRONIC PUMPS	6
*SECTION 23 31 13.01 - METAL DUCTS - LOW PRESSURE TO 500 PA	6
*SECTION 23 33 00 - AIR DUCT ACCESSORIES	4
*SECTION 23 33 14 - DAMPERS - BALANCING	3
*SECTION 23 33 15 - DAMPERS - OPERATING	3
*SECTION 23 33 16 - DAMPERS - FIRE AND SMOKE	4
*SECTION 23 34 00 - HVAC FANS	5
*SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES	4
*SECTION 23 37 20- LOUVRES, INTAKES AND VENTS	3
*SECTION 23 51 00- BREECHING, CHIMNEYS AND STACKS	3
*SECTION 23 52 00- HEATING BOILERS	7
*SECTION 23 73 10- AIR HANDLING - BUILT-UP	6
*SECTION 23 82 39- UNIT HEATERS	4
DIVISION 25 - INTEGRATED AUTOMATION (NOT USED)	
DIVISION 26 - ELECTRICAL	
*SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL	8
*SECTION 26 05 20 - WIRE AND BOX CONNECTORS (0-1000V)	2
*SECTION 26 05 21 - WIRES AND CABLES (0-1000 V)	3
*SECTION 26 05 28 - GROUNDING SECONDARY	4
*SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	1
*SECTION 26 05 31 - SPLITTERS, JUNCTION, PULL BOXES AND CABINETS	1
*SECTION 26 05 32 - OUTLET BOXES CONDUIT BOXES AND FITTINGS	2
*SECTION 26 05 34 - CONDUITS, CONDUIT FASTENINGS, CONDUIT FITTINGS	3
*SECTION 26 24 02 - SERVICE ENTRANCE BOARD	4
*SECTION 26 24 16.01 - PANELBOARD BREAKER TYPE	3
*SECTION 26 27 26 - WIRING DEVICES	3
*SECTION 26 28 16.02 - MOULDED CASE CIRCUIT BREAKERS	3
*SECTION 26 28 20 - GROUND FAULT CIRCUIT INTERRUPTERS - CLASS "A"	2
*SECTION 26 28 23 - DISCONNECT SWITCHES - FUSED AND NON - FUSED	2
*SECTION 26 29 01 - CONTACTORS	2
*SECTION 26 29 10 - MOTOR STARTERS TO 600V	4

DOCUMENT/SECTION NAME

NO. OF PAGES

*SECTION 26 50 00 - LIGHTING	3
*SECTION 26 53 00 - EXIT SIGNS	2

DIVISION 27 - COMMUNICATIONS

*SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS	2
---	---

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

*SECTION 28 31 00 - FIRE DETECTION AND ALARM	15
*SECTION 28 32 00 - STRUCTURAL WIRING REQUIREMENTS	10
*APPENDEX -STRUCTURED WIRING REQUIREMENTS	11

DIVISION 31 - EARTHWORK

*SECTION 31 00 00.01 - EARTHWORK - SHORT FORM	5
---	---

DIVISION 32 - EXTERIOR IMPROVEMENTS

DIVISION 33 - UTILITIES

LEGEND

* - SPECIFICATIONS PREPARED BY CONSULTANTS OTHER THAN PARKIN ARCHITECTS LIMITED HAVE BEEN PREFIXED WITH AN ASTERISK. THESE SPECIFICATIONS ARE NOT INCLUDED UNDER, NOR GOVERNED BY, PARKIN ARCHITECTS LIMITED'S SEAL

END OF DOCUMENT

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: Provide gypsum board work including but not limited to following:
 - .1 supplementary steel supports for ceilings.
 - .2 reinforcement for suspension systems for lighting fixtures, access hatches, etc.
 - .3 steel studs and furring channels.
 - .4 concealed sheet steel reinforcing.
 - .5 ceiling, bulkhead and soffit suspension system.
 - .6 gypsum board ceilings, partitions, bulkheads and soffits.
 - .7 gypsum board fireproofing on columns.
 - .8 shaft wall.
 - .9 corner beads, casing beads, trim, control joints and corner reinforcement.
 - .10 taping and filling.
 - .11 acoustically insulated gypsum board partitions.
 - .12 acoustic caulking for acoustically insulated gypsum board partitions.
 - .13 fire rated wall assemblies.
 - .14 installation in gypsum board, access hatches, panels and doors supplied by other trades.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Definitions
 - .1 Drywall: Gypsum Board.
 - .2 Critical Lighting: Strong side lighting from windows or surface-mounted light fixtures.
 - .3 Textured Wall Finishes: Regular or irregular patterns typically produced by applying a mixture of joint compound and water, or proprietary texture materials to a gypsum board surface previously coated with primer.
 - .4 Steel Thickness:
 - .1 Base Steel Thickness: Thickness of bare steel exclusive of coatings.
 - .2 Design Thickness: Target or "nominal" thickness used to determine structural properties of the cold formed Products.

- .3 Minimum Thickness: Design thickness minus minimum allowable under-tolerance required by CSA S136 (95% of design thickness) or material specification; whichever is more stringent.
- .4 Designation Thickness: For the purposes of this specification; thicknesses provided will be minimum base steel thicknesses in accordance with CSA S136 and determined by the following table:

Designation Thickness (mils)	Minimum Base Steel Thickness		Gauge No. (For reference Only) Ga	Colour
	(in)	(mm)		
18	0.0179	0.455	25	Not Painted
33	0.0329	0.836	20	White
43	0.0428	1.087	18	Yellow
54	0.0538	1.367	16	Green
68	0.0677	1.72	14	Orange

.2 Reference Standards

- .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
- .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing: Coordinate installation with related Sections referenced herein.

.2 Pre-Installation Meetings:

- .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Division 01. Ensure data sheets Provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual for following items without limitations: adhesives, sealants and other items designated later by Consultant.
- .3 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, in particular locations of construction joints, connections and relationship with adjacent construction. Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Ensure Shop Drawings show following:
 - .1 standard construction of assemblies,
 - .2 sound attenuating construction,
 - .3 locations of access panels,
 - .4 elevations,
 - .5 finishes and relevant details of furring,
 - .6 enclosures and partitions which require fire rating.
- .4 Certificates:
 - .1 Submit certification from structural engineer registered in Territory of Nunavut, who shall affix his/her seal and signature to certificate, stating that installed suspended ceiling system is capable of supporting its own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by Mechanical and Electrical Divisions.
 - .2 Obtain approval of electrical utility authorities having jurisdiction for support of light fixtures, by ceiling grid and supports, to satisfy requirements of electrical inspection

department. Adjust grid, fixing devices and support hangers as required to obtain approval.

- .5 Samples:
 - .1 Samples: Submit samples in accordance with Division 01. Submit following samples in sizes indicated:
 - .2 each trim accessory minimum 300 mm (12") long.

1.6 QUALITY ASSURANCE

- .1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified.
- .2 Licensed Professionals: Employ a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design the components of the work of this Section requiring structural performance,
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,
 - .4 be responsible for production and review of Shop Drawings,
 - .5 inspect the work of this Section during fabrication and erection,
 - .6 stamp and sign each shop drawing,
 - .7 Provide site administration and inspection of this part of the Work.
- .3 Mock-ups: Provide minimum 9 m² (100 sq. ft) Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Approved Mock-ups may become part of finished Work if undisturbed at time of Substantial Performance. Provide Mock-ups for following:
 - .1 Each level of gypsum board finish indicated herein for use in exposed locations.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site with manufacturer's original labels intact. Do not remove wrappings until ready for use.
- .2 No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.
- .3 Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged Products from moisture or wetting.

1.8 PROJECT CONDITIONS

- .1 Cooperate and coordinate with Sections applying wet trades and trades installing mechanical and electrical services. Do not Install work of this Section in any area unless satisfied that work in place has dried out and that no further installation of materials requiring wetness, moisture or dampness is contemplated. Relative humidity in area of work of this Section shall not exceed 55% for duration of Project. Coordinate stud layout at partitions accommodating wall mounted fixtures by other trades.
- .2 Ensure temperature of surrounding areas is min 13 deg C (55 deg F) and max 21 deg C (70 deg F) for 7 Days before and during application of gypsum board; maintain for 4 Days thereafter. Ensure heat is provided at appropriate time before work has started to bring surrounding and adjacent materials up to required temperature and maintained as specified. Avoid concentrated or irregular heating during drying by means of deflectors or protective screens.
- .3 Ensure ventilation is provided for proper drying of joint filler and adhesive and to prevent excessive humidity. Do not force dry adhesives and joint treatment.
- .4 Provide protection of materials and work of this Section from damage by weather and other causes. Perform work in areas closed and protected from damage due to weather. Protect work of other trades from damage resulting from work of this Section. Make Good such damage immediately.
- .5 Coordinate installation and cooperate with mechanical and electrical trades to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with ceiling and soffit systems.

1.9 WARRANTY

- .1 Warrant Work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of joints, seams, bond failure where laminated gypsum board.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Metal Framing:
 - .1 Bailey Metal Products Ltd.; www.bmp-group.com
 - .2 Dietrich Metal Framing; www.detrichmetalframing.com
 - .3 CGC Inc; www.cgcinc.com
 - .4 Gordon Incorporated.; www.gordongrid.com
 - .5 Trim-Tex Inc.; www.trim-tex.com
 - .6 Roll Formed Specialty; www.rollformed.com

- .7 Unifix Inc.; www.unfixinc.ca
- .8 Chicago Metallic; www.chicagometallic.com
- .2 Gypsum Board and Accessories:
 - .1 CertainTeed Gypsum Canada Inc.; www.certainteed.com
 - .2 CGC Inc; www.cgcinc.com
 - .3 Georgia-Pacific Canada, Inc.; www.gpgypsum.com

2.2 DESCRIPTION

- .1 Design and Performance Requirements:
 - .1 Gypsum Partition Design:
 - .1 Typical interior partitions shall be 33 mils (0.0329" - 0.836 mm - 20 ga - White) (or structurally equivalent) metal studs at 400 mm (16") on center with minimum 1 layer of 15.9 mm thick (5/8") gypsum board on each side. Provide heavier gauges where required for extra unsupported height or wall-mounted accessories or equipment mounting.
 - .2 Provide moisture resistant gypsum board (MRGB) at all wet areas and toilet rooms. Provide tile backer board at walls surrounding showers. Refer to Drawings for exact locations.
 - .3 As a minimum, Provide full height partitions at following locations:
 - .1 mechanical, electrical, security, and telecommunications rooms, stairs, shafts, chases and toilets, at fire rated walls, private offices, conference rooms, and break rooms.
 - .4 Ensure partition design can accommodate following loadings with deflection not exceeding L/240 in any direction:
 - .1 Minimum Lateral Load for Partitions: 24 kg/m²
 - .2 Minimum Lateral Load for Firewalls: 51 kg/m²
 - .3 Minimum Lateral Load for Cavity Shaft Walls: 73 kg/m²
 - .2 Shaft Wall and Ceiling Design:
 - .1 Design and size partitions surrounding elevator shafts to accommodate all internal structural members completely within the required fire resistance rated construction, while maintaining the shaft wall rating without interruption. Shaftwall system for elevator shafts shall not have pointed ends of screws penetrating into shaft.
 - .2 Supply components from same manufacturer. Ensure components are compatible and tested by approved independent testing facilities acceptable to authorities having jurisdiction.
 - .3 Ensure shaftwall framing, shaftliner, gypsum board and joint treatment materials Provide 1 or 2 or 3 hour fire resistance rating as noted on Drawings when tested in accordance with ULC S101.
 - .3 Reinforcing:
 - .1 Design metal stud reinforcements from hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 43 mils (0.0428" - 1.087mm - 18ga - Yellow) thick. Provide where required to support manufactured component items such as washroom accessories, millwork, expansion control covers and similar items.

- .2 Brace and reinforce partitions as required to support wall mounted equipment, furniture, and casework. Do not use wood blocking for this purpose.
- .3 Design weld connections ensuring rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Galvanize items in moist areas.
- .4 Provide boxed double studs at each door jamb.
- .5 Comply with ASTM C840 for application and finishing gypsum board and manufacturer's written information.
- .4 Gypsum Board Ceiling Design:
 - .1 Obtain services of professional engineer with experience in type of work of comparable complexity and scope, licensed to practice in Territory of Nunavut to design, review and Provide professional services for work of this Section.
 - .2 Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements. Do not suspend any items from acoustical metal deck. Do not support work of this Section from, nor make attachments to, ducts, pipes, conduits or support framing of other trades.
 - .3 Design metal ceiling suspension system to sustain loads imposed to L/360 deflection limit in any direction. Use grid of hangers, runner and furring channels securely anchored to structure above. Allow for thermal movement.
 - .4 Design exposed to view ceiling suspension system for 'floating ceiling' and take extra care to ensure that hanger rods are vertically plumb, evenly and neatly spaced and neatly tied with tie wire free of any kinks complete with fascia trim. Install fascia trim in accordance with manufacturer's recommendations.
 - .5 Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Department.
 - .6 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.
 - .7 Design suspension system to support weight of mechanical and electrical items such as air grilles, lighting fixtures, drapery track, drapes and with adequate support to allow rotation / relocation of light fixtures.
 - .8 Design exterior soffit and ceiling system where applicable to withstand positive and negative wind loads effect to suit Project design requirements.
 - .9 Design sub-framing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.
- .5 Fire-resistance:
 - .1 Design fire rated construction including ceiling, partition or fire protective membranes and furring in accordance with National Building Code Of Canada and to approved ULC design or other design acceptable to authorities having jurisdiction, to Provide design fire rating indicated and/or required. Submit

- written evidence of acceptable test design.
- .6 Comply with following guide recommendations unless specified otherwise:
 - .1 Applications Guide CGC folder SA-130;
 - .2 Fire Resistant Assemblies CGC folder SA-100;
 - .3 Acoustical Assemblies CGC folder SA-200;
 - .4 Abuse-Resistant Assemblies CGC folder SA-929;
 - .5 Moisture Resistant Assemblies CGC folder SA-934;
 - .6 Shaft Wall Systems CGC folder SA-926;
 - .7 Gypsum Fire Wall Systems CGC folder SA-925.
 - .7 Acoustic Design:
 - .1 Provide sound rated construction having STC rating indicated in accordance with National Building Code of Canada and tested in accordance with ASTM E90.
 - .2 Provide sound attenuation batts as specified herein within cavities of partitions indicated on Drawings including but not limited to toilet rooms, conference rooms, private offices and other specialized rooms as appropriate to achieve additional sound control.

2.3 MATERIALS

- .1 Non-Structural Steel Framing Components:
 - .1 Galvanized sheet steel: Conforming to ASTM A653/A653M, structural and commercial quality sheets; specially treated by phosphate conversion process if steel is to be exposed and finish painted.
 - .2 Hot-Dip Galvanizing: Conforming to ASTM A123/A123M, for galvanizing steel and iron Products; and ASTM A153/A 153M, for galvanizing steel and iron hardware.
 - .3 Cold-Rolled Sheet Members: ASTM A1003/A1003M, 33 mils (0.0329 in - 0.836mm - 20ga - White) galvanized sheet steel unless otherwise indicated as required to support manufactured components such as washroom accessories, expansion control covers and similar items.
 - .4 Regular Steel Studs:
 - .1 ASTM C645, galvanized sheet steel, 33 mils (0.0329" - 0.836mm - 20ga - White) thick studs unless otherwise indicated. Provide heavier thicknesses where required at unrestrained heights or for impact resistance requirements.
 - .2 Zinc coating: Z275 (G90) in accordance with ASTM A653/A653M.
 - .3 Studs to be screwable with crimped web and returned flange; of depth shown in maximum continuous lengths practicable. Provide knockout openings in web at 600 mm (24") oc to accommodate (if required) horizontal mechanical and electrical service lines and bracing.
 - .4 Provide at following locations and as indicated on Drawings and Schedules:
 - .1 studs at all gypsum partitions unless otherwise indicated.
 - .5 Heavy Duty Steel Studs:
 - .1 ASTM C645, galvanized sheet steel, 43 mils (0.0428" - 1.087mm - 18ga - Yellow) or heavier gauges if required at unrestrained heights, for openings or for impact resistance requirements.

- .2 Zinc coating: Z275 (G90) in accordance with ASTM A653/A653M.
- .3 Studs to be screwable with crimped web and returned flange; of depth shown in maximum continuous lengths practicable. Provide knockout openings in web at 600 mm (24") oc to accommodate (if required) horizontal mechanical and electrical service lines and bracing.
- .4 Provide Heavy Duty Steel Studs at following locations and as indicated on Drawings and Schedules:
 - .1 Studs supporting impact-resistant gypsum board.
 - .2 Where required for unrestrained heights or in openings.
- .6 Floor and Ceiling Partition Track for Gypsum Board: ASTM C645, galvanized sheet steel, 33 mils (0.0329 in - 0.836mm - 20ga - White) thick. Zinc coating: Z275 (G90) in accordance with ASTM A653/A653M. Minimum Leg Length: 30 mm (1-1/4") legs. Provide top track with longer legs where required to compensate for deflection of structure above. Width: to suit metal studs.
- .7 Furring Channels: Galvanized sheet steel, 33 mils (0.0329" - 0.836mm - 20ga - White) thick. Zinc coating: Z275 (G90) in accordance with ASTM A653/A653M. Screw channels: 67 mm (2-5/8") wide x 22 mm (7/8") deep.
- .8 Screws for Sheet Steel Members: ASTM C954, self-drilling, self-tapping gypsum board screws. Provide minimum 15.9 mm (5/8") long, #6 for single layer application; and minimum 38 mm (1-1/2") long #7 for double layer application meeting following requirements:
 - .1 For single layer application over metal framing: self-drilling, self-tapping, case hardened, No. 6 contoured Phillips head or Type S bugle head, sized for minimum 15.9 mm (5/8") penetration into steel framing. Fasteners to be corrosion resistant. Use drill point screws for abuse resistant gypsum panels.
 - .2 For double layer application over gypsum backing board; 38 mm (1-1/2") Type G bugle head. For each additional layer of board, increase length of fasteners proportionally.
- .2 Suspended Ceiling Components:
 - .1 Carrying Channels: ASTM C645, galvanized sheet steel. Zinc coating: Z275 (G90) in accordance with ASTM A653/A653M. Items to be 38 mm (1-1/2") high with 19 mm (3/4") flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.
 - .1 For Gypsum Board: Provide 33 mils (0.0329" - 0.836mm - 20ga - White) thickness.
 - .2 Furring anchorages: 1.291 mm (0.051" - 16 AWG) diameter galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ASTM C754.
 - .3 Hanger wire: ASTM A641, soft, Class 1 galvanized wire, minimum 3.26 mm (0.129" - 8 AWG) diameter.
 - .4 Tie Wire: 1.291 mm (0.051" - 16 AWG) diameter galvanized, soft annealed steel.
 - .5 Composite Decking Tie Anchor Systems: Ceiling wire fastening assembly, "X-CW Ceiling Wire Assembly" by Hilti or approved

equivalent.

.3 Concealed Reinforcing:

- .1 Sheet Steel Reinforcing: 48 mils (0.0478" - 1.2141 mm) thick, commercial quality cold rolled galvanized sheet steel. Zinc Coating: Z275 (G90); ASTM A653/A653M.
- .2 Structural Shapes, Plates, Reinforcements: 3 mm (1/8") New material conforming to CSA G40.20 and CSA G40.21, Grade 300W. Hot dipped galvanizing with minimum zinc coating of 600 g/m² to ASTM A153/A 153M
- .3 Metal Stud Reinforcements: 43 mils (0.0428" - 1.087mm - 18ga - Yellow) galvanized heavy gauge sheet steel stud as specified herein, where required to support manufactured components.
- .4 Stud Spacer Bars: Pre-notched bridging and spacing bar to facilitate erection of interior, non load-bearing studs and to Provide resistance to stud rotation and displacement. Acceptable Product: "Spazzer® 9200 Spacing Bar" by Dietrich Metal Framing or approved equivalent.
- .5 Knee Brace Kit for Low Wall Partitions:
 - .1 Tube: 50 mm x 50 mm (2' x2"); wall thickness: 3 mm (1/8")
 - .2 Baseplate: 88 mm x 127 mm x 9 mm (3-1/2" x 5" x 3/8") complete with 4 holes with 10 mm (7/16") diameter.
 - .3 Finish: flat black primer to yield corrosive resistant surface compatible with joint compounds and interior finishes.
 - .4 Height: to suit low wall partitions.
 - .5 Acceptable Products: "SKB Knee Brace Kit" by Pittcon Softforms LLC or approved equivalent.
- .6 Shaftwall Framing including Galvanized Metal Studs and Runners: ASTM C645, minimum 33 mils (0.0329" - 0.836mm - 20ga - White) thick galvanized steel, designed for use in shaft wall construction. Zinc coating: Z275 (G90). Member depth: as indicated on Drawings.
 - .1 Provide C-T, C-H and E studs and J-L Corners, J track and J runners and other associated components by shaftwall liner panel manufacturer.

.4 Interior Board Types:

- .1 General-Purpose Gypsum Board (GB): Conform to ASTM C1396M. Unless indicated otherwise use 15.9 mm (5/8") thick by 1200 mm (4') wide standard facing board in maximum continuous lengths up to 3600 mm (12') with beveled and/or tapered edges with butted square ends to suit design requirements:
 - .1 Walls: Provide 15.9 mm (5/8") (Type X) thick with tapered edges unless otherwise specified.
 - .1 Acceptable Products:
 - .1 "Sheetrock® - Regular Gypsum Panels" by CGC
 - .2 "ToughRock® Gypsum Boards" by Georgia Pacific
 - .3 "Air Renew Essential (Type X) Indoor Air Quality Gypsum Board" by CertainTeed
 - .2 Ceilings: 15.9 mm (5/8") thick (Type X) gypsum board or 13 mm (1/2") thick anti-sag interior ceiling gypsum board.
 - .1 Acceptable Products:
 - .1 "Sheetrock® - Regular Gypsum Panels" or
 - "Sheetrock® - Sag-Resistant Interior Gypsum Ceiling

- Board" by CGC
- .2 "ToughRock® Gypsum Boards" or "ToughRock® CD® Ceiling Board" by Georgia Pacific
 - .3 " Interior Ceiling Gypsum Board" by CertainTeed
- .3 Fire Rated Gypsum Board (GB): ASTM C1396M, Type X, 12.9 mm (1/2") thick or 15.9 mm (5/8") thick (as applicable) by 1200 mm (4') wide gypsum board in maximum practical lengths and tapered edges as required by each fire resistance assembly.
- .1 Acceptable Products:
 - .1 "ToughRock® Fireguard or Fireguard C" by Georgia-Pacific
 - .2 "Sheetrock Firecode or Firecode C" by CGC Inc.
 - .3 "Type X or Type C Indoor Air Quality Gypsum Board" by CertainTeed Gypsum Canada Inc.
- .2 Moisture Resistant Gypsum Board (MRGB): 12.7 mm (1/2") or 15.9 mm (5/8") (Type X) thick glass mat reinforced board with moisture treated core conforming to ASTM C1658M and ASTM C1396M with following characteristics:
- .1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
 - .2 Permeance (for tile backer boards at showers and other areas exposed to high moisture only): < 1.2 ng/(Pa s m²) when tested with no tile or coating and in accordance with ASTM E96
 - .3 Boards containing paper or other organic materials in their composition are not acceptable.
 - .4 Acceptable Fiberglass mat faced (Paperless)Products:
 - .1 Regular-purpose type:
 - .1 "Dens Armor Plus High performance Interior Panel" by Georgia-Pacific Canada, Inc.
 - .2 "SheetRock Brand Glass-Mat Panel - Mold Tough" by CGC
 - .3 approved equivalent containing no paper or organic materials in core assembly.
 - .2 Tile backer board for showers and other areas exposed to high moisture:
 - .1 "DensShield Tile Backer™" by Georgia-Pacific Canada, Inc.,
 - .2 "Diamondback Tile Backer" by CertainTeed Gypsum, Canada Inc.
- .3 Impact Resistant Gypsum Board (IRGB): 12.7 mm (1/2") or 15.9 mm (5/8") thick (Type X) board smooth paintable surface consisting of fibre-reinforced gypsum core with fibre-reinforced gypsum perlite interlayers and embedded fibreglass with moisture treated core conforming to ASTM C1658M and ASTM C1396M with following characteristics:
- .1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
 - .2 Impact resistance: in accordance with ASTM C1629.
 - .1 Minimum Surface Abrasion: Level 1;
 - .2 Minimum Surface Indentation: Level 1,
 - .3 Minimum Soft body impact: Level 2.
 - .4 Minimum Hard body impact: Level 1.

- .3 Acceptable Products:
 - .1 Paperless Type (at locations exposed to moisture and/or at dry locations):
 - .1 "DensArmour Plus Impact Resistant Wallboard" by Georgia-Pacific Canada, Inc.
 - .2 Paper-faced Type (at dry locations only):
 - .1 "Fiberock® Aqua-Tough™ Interior Panel" by CGC Inc.
 - .2 "AirRenew® Extreme Impact Resistant Gypsum Board" by CertainTeed Gypsum Canada Inc.
- .4 Board Types at Shaft Walls: Liner Panels: 25 mm (1") thick (Type X), shaft wall liner panels consisting of water-resistant, noncombustible gypsum core with bevelled edges conforming to ASTM C1658 with following characteristics:
 - .1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
 - .2 Fire-performance: non combustible according to ASTM E136/CAN4-S114-M; flame spread: 0, smoke developed: 0 in accordance with ASTM E84/CAN/ULC-S102-M.
 - .3 Boards containing paper or other organic materials in their composition are not acceptable.
 - .4 Acceptable fiberglass mat faced (Paperless) Products:
 - .1 Dens Glass Ultra Shaftliner by Georgia-Pacific Canada, Inc
 - .2 "GlasRoc® Shaft Liner Type X" by CertainTeed Gypsum, Canada Inc
 - .3 "Sheetrock Brand Glass Mat liner Panels" by CGC Inc
 - .5 Acceptable paper faced Products:
 - .1 "Sheetrock Enhanced Gypsum Liner Panels/Cavity Shaft Wall" by CGC Inc.
 - .2 "M2Tech Shaft Liner Type X" by CertainTeed Gypsum, Canada Inc.
- .5 Core Boards: 25 mm (1") by 600 mm (24") sizes with tongue and grooved edges. Product as recommended by shaftwall liner panel manufacturer.
- .6 Face Boards: 15.9 mm (5/8") thick fire-rated gypsum board as specified herein.
- .5 Exterior Board Types:
 - .1 Gypsum Exterior Soffit Board: Glass: 12.7 mm (1/2") or 15.9 mm (5/8") (Type X) thick glass mat reinforced, weather and sag resistant exterior gypsum ceiling panel conforming to ASTM C1177M with following characteristics:
 - .1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
 - .2 Fire-performance: non combustible according to ASTM E136/CAN4-S114-M; flame spread: 0, smoke developed: 0 in accordance with ASTM E84/CAN/ULC-S102-M.
 - .3 Boards containing paper or other organic materials in their composition are not acceptable.
 - .4 Acceptable Products:
 - .1 "DensGuard Dens Glass Gold" by Georgia-Pacific Canada, Inc.,
 - .2 "GlasRock® Sheathing" by CertainTeed Gypsum, Canada Inc.

- .3 "Securock Glass Mat Sheathing" by CGC Inc
- .2 Exterior Gypsum Sheathing Board: 12.7 mm (1/2") or 15.9 mm (5/8") (Type X) thick glass mat reinforced, weather and sag resistant exterior gypsum ceiling panel conforming to ASTM C1177M with following characteristics:
 - .1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
 - .2 Fire-performance: non combustible according to ASTM E136/CAN4-S114-M; flame spread: 0, smoke developed: 0 in accordance with ASTM E84/CAN/ULC-S102-M.
 - .3 Boards containing paper or other organic materials in their composition are not acceptable.
 - .4 Acceptable Products:
 - .1 "DensGuard DensGlass Exterior Sheathing" by Georgia-Pacific Canada, Inc.
 - .2 "GlasRoc® Sheathing" by CertainTeed Gypsum, Canada Inc.
 - .3 "Securock Glass Mat Sheathing" by CGC Inc.
- .6 Miscellaneous Gypsum Board Treatments Trims and Accessories:
 - .1 Joint Treatment for Gypsum Board Including Joint Cement, Tape, Topping Compound and Accessories: Conforming to ASTM C475 and gypsum board manufacturer's recommendations. Confirm following Products with gypsum board manufacturer prior to application.
 - .2 Mould Resistant Joint Treatment:
 - .1 Joint Tape: Fibreglass mesh tape, mould resistant;
 - .2 Joint treatments: Ready mix drywall compound, Mould resistant: ProRoc® Mould Resistant Lite Ready-Mixed Joint Compound;
 - .3 Setting Compound: ProRoc® Moisture and Mould Resistant 90
 - .3 Dust Barrier: Minimum 0.152 mm (6 mil) polyethylene, CAN/CGSB-51.33-M, Type 2.
 - .4 Resilient Sponge Tape: Self-sticking adhesive on 1 side, closed cell neoprene sponge tape, "Rubatex" by Rubatex Corp. or "Perma-Stik 122X" by Jacobs and Thompson Inc., foamed vinyl "Arnofoam" by Arno Adhesive Tapes Incorporated or "Greyflex Expanding Foam Sealant" by Emseal Corporation.
 - .5 Laminating Compound: Asbestos-free, as recommended by manufacturer. Manufacturer's standard, multi-purpose construction adhesive. Sheetrock brand laminating compound by CGC Inc., or Dehydratine 9T by W.R. Grace and Co., or Stangard Foamastic by Standard Chemicals Ltd. At fire-rated construction, use adhesive which conforms to that used in applicable fire tests.
 - .6 Joint Tape: For regular gypsum board, use either kraft paper joint tape with feathered edges and minute perforations 50 mm (2") wide or glass fibre tape manufactured by CGC and for MRGB or cement board, use glass fibre tape only. For exterior joints, 50 mm (2") and 100 mm (4") widths, Durock Tape, open weave, with pressure sensitive adhesive 1 side;
 - .7 Joint Fillers and Topping Compound: Either slow or fast setting, low shrinkage type free of asbestos fillers and as recommended by manufacturer. Use "Gyproc 90" by Georgia-Pacific Canada, Inc. or "Durabond 90" by CGC Inc. at exterior soffits, or "ProRoc 90" by

- CertainTeed Canada Inc., for ProRoc M2Tech use ProRoc 90 M2Tech Setting Compound.
- .8 Dust Control Drywall Compound for Joint Fillers and Topping Compound: "Dust Control Drywall Compound" by CGC Inc or "Dust Away" by CertainTeed Canada Inc.; for ProRoc M2Tech use ProRoc 90 M2Tech Ready Mix Compound.
- .9 For fire rated assemblies setting compound shall be tested in accordance with ASTM E814 and ULC-S115 for required rating. "Gyproc Fire-Halt Sealant Setting Compound" by Georgia-Pacific Canada, Inc.
- .10 Sealant for Moisture Resistant Gypsum Board Edges: Water resistant sealant as recommended by gypsum board manufacturer and type acceptable to Consultant.
- .11 Corner Bead: ASTM C1047, "Dur-A-Bead #114" at corners by CGC Inc. at reveals, or similar. Provide custom shapes of similar materials and design as noted.
- .12 Metal Trim: BMP D-4411 in lieu of "J" Mould. Do not Provide "J" Mould unless specifically noted on Drawings as 'Exposed "J" Mould'.
- .13 Paper Faced Metal Bead and Trim: ASTM C1047, accessories used in conjunction with assemblies of gypsum wall board to protect edges, corners and to Provide design features including outside bullnose bead; 'J' trim.
- .14 Flexible Casing Beads: 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm (0.0179 in.)/25 ga) steel, wipe coated, angle shaped in size to fit over edge of gypsum board, to suit curved applications.
- .15 Ceiling fascia suspension trims: 8" (200mm) high x 15/16" (23.8mm) wide, factory formed extruded aluminum ceiling fascia suspension trims having factory applied paint finish. Provide straight and curved sections of the ceiling fascia suspension trims attachment clips, diagonal bracing, as required to meet the design requirements. Acceptable Products:
- .1 Compasso Elite Ceiling Suspension Trims by CGC Inc or Axiom Classic Trims by Armstrong World Industries or approved equivalent.
- .16 Light Pockets: #LP-700-800 for Lay-in-tile ceiling, #SLP-700-800 for Gypsum Board Ceilings by Pittcon Industries Inc., lengths to suit inside surfaces, finished in flat white paint.
- .17 Control Joints: Pre-fabricated control joints prepared to suit site conditions; No. 093 by CGC Inc. zinc alloy control joint.
- .18 Access Doors for Architectural, Mechanical and Electrical:
- .1 Where supplied by Division 21, 22 23 and 26 shall be installed under this Section.
- .2 Non-Rated Access Panels: minimum size 406 mm x 406 mm (16" x 16") with drywall bead frame and key operated cylinder lock. Access panels shall be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch or key operated cylinder lock to suit design requirements. Non-fire rated shall have 1.9 mm (14 ga) and 1.52 mm (16 ga) frame.
- .1 "N/W Series, Flush Non-Rated Access Panels" by Nystrom Building Products; www.nystrom.com
- .2 "DW-5040" by Acudor Products Inc.;

- www.acudoracornltd.com,
- .3 "Van-Met Series" by Mexam Metal Products;
www.maxammetal.com by Zurn Industries Canada Ltd.,
 - .3 Fire Rated Access Panels: Conform to requirements of authorities having jurisdiction under law and shall be labeled. Non combustibility Classification: CAN/ULC S114, ASTM E136, CAN/ULC S102, ASTM E84, UL723; Flame Spread 0; Fuel Contribution 0; Smoke Developed 0.
 - .1 "Concealed Tile AP-AT5020" by Acudor Products Inc. or approved equivalent.;
 - .2 "Concealed Gypsum Board BP-58" by Acudor Products Inc. or approved equivalent.; match thickness of gypsum board;
- .7 Sound Control Materials:
- .1 Sound Attenuation Batts: CAN/ULC-S702, mineral (glass and rock wool) fibre, flame spread and smoke developed in conformance with National Building Code Of Canada requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102-M. Non combustible in accordance with requirements of CAN4-S114-M. Acceptable Products:
 - .1 "NoiseReducer™ Sound Attenuation Batts" by CertainTeed Canada Inc., or "EcoTouch™ QuietZone® PINK™ FiberGlas® Acoustical Batts" by Owens Corning Canada LP. or "Roxul AFB - Acoustical Fire Batts" by Roxul Inc., of sufficient thickness to meet required STC rating for sound-rated partitions and of width to suit metal framing spaces.
 - .2 Strip Impalement Clips: 25 mm (1") wide strip of Insul-Hold by Insul-Hold Canada Ltd., fabricated from 0.531 mm (designation thickness 18 mils/minimum base steel thickness 0.455 mm (0.0179 in.)/25 ga) galvanized sheet metal in 30 m (100') rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.
 - .3 Acoustical Sealant:
 - .1 Sealant for sound isolation and for interior use between joints, highly resilient, suitable for all clean gypsum, steel, wood and aluminum surfaces without priming
 - .2 Gun applied, smoke-rated and acoustic sealant: for sealing joint openings in non-fire-rated acoustic assemblies and smoke partitions;
 - .1 Material Characteristics: ASTM C834, Type P, Grade -18°C and ASTM C920, Class 12.5. Flammability: ASTM E84 and CAN/ULC S102 Class A. Mold resistance: Complying with ASTM G21.
 - .2 Acceptable Products:
 - .1 QuietZone Acoustic Sealant" by Owens-Corning Canada Inc.
 - .2 "Tremco Acoustical Sealant" by Tremco Ltd.,
 - .3 "QuietSeal" by Serious Materials or "QuietSeal 350" by Serious Materials represented by Building Resource Inc. www.buildingresource.ca;
 - .4 "CP506 - Smoke and Acoustic Sealant" by Hilti

(Canada) Limited; www.ca.hilti.com or approved equivalent.

- .3 Acoustic Sprayed-on Sealant: Acrylic based, sprayed-on acoustic seal for sealing joint openings in non fire-rated acoustic assemblies and smoke partitions;
 - .1 Material Characteristics: Minimum 12.5% movement capacity. Flammability: ASTM E84 and CAN/ULC S102 Class A. Mold resistance: Complying with ASTM G21.
 - .2 Acceptable Products: "CP572 - Smoke and Acoustic Spray" by Hilti or approved equivalent.
- .4 Elastomeric Sealant: As recommended by manufacturer of fibre-reinforced gypsum sheathing board.
- .5 Putty Pad for sealing electrical boxes and other penetrations: Non corrosive, easily cleanable, QuietPutty 380, fire-rated, mouldable putty, to maintain performance of acoustically rated walls with penetrations such as electrical outlets, HVAC ducts, water hookups and cables. 1 hour fire rated to UL 1479.
- .6 Gaskets: ASTM D1056, Closed cell neoprene, 3 mm (1/8") thick x 64 mm (2-1/2") wide.
- .7 Asphalt Felt: CSA A123.3; No. 15 Type.

PART 3 -EXECUTION

3.1 PARTITION TYPES

- .1 Refer to Drawings for partition types and their respective sound attenuation requirements.
- .2 Provide partitions complete to underside of structure, unless otherwise indicated on Drawings.

3.2 EXAMINATION

- .1 Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.3 PREPARATION

- .1 Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

3.4 INSTALLATION

- .1 Give minimum 48 hours notice for Consultant's inspection of internal wall insulation, vapour barriers and services prior to concealing with gypsum board.
- .2 Carry out work using skilled tradesmen carefully supervised by competent

- foremen. Take all measurements accurately.
- .3 Comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation. Install framing, blocking and furring in accordance with ASTM C645, ASTM C1280.
 - .4 Maintain wallboard panels minimum 6 mm (1/4") and maximum 13 mm (1/2") above floor to prevent moisture transfer. Extend panels to underside of acoustical deck or structure and at fire rated and sound control partitions. Do taping and filling of concealed surfaces above ceiling line, at fire rated and sound control partitions and walls.
 - .5 Erect plain wallboard vertically or horizontally, whichever results in fewer end joints. Keep end joints away from prominent locations and central portions of ceilings. Locate vertical joints at least 300 mm (12") from jamb lines of openings.
 - .6 Space screws for regular wallboard at 300 mm (12") oc along board edges and in board field on walls and ceilings; at fire-rated assemblies, reduce spacings to comply with labelling authorities assembly listings. For other specialty boards screw spacing shall be in accordance with manufacturer's recommendations.
 - .7 Drive screws with power screw-gun and set with countersunk heads slightly below surface of board. Do not secure gypsum board by installing screws into aluminum or steel window and door frames.
 - .8 Install resilient sponge tape where gypsum board ceilings abut heads of door frames and where wallboard abuts heads or jambs of exterior door and window frames. Adhere tape to casing bead and compress during installation. Compressed thickness; 1.6 mm (1/16").
 - .9 Where framing members are installed against exterior walls or over slab on grade, Install asphalt felt strips between studs and substrates such as exterior wall or slab on grade.
 - .10 At partitions except shaft walls, apply 1 continuous 6 mm (1/4") bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials. Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.
 - .11 Apply sealant beads at perimeter of all other services and like objects which penetrate wallboard in accordance with manufacturer's directions.
 - .12 Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services. Consultant reserves right to relocate access panels up to 3600 mm (12') from locations shown on Drawings due to site conditions, providing ample warning is given prior to installation.
 - .13 Provide access panels in locations and sizes required by other Sections. Coordinate with other Sections for locations and sizes. Install in accordance with manufacturer's instructions.

- .14 Provide control joints 9000 mm (30') on centre maximum and at both sides of door jambs.
- .15 Metal Framing for Partitions and Bulkheads:
- .1 Comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation and recommendations of CGC Drywall Steel-Framed Systems for metal stud partition, ceiling, column fireproofing and bulkhead detailing.
 - .2 Install members true to lines and levels and to maintain surface flatness with maximum variation of 3 mm (1/8 ") in 3000 mm (10'-0") in any direction.
 - .3 Provide partition tracks at floor and underside of ceiling or structure above. Align accurately. Lay out to partition layout.
 - .4 Install stud spacer bars specified herein as required to restrain studs against lateral and torsional movement, and to Provide supplementary horizontal bracing.
- .16 Provide heavy duty double boxed studs at each side of openings to extend in 1 piece from floor to underside of structure above.
- .17 Co-ordinate erection of studs and installation of service lines.
- .18 Do not secure studs to exterior window framing, or to ceiling grid members.
- .19 Provide continuous gasket between floor tracks and structure.
- .20 Concealed Reinforcements in Partitions:
- .1 Provide hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel as specified herein before where required to support manufactured components. Weld connections. Ensure rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Galvanize stud reinforcements in moist areas. Do not use wood blocking for this purpose.
 - .2 Concealed Sheet Steel Reinforcing: Provide galvanized sheet steel minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm (0.0428 in.)/colour-yellow/18 ga) where required to support manufactured components. Provide sheet plate, steel stud, angle and other accessories to complete reinforcement.
 - .3 Concealed Knee Brace for Low Wall Partitions: Concealed welded steel assembly made up of 50 mm x 50 mm (2' x2") tube and 3 mm (1/8") wall and 88 mm x 127 mm x 9 mm (3-1/2" x 5" x 3/8") base plate with 4 holes 10 mm (7/16") diameter. Assembly shall be provided with flat black primer to yield corrosive resistant surface compatible with joint compounds and interior finishes. Height to suit low wall partitions. SKB Knee Brace Kit by Pittcon Softforms Corp.
 - .4 Concealed Structural Shapes, Plates, Reinforcements: 3 mm (1/8") New material conforming to CSA G40.20 and CSA G40.21, Grade 300W. Hot dipped galvanizing with minimum zinc coating of 600 g/m2 to ASTM A123.
 - .5 Concealed Metal Stud Reinforcement: Provide Galvanized steel, stud, galvanized sheet steel minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm (0.0428 in.)/colour-yellow/18 ga) where required to support manufactured

- components. Ensure studs reinforcements are galvanized in moist areas. Provide stud bridging and spacing bars to facilitate rapid erection.
- .6 Concealed Reinforcement for Hand Railing and Architectural Woodwork Supports in Partitions: Provide hand rail and millwork support in accordance with Hand Rail Support System by Bailey Metal Products Ltd. as specified herein. Install with studs before gypsum is attached. Install load distribution bridging channel through knockouts in stud, Install one sided load transfer bracket or two sided bracket where hand rails are on both sides of partition. Ensure system accommodates backing plates and mechanical and electrical services.
 - .7 In general weld connections. Ensure rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Do not use wood blocking for this purpose. Provide additional reinforcing framing studs or furring channels secured between studs for attachment and support without limitations following:
 - .1 washroom accessories.
 - .2 fire hose cabinets.
 - .3 access panels.
 - .4 architectural woodwork.
 - .5 miscellaneous specialties.
 - .6 fitments and fixtures.
 - .7 equipment.
 - .8 dwarf wall, cornice height wall, partial height wall or rail height wall.
 - .9 wall mounted equipment.
 - .10 Cooperate and coordinate reinforcement requirements with those sections requiring concealed reinforcements in partitions.
 - .21 Provide continuous horizontal furring channels as backing to wall cabinets.
 - .22 Access Doors and Panels: Install access doors and panels supplied as part of work of Divisions 21, 22, 23 and 26 and where required as part of work of this Section in walls, bulkheads, ceilings and soffits.
 - .23 Metal Furring:
 - .1 Erect furring in accordance with manufacturer's directions and as specified herein.
 - .2 Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated. Allow for thermal movement.
 - .3 Provide furring around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.
 - .4 Where indicated, provide metal furring channels fastened to surfaces in parallel rows at 400 mm (16") oc. Shim metal furring channels to Provide a level surface.
 - .24 Shaft Wall:
 - .1 Construct shaft wall assemblies to Provide fire resistance ratings indicated, from both sides, and to maintain airtight seal.
 - .2 Install shaft wall studs at centres to meet design requirements in

accordance with manufacturer's instructions or fire rated test design. Provide framing to enclose sides, tops and bottoms of shafts terminating at floor or in ceiling space, to maintain fire rating of shaft assembly.

- .3 Install shaft wall liner in accordance with manufacturer's instructions at areas where specially designed studs require shaft wall liner panel application as required.
 - .4 Apply continuous sealant around partitions to ensure airtight shaft enclosures. Firestopping and smoke seals at penetrations specified under Section 07 84 00.
 - .5 Where shaft wall height exceeds maximum available panel height, liner panel joints shall be positioned within upper and lower third points of wall and shall be staggered to prevent continuous horizontal joint.
 - .6 Frame around duct openings through shaft walls with 'J' runners.
- .25 Gypsum Board Application:
- .1 Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Ensure moisture resistant gypsum board is installed on any wall/partition containing a plumbing fixture (i.e. water closets, sinks, tubs, etc.).
 - .2 Provide metal trim casing bead at junctions with dissimilar materials. Provide reveals at junctions with dissimilar materials where indicated.
 - .3 Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.
 - .4 Cut and fit gypsum board to accommodate or fit around other parts of Work. Provide work of this Section accurately and neatly.
 - .5 Butt gypsum board sheets together in moderate contact. Do not force into place. Place tapered or wrapped edges next to 1 another.
 - .6 Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints. If butt joints do occur stagger and locate them as far from centre of walls and ceilings as possible. Accurately fit exposed butt joints together and make edges smooth.
 - .7 Support ends and edges on framing.
 - .8 Fasten gypsum board to metal furring and metal studs with screws. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field. Ensure perimeter screws are not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards.
 - .9 Gypsum Board - Single Layer:
 - .1 Ceilings: Apply gypsum board to metal furring with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Space screws at 200 mm (8") oc.
 - .2 Partitions: Apply gypsum board to metal studs with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Locate vertical joints at least 300 mm (12") from jamb lines of openings. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field.
 - .3 Ceiling and Partition Fasteners: Ensure perimeter screws are

- not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards. Drive screws with power screw gun and set with countersunk head slightly below surface of board.
- .4 Joints: Finish all joints unless specified otherwise.
- .10 Gypsum Board - Double Layer:
- .1 Lay out work to minimize end joints on face layer; to offset parallel joints between face and base layers by at least 250 mm (10") and to apply face layer at right angles to base layer.
 - .2 Base Layer: Base layer shall be same as face layer, or backing board, and applied at right angles to framing members. Secure base layer with screws spaced 300 mm (12") oc to each member. Ensure perimeter screws are not more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards. Ensure surface of erected base layer is straight, plumb or level and without protrusions before face layer is applied.
 - .3 Face Layer: Apply face layer at right angles to base layer with adhesive. Apply adhesive with notched spreader to leave 9 mm x 13 mm (3/8" x 1/2") ribbons, 38 mm (1-1/2") apart over entire back side of face layer. Erect board immediately after spreading adhesive. Supplement adhesive with screw fasteners. Provide temporary support for board until adhesive bond has fully developed. As alternative to adhesive specified, joint cement mixed with water in accordance with manufacturer's directions may be used. Allow joint cement and water mixture to stand 30 minutes before using.
 - .4 Joints: Finish joints in face layers only, unless otherwise required to achieve fire resistant ratings indicated, as hereinafter specified. Setting compound for fire rated construction shall conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings.
- .26 Interior Ceilings:
- .1 Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923
 - .2 Provide hanger wires spaced at maximum 1200 mm (4') oc along carrying channels and within 150 mm (6") of ends of carrying channel runs. Secure hanger wires to inserts in structure above.
 - .3 Provide carrying channels maximum 1200 mm (4') oc and within 150 mm (6") of walls. Secure with hanger wire saddle-tied along channels. Provide 25 mm (1") clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm (1/8") over 3600 mm (12').
 - .4 Provide metal furring channels at right angles to carrying channels at maximum 600 mm (24") oc and within 150 mm (6") of walls. Provide 25 mm (1") clearance between furring ends and abutting walls. Attach furring channels to carrying channels with saddle-tie of double strand tie wire.
 - .5 Provide additional cross-reinforcing at bulkheads and at other openings.
 - .6 Provide ceiling gypsum board, smooth and level.

- .27 Fibre Reinforced Gypsum Column Covers:
- .1 Prior to manufacturing, check dimensions and conditions not shown on Drawings.
 - .2 Prior to installation, check site dimensions. Bring any discrepancies between design and field dimensions to the attention of Consultant for rectification. Do not proceed until discrepancies are corrected.
 - .3 Lift units carefully with suitable devices.
 - .4 Install units plumb and level.
 - .5 Secure units with full coating of adhesive applied with notched trowel.
- .28 Exterior Sheathing:
- .1 Provide exterior sheathing in accordance with manufacturer's instructions.
 - .2 Minimum Fastening Requirements:
 - .1 Perimeter Edge of Each Board: 200 mm (8") oc max.
 - .2 Intermediate Supports: 300 mm (12") oc max.
 - .3 Provide exterior sheathing neatly with tight butt joints and without gaps and holes.
 - .4 Bear edges of exterior sheathing fully onto structural framing.
 - .5 Do not crush exterior sheathing edges.
 - .6 Secure exterior sheathing to exposed leg of inner track of telescopic 2-piece top track.
 - .7 Provide ready to receive air/vapour barrier membrane.
- .29 Exterior Soffits:
- .1 Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923
 - .2 Provide hanger wires spaced at maximum 1200 mm (4') oc along carrying channels and within 150 mm (6") of ends of carrying channel runs. Secure hanger wires to inserts in structure above.
 - .3 Provide carrying channels maximum 1200 mm (4') oc and within 150 mm (6") of walls. Secure with hanger wire saddle-tied along channels. Provide 25 mm (1") clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm (1/8") over 3600 mm (12').
 - .4 Provide metal furring channels at right angles to carrying channels at maximum 400 mm (16") oc and within 150 mm (6") of walls. Provide 25 mm (1") clearance between furring ends and abutting walls. Attach furring channels to carrying channels with saddle-tie of double strand tie wire.
 - .5 Provide additional cross-reinforcing at light troffers and at other openings.
 - .6 Provide gypsum soffit board, smooth and level using joint treatment as recommended by gypsum board manufacturer. Provide a skim coat over entire soffit surface to smoothen soffit and equalize surface porosity.
- .30 Metal Trim and Accessories:
- .1 Provide metal trim casing beads at reveals; at ceiling-wall intersections and partition perimeters; and at intersection of dissimilar constructions.

- .2 Provide metal trim casing beads where gypsum board abutts against a surface having no trim concealing junction.
 - .3 Provide paper faced metal bead and trims for outer and inner corners, L trim, cut to suit design, aligned, using setting and finishing compound in accordance with manufacturer's recommendations. Sand lightly where necessary prior to applying finishing coat. For mechanical fastening use paper faced nail on bead and trim. Install by using commercial staples and screws. Finish as specified herein.
 - .4 Provide ceiling fascia suspension trims at perimeter of "floating" suspended gypsum board ceilings as indicated on the Drawings.
 - .5 Provide a 13 mm (1/2") separation gasket between metal trim casing beads and window frames or other cold surfaces or Provide sponge tape between gypsum board partition or furring framing, where such framing abuts exterior door or window frame. sponge tape between floor and gypsum board partition track. Tape shall be either full width or 1 strip 9 mm (3/8") wide on each side of framing member.
 - .6 Provide casing bead and sponge tape where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on Drawings. Unless indicated otherwise, use tape 3 mm (1/8") narrower than casing bead to Provide recess at exposed side. Compress tape by 25%.
 - .7 Provide metal trim casing beads where indicated on Drawings.
 - .8 Provide prefinished metal angle trim supports and Provide light pockets and eggcrate grilles and/or louvres in accordance with manufacturer's instructions. Install light pockets and eggcrate grilles and/or louvre units square, straight and in 1 piece where possible or with inconspicuous joints at long runs.
- .31 Control Joints:
- .1 Provide pre-fabricated, pre-manufactured control joints and/or prepared to suit site conditions control joints and in accordance with manufacturer's instructions and in accordance with ASTM C840.
 - .2 Set in gypsum facing board, supporting control joints with studs or furring channels on both sides of joint. Ensure double studs with discontinuous tracks and double suspended ceiling furring channels have been installed prior to commencing board and bead application at control joints. Provide control joints at following locations:
 - .1 support construction changes.
 - .2 partition, ceiling or furring runs exceed 9000 mm (30').
 - .3 Provide control joints full height floor to ceiling or door header to ceiling in partitions and furring runs.
 - .4 Provide control joints from wall to wall in ceiling areas.
 - .5 Provide continuous polyethylene dust barrier behind and across control joints.
 - .6 Obtain Consultant's acceptance of exact locations of control joints.
- .32 Sound Control:
- .1 Where indicated on Drawings, Provide sound rated partitions and ceiling in locations indicated to meet required minimum Sound Transmission Class STC rating. Gypsum board shall be applied on both sides of sound-proofed partitions. Follow manufacturer's details and

recommendations.

- .2 Provide sound attenuation insulation to completely fill height of stud cavities. Tightly butt ends and sides of blankets within cavities. Cut blankets to fit small spaces. Carefully fit blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.
- .3 Staple blankets to back of gypsum board as recommended by gypsum board manufacturer.
- .4 At sound attenuating suspended ceiling and enclosures having spring isolator hangers, terminate ceiling or enclosure at adjacent construction by providing continuous isolator strip and sealed joint.
- .5 Do not allow drywall furring channels or gypsum board to contact foreign materials, including floors, ceilings, or wall framing members.
- .6 Sealant:
 - .1 Conform to ASTM C919 for use of sealants in sound attenuation partitions.
 - .2 Apply acoustical sealant to every air gap, such as gaps around perimeter of wall, between wall panels and around any penetrations made for plumbing or electrical wiring. Seal off any piping, electrical output boxes, and duct work with acoustical treatments. Treat junction boxes with acoustic putty, treat piping and duct work either with fiberglass duct liner or damping material or both. Treat frame with gasket material (weather-strip) and Install security flap on bottom of door to seal it off.
 - .3 Apply acoustical sealant around partition cutouts including, but not limited to, gaps between wall stud plates and subfloor, electrical outlets and boxes, plumbing and duct outlets, air ducts and boots, doors, windows and other miscellaneous wall and floor penetrations or gaps.
 - .4 Apply sealant between track or runner, walls, floors and ceiling; areas may require premoulded, loose-cell filler between tracks and drywall at top and bottom edges to meet design requirements.
 - .5 Seal off piping, electrical output boxes, and ductwork occurring with acoustical treatments.
 - .6 Treat junction boxes with acoustic putty. Treat piping and ductwork with fiberglass duct liner or damping material, or combination thereof. Treat frame with gasket material (weatherstrip) and install security flap on bottom of door to seal it off.
 - .7 Apply minimum 13 mm (1/2") diameter bead of acoustic sealant continuously around periphery of each face of partition to seal gypsum board/structure junction where partitions abut fixed building components in accordance with recommendations of "CGC Drywall/Steel Framed Systems, Folder SA923 09250".
- .33 Joint Treatment - Gypsum Board:
 - .1 Verify board is firm against framing members and screw heads are

- properly depressed.
- .2 Mix joint compound or ready-to-use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing. Permit mixed material to stand 30 minutes before using. Do not mix more material than can be used within 1 hour. Do not use set or hardened compound. Clean tools and equipment after mixing each batch.
 - .3 Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions. Fill either manually, using hand tools of trade, or by mechanical taping and filling machine of proven efficiency. Apply thin layer of compound to tapered edge. Press joint tape firmly into compound, while centering it over the seam and embed with a broad knife. Sufficient drywall compound shall remain under tape to ensure proper bond. Allow to dry. Apply a second coat of drywall compound over embedding coat and feather out beyond first coat. Allow second coat to dry thoroughly prior to application of finish coat. Spread finish coat evenly over second coat and feather to a smooth uniform finish. After each coat has dried, sand or sponge smooth prior to application of ensuing coat. Remove plastic tape from control joints after finishing with joint compound. After final coats of filler have dried at least 24 hours, sand surface lightly with No. 00 sandpaper to leave it smooth, ready for decoration. Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.
 - .4 Exposed Moisture Resistant Gypsum Board Joint Finish: All joints and interior angles shall have fiberglass tape embedded in setting 90 joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Cover fasteners heads and accessories with 3 separate coats of joint compound. Ensure surface is smooth and free of tool marks and ridges.

3.5 FIRE RATED PARTITIONS

- .1 Ensure materials for fire rated construction conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings. Where dissimilar components are built into fire rated assemblies ensure continuity of fire separation by boxing in elements with gypsum board and framing to suit authorities having jurisdiction. Work in cooperation with Section providing firestopping work.
- .2 Provide fire rated enclosures, separations and assemblies as indicated on Drawings conforming to requirements of authorities having jurisdiction.
- .3 Where required, secure sound attenuation blanket insulation between studs as specified in Article on Sound Control Partitions.

3.6 CUTTING AND PATCHING

- .1 Cooperate and coordinate with other Sections to obtain satisfactory gypsum board finish work. Do all cutting, patching and Make Good as required by installation of work of other Sections.

3.7 CLEANING

- .1 Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed.

3.8 GYPSUM BOARD FINISHING SCHEDULE

- .1 Levels of Finish: Provide following levels of finish in accordance with ASTM C840:

Finishing Level	General Areas	Final Appearance
0	Temporary construction areas and unfinished construction areas.	Unfinished
1	Plenum areas above ceilings, service corridors or any places not viewed by public and where assembly would generally be concealed.	Tool marks and ridges are acceptable.
2	Following Areas: - where moisture resistant gypsum backing board (MRGB) is used as substrate for tile; -exposed assemblies in garages, warehouse storage areas and service corridors.	Tool marks and ridges are acceptable. Thin coating of compound covers tape; one coat compound over fastener heads.
3	Areas scheduled to receive textured finishes (spray or hand applied) and not subject to critical lighting.	No marks or ridges. Ready for priming, to be followed by textured finish.
4	All public exposed areas where flat, velvet, eggshell paints, glazed coatings, light textured finishes or wall coverings (including wall protection items) are scheduled to be applied.	No marks or ridges. Ready for priming, followed by wall coverings, flat paints or light textures.

5	Public exposed areas as follows: where exposed moisture-resistant gypsum board (MRGB) or fiberglass-mat faced gypsum board (ARGB, IRGB etc.) is scheduled to be installed.	No marks or ridges. Entire surface covered with skim coat of compound and ready for priming.
---	---	--

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* ceramic tile including but not limited to following:
 - .1 grouting control joints in floor slab under tile.
 - .2 wall tile installed over thin set mortar bed.
 - .3 waterproof/crack isolation membrane.
 - .4 leveling bed.
 - .5 installation systems, mortars and grouts.
 - .6 ceramic/porcelain wall tile and trims.
 - .7 ceramic/porcelain floor tile, cove base, trims and fittings.
 - .8 sealing of tile control joints and other accessories.
 - .9 sealing of penetrations through wall tile.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Definitions:
 - .1 Ceramic Tile: Ceramic surfacing unit relatively thin in relation to facial area, made from clay or mixture of clay and ceramic materials, fired at temperature sufficiently high enough to produce specific physical properties and characteristics conforming to Standards specified herein above
 - .2 Porcelain Tile: Porcelain tile manufactured in various thickness and sizes having matt or unglazed or high polish finish is ceramic tile that is generally made by dust pressed method from a composition which results in tile that is dense, impervious, fine grained, smooth and textured with sharply formed face. Water absorption conforming to ASTM C373.
- .2 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing:
 - .1 Coordinate installation with related Sections referenced herein.
 - .2 Proceed with tile work only after piping and other projections through

substrate have been installed and when substrate construction and framing of openings have been completed.

- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for *Project* site meeting of parties associated with work of this Section, including non-exhaustively *Subcontractor* performing work of trade involved, testing company's representative and *Contractor's Consultants* of applicable discipline. *Consultant* may attend.
 - .2 Review *Contract Documents* to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 *Project* staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 *Product Data*: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets *Provide* required information including detailed instructions for installing as well as maintaining,

preserving and keeping materials in clean and safe conditions. *Provide* adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

- .1 Where more than 1 manufacturer's *Products* are part of single tile assembly, arrange for each manufacturer to submit a written statement of compatibility with respect to other manufacturer's materials.
 - .2 Indicate *Product* description including compliance with specified performance requirements.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound and other materials designated later by *Consultant*.
- .3 Source Quality Assurance/Control Submittals:
- .1 Submit manufacturer's certification confirming materials supplied conform to ANSI 137.1 and CAN/CGSB-75.1-M.
 - .2 If requested, submit sample installation system demonstrating compatibility/functional relationship between adhesives, mortars, grouts and other components.
 - .3 If requested, *Provide* laboratory confirmation signed by manufacturer of installation system to identify proper usage of specified materials.
 - .4 Submit written statements from manufacturers indicating compatibility with respect to other manufacturer's materials where more than one manufacturer's *Products* form a part of a single tile assembly.
- .4 *Shop Drawings*: Submit *Shop Drawings* for work of this Section in accordance with Division 01. In addition to minimum requirements indicate following:
- .1 Ensure *Shop Drawings* indicate material characteristics, details of construction, connections and relationship with adjacent construction;
 - .2 Special conditions affecting installation;
 - .3 Setting methods and details of construction;
 - .4 joint layouts;
 - .5 dimensions;
- .5 Samples: Submit samples in accordance with Division 01. Submit individual sample panels of each colour of ceramic tile, set with adhesive, grouting and bonding method as specified, showing quality, colour and finish of material, grout and pattern of tiles. Each panel shall be minimum 600 mm x 600 mm (24" x 24").
- .6 Maintenance Instructions: Submit maintenance instructions in accordance with Division 01. *Provide Owner* with 3 copies of TTMAC Maintenance Guide. Include specific warnings of any maintenance practice or materials which may damage or disfigure tile work. Include cleaning methods, cleaning solutions recommended, stain removal methods, polishes and waxes recommended.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:

- .1 *Supply* in addition to quantities required for work, extra materials and *Products* to be stored by *Owner* as follows:
 - .1 *Provide* 5% extra stock of each type of tile and special units.
- .2 Deliver extra stock to *Owner* as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed.

1.7 QUALITY ASSURANCE

.1 *Provide Product* of company specializing in manufacture of ceramic tile, porcelain tile, mosaics, pavers, trim units and thresholds with minimum experience of 5 years. *Provide* test reports if requested to substantiate that *Products* supplied on this *Project* will be of consistent quality in appearance and physical properties.

.2 Execute work of this Section using a company who is a member in good standing with TTMAC and has minimum 5 years successful experience in application of *Products*, systems and assemblies specified. Perform tile work using skilled mechanics trained and experienced in work of this complexity. *Install* waterproofing system using an applicator approved by system manufacturer.

.3 Single Source Responsibility: Use proprietary *Products* in full compliance with manufacturer's recommendations. As far as possible obtain *Product* from single manufacturer ensuring single source responsibility for consistent quality in appearance and physical properties, compatibility with adjacent components while maintaining quality. If requested, manufacturer of installation system shall *Provide* laboratory confirmation to identify proper usage of specified materials. Have manufacturer's representative visit site at commencement of tile work to give proper direction and thereafter at regular interval to ensure proper workmanship.

.4 *Mock-Ups*:

- .1 Where designated or requested, *Provide Mock-Ups* on site, of each type, style, finish, size, colour of ceramic tile, trims and threshold along with respective installation system.
- .2 Record pertinent remarks, observations and recommendations discussed in presence of participants.
- .3 Sample tiled area, once accepted, including recorded remarks and recommendations shall become a permanent part of *Project* and shall be the standard of workmanship against which balance of ceramic tile work will be judged

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

- .1 Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays.
- .2 Coordinate deliveries to comply with construction progress schedule and arrange for above ground, under cover storage before materials are delivered to site.

- .2 Storage and Handling Requirements:
 - .1 Store packaged materials in original containers with seals unbroken complete with labels in accordance with manufacturer's instructions.
 - .2 Prevent damage to materials and *Products* during handling and storage. Keep delivered materials dry and free from stains inside weatherproof structure or otherwise protected from freezing and elements. Store cementitious materials off damp surfaces.
 - .3 Protect epoxy adhesives, additives, mortar mixes and grouts from freezing, moisture and excessive heat during transportation and storage. Maintain temperatures in storage area between 15 deg C (59 deg F) and 20 deg C (68 deg F).

1.9 PROJECT CONDITIONS

- .1 Ambient Conditions:
 - .1 Do not perform work of this Section at temperature below 12 deg C (54 deg F) when using portland cement mortars or dry set mortars, latex portland mortars or bond coat. Maintain temperature between 12 deg C (54 deg F) and 32 deg C (90 deg F). Maintain temperature in tiled areas between 12 deg C (54 deg F) and 35 deg C (95 deg F) during installation and for 7 *Days* after completion unless otherwise indicated by the manufacturer or in applicable installation standards (e.g ANSI A108).
 - .2 *Provide* ventilation and protection of environment as recommended by manufacturer. Maintain appropriate environmental conditions and protect work during and after installation. Comply with trade standards and manufacturer's *Product* instructions. Follow *Product* MSDS and label instructions concerning safety, health and other related precautionary and environmental protection. Comply with applicable federal, provincial, local and statutory regulations.
 - .3 Observe manufacturer's recommended working temperatures for installation of adhesives and grouts. Ensure epoxy mortars and grouts have surface temperatures between 16 deg C (60 deg F) and 32 deg C (90 deg F) at time of installation.
- .2 Site Conditions:
 - .1 Close doors and windows and turn off direct forced ventilation systems and apparatus. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.
 - .2 When necessary build temporary shelter and use indirect auxiliary heaters to maintain adequate temperature level in working environment.
 - .3 Exhaust temporary heaters to building exterior to prevent health hazards and damage to work from toxic fumes and emanations.
 - .4 Protect work of this Section against damage by other trades during application and 3 *Days* after application.

1.10 WARRANTY

- .1 Warrant work of this Section for a period of 3 years against defects,

excessive wear, and loss of adhesion including replacement of defective tile work, materials, labour costs for demolition of defective work, accessories, and installation systems at *Owner's* convenience. Defective work includes without limitation, tiles broken in normal use due to deficiencies in setting bed, loose tiles or grout and similar defects which can be attributed to poor performance of work or defective materials.

.2 Warrant waterproofing work of this Section against defects of workmanship and materials, and against any actual leakage, for a period of 5 years. Leakage due to structural failure of concrete shall be excepted. Cracks arising from normal shrinkage and/or expansion of concrete shall not be considered as structural failure. Hairline cracks which result from these causes shall be considered normal and warranty shall not be voided as a result of these minor defects.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

.1 *Products* of following manufacturers and distributors are acceptable subject to conformance to requirements of *Drawings*, Schedules and *Specifications*:

- .1 Ceramic Tile:
 - .1 Stone Tile; www.stone-tile.com
 - .2 Ceragres; www.ceragres.ca
- .2 Setting Materials and Adhesives:
 - .1 Flextile Ltd.; www.flextile.com
 - .2 Laticrete International, Inc.; www.laticrete.com
 - .3 Mapei Inc.; www.mapei.com
 - .4 Ardex Americas ;www.ardex.com

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to NBC requirements and in particular slip resistance requirements of tile surfaces on horizontal applications
 - .2 Provide materials having a minimum Dynamic Coefficient of Friction (DCOF) of 0.42 in accordance with ANSI A 137.1 when tested using the BOT 3000 Digital Tribometer.
- .2 Design and Performance Requirements:
 - .1 *Provide* tiles conforming to the following standards:
 - .1 ANSI A137.1.
 - .2 CAN/CGSB-75.1-M
 - .2 Design and *Install* ceramic tile assemblies in accordance with TTMAC-Specification Guide 09 30 00; Tile Installation Manual 2009 - 2010. In particular, design assemblies in conformance with following details unless otherwise indicated:
 - .1 Expansion and Control Joints for Tile Installation: TTMAC Detail 301MJ-2012/2013 Movement Joints.
 - .2 Tile Installed Over Gypsum Board - Thin Set Method, Dry Areas

- Only TTMAC Detail 304W-2012/2014.
- .3 Tile Installed Over Tile Backer Board, Wet/Dry Areas: TTMAC Detail 305W-2012/2014 Detail B.
 - .4 Tile Installed Bonded to Concrete Slab, Thin Set Method Interior/Exterior Areas: TTMAC Detail 311F-2012/2014 Detail A and Detail B.
- .3 Floor Tiles:
- .1 CAN/CGSB-75.1-M, Type 7 glazed floor tile, slip resistant.
 - .1 Moisture Resistance: MR 1 or 2, CAN/CGSB-75.1-M
 - .2 Aesthetic Class: ASTM C609 - V0 or V1
 - .3 Water Absorption: ASTM C373 \leq 3.0%.
 - .4 Breaking Strength: ASTM C648 \geq 250 lbs.
 - .5 Abrasion Resistance: ISO 10545-7 - Class 4 Heavy Traffic.
 - .6 Scratch Hardness: Mohs Scale Rating: $>$ 7
 - .7 Chemical Resistance: ASTM C650 - Resistance Class A.
 - .8 Stain Resistance: ASTM C1378 - Resistance Class A
 - .9 Slip Resistance: ASTM D2047:
 - .1 Level Surfaces: \geq 0.6 (Wet and Dry)
 - .2 Step Treads: \geq 0.6 (Wet and Dry)
 - .3 Ramp Surfaces: \geq 0.6 (Wet and Dry)
 - .4 Shower Areas: \geq 0.9 (Dry), \geq 0.8 (Wet)
 - .10 Traffic Level Performance: Floor tiles shall meet traffic level performance passing in accordance with ASTM C627, cycles 1 through as specified herein.
 - .1 Extra Heavy: Passes cycles 1 through 14;
 - .2 Heavy: Passes cycles 1 through 12;
 - .11 Frost Resistance: Provide exterior tiles having a maximum water absorption rating of 0.5% or less when measured in accordance with ASTM C373 for ceramic materials or ISO 10545-3; submit proof of freeze-thaw stability for tile materials having water absorption higher than 0.5%.
 - .12 Floor Traffic Load Bearing Performance: Provide installations rated for following load bearing performance in accordance with ASTM C627 for ceramic tile installed on walkway surfaces:
 - .1 Extra Heavy: Passes cycles 1 through 14
 - .2 Heavy: Passes cycles 1 through 12
 - .3 Moderate: Passes cycles 1 through 10
 - .4 Light: Passes cycles 1 through 6
 - .2 Wall Tile: Glazed, Interior, CAN/CGSB-75.1-M, Type 1- mosaic glazed, Type 3- facing veneer and/or Type 5 - wall type.
 - .1 Aesthetic Class: ASTM C609 - V0 or V1
 - .2 Water Absorption: ASTM C373 \leq 10%.
 - .3 Breaking Strength: ASTM C648 \geq 250 lbs.
 - .4 Abrasion Resistance: ISO 10545-7 - Class 4 Heavy Traffic.
 - .5 Scratch Hardness: Mohs Scale Rating: $>$ 7
 - .6 Chemical Resistance: ASTM C650 - Resistance Class A.
 - .7 Stain Resistance: ASTM C1378 - Resistance Class A
 - .3 Porcelain Tile: Provide porcelain based, impervious unglazed ceramic tile conforming to requirements referred to herein. Water Absorption: $<$ 0.1% in accordance with ASTM C373. Trim

- shapes, caps, returns and other trim accessories as required with same characteristics as tile.
- .4 Substrate and Backing Surface Flatness Tolerances: Section 03 35 00 establishes a flatness requirement for FF25 for slabs on grade for in place concrete and is considered as the starting flatness for work of this Section; final measurement for flatness and level using mortar bed or self-levelling screed materials provided by this Section will be measured in same manner as specified in Section 03 35 00 to achieve the following:
- .1 Standard Format Floor Tile: Tiles having dimensions from 100 mm x 100 mm and less than 400 mm x 400 mm require floor flatness measured to a minimum FF35; equivalent to 5 mm with no more than 2 gaps under a 3000 mm straightedge measurement.
 - .2 Large Format Floor Tile: Tiles having dimensions 400 mm x 400 mm and larger require floor flatness measured to a minimum of FF50; equivalent to 3 mm with no more than 2 gaps under 3000 mm straightedge measurement.
 - .3 Wall Tiles: Provide wall levelling similar to that specified for floors for tiles having similar sizes listed above.

2.3 MATERIALS

- .1 Surface Preparation:
- .1 Mixes and Accessories: *Provide* following as required for installation systems indicated. Conform to admixture manufacturer's recommendations for *Products* and mixtures.
 - .1 Cement: CSA A3000 grey or white Portland cement; white for grout.
 - .2 Sand: ASTM C144 or CSA A23.1, sharp, screened mortar sand free from organic and deleterious materials.
 - .3 Water: Potable.
 - .4 Lime: ASTM C207, Type S, hydrated lime (where recommended)
 - .2 Reinforcing Mesh: Non corrosive, 50 mm x 50 mm (2" x2") x 16 ASW gauge or 1.5 mm (0.0625") diameter galvanized steel welded wire mesh complying with CSA G30.5 or ASTM A185 or ASTM A821.
 - .3 Waterproofing & Crack isolation Membrane: Supply 1 of following:
 - .1 2 part system: ANSI A118.10, extra heavy duty, seamless, load bearing for installation of ceramic tile for showers, kitchens, and other wet areas. Ensure reinforcing fabric is non-woven fabric designed specifically for use with waterproofing membrane. *Supply* 1 of following:
 - .1 "Flextile WP-980 Waterproof & Crack Isolation Membrane with Reinforcing Fabric" by Flextile Ltd.
 - .2 "Latacrete 9235" waterproof membrane system with Latacrete's fiberglass cloth reinforcement by Laticrete International, Inc.
 - .3 "Mapelastic™ 315" by Mapei Corporation.
 - .2 Single Component System: ANSI A118.10; Self-curing liquid rubber polymer that forms a flexible, seamless waterproofing membrane; *Supply* 1 of following:
 - .1 "Hydro Ban" by Laticrete International, Inc.,

- .2 "Aqua Defense" by Mapei Corporation
- .3 "WP-900 Hydro-Bloc Waterproof & Crack Isolation Membrane" by Flextile Ltd.
- .4 Self-leveling Underlayment: Fast setting, sanded HCT cement mortar screed for interior concrete floor preparation, repair and leveling from 10 mm (3/8") to 38 mm (1-½") thickness or for building slopes and metal reinforced floating screeds up to 50 mm (2") thickness over polyethylene cleavage membrane.
 - .1 "Flex-Flo" (up to 12 mm (15/32")) or "Flex-Flo Plus" (up to 50 mm (2")), by Flextile Ltd.
 - .2 "Laticrete 86" (up to 12 mm (15/32")), by Laticrete International, Inc.
 - .3 "Ultra Plan/Ultra Plan MB" (up to 5 mm (3/16")) or "Planicrete M20" (up to 50 mm (2")) by Mapei Inc.
 - .4 "ARDEX Liquid Backer Board" (up to 30mm (1¼")) or "ARDEX K15" (up to 50mm(2"))by Ardex Engineered Cements.
 - .5 Servoplan P 200 Plus (concrete substrates, 1mm - 30mm (1/32" -1 ¼")) or Servoplan BF 850, 5mm-100mm (3/16"- 4") - pre-leveler, Servoplan S 444 (3mm-15mm; 1/8"-9/16" over wood construction-fiber reinforced, all products are pumpable; by Kiesel.
- .5 Fast Setting Mortar for Interior Concrete Floor: Fast setting shrinkage compensated, sanded HCT cement mortar screed for interior concrete floor preparation, repair and leveling from 10 mm (3/8") to 38 mm (1-½") thickness or for building slopes and metal reinforced floating screeds up to 50 mm (2") thickness over polyethylene cleavage membrane. *Supply* 1 of following:
 - .1 "Topcem Premix with Planigrout AC," Accelerated Cure thick bed Screed and additive by Mapei Inc.
 - .2 "Flextile FS Screed" by Flextile Ltd or "4:1 Dry Pack Mortar and Flextile #43" by Flextile Ltd.
 - .3 "Laticrete 3701 Mortar Admix" and "Laticrete 226" thick bed mortar by Laticrete.
 - .4 "ARDEX AM100" by Ardex Engineered Cements
 - .5 "Servocret RS (fast setting - 1hr), Servocret RS-N (normal setting), non-sag, walls and floors, pumpable by Kiesel
- .2 Mortars and Bond Coats:
 - .1 Latex Modified Thin-Set System: ANSI A118.4, Latex portland mortar consisting of 2 component liquid latex mixed with factory blended dry set mortar. *Provide* as bond coat for setting tiles on concrete, cementitious backer units, coated glass mat backer boards and other suitable backing.
 - .1 Performance characteristics: *Provide* setting *Products* that exceed the requirements of ANSI A118.4 as indicated below.

Test Method	ANSI performance requirements	Minimum required performance
ANSI A118.4 - Glazed Wall Tile	> 2.06 MPa (300 psi)	≥ 4.13 MPa (600 psi)
ANSI A118.4 - Impervious Ceramic	>1.37 MPa (200 psi)	≥ 3.10 MPa (450 psi)

Tile (Porcelain) Mosaics		
ANSI A118.4 - Quarry Tile	> 1.03 MPa (150 psi)	≥ 3.44 MPa (500 psi)

- .2 "Flextile #51 Thin-Set Mortar" and "Flextile #44 Acrylic Latex Mortar Additive" by Flextile Ltd.
- .3 "Laticrete 4237" with "211 Crete Filler Powder" by Laticrete International Ltd.
- .4 "Kerabond/Keralastic" by Mapei Inc.
- .2 Thin-Set and Medium Bed System (Wall and Floor Applications - Large Format Tiles):
 - .1 Performance characteristics: *Provide* setting *Products* that exceed the requirements of ANSI A118.4 as indicated below.

Test Method	ANSI performance requirements	Minimum required performance
ANSI A118.4 - Glazed Wall Tile	> 2.06 MPa (300 psi)	≥ 3.10 MPa (450 psi)
ANSI A118.4 - Impervious Ceramic Tile (Porcelain) Mosaics	>1.37 MPa (200 psi)	≥ 2.76 MPa (400 psi)
ANSI A118.4 - Quarry Tile	> 1.03 MPa (150 psi)	≥ 2.07 MPa (300 psi)

- .2 "56SR Non-Sag Mortar" by Flextile
- .3 "Ultraflex LFT" by Mapei.
- .4 "ARDEX S14™" by Ardex Americas
- .3 Epoxy Bond Coat (for applications including large format natural stones, steel and other special conditions): ANSI A118.3, 100% solids epoxy adhesive, chemical resistant, water cleanable and grouting epoxy resin filled with silica sand and combined with hardener before application. *Provide* as bond coat for setting tiles in areas requiring chemical resistance and high bond strength (e.g kitchens, serveries, dishwashing areas etc.). *Supply* 1 of following:
 - .1 "Latapxy 300" by Laticrete International, Inc.,
 - .2 "Kerapoxy K 400" by Mapei Inc.
 - .3 "Flex-Epoxy 100 setting mortar" by Flextile.
- .3 Ceramic/Porcelain Tile (CT):
 - .1 Conforming to ANSI A137.1, CAN/CGSB-75.1-M.
 - .2 Tile installation materials shall comply with ANSI standard referenced with *Products* and materials specified for setting and grouting.
 - .3 *Provide* tile trims and accessories such as bullnoses, copings, caps, cove base, nosings, corner pieces, and other special units as specified, indicated, and required.
 - .4 Without limitations and unless required otherwise, allow for minimum 3 tile colours.
 - .5 Without limitations and unless noted otherwise, *Provide* tile trim and accessories for each type of tile including:

- .1 rounded and squared finished edges;
 - .2 inside and outside corners;
 - .3 cove bases, outer and inner;
 - .4 sanitary caps and corners;
 - .6 *Provide* tile with minimum following characteristics:
 - .1 Water Absorption: ASTM C373 - < 3.0%.
 - .2 Breaking Strength: ASTM C648 - > 250 lbs.
 - .3 Abrasion Resistance: ISO 10545-7 - Class Four Heavy Traffic.
 - .4 Scratch Hardness: MOH's - 7.
 - .5 Chemical Resistance: ASTM C650 - Resistant.
 - .6 Slip Resistance (Floor Tiles): ASTM D2047, DIN 51130 (shoe traffic) and DIN 51097 (bare foot traffic)
 - .7 Floor and Wall Tile (CT-1 and CT-2):
 - .1 CT-1: Provide 305 mm x 600 mm (12" x 24") "Cera Gres - ABK Fossil Stone - Light Grey" by Ceragres.
 - .2 CT-2: Provide 50 mm x 50 mm (2" x 2") "Cera Gres - ABK Fossil Stone - Light Grey" by Ceragres.
OR
 - .3 CT-1: Provide 305 mm x 600 mm (12" x 24") "Division 9 - Avenue Collection - Café (CASAV0336)" by Casa Roma
 - .4 CT-2: Provide 305 mm x 600 mm (12" x 24") "Division 9 - Avenue Collection - Café Hexagon Mosaic (CASAV03LJ) by Casa Roma
OR
 - .5 CT-1: Provide 305 mm x 600 mm (12" x 24") "Olympia Tile - Regal Series - Dark Grey Matte (NY.RG.DGR.1224.MT)" by Olympia Tile.
 - .6 CT-2: Provide 302 mm x 248 mm (11.9" x 9.76") "Olympia Tile - Regal Series - Dark Grey Polished (NY.RG.DGR.LN.IRR.PL.)" by Olympia Tile.
 - .8 Base: 100 mm (4") or as indicated on Drawings/Schedules.
- .4 Grout: Do not add water or other materials to dilute mortar or grout additives unless recommended by admixture manufacturer.
- .1 Chemical Resistant Grouts:
 - .1 Epoxy Grout (Wet Areas): ANSI A118.3; 100% Solids, two component water based washable epoxy grout, consisting of hardening resin and premixed portion of epoxy resin, colour pigments, and graded aggregate; Joint Width: 1.6 mm (1/16"). *Supply* 1 of following:
 - .1 "Epoxy Grout Flex-Epoxy 100" by Flextile Ltd.,
 - .2 "SPECTRALock Pro Gout" by Laticrete International, Inc.
 - .3 "Kerapoxy " by Mapei Inc.
 - .2 Cementitious Grout:
 - .1 Walls (Unsanded): ANSI A118.7, for porous and absorbent type tiles, non-vitreous clay tiles, marbles or soft glazed wall tiles; Joint Width: 1.6 mm (1/16"). *Supply* 1 of following:
 - .1 "Flextile 500 Series Polymer Modified Grout" by Flextile Ltd.
 - .2 "Laticrete Unsanded Grout, 1600 series with Laticrete 1776 grout admixture" by Laticrete International Inc.
 - .3 "Keracolor-U" or "Ultracolor® Plus" (Fast Set) by Mapei Corporation.
 - .2 Floors (Sanded): ANSI A118.7, highly abrasion resistant grout

for impervious and vitreous tile types; *Supply* 1 of following:

- .1 "600 Polymer Modified Sanded Grout" or "1600 RSF (fast set)" by Flextile Ltd.,
 - .2 "Laticrete sanded grout, 500 series" with "Laticrete 1776" grout admixture by Laticrete International, Inc.
 - .3 "Keracolor-S" or "Ultracolor® Plus" (Fast Set) by Mapei Corporation.
 - .4 "ARDEX FL Grout" by Ardex Engineered Cements
 - .5 "Servoperl royal" universal, high performance grout by Kiesel
- .3 Joint Widths for Grout: Unless otherwise recommended by tile manufacturer for specific conditions, *Provide* grout joint width as follows:
- .1 Rectified Tiles: 1.5 mm (1/16")
 - .2 Non-rectified Tiles: 3 mm (1/8")
- .4 Grout Sealer: Penetrating sealer as recommended by grout manufacturer to suit grout selected.
- .5 Grout Colours: To be selected by *Consultant* at a later date from manufacturer's full range.
- .5 Transitions and Trims:
- .1 Extruded Aluminum components: *Provide* items with height of profile and type to suit design requirements and installation requirements, as manufactured by Schlüter-Systems Inc. or approved equivalent. *Provide* one of the following transition or expansion systems as required to suit application indicated:
 - .2 Transition Systems:
 - .1 Schlüter - RENO-T: Use to adjoin different types of floor coverings of same height.
 - .2 Schlüter - RENO-TK: Use to *Provide* smooth transition between tiled surfaces and lower neighbouring floor covering.
 - .3 Schlüter - RENO-U: Use to *Provide* smooth transition between floor covering of different heights.
 - .4 Schlüter - RENO-RAMP: Use to create a gradual transition between tiled surfaces and lower neighbouring floor covering. Use in areas where carts traffic is anticipated.
 - .5 Schlüter - RENO-V with variable transition leg: Used to smoothly join floor covering of different heights.
 - .6 Schlüter - JOLLY: Use to *Provide* finishes and protection for tiled edges and tile skirtings.
 - .7 Schlüter - RONDEC: Use to *Provide* symmetrical rounded profile to protect outside wall corners and *Provide* integral joint with grouts.
 - .3 Movement and Control Joints:
 - .1 Schlüter - DILEX-MOP: rigid PVC expansion joint for use in screed applications.
 - .2 Schlüter - DILEX-BWS: rigid PVC expansion joint 5 mm (3/16") wide for use for movement joints.
 - .3 Schlüter - DILEX-KSN: expansion joint with aluminum anchoring legs with movement zone made of soft synthetic rubber with sizes varying from 2.5 mm to 30 mm (3/32" to 1-3/16") for use for

- movement joints.
- .4 Schlüter - DILEX-AKWS: expansion joint with aluminum anchoring legs with movement zone made of PVC with sizes varying from 8 mm to 21 mm (5/16" to 13/16") for use for movement joints.
 - .5 Schluter-DILEX-AHK: 10 mm (0.39") radius anodized aluminum cove for floor and wall transitions in tile areas.

2.4 MIXES

.1 Mix mortars and grouts to comply with requirements of referenced Standards and manufacturer's recommendations for accurate proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, pot life and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics.

.2 Prepare and mix latex cement leveling bed/scratch coat mortar using recommended mixing proportions to achieve proper consistency in accordance with manufacturer's instructions.

.3 Prepare and mix dry-set cement mortar, latex cement mortar using recommended mixing proportions to obtain proper consistency in accordance with manufacturer's instructions and requirements of ANSI A108.5.

.4 Prepare and mix ceramic tile grout using recommended mixing proportions to obtain proper consistency in accordance with manufacturer's instructions and requirements of ANSI A108.10.

.5 Prepare and mix modified epoxy emulsion mortar using factory proportioned adhesive units to obtain proper consistency in accordance with manufacturer's instructions and requirements of ANSI A108.9.

.6 Prepare and mix chemical resistant, water cleanable, tile setting epoxy adhesive using factory proportioned adhesive units to obtain proper consistency in accordance with manufacturer's instructions and requirements of ANSI A108.6.

.7 Prepare and mix chemical resistant, water cleanable, grouting epoxy using factory proportioned epoxy grout units to obtain proper consistency in accordance with manufacturer's instructions and requirements of ANSI A108.6.

PART 3 -EXECUTION

3.1 EXAMINATION

.1 Verify existing conditions and finishes are ready to receive specified tile work. Ensure backings are structurally sound, level, and plumb within required tolerances.

.2 Ensure concrete is cured for a minimum of 28 *Days* and has following finishes as required to suit designated application methods:

- .1 Steel trowel finish if installation includes load bearing waterproof membrane over concrete and thin set applications.
- .2 Fine broom or wood float finish for thin set applications.

- .3 Screed finish for mortar bed applications
- .4 Notify *Consultant* in writing of unacceptable substrate conditions. Beginning of installation implies acceptance of existing conditions.
- .5 Ensure compatibility of adhesives, waterproofing, reinforcing and fillers with adjacent substrate and component coming in contact with these *Products*.
- .6 Ensure waterproofing and adhesive manufacturers; examine substrate conditions, verify conditions are suitable for installation prior to commencement, and review application procedures. If requested submit written report.

3.2 PREPARATION

- .1 Refer to Section 03 30 00 and 09 21 16 for provision of substrates.
- .2 Ensure surface is dimensionally stable, cured free of contaminants such as oil, sealants and curing compounds
- .3 Scarify concrete substrate with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials.
- .4 Mortar bed application substrate surface variation shall not exceed 6 mm in 3000 mm (1/4" in 10').
- .5 Thin set application substrate surface variation shall not exceed 3 mm in 3000 mm (1/8" in 10').
- .6 Apply latex cementitious leveling coat to correct substrate irregularity up to 8 mm (5/16") thickness. Above 8 mm (5/16") correct irregularity by mortar bed method.
- .7 Review setting out point with *Consultant* for each location, verify patterns and edge condition.
- .8 Verify expansion joints have been installed properly.
- .9 Verify service fittings, floor drains, rough-ins and similar requirements are completed and are at proper levels to receive ceramic work.

3.3 INSTALLATION

- .1 *Provide* tile in accordance with Terrazzo Tile & Marble Association of Canada - Specification Guide 09 30 00; Tile Installation Manual unless specified otherwise.
- .2 Prior to installation ensure back of each tile is free of contaminants. Distribute production run variations evenly, maintaining continuity of appearance.
- .3 Lay out tile so field or patterns are centered on wall areas, or conform architectural details so no tile less than 1/2 size occurs. No cut tiles are

allowed at finished ceiling level. Align joints in walls and bases where tile sizes accommodate. *Provide* uniform joint widths throughout.

.4 Arrange accessories in tile work so they are spaced evenly, centered with joints and set true with proper and adequate projection conforming to manufacturer's recommendations.

.5 Ensure tile has adequate solid backing with corner and edges are fully supported by bonding material. Avoid slippage. Tile installation shall have a minimum of 95% bond coverage by backbuttering or other approved technique.

.6 Fit tile units around corners, fitments, fixtures, drains and other built-in-objects to maintain uniform joint appearance. Cut, drill and set anchors, bolts for fastening fixtures and fittings in tile work. Make cut edges smooth, even and free from chipping. Do not split tile.

.7 *Provide* grout to match colour of tile unless indicated otherwise. Fill joints.

.8 Control Joints: *Provide* control joints in accordance with following layout guidelines and as indicated:

- .1 Slabs-on-Grade:
 - .1 Over saw cut control joints.
 - .2 Around columns.
 - .3 Over perimeter joints.
 - .4 Every 4500 mm to 6000 mm (15' to 20') in a grid.

.9 Waterproof Membrane:

- .1 *Install* waterproofing membrane in strict compliance with manufacturer's instructions.
- .2 Pre cut reinforcing fabric allowing 50 mm (2") for overlap at ends and sides. Extend fabric 150 mm (6") through door openings and up adjacent walls. Roll up fabric so that each piece can be placed when ready. Reinforce joints. Spread layer of waterproofing liquid at joints and cracks.
- .3 Embed 150 mm (6") wide strip of reinforcing fabric into liquid. Spread coat of liquid over fabric to seal it. At flash cove spread layer of waterproofing liquid in coves. Embed 150 mm (6") wide strip of reinforcing fabric and allow 100 mm (4") of fabric to be flashed up walls. Spread coat of liquid over fabric to seal it.
- .4 Flash fabric and waterproofing liquid into any drain and around all projections. Use roller or brush to apply a liberal coat of waterproofing liquid to wall slightly wider than reinforcing fabric width. Include joints and covers which have been previously reinforced. While surface is still wet, unroll pre cut piece of fabric into it. Embed fabric and smooth out any wrinkles. Ensure liquid shall bleed through fabric. Seal fabric. Immediately apply liberal coat of liquid to completely cover fabric. Lap fabric 50 mm (2") at seams. Allow to dry until dry to touch.
- .5 Apply final application of liquid to entire surface.
- .6 If requested, flood test installation in designated locations after allowing membrane to cure fully for 7 Days at 21 deg C (70 deg F).

Allow more cure time during cold weather. Flood test installation for 24 to 48 hours before setting of tile to ensure no water penetration.

- .7 Repair and retest if required.
- .8 Do not allow traffic on exposed waterproof membrane.
- .9 *Provide* waterproof membrane behind tiles in following areas:
 - .1 showers
 - .2 kitchens
 - .3 vestibules
 - .4 other areas subject to high levels of moisture
- .10 Leveling Bed:
 - .1 *Provide* minimum 1.6 mm (1/16") leveling bed to surfaces to receive waterproof membrane, in accordance with manufacturer's instructions.
 - .2 *Provide* ramped leveling bed beneath finish flooring adjacent to ceramic tile, for minimum 600 mm (24") strip, to achieve flush finished surfaces at finished flooring transition.
- .11 Ceramic Tile:
 - .1 General:
 - .1 *Install* tile materials in accordance with ANSI A137.1 and other referenced standards;
 - .2 Cut and fit tile tight to protrusions and vertical interruptions; form corners and bases neatly.
 - .3 Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joint watertight, without voids, cracks, excess mortar or grout;
 - .4 Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards.
 - .2 *Provide* setting bed in accordance with manufacturer's printed instructions and as specified herein.
 - .3 Prepare gypsum board and cement board surfaces, by applying a scratch coat of setting bed material.
 - .4 *Provide* setting compound in 1 layer with notched trowel to *Provide* a continuous 3 mm to 6 mm (1/8" to 1/4") bed, in accordance with tile manufacturer's written instructions.
 - .5 Place tiles to achieve uniform:
 - .1 Shading.
 - .2 Colouring.
 - .3 Jointing.
 - .6 Lay tiles in true lines, conforming to lines of building and arrange symmetrically in accordance with *Drawings* layouts. Review layout and slopes with *Consultant* prior to setting of tiles.
 - .7 When tiles are laid by thin-set method in wet areas or laying large size tiles, achieve minimum of 95% coverage. Bonding shall be notched in horizontal straight lines. Lay tile on freshly notched thin-set mortar, slide tile back and forth at 90 degree to notches. Ensure tiles are set while bond coat is wet and in tacky stage without skin. *Provide* back buttering by applying thin troweled coat to back side of tile using flat side of trowel immediately before laying to achieve minimum 95% adhesion for exterior work, or large tile area or wet areas.
 - .8 Lay ceramic tile with 1.6 mm (1/16") joints, with joints running through in both directions.

- .9 Lay out work to produce a symmetrical pattern with minimum amount of cutting. Cut tile at room perimeter shall be not less than 1/2 full size.
 - .10 *Provide* space or control or expansion joints in widths and depth as located and detailed on *Drawings*. *Install* expansion joints where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, wall corners and similar components, directly over joints in structural surfaces to details indicated. *Provide* expansion joints at edges manufactured by Schlüter-Systems Inc.
 - .11 Set wall tile in a true vertical plane with edges of tiles flush with each other.
 - .12 *Provide* ceramic tile bases to work of Architectural Woodwork and Modular Casework Sections as indicated.
 - .13 Neatly and closely fit tiles around pipes, accessories and other items occurring in walls. *Provide* necessary cutting without marring tile.
 - .14 Replace cracked, discoloured, chipped, and damaged tile.
 - .15 Align joints of floor, wall and base tiles.
- .12 Grouting:
- .1 Apply grout in accordance with manufacturer's printed instructions. Minimum of 2/3 of joint depth shall be kept open for grouting and grout shall penetrate joint to bond coat.
 - .2 When tiles have set, fill joints full with grout. Wipe clean surplus grout from face of tile, down to sharp edge of cushion edge of tile.
 - .3 After grout has attained slight initial set, completely clean-up and polish surfaces of tile.

3.4 FIELD QUALITY CONTROL

- .1 Site Visits:
- .1 Have manufacturer's representative visit site at commencement of tile work to give proper direction, and at regular intervals during installation to ensure proper workmanship.
 - .2 Ensure that all proprietary materials used in strict accordance with state of art trade standards and manufacturer's instruction, materials manufacturers and/or *Suppliers* shall, in addition to furnishing appropriate directions, make regular site visits prior to and during installation.
 - .3 Frequency and number of such site visits shall be determined through prior agreement between *Consultant* and the material and setting materials manufacturers and/or *Suppliers* designated representatives.
 - .4 After each visit, material manufacturer and/or *Supplier's* designated representative shall report his/her current observations concerning work conditions and progress in writing to *Consultant*.
 - .5 Any condition, work, or part of other work reported as unacceptable or in non-conformity to trade standards requirements following these observations, shall be rectified or removed and replaced at *Sub-contractor's* sole expense and responsibility.

3.5 CLEANING

.1 Upon completion remove protective coverings and clean down finished work of this Section leaving it in perfect condition, satisfactory to *Consultant*. Correct defective pointing and other unsatisfactory conditions.

.2 Clean adjacent surfaces which have been soiled or otherwise marred, to completely remove evidence of material causing same.

3.6 PROTECTION

.1 Protect other parts of *Work* from spatters.

.2 Remove and replace with perfect materials, sections of work which have become stained, soiled, broken, chipped or otherwise damaged.

.3 Prohibit traffic during installation and for 96 hours after completion.

3.7 SCHEDULES

.1 *Install* ceramic tiles according to Terrazzo Tile & Marble Association of Canada - Specification Guide 09 30 00; Tile Installation Manual 2009 - 2010.

.2 Expansion and Control Joints for Tile Installation: TTMAC Detail 301MJ-2012/2014 Movement Joints.

.3 Wall Tile:

.1 Tile Installed on Cement Mortar Over Masonry or Concrete Walls TTMAC Detail 302W-2012/2014.

.2 Tile Installed Over Masonry or Concrete walls - Thin Set Method TTMAC Detail 303W-2012/2014.

.3 Tile Installed Over Gypsum Board - Thin Set Method, Dry Areas Only TTMAC Detail 304W-2012/2014.

.4 Tile Installed on Cementitious Backer Unit (CBU), Thin Set Method, Walls, for Interior Wet/Dry Areas and Exterior Use; TTMAC Detail 305W-2012/2014.

.5 Tile Installed on Cementitious Backer Unit (CBU)/ Coated Glass Mat Backer Board, on Bath Tub/Walls, Thin Set Method, TTMAC Detail 306W-2012/2014.

.6 Tile Installed Over Cementitious Backer Unit (CBU) and Tile Installed on Coated Glass Mat Backer Board, on Bath Tub/Walls, Thin Set Method Detail A and Detail B respectively, TTMAC Detail 306W-2012/2014.

.7 Tile installed on cement mortar over solid backing on interior/exterior walls, TTMAC Detail 307W-2012/2014.

.8 Tile installed on interior/exterior walls on cement mortar over wood or metal studs, TTMAC Detail 308W-2012/2014.

.4 Floor Tile:

.1 Tile Installed on Interior/Exterior Cement Mortar Bed on Concrete Slab. TTMAC Detail 310F-2012/2014; Detail A and Detail B Chemical Resistance as applicable.

.2 Tile Bonded to Concrete Slab - Thin Set Method, TTMAC Detail 311F-2012/2014; Detail A and Detail B Epoxy Method as applicable.

.3 Conductive Tile Bonded to Concrete Slab, Thin Set Method Interior Only. TTMAC Detail 312 F-2012/2014.

- .4 Tile over mortar bed with cleavage membrane interior only, TTMAC Detail 309F-2012/2014.
- .5 Tile installed on cement mortar bed on concrete slab, TTMAC Detail 310F-2012/2014.
- .6 Tile bonded to concrete slab - Thin-set method, TTMAC Detail 311F-2012/2014.
- .7 Conductive tile bonded to concrete slab-interior only - Thin-set method, TTMAC Detail 312F-2012/2014.
- .8 Tile applied over wood sub-floor in dry areas - Thin-set method, TTMAC Detail 313F-2012/2014.
- .9 Tile over heated floors, TTMAC Detail 314F-2012/2014.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* acoustic tile ceilings including but not limited to following:
 - .1 ceiling suspension systems.
 - .2 lay-in acoustic ceiling panels.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,

- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Submit *Product* data on ceiling grid system, acoustic tile; clearly indicate specific items proposed for use if manufacturer's catalogues are submitted.
- .3 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound, solid polymer and as designated later by Consultant.

.2 *Shop Drawings*: Submit *Shop Drawings* for work of this Section in accordance with Division 01. In addition to minimum requirements indicate following:

- .1 reflected plans of ceilings, joint pattern, position of suspension grids, methods of suspension and termination at walls, partitions, bulkheads, lighting fixtures and mechanical fixtures.
- .2 Submit reflected ceiling plans detailed in measurement system (e.g. imperial or metric) to match *Drawings*.

.3 Samples: Submit samples in accordance with Division 01. Submit following samples in sizes indicated:

- .1 Submit 300 mm (12") long samples of suspension system parts, including trim.
- .2 Submit 300 mm x 300 mm (12" x 12") samples of acoustic panels.
- .4 Certificates:
 - .1 Submit independent test data and certificate confirming system meets or exceeds specified acoustic ratings.
- .5 Maintenance Data: Submit maintenance instructions to *Owner* for recommended cleaning materials and methods for panels and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

1.6 QUALITY ASSURANCE

- .1 Applicator Qualifications: *Provide* work of this Section executed by competent installers with minimum of 5 years' experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name.
- .2 Store materials in a covered area, off ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from site.
- .3 Comply with ceiling panel manufacturer's recommendations regarding temperature and humidity conditions before, during and after ceiling installation.

1.8 PROJECT CONDITIONS

- .1 Environmental Requirements: Continuously maintain rooms or areas scheduled to receive acoustical treatment at not less than 21 deg C (70 deg F), and at occupancy humidity, at least 3 *Days* prior to installation and 3 *Days* after work is completed. Schedule work to eliminate risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after work is installed.

1.9 WARRANTY

- .1 Warrant work of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*.

1.10 MAINTENANCE

- .1 Spare Parts: Leave 1 carton per 93 m² (1000 sq ft) of each type of ceiling panel specified for *Owner's* future maintenance use. *Supply* spare panels from same production run as installed panels.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings, Schedules and Specifications*:
 - .1 Armstrong World Industries Canada Ltd.; www.armstrong.com
 - .2 Bailey Metal Products Ltd.: www.bmp-group.com
 - .3 CGC Inc.; www.cgcinc.com
 - .4 CertainTeed Ceilings; www.certainteed.com
- .2 Substitution Limitations: This Specification is based on Armstrong's Products. Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Surface Burning Characteristics: All ceiling panels to meet fire resistance characteristics equivalent to Class A per ASTM E1264
- .2 Design Requirements:
 - .1 Design suspension system to support safely and without distortion, superimposed loads of:
 - .1 Lighting fixtures;
 - .2 Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles;
 - .2 Design suspension system to support safely and without distortion, superimposed loads of:
 - .1 Lighting fixtures;
 - .2 Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles;
 - .3 Design and selection of ceiling system shall be flexible to provide access to above ceiling services, shall be compatible with mechanical, electrical, communication services and fixtures, low VOC emissions determined in accordance with ASTM D6886 with reduction in glare.
 - .4 Coordinate installation and cooperate with Mechanical and Electrical Subcontractors, to accommodate mechanical and electrical items, or any other work required to be incorporated in or coordinated with the ceiling system.
 - .5 Unless otherwise indicated, ceiling suspension Products shall be manufactured to minimum requirements of ASTM C635, for Heavy Duty, modified as required to suit grid design shown.

2.3 MATERIALS

- .1 Exposed Grid System: Unless otherwise indicated fabricate ceiling suspension Products to minimum requirements of ASTM C635, for Heavy Duty, modified as required to suit grid design shown. Ensure system provides lock joint intersections of cross and main tees. Provide 1 of following systems:
 - .1 Exposed Grid System (ACT-1, PMCT and ACT-4): "Series "DX Quick

- Release" by CGC Inc., "Prelude XL" by Armstrong World Industries, "Standard B.E. Safe-T-Lock" by Bailey Metal Products Ltd. or "1200 System" by Chicago Metallic Corp., or "Classic Stab System" by CertainTeed Ceilings, factory finished satin white on hot dipped galvanized cold rolled steel.
- .2 Finish: Factory-finished satin white or metallic coating on hot dipped galvanized cold rolled steel.
- .2 Basic Steel Material and Finish: Commercial quality cold rolled steel 0.179" (26 ga) minimum thickness, and heavier gauge for Heavy Duty as necessary, galvanized to zinc coating designation Z275. Exposed surfaces of metal *Products* shall be factory finished in non-yellowing, low sheen satin white enamel to *Consultant's* acceptance to match whiteness in panels.
- .3 Accessories for Suspension System: Complete with splices, clips, and perimeter moulding, of manufacturer's standard and aluminum types to suit the applicable conditions unless special conditions and access areas are shown or specified. In high humidity areas *Provide* galvanized suspension system.
- .4 Hangers: Minimum 0.104" (12 ga) overall thickness galvanized steel wire to zinc coating designation Z275, meeting "Heavy-duty" classification of ASTM C635.
- .5 Main Tees: 3.66 m (12') long, 23.8 mm (15/16") face width double web design, rectangular bulb at top of web, 38 mm (1-1/2") web height. Expansion cut-outs in main tees controlling buckling caused by heat expansion.
- .6 Main Tee Splices: Designed to lock lengths of main tees together so that joined lengths of tee function structurally as single unit with tee faces at joint perfectly aligned and presenting tight seam.
- .7 Cross Tees: 1220 mm (4') long, 25 mm (1") web height structural cross-section, design same as main tees, designed to connect at main tees forming positive lock without play, loss or gain in grid dimensions with offset over-ride of face flange over main tee flange to provide flush joint. *Provide* 38 mm (1-1/2") web height of cross-tee for fire rated assemblies.
- .8 Edge Moulding Around Ceiling Perimeters: Materials and finish to match tees.
- .9 Radiant Panel Perimeter Mouldings: 38 mm X 25 mm (1 1/2" X 1") edge moulding, 22 ga. (.030") thick steel with slotted holes at 203 mm (8") centres to allow for expansion at building perimeter. Radiant panel edges adjacent to metal acoustic tile suspension system are fit into suspension system tees. Note: Radiant panels are structurally supported by Division 23 and not by perimeter mouldings.
- .1 *Provide* 3 mm (1/8") gap between edge moulding lengths to allow for expansion. At curved building perimeter sections, *Provide* 5 mm (3/16") gap between edge moulding lengths to allow for increased geometric expansion.
- .10 Hanger Connection:
- .1 Ceiling Wire Fastening Assembly: Consisting of pre-mounted powder

actuated fastener recommended by manufacturer with pre-mounted steel clamping washer and galvanized, soft annealed mild carbon steel wire for supporting direct and indirect hung suspended lay in panel ceilings. Provide "X-CW Ceiling Wire Assembly" by Hilti.

- .11 Fasteners: Galvanized and of size suited to loading conditions.
- .12 Metal Closures and Trim: Bonderized and with factory-applied white baked enamel finish. Provide anchors as standard with manufacturer.
- .13 Supplementary Steel Supports: Steel conforming to Section 05 50 00.
- .14 Sound Attenuation Batts (Acoustical Ceiling Insulation): CAN/ULC-S702, mineral (glass and rock wool) fibre, flame spread and smoke developed in conformance with NATIONAL BUILDING CODE OF CANADA requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102. Non combustible in accordance with requirements of CAN4-S114, having a minimum density of 1.1 lb/cu ft and minimum Noise Reduction Coefficient of 1.10 at 1/3 Octave Centre Frequency (Hz).
 - .1 Acceptable Products: "QuietZone Acoustical Batts" by Owens Corning Canada Inc., "Roxul AFB - Acoustical Fire Batts" by Roxul Inc or "Thermafibre Sound Attenuation Blankets" by CGC Inc. Thickness; 64 mm (2-1/2") except as otherwise noted.
- .15 Acoustic Lay-in Panels: CAN/CGSB-92.1-M, acoustical units, prefabricated, with white painted textured and/or smooth face and meeting following performance criteria as determined by CAN/ULC-S101-M and as specified:
 - .1 Flame Spread Rating: 25 or under.
 - .2 Smoke Developed: 50 or under.
 - .3 Fuel Contributed: 25 or under.
 - .4 Acoustic Lay-In Panels (ACT-1): 610 mm x 610 mm x 19 mm (24" x 24" x 3/4" incombustible mineral fibre, non-directional fissured, square edge, white factory-painted exposed surface, "School Zone Fine Fissured Item No. 1713" by Armstrong World Industries or approved equivalent by CGC Inc, CertainTeed Ceilings or Bailey Metal Products Ltd; meeting following performance criteria:
 - .1 Noise Reduction Co-efficient: 0.7 or better.
 - .2 Light Reflectance: 0.85 or better.
 - .3 Edges: Square Lay-in edge 15/16
 - .5 Metal Security Ceilings (ACT-2): Refer to Section 09 57 53.
 - .6 Acoustic Lay-In Panels (ACT-3): Not Used.
 - .7 Vinyl Face Acoustic Lay-In Panels (ACT-4): 610 mm x 1220 mm x 16 mm (24" x 48" x 5/8") mineral fibre core surfaced on exposed face with vinyl sheet, square edged, white factory-applied finish on exposed surface, without perforated face, "VL Design No. 871" by Armstrong World Industries, "Clean Room ClimaPlus Class 10M - 100M Item #56090" by CGC Inc., CertainTeed Ceilings or Bailey Metal Products Ltd; meeting following performance criteria:
 - .1 Noise Reduction Co-efficient: 0.55 - 0.60 or better.
 - .2 Light Reflectance: LR (0.79 - 0.88).
 - .8 Perforated Metal Lay-In ceiling Panel (PMCT): 610 mm x 610 mm (24" x 24" metal ceiling panel, P4 microperforated, square edge,

factory-applied powder-coated finish; colour to be selected at a later date from manufacturers full range, Provide "METALWORKS SecureLock Lay-In" by Armstrong World Industries or approved equivalent by CGC Inc, CertainTeed Ceilings or Bailey Metal Products Ltd;, meeting following performance criteria:

- .1 Noise Reduction Co-efficient: 0.8 or better.
- .2 Light Reflectance: 0.60 or better.
- .3 Edges: Square Lay-in edge 15/16
- .9 Wood Slat Ceiling (WSC): Refer to Section 06 40 00.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Inspect substrates and previously placed work to determine suitability and completeness. Start of work constitutes an acceptance of existing conditions, and failure of work due to unsatisfactory existing conditions shall be corrected at no cost to *Owner*. Similarly, if work needs to be removed to correct defects in substrates or previously placed work, both removal and replacement shall be done at no cost to *Owner*.

3.2 INSTALLATION

- .1 Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 21 deg C (72 deg F) for 72 hours prior to commencement of work and maintain temperature until 72 hours after completion.
- .2 *Install* ceiling panels and metal suspension system in accordance with applicable requirements of ASTM C636 and manufacturer's directions.
- .3 Where manufacturer's directions are at variance with *Contract Documents*, notify *Consultant* before proceeding with work.
- .4 Do not commence installation until all work above suspended ceiling has been completed, inspected and accepted.
- .5 *Install* supporting inserts for hangers of suspended ceiling system into deck above.
- .6 *Install* acoustic ceilings using tradesmen skilled in this class of work, in accordance with manufacturer's instructions and as specified herein.
- .7 Neatly and symmetrically *Install* suspended ceiling to true lines, evenly balanced to pattern indicated on *Drawings* or as directed.
- .8 Centre ceiling system on room axis unless otherwise thereon or directed leaving equal border panels not less than 1/2 a full width.
- .9 Recessed items shall replace or be centred on acoustical panels, except where shown otherwise. Consult with Mechanical and Electrical Divisions to co-ordinate work. *Provide* additional supports where required.

- .10 Space hangers for suspended ceilings to support ceiling grids independent of walls, columns, pipes and ducts at maximum 1220 mm (4') centres along support grillage, not more than 150 mm (6") from ends, within 150 mm (6") from each corner and at a maximum of 1220 mm (4') around fixture perimeters. Provide additional hangers at light fixtures and diffusers.
- .11 Attach hangers to inserts in overhead deck. Bend top of hangers at right angles, turn down and securely fasten. Turn bottom of hangers upwards and securely wrap 3 times.
- .12 Do not suspend any items from structural steel deck.
- .13 Provide written confirmations to Divisions 22, 23 and 26, when requested by *Consultant*, that suspended ceiling is capable of supporting additional weight of mechanical and electrical fixtures specified in Division 22, 23 and Division 26.
- .14 Run main tees at right angles to length of light fixtures.
- .15 Space main tees 1220 mm (4') or at 610 mm (2') oc in 1 direction and securely tie to hangers (as applicable).
- .16 Space cross tees 610 mm (2') oc at right angles to main tees and properly lock at intersections.
- .17 Level suspended systems with a maximum tolerance of 3 mm (1/8") over 3 m (10').
- .18 Use longest practical lengths of tees, furring and running channels to minimize joints. Make joints square, tight, flush and reinforced with concealed splines. Assemble framework to form a rigid and interlocking system.
- .19 Design suspension system to accommodate movement caused by thermal expansion or contraction.
- .20 Design and space hangers and carrying members to support entire ceiling system, including lighting fixtures, diffusers and equipment openings in locations indicated on *Drawings*.
- .21 Use edge moulding where ceiling abutts vertical surface.
- .22 Use corner moulding along external edges at ceiling steps.
- .23 Exposed Grid Lay-in Panel Ceilings:
 - .1 *Install* direct-hung exposed grid lay-in acoustic panel ceilings where shown. *Install* main tees, cross tees, and wall mouldings so bottom flanges are in flat, level plane at finish ceiling elevations. Arrange grid so opposite wall edge panels are of equal width but not less than 1/2 panel width and lay out and erect grid system to provide following panel pattern as shown:
 - .1 Pattern of 610 mm x 1220 mm (24" x 48"), with main beam tees spaced 1220 mm (48") oc and cross tees 610 mm (24") oc unless reviewed otherwise.

- .2 Pattern of 610 mm x 610 mm (24" x 24"), with main beam tees spaced 1220 mm (48") oc, primary cross tees at 610 mm (24") oc and secondary cross tees at 610 mm (24") oc.
- .2 *Install* exposed ceiling grid per ASTM C636, reviewed *Shop Drawings* and specified herein.
- .3 Erect main beams parallel to main wall and to each other; space uniformly at centres specified. Stop ends of main beams 13 mm (1/2") from walls allowing for expansion. *Supply* main beams in as long lengths as possible to minimize number of joints in a run. Join lengths of main beams together at hangers only; use special splice pieces. In ceilings having recessed lighting fixtures, modify grid framing to provide main beams along and parallel to both long sides of lighting fixtures; at each 300 mm (12") wide fixture, *Provide* an additional main beam along the long side of fixture. At other items recessed in ceiling and designed to be framed by main beams, *Provide* additional main beams necessary. Rest ends of main beams on horizontal leg of wall mouldings.
- .4 Support main beams with hangers along each run, spaced at not more than 1220 mm (48") centres; except in areas of steel framing, *Provide* hangers at each intersection of main beam and framing. If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, *Provide* a trapeze or other arrangement reviewed by *Consultant* to support main beams at proper spacing. Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment or support system for any of these. *Provide* an additional hanger at each corner of each opening to receive a recessed lighting fixture and each opening that has been framed by main beam members. *Provide* additional hangers at each diffuser, grille and other points of extra loading. Secure hangers to main beams to develop full strength of hangers and per manufacturer's published directions. Secure hangers to construction above per ASTM C636 and following requirements:
- .1 Steel Beams: Use beam clips.
- .2 Steel Joists: Wrap hanger wire around lower chord member.
- .3 Permanent Metal Forms and Cellular Floor Deck: Tabs, holes or slots specifically provided for hanger attachment. Prevent hanger twisting or turning by cross tying.
- .5 *Install* primary cross tees at right angles to main beam tees and space uniformly at centres specified. Join ends of cross tees to web of main beams with a positive interlock; except at light fixtures, secure members together with concealed steel clips and bolts. *Install* tees to produce fine-line joints between flanges of abutting members.
- .6 *Install* secondary cross tees at right angles to primary tees and space uniformly at centres specified, and secure in a manner similar to primary tees.
- .7 At locations where ceilings abut walls, columns and other vertical surfaces, *Install* continuous wall moulding to trim ceiling edges. *Install* moulding with bottom horizontal leg at elevation required to support acoustic panel and to be flush with bottom flange of grid members, and with vertical leg concealed. Bolt mouldings to supporting construction at 610 mm (24") on centres and within 150 mm (6") of end of each moulding piece. *Provide* tight, inconspicuous butt

- joints in moulding if several pieces are required in any 1 run.
- .8 At recessed-grid system for reveal-edge lay-in panels, *Install* "W" shaped wall moulding, of profile specified, to retain recessed detail at ceiling perimeters.
 - .9 *Install* acoustic panels in grid system openings supported by bottom flanges of members. *Provide* special shapes and sized to provide a complete installation by cutting panels to fit into less than full size openings. Fit panels moderately tight between upright legs of members. Cut panels neatly and accurately to fit closely around items piercing the finish ceiling plane. Secure each panel into grid opening.
 - .10 *Install* reveal-edge panels with face-rebated edges resting on bottom flanges of members, with panel surface extending below bottom flanges.

3.3 ADJUSTING AND CLEANING

- .1 After interior finishing work has been substantially completed, or when directed by *Consultant*, inspect acoustical treatment work. Replace broken, chipped or damaged work, reset loose units or units out of place and touch up marred surfaces with matching paint. Upon completion of *Project*, acoustical treatment finished surfaces shall be clean and free from dirt and other markings and in good condition acceptable to *Consultant*.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: Provide metal security ceilings including but not limited to following:
 - .1 metal security ceiling suspension system.
 - .2 metal ceiling panels.
 - .3 keyed security access panels.
 - .4 acoustical insulation pads.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 SYSTEM DESCRIPTION

- .1 Design basic steel material thickness for 'Heavy Duty' application in accordance with ASTM C635. Design suspension system to support safely, and without distortion, superimposed loads of:
 - .1 Lighting fixtures;
 - .2 Air supply diffusers, boots, fire alarm grilles, and exhaust and return air grilles;
 - .3 Design suspension system to accommodate movement caused by thermal expansion or contraction.
 - .4 Design and space hangers and carrying members to support entire ceiling system in locations indicated on *Drawings*.
- .2 Design suspension system to support lighting fixtures according to local hydro authorities and submit certification of acceptance..
- .3 Prepare panels for sprinkler head penetrations and suspension of other members from ceiling.
- .4 Design suspension system to support security access panels.
- .5 Coordinate installation and cooperate with Mechanical and Electrical *Subcontractors*, to accommodate mechanical and electrical items, or any

other work required to be incorporated in or coordinated with ceiling system.

1.5 SUBMITTALS

.1 *Product Data:*

- .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for *Project*. Data sheets shall provide all required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit manufacturer's installation instructions.
- .2 Submit manufacturer's descriptive literature or standard drawings showing details of system with *Project* conditions clearly identified, and manufacturer's recommended installation instructions.
- .3 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound, solid polymer and as designated later by *Consultant*.

.2 *Shop Drawings:* Submit *Shop Drawings* for work of this Section in accordance with Division 01. In addition to minimum requirements indicate following:

- .1 reflected ceiling plans, types of suspension systems and locations of all inserts and openings, termination of walls, lateral bracing methods, partitions, bulkheads, curtain tracks, mechanical fixtures, lighting fixtures, bulkheads, coves, and access panels. Identify ceiling panel type and suspension grid type.

.3 *Samples:* Submit samples in accordance with Division 01. Submit following samples in sizes indicated:

- .1 Submit 3 samples of each component of ceiling system to *Consultant* for review. Samples shall fully represent materials to be supplied in colour, texture, finish and construction.
- .2 Submit samples, independent load test data and design tables for each type of insert to be used on this *Project* for hanger supports.
- .3 Submit 300 mm (12") long samples of suspension system parts, including trim.
- .4 Submit 300 mm x 300 mm (12" x 12") samples of metal security ceiling panels.
- .5 Color chart: Submit manufacturer's standard color chart for selection of color.

.4 *Certificates:* Submit written certification from a full time professional structural engineer carrying a minimum \$2,000,000.00 professional liability insurance and is registered in the Territory of Nunavut, who shall affix his/her seal and signature to certificate, stating that suspended ceiling system is capable of supporting its own weight and weight of lighting fixtures, grilles, and other mechanical and electrical fixtures required by Division 15, Mechanical and Division 26, Electrical.

.5 Obtain approval of electric utility authorities having jurisdiction for ceiling grid and supports as related to support of light fixtures. Adjust

- grid, fixing devices and support hangers as required to obtain approval. Submit copy of approval in triplicate to *Consultant*.
- .6 Obtain and submit anchor manufacturer's certification for hanger anchors to be used, stating that anchors are suitable for hanger loading, spacing, and other conditions relating to use intended. Submit anchor manufacturer's printed instructions for anchor installation.
 - .7 Certification: Submit independent test data and certification attesting to ceiling panel's ability to meet or exceed specified STC ratings. Testing facility submitting data shall be independent and accredited agency acceptable to *Consultant*.
 - .8 Maintenance Data: Submit maintenance instructions to *Owner* for recommended cleaning materials and methods for panels and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

1.6 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section executed by competent installers with minimum of 5 years experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 Complete ceiling assemblies including panel and suspension system shall be fire rated and labelled in accordance with ULC Design number noted on *Drawings*.
- .3 Installed system shall provide a flame spread rating of 0-25 in accordance with ASTM E84.
- .4 Test Certificate: If requested, submit test results indicating that completed ceiling system will not deflect more than 1/360 of span.
- .5 Mock-ups:
 - .1 Erect in area designated at *Project*, a nominally 3000 mm x 4500 mm (10'-0" x 15'-0") typical sample installation. Modify sample installation as directed and as required to obtain approval.
- .6 Do not begin fabrication and erection of remainder of ceiling system until sample installation has been inspected and approved.
- .7 Approved sample installation shall represent standard of quality required for remainder of acoustical ceiling work.
- .8 When directed, remove and dispose of sample installation except where approval has been obtained for sample installation to become a part of final work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name.

- .2 Inspection: Promptly inspect delivered materials, file freight claims for damage during shipment, and order replacement materials, as required.
- .3 Store materials in a covered area, off ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from site.
- .4 Handling: Handle in such manner to ensure against racking, distortion, or physical damage of any kind.
- .5 Comply with ceiling panel manufacturer's recommendations regarding temperature and humidity conditions before, during and after metal security ceiling installation.

1.8 PROJECT CONDITIONS

- .1 Environmental Requirements: Continuously maintain rooms or areas scheduled to receive acoustical treatment at not less than 21 deg C (70 deg F), and at occupancy humidity, at least 3 Days prior to installation and 3 Days after work is completed. Schedule work to eliminate risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after work is installed.
- .2 Coordinate installation of wet trades, overhead work, mechanical and electrical work to be incorporated into metal ceiling tile work.

1.9 WARRANTY

- .1 Warrant work of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

1.10 MAINTENANCE

- .1 Spare Parts: At completion, place on Site as directed, a quantity representing 5% of security metal ceiling panels installed, and 2% of ceiling grid systems. Pack panels in suitably marked containers and store where directed for future use by Owner. Clearly identify containers listing types of panels. Note date. Execute "Document 00 65 37, Maintenance Material Form (Specimen)".

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Security Metal Ceiling system of following manufacturers are acceptable provided they meet requirements of Drawings, Schedules and Specifications:
 - .1 Simplex Ceiling Division of Intalite Ceiling Systems;
www.simplexceilings.com
 - .2 Steel Ceilings Inc. www.steelceilings.com
 - .3 Trussbilt; [www.trussbilt](http://www.trussbilt.com)

2.2 MATERIALS

- .1 Security Metal Ceiling System:
- .1 Basic Steel Material and Finish: ASTM A653M, Commercial quality cold rolled steel 1.2 mm 0.052" (18 ga) thick, galvanized to zinc coating designation Z275. Exposed surfaces of metal *Products* including security metal panels shall be factory finished with baked on enamel or polyester based powder coating in non-yellowing, low-sheen white to *Consultant's* acceptance. Provide paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in ceiling assemblies.
 - .2 Security Metal Ceiling System is based on Intalite Security Ceiling CLIP-ON system represented by Patry Products Inc. Toronto. System consisting of 25 mm (1") wide x 37 mm (1-1/2") high formed 1.99 mm (14 ga) steel, main T grid system and angle cross tee, 600 mm x 600 mm, (24" x 24") and 300 mm x 600 mm, (12" x 24"), 1.61 mm (16 ga) (0.052") steel panels with die formed stainless steel gravity clip and leaf springs to enable panels to have butt joints. Security ceiling panels shall have four (4) security clips per panel. Where specifically shown ceiling panels without security clips shall be only accessible from below with special tool. Security panels shall have finish specified herein and shall have perforations based on Intalite Pattern No: 2, 12% open, 0.0625' dia holes on 0.160' diagonal centres, with 0.240" un perforated border.
 - .3 Security Prefinished Metal Panels (ACT-2): 1.2 mm , 0.052" 18 gauge, 600 mm x 600 mm, (24" x 24") 300 mm x 600 mm, (12" x 24") prefinished galvanized security metal panels, with manufacturer's standard engagement features to provide positive engagement into primary and secondary suspension system. Provide panels with solid 6 mm border and 16% opening.
- .2 Suspension System Components:
- .1 Fabricate grid systems to ASTM C 635, for Heavy Duty, Commercial Quality, cold-rolled steel, exposed surfaces prefinished as previously specified.
 - .2 Cross Tees 610 mm (24") on center for 2 directional system or stabilizer bars 1220 mm (48") on center with 610 mm (24") cross tees at row ends when using 1 directional system.
 - .3 Hanger Wire: ASTM C635, commercial quality cold-rolled steel; exposed surfaces pre-finished in manufacturer's standard color.
 - .4 Primary Suspension: Runners shall be 1.64 mm (16 ga) minimum overall thickness zinc coating designation Z275 galvanized mild steel prefinished and punched to receive security metal panels.
 - .5 Secondary Suspension: Runners shall be 0.64 mm (24 ga) minimum overall thickness zinc coating designation Z275 galvanized mild steel prefinished and punched to receive security metal panels.
 - .6 Suspension Devices: Primary hangers 6 mm (1/4") threaded galvanized steel rods and rod hanger clips; Secondary hangers min 2.8 mm, 0.1084" (12 gsg) overall thickness galvanized steel wire to zinc coating designation Z275.
 - .7 Tie Wire: 16 ga, galvanized steel wire and aluminum as applicable.
 - .8 Inserts for Concrete Slabs: Further to ASTM C 754, inserts shall

be certified type for setting in concrete or self-drilling expansion inserts for placing afterwards. Acceptable *Products*; tie wire anchors; "Red Head TW-1614" by ITW Canada, Inc., or "Parabolt Wire Anchor" by Acrow Richmond, or "T-14 Eyebolt" by Ramset Ltd., or "Tire Wire Drive TW-932" by Isometric Ltd., or "Tie-Wire Anchor" by Hilti Corp. are acceptable.

.3 Accessories for Suspension System:

- .1 Complete with suspension devices, splices, clips, and perimeter moulding, of manufacturer's standard types to suit applicable conditions unless special conditions and access areas are shown or specified. Security clips shall snap tile on primary and secondary runners prohibiting access to plenum except thorough specified keyed access panels.
- .2 Keyed Security Access Panels: Security access 1.2 mm, 0.052" 18 ga panels and 1.64 mm (16 ga) frames from complete with stainless steel continuous hinge and security cylinder lock and key for locations shown matching security tile in every respect complete with acoustical insulation pad.

.4 Acoustical Insulation Pads: CAN/ULC-S702, nominal 50 mm x 300 mm x 600 mm (2" x 12" x 24") and 50 mm x 610 mm x 610 mm (2" x 24" x 24") semi-rigid fibrous glass pads, nominal density 17.62 kg/m³ (1.1 lbs./cf), noise reduction coefficient for 50 mm (2") thickness, enclosed in black pvc jacket suitable to fit tightly in each ceiling tile.

- .1 Filler Pieces: matching security metal tile in every respect to fit filler size.

PART 3 -EXECUTION

3.1 EXAMINATION

.1 Inspection:

- .1 Examine areas to receive materials for conditions that will adversely affect installation. Provide written report of unacceptable surfaces.
- .2 Do not start work until unsatisfactory conditions are corrected.
- .3 Ensure work above ceilings is complete, inspected and accepted by *Consultant* and authorities having jurisdiction before commencing installation. Verify work above ceiling suspension system is complete will not affect installation of security metal panels and suspension system components.

3.2 PREPARATION

- .1 Verify field dimensions prior to installation.

3.3 INSTALLATION

- .1 Standard Reference: *Install* in accordance with ASTM C636, CISCA installation standards, and other applicable code requirements.

- .2 Manufacturer's reference: *Install* acoustic security metal ceilings using tradesmen skilled in this class of work, in strict accordance with manufacturer's instructions and as specified herein.
- .3 *Drawing* reference: *Install* in accordance with reviewed *Shop Drawings*.
- .4 Neatly and symmetrically *Install* suspended ceiling to true lines, evenly balanced to pattern indicated on reflected ceiling *Drawings* or as directed. *Provide* a tolerance of L/360 of span. Allowable tolerance of finished ceiling system: 3 mm in 3600 mm (1/8" in 12'-0") and 0.25 mm (0.010") between adjacent metal members where exposed. Tolerances shall not be cumulative.
- .5 Accessibility shall be as indicated through keyed access panels.
- .6 Coordinate work with trades affected by work of this Section. *Provide* a layout of hangers and framing suitable to accommodate fittings and units of equipment. Failure to follow this procedure will require that hangers and framing be revised as necessary, without additional cost to *Owner*.
- .7 Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers and all related framing and furring as required to span greater distance without interference to mechanical or electrical items occurring in finished ceiling.
- .8 Pay cost of repair to damaged or disturbed adjacent work as a result of work of this Section.
- .9 Use laser equipment to lay out, align, and level ceiling system.
- .10 Where hanger is suspended from concrete slab, *Supply* and *Install* hangers or insert anchors in ample time or use hanger wire anchors as specified, in drilled holes.
- .11 Ensure that free ends of hangers are wrapped around vertical portion of hanger, or are double wire tied, at structure and tee.
- .12 Recessed objects shall be centred on panels, except where indicated otherwise. Consult with mechanical and electrical sections to coordinate work.
- .13 Secure hangers to structure. Hang suspended ceilings independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced avoid visible displacement of longitudinal axis or face plane of adjacent members.
- .14 *Provide* a row of hangers adjacent to and parallel with walls for support of ends of main tee runners at not more than 150 mm (6") mm from ends of runners. Lay directionally patterned panels one way with pattern parallel to longest floor axis unless otherwise directed.
- .15 *Install* components to form a level ceiling with all parts flush and true, parallel to module lines, and to pattern shown. *Install* panels in level, uniform plane free from twist, distortion, warp, dents, and flush, without gaps to exposed face of carrying members. Fit border units neatly against

- abutting surfaces. Cut tile shall be large enough to lap all edges of supporting grid or moulding by a minimum of 6 mm (1/4").
- .16 Do not support fixtures from primary main runners or secondary cross runners if weight of fixture causes total dead load to exceed deflection capability of suspension system. In such cases support fixture load by supplementary hangers located within 150 mm (6") of each corner, or support fixture independently. Do not *Install* fixtures so that main runners and cross runners will be eccentrically loaded. Where fixtures installation would produce rotation of runners, *Provide* stabilizer bars. *Provide* carrying channels to transfer fixture load to carrying members as required. Ensure that joints in suspension members do not occur at recessed fixture sides. Frame around recessed fixtures, diffusers, grilles and other openings. *Provide* allowance for thermal movement. *Fur* around ducts, beams and bulkheads as required.
 - .17 *Install* supporting inserts for hangers of suspended ceiling system into concrete slab above.
 - .18 Centre ceiling system on room axis unless otherwise thereon or directed leaving equal border panels not less than 1/2 a full width.
 - .19 Recessed items shall replace or be centred on panels, except where shown otherwise. Consult with Mechanical and Electrical Divisions to co-ordinate work. *Provide* additional supports where required.
 - .20 Space hangers for suspended ceilings to support grillage independent on walls, columns, pipes and ducts at maximum 1220 mm (4') centres along support grillage and not more than 150 mm (6") from ends. *Provide* additional hangers at light fixtures and diffusers.
 - .21 Attach hangers to inserts in overhead concrete slab. Bend top of hangers at right angles, turn down and securely fasten. Turn bottom of hangers upwards and securely wrap 3 times.
 - .22 Use longest practical lengths of tees, furring and running channels to minimize joints. Make joints square, tight, flush and reinforced with concealed splines. Assemble framework to form a rigid and interlocking system.
 - .23 Use edge moulding where ceiling abutts vertical surface.
 - .24 Use corner moulding along external edges at ceiling steps.
 - .25 Comply with ULC listings for fire rated ceiling system installations.
 - .26 In fire rated ceiling systems, completely enclose recessed fixtures with ceiling panels in manner approved by ULC. Ensure enclosures provide same fire rating as ceiling assembly.

3.4 CLEANING

- .1 Carefully examine work on completion and replace uneven or defective materials, eliminate all waves, remedy damaged exposed finished surfaces and remove soiled or stained areas.

- .2 Suspension: Remove infill material and perform any necessary cleaning maintenance with nonsolvent-based commercial cleaner.
- .3 Immediately remove any corrosive substances or chemicals that would attack painted finishes (i.e., wallpaper adhesives).
- .4 Touch up all minor scratches and spots, as acceptable, or replace damaged sections when touch-up is not permitted.
- .5 Painting: Repainting of suspension members shall be with a high-quality, solvent-based paint and applied as recommended by paint manufacturer.
- .6 Removal of debris: Remove all debris resulting from work of this section.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: Provide resilient sheet flooring including but not limited to following:
 - .1 Sheet vinyl flooring (SHV-1)
 - .2 preparing substrate
 - .3 moisture reducing barrier coating
 - .4 fast setting cement patching compound with high performance additive.
 - .5 reducing strips and thresholds at junction with adjacent architectural finishes.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
- .3 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
- .4 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable

- discipline. Consultant may attend.
- .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
 - .3 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:
 - .1 floor flatness and floor levelness requirements for Work of this Section installation and their acceptability by flooring manufacturer;
 - .2 surface texture of finished floor required for installation of Work of this Section;
 - .3 acceptable approaches to remediation of high moisture and high pH floors;
 - .4 adhesive application and floor covering installation.
 - .5 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project. Data sheets shall Provide all required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit manufacturer's installation instructions.
 - .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants,

patching and leveling compound, solid polymer and as designated later by Consultant.

- .2 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Division 01. Submit Shop Drawings for all areas showing seam layout for major seams between rolls, coving details, treatment at walls, floor drains, treatment where flooring meets dissimilar materials and all other special conditions. Obtain reviewed Shop Drawings from Consultant prior to commencement of laying resilient sheet flooring.
- .3 Samples:
 - .1 Submit samples in accordance with Division 01.
 - .2 Submit duplicate 300 mm x 300 mm (12" x 12") sample pieces of sheet material. Where applicable nosing, feature strips, edge strips and applicable accessories.
 - .3 Submit samples for welding rod, each type of seam specified, to indicate quality of joint treatment and each type of flooring accessory.
- .4 Site Quality Control Submittals: Submit a diagram of area showing locations and results of each of the following tests as required by pre-installation testing:
 - .1 Calcium chloride test
 - .2 Acidity and alkalinity test
- .5 Relative humidity test
Operating and Maintenance Instructions Manual: Provide maintenance data for resilient flooring for incorporation into maintenance manual specified in Division 01.

1.6 QUALITY ASSURANCE

- .1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of Products, systems and assemblies specified, including 2 years in heat welding of seams and with approval and training of the Product manufacturers. Upon request, Provide proof of manufacturer's certificate to Consultant prior to commencement of installation.
- .2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
- .3 Site Sample Mock-Up Area:
 - .1 Lay a typical interior flooring area of approximately 10 m² (100 sq ft) in a permanent location designated by Consultant. Site sample Mock-Up area shall include 2 steps, each threshold condition, fused joint treatment and perimeter joint sealant.
 - .2 All pertinent remarks, observations and recommendations shall be discussed in presence of all participants shall be recorded.
 - .3 Sample flooring area, once accepted, including recorded remarks and recommendations shall become a permanent part of Project and shall

be the standard of workmanship against which balance of resilient sheet flooring work will be judged.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays. Deliver materials in good condition to site in manufacturer's original unopened containers that bears name and brand of manufacturer, Project identification, shipping and handling instructions.
- .2 Store on site in designated space at minimum temperature of 20 deg C (68 deg F) for period of 48 hours immediately prior to, during and after installation. Store sheet goods on ends of rolls only.

1.8 PROJECT CONDITIONS

- .1 Environmental Requirements: Air temperature and structural base temperature at flooring installation are shall be above 20 deg C (68 deg F) for 72 hours before, during and 48 hours after installation. Allow flooring materials and application adhesives to acclimatize to these temperatures for 48 hours.
- .2 Do not allow traffic on floor for following duration of time (after installation): 24 hours for walking traffic; 48 hours for light static loads; and 72 hours for heavy traffic or static loads.

1.9 WARRANTY

- .1 Warrant work of this Section against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant. Include in warranty costs of complete system replacement of affected areas involved and at no expense to Owner.
 - .1 Flooring material: for period of 5 years. Defects include but are not limited to: shrinkage, cracking, buckling, splitting, opening of seams, and extensive colour fading.
 - .2 Adhesive material and workmanship: Full system replacement non pro-rated warranty for period of 10 years. Defects include but are not limited to: bond failure or delamination, blistering, re-emulsification and other symptoms of adhesive failure.

1.10 MAINTENANCE

- .1 Extra Materials: Supply to Owner at completion of job, 3% gross area as spare flooring of each colour, packaged in original cartons. Maintenance materials shall be same production run as installed materials.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Armstrong World Industries Canada Ltd.; www.armstrong.com
 - .2 Altro Limited; www.altrofloors.com
 - .3 Forbo Flooring Inc. www.forboflooringna.com
 - .4 Lonseal, Inc.; www.lonseal.com
 - .5 Tarkett Inc.; www.tarkett.com
 - .6 Toli International; www.toli.com
- .2 Underlayment and accessories
 - .1 Ardex Engineered Cements; www.ardex.com
 - .2 W.W. Henry Co.; www.wwhenry.com
 - .3 Koster American Corporation; www.koesterusa.com
 - .4 Mapei Inc.; www.mapei.com
- .2 Substitution Limitations: This Specification is based on Tarkett Products. Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Fire-Test-Response Characteristics: Provide Products with following flame spread rating and smoke developed rating when tested in accordance with following standards:
 - .1 Conform to NBCC requirements for internal finishes; Surface burning characteristics to CAN/ULC-S102.2-M.
 - .2 Conform to NFPA 101 and requirements of authorities having jurisdiction for critical radiant flux limitations in exits and in accesses to exits.
 - .3 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm² - Class I
 - .4 Smoke Developed (ASTM E662): ≤ 450
 - .2 Design and Performance Requirements:
 - .1 Provide resilient vinyl sheet flooring as specified herein complete with preparation of substrate, moisture reducing barrier coating, metal reducing strips and thresholds at junction with adjacent architectural finishes and other accessories to complete flooring to meet design requirements.
 - .2 Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects. Comply with applicable regulations regarding VOC (volatile organic compound) content of adhesives.
 - .3 Static Coefficient of Friction: Ensure floor surfaces are stable, firm and slip resistant. Ensure slip resistant surfaces provide sufficient frictional counterforce to forces exerted in walking in order to permit safe ambulation. Provide Products with the following minimum values as determined by ASTM D2047 unless otherwise indicated:
 - .1 Level Surfaces: Minimum 0.6.
 - .2 Ramp Surfaces: Minimum 0.8.
 - .4 Critical Radian Flux of 0.45 watts per cm² or greater, Class I in

- accordance with ASTM E648.
- .5 Smoke Generation, Maximum Specific Optical Density of 450 or less in accordance with ASTM E662.
- .6 Vinyl sheet Flooring shall have treatment to inhibit growth of bacteria including Methicillin Resistant Staphylococcus Aureus (MRSA) commonly known as 'staph' to avoid skin infection.

2.3 MATERIALS

- .1 Homogenous sheet vinyl flooring shall have treatment to inhibit growth of bacteria including Methicillin Resistant Staphylococcus Aureus (MRSA) commonly known as 'staph' to avoid skin infection.
- .2 Homogeneous Sheet Vinyl Flooring (SHV-1):
 - .1 ASTM F1913, 2.00 mm (0.080") thick, non-backed, non-layered, homogenous vinyl composition composed of polyvinyl chloride resin, stabilizers, fillers and pigments for use on approved slab on grade and suspended floors, maximum 10 colours and Product design selected by Consultant from manufacturer's full colour range.
 - .2 Acceptable Products: "Optima" by Tarkett Inc. or approved equivalent.
- .3 Base: Refer to Section 09 65 30.
- .4 Sheet Vinyl Safety Flooring: Refer to Section 09 65 17.
- .5 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:
 - .1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m² (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.
 - .2 Final Product selection to suit condition encountered at time of installation. Where applicable, Provide manufacturer's floor leveling systems for use with specified Products.
 - .3 Provide 1 of following:
 - .1 "Planiseal Series - Moisture Barrier Systems" by MAPEI Inc.;
 - .2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;
 - .3 "Koester VAP I - 2000" by Koester USA Moisture Control System.
 - .4 Approved proprietary equivalent moisture control system recommended in writing by floor covering manufacturer and approved by Consultant in order to authenticate floor covering warranties.
- .6 Underlayment: Latex/cement/sand patching compound compatible with resilient flooring and associated adhesives; self drying, trowelable, by Armstrong World Industries Canada Ltd., or by Mapei Canada Inc. or by "ARDEX Feather Finish" by Ardex Engineered Cements or by Koester USA Moisture Control System by Koester American Corporation. Do not use gypsum based materials.

- .7 Sub-Floor Filler for smoothing, patching, filling cracks, holes, voides and depression: Fast setting cementitious patching compound requiring water only to produce cementitious paste to manufacturer's recommendations. "Plani/Patch" by Mapei Inc. or primer, sealer, crack and joint filler, smoothing compound, by Ardex Engineered Cements; or Koester USA Moisture Control System by Koester American Corporation.
- .8 Admixture: Acrylic latex additive used with fast setting cementitious patching compound for superior cohesive strength and extend pot life of sub-floor filler, "Patch Enhancer by Mapei Inc. or by Ardex Engineered Cements or by Koester USA Moisture Control System by Koester American Corporation.
- .9 Sub-Floor Leveler for leveling out of tolerance floors to be "Ultraplan Easy" by MAPEI Inc., or approved Product by Ardex Engineered Cements or Koester American Corporation.
- .10 Primers and Adhesives: Low VOC, Waterproof, of types recommended by rubber flooring manufacturer and compatible with applied curing material for specific material on applicable substrate, above, on or below grade. Following types are acceptable:
 - .1 Concrete Substrates: "Ultrabond Eco 360" by Mapei Canada Inc or approved equivalent by Ardex Engineered Cements or Koester American Corporation or approved equivalent recommended in writing by manufacturer.
- .11 Metal Edge Strips: Aluminum extruded, smooth, mill finish and polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

Solid Polymer Door Thresholds (Staff Shower): Refer to Section 06 61 16; Solid Polymer Fabrications. Provide tamper-resistant sealant at junction between thresholds and adjacent flooring. Conform to requirements of Section 07 92 00.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Ensure concrete is aged minimum 6 weeks and floors are fully cured. Verify concrete floor dryness by using test methods recommended by flooring manufacturer.
- .2 Verify curing, hardening or other admixtures have been used and if used ensure these compounds have been removed.
- .3 Installation of flooring shall be considered an acceptance of surfaces to be covered. If repair of surfaces is required after commencement of flooring work it shall be included as part of The Work specified herein.
- .4 Substrates shall be:
 - .1 dry and clean;

- .2 free of depressions, raised areas or other defects which would telegraph through installed flooring;
- .3 temperature of resilient flooring and substrate shall be within specified tolerances;
- .4 perform moisture and adhesive bond test.
- .5 Perform adhesive bond test in each major area, minimum 1 per 93 m² (1000 sq ft), prior to installation. Examine after 72 hours to determine whether bond is solid and no moisture is present. Do not proceed with work until results of bond test are acceptable.

- .5 Concrete shall have dampness no greater than recommended by flooring and adhesive manufacturers when tested with moisture meter. Where floors exhibit negative alkalinity, carbonization or dusting conform to manufacturers' recommendations for removal of these elements detrimental to work.

- .6 Be responsible to report conditions contrary to requirements that would prevent proper installation. Do not commence with Work until unsatisfactory conditions have been corrected.

- .7 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of Work shall imply acceptance of substrate with regard to conditions of substrate at time of installation.

- .8 Pre-Installation Testing:
 - .1 Calcium Chloride Test:
 - .1 Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of resilient strip flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.
 - .2 Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Moisture emission from concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours. Do not proceed with installation until moisture problems have been corrected. Provide results to Consultant in writing prior to commencement of installation.
 - .2 Acidity and Alkalinity Test:
 - .1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.
 - .2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.
 - .3 Relative Humidity Test:
 - .1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior

- to measuring concrete relative humidity.
- .2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.
 - .3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. Provide results to Consultant prior to commencement of installation.

3.2 PREPARATION

- .1 Prepare concrete floors to receive resilient sheet flooring in accordance with requirements of ASTM F710. Consultant individual manufacturer for their specific recommendations and follow them as required.
- .2 Clean floor free of paint, oil, dirt or any other foreign matter detrimental to sheet flooring application. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor approved filler.
- .3 Moisture Barrier:
 - .1 Apply moisture reduction barrier at following locations, where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing:
 - .1 Concrete slabs scheduled to receive moisture sensitive flooring.
 - .2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).
 - .3 Apply moisture barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.
 - .4 Do not proceed with work until unsatisfactory conditions have been resolved.
 - .4 Clean floor and apply fast setting cement based compound filler mixed with high performance acrylic latex additive to form skim coat; fill low spots, cracks, joints, holes and other defects with sub-floor filler; trowel and float to leave smooth, flat hard surface ready for direct glue down installation of floor covering. Prohibit traffic until filler has cured.
 - .5 Vacuum, prime and seal substrate to resilient sheet flooring manufacturer's recommendations.

3.3 INSTALLATION

- .1 Resilient Sheet Flooring:

- .1 Install resilient sheet flooring in accordance with manufacturer's written installation procedures and as specified herein. Mix and apply adhesives to manufacturer's recommendations.
- .2 Install flooring wall to wall before installation of floor set cabinets, casework, furniture, equipment and fixed partitions.
- .3 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .4 Seams:
 - .1 Lay resilient sheet flooring using heat seam and welding rod process. Prepare heat welded seams with special tool for this purpose and heat weld with vinyl welding rod in seams.
 - .2 Use method and sequence of work in conformance with approved Shop Drawings and in conformance with manufacturer's recommendations.
 - .3 Finish seams flush and free from voids, recesses and raised areas. Lay flooring (with seams parallel to building lines) to produce a minimum number of seams. In corridors center flooring along length of corridor with equal amounts of material on each side resulting in 2 seams.
 - .4 Border widths minimum 1/3 width of full material. Lay sheet flooring true, level and with even tight joints. Fit borders accurately as required.
- .5 Run sheets parallel to length or width of room as approved. Double cut sheet joints and continuously seal. Avoid excessive overlapping as it may result in insufficient adhesive after removing cut piece. Confirm adequate adhesive transfer before sealing.
- .6 As installation progresses, roll flooring with 45 kg (100 lb) roller to ensure full adhesion. Keep edges of sheet flooring at seams devoid of extra adhesive.
- .7 Cut flooring neatly around fixed objects. Provide borders around permanent fixtures.
- .8 Install floor markings where indicated. Fit joints tightly.
- .9 Install flooring in pan type floor access covers with recommended adhesive for specific application. Maintain floor pattern.
- .10 Continue flooring over areas which will be under built-in furniture.
- .11 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .12 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .13 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.4 CLEANING

- .1 Remove excess adhesive from floor and wall surfaces without damage.
- .2 Clean, seal and wax floor surface to flooring manufacturer's instructions.

3.5 PROTECTION

- .1 In laboratories protect installed with minimum 1 layer of kraft paper, joints taped, covered with minimum 3 mm (1/8") thick masonite board, joints taped.
- .2 Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades or placement of fixtures and equipment.
- .3 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* resilient sheet safety flooring including but not limited to following:
 - .1 substrate preparation.
 - .2 moisture reducing barrier coating
 - .3 resilient homogenous safety sheet flooring
 - .4 reducing strips and thresholds at junction with adjacent architectural finishes.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with other related Sections.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: *Provide* pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for *Project* site meeting of parties associated with work of this Section, including non-exhaustively *Subcontractor* performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. *Consultant* may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities

relative to:

- .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:
- .1 floor flatness and floor levelness requirements for flooring installation and their acceptability by flooring manufacturer;
 - .2 surface texture of finished floor required for flooring installation;
 - .3 acceptable approaches to remediation of high moisture and high pH floors;
 - .4 adhesive application and floor covering installation.
- Scheduling:
- .4 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .5 Cooperate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .6 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location thereof.
 - .7 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 **Product Data:** Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 **Material Safety Data Sheets:** Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound, and other materials designated later by Consultant.
- .3 **Shop Drawings:**
 - .1 Submit *Shop Drawings* for work of this Section in accordance with Division 01. Submit *Shop Drawings* for all areas showing the following:
 - .1 seam layout;
 - .2 coving details, treatment at walls and floor drains;

- .3 treatment where flooring meets dissimilar materials and all other special conditions.
- .2 Obtain reviewed *Shop Drawings* from *Consultant* prior to commencement of resilient flooring application.
- .4 Samples:
 - .1 Submit 450 mm 450 mm (18" x 18") samples of specified sheet flooring with centre seam, 1 sample for each type of seam specified herein, to indicate quality of joint treatment.
 - .2 Submit additional samples, if required, until approval is obtained.
 - .3 Identify samples with description of material, *Project* name and number.
 - .4 Approved samples shall serve as standard of quality for installed work. Installed areas which, in opinion of *Owner*, are inferior to approved samples shall be replaced.
 - .5 Test Reports: If requested, submit test reports from recognized approved independent testing laboratory for following requirements:
 - .1 Static Coefficient of Friction (SCOF) of minimum 0.6 on level surface and 0.8 on ramps in accordance with ASTM D2047.
- .5 Maintenance Data: Submit a maintenance manual to the *Owner*. Contribute to this manual complete, detailed and specific instructions for maintaining, preserving and keeping clean surfaces of this work and which give adequate practices or material detrimental to safety sheet flooring.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Application of materials shall be by an approved firm using trades person experienced and skilled installation of resilient safety flooring with heat welded joints. Work shall be under the supervision of a competent foreman at all times. If requested, submit history of successful applications for this type of work.
- .2 Colour Uniformity: Sheet flooring used shall be from consecutive manufacturing process to maintain consistent colour match between adjacent sheets. Installed areas showing undue colour variation, in the opinion of the *Owner*, shall be replaced.
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
- .4 Site Sample *Mock-Up* Area:
 - .1 Lay safety sheet flooring area of approximately 9 m² (100 sq ft) in a permanent location designated by *Consultant*. Site sample *Mock-Up* area shall include threshold condition, fused joint treatment and perimeter joint sealant.
 - .2 Sample flooring area, once accepted, shall become a permanent part of *Project* and shall be the standard of workmanship against which balance of safety sheet flooring work will be judged.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Store materials in areas designated by *Owner*. Protect materials from damage.

1.8 PROJECT CONDITIONS

- .1 Environmental Requirements:
 - .1 Ensure air temperature and structural base temperature at time of flooring installation is above 20 deg C (68 deg F) for 72 hours before, during and 48 hours after installation. Allow flooring materials and application adhesives to acclimatize to these temperatures for 48 hours.
 - .2 Do not allow traffic on floor for following duration of time (after installation): 24 hours for walking traffic; 48 hours for light static loads; and 72 hours for heavy traffic or static loads.
 - .3 Give minimum 1 week's notice to *Owner* prior to working near stored food.

1.9 SCHEDULING

- .1 Conform to Preliminary Schedules and Sequence of *Work* installation specified and to approved preliminary schedule.

1.10 WARRANTY

- .1 Warrant work of this Section against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant. Include in warranty costs of complete system replacement of affected areas involved and at no expense to *Owner*.
 - .1 Flooring material: for period of 5 years. Defects include but are not limited to: shrinkage, cracking, buckling, splitting, opening of seams, and extensive colour fading.
 - .2 Adhesive material and workmanship: Full system replacement non pro-rated warranty for period of 10 years. Defects include but are not limited to: bond failure or delamination, blistering, re-emulsification and other symptoms of adhesive failure.

1.11 MAINTENANCE

- .1 Extra Materials: Supply to *Owner* at completion of job, 3% gross area as spare flooring of each colour, packaged in original cartons. Maintenance materials shall be same production run as installed materials.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, Schedules and *Specifications*:
 - .1 Flooring:
 - .1 Altro Limited; www.altrofloors.com

- .2 Underlayment and accessories:
 - .1 Ardex Engineered Cements; www.ardex.com
 - .2 W.W. Henry Co.; www.wwhenry.com
 - .3 Koster American Corporation; www.koesterusa.com
 - .4 Mapei Inc.; www.mapei.com
 - .5 Armstrong World Industries Canada Ltd.; www.armstrong.com
- .2 Substitution Limitations: This Specification is based on Altro Products. Comparable *Products* from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Fire-Test-Response Characteristics: Provide Products with following flame spread rating and smoke developed rating when tested in accordance with following standards:
 - .1 Conform to NBCC requirements for internal finishes; Surface burning characteristics to CAN/ULC-S102.2-M.
 - .2 Conform to NFPA 101 and requirements of authorities having jurisdiction for critical radiant flux limitations in exits and in accesses to exits.
 - .3 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm² - Class I
 - .4 Smoke Developed (ASTM E662): ≤ 450
- .2 Design and Performance Requirements:
 - .1 Provide resilient sheet safety flooring as specified herein complete with preparation of substrate, moisture reducing barrier coating, metal reducing strips and thresholds at junction with adjacent architectural finishes and other accessories to complete flooring to meet design requirements.
 - .2 Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects. Comply with applicable regulations regarding VOC (volatile organic compound) content of adhesives.
 - .3 Ensure safety sheet flooring provided contain treatment to inhibit growth of bacteria including Methicillin Resistant Staphylococcus Aureus (MRSA) commonly known as 'staph' to avoid skin infection.
 - .4 Static Coefficient of Friction: Ensure floor surfaces are stable, firm and slip resistant. Ensure slip resistant surfaces provide sufficient frictional counterforce to forces exerted in walking in order to permit safe ambulation. Provide Products with the following minimum values as determined by ASTM D2047 unless otherwise indicated:
 - .1 Level Surfaces: Minimum 0.8.
 - .2 Ramp Surfaces: Minimum 0.8.

2.3 MATERIALS

- .1 Sheet Flooring (SHV-1): Refer to Section 09 65 16.
- .2 Safety Sheet Flooring (SHV-S1 and SHV-S3): Not used.

- .3 Safety Sheet Flooring (SHV-S2 and SHV-S4): ASTM F1303, minimum 2.0 mm (0.080") thick, abrasive polyvinyl chloride containing silicone carbide on surface, aluminum oxide grit and silica quartz aggregate throughout full thickness.
 - .1 Chemical Resistance: Unaffected by surface water and most of chemicals.
 - .2 Slip Resistance: ASTM D2047, minimum 0.8.
 - .3 Static Load Capacity (ASTM F970): > 10.3 MPa (1500 psi).
 - .4 Indentation resistance: In accordance with ASTM F1303.
 - .5 Colour selected by Consultant from manufacturer's standard colour range.
 - .6 Acceptable Products:
 - .1 SHV-S2: "Altro Walkway Plus 20" by Altro Limited or approved equivalent.
 - .2 SHV-S4: "Altro Aquarius" by Altro Limited or approved equivalent.
- .4 Base: Refer to Section 09 65 30.
- .5 Accessories, Filler Mix and Admixture:
 - .1 Sheet Flooring Primers and Adhesives: Waterproof type recommended by resilient sheet safety flooring manufacturer.
 - .2 Seam Welding Rod: PVC rod of colour to match sheet flooring, supplied by resilient sheet safety flooring manufacturer.
 - .3 Concrete Filler Mix: Cement based underlayment mix, as recommended by resilient sheet safety flooring manufacturer. Latex/cement/sand patching compound compatible with resilient flooring and associated adhesives; self drying, trowelable, by Armstrong World Industries Canada Ltd., or by Mapei Canada Inc. or by "ARDEX Feather Finish" by Ardex Engineered Cements or by Koester USA Moisture Control System by Koester American Corporation. Do not use gypsum based materials.
 - .4 Sub-Floor Filler for smoothing, patching, filling cracks, holes, voids and depression: Fast setting cementitious patching compound requiring water only to produce cementitious paste to manufacturer's recommendations. "Plani/Patch" by Mapei Inc. or primer, sealer, crack and joint filler, smoothing compound, by Ardex Engineered Cements; or Koester USA Moisture Control System by Koester American Corporation.
 - .5 Admixture: Acrylic latex additive used with fast setting cementitious patching compound for superior cohesive strength and extend pot life of sub-floor filler, "Plani/Patch Plus" by Mapei Inc. or by Ardex Engineered Cements or by Koester USA Moisture Control System by Koester American Corporation.
- .6 Primers and Adhesives: Low VOC, Waterproof, of types recommended by rubber flooring manufacturer and compatible with applied curing material for specific material on applicable substrate, above, on or below grade. Following types are acceptable:
 - .1 Concrete Substrates: "Ultrabond Eco 360" by Mapei Canada Inc or approved equivalent by Ardex Engineered Cements or Koester American Corporation or approved equivalent recommended in writing by manufacturer.

- .7 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:
- .1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m² (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.
 - .2 Final *Product* selection to suit condition encountered at time of installation. Where applicable, Provide manufacturer's floor leveling systems for use with specified Products.
 - .3 *Provide* 1 of following:
 - .1 "Planiseal Series - Moisture Barrier Systems" by MAPEI Inc.;
 - .2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;
 - .3 "Koester VAP I - 2000" by Koester USA Moisture Control System.
 - .4 Approved proprietary equivalent moisture control system recommended in writing by floor covering manufacturer and approved by *Consultant* in order to authenticate floor covering warranties.
 - .8 Floor Sealing Compound: *Supply* acrylic floor sealer as recommended by resilient sheet safety flooring manufacturer.
 - .9 Edging Strip: Provide gulley Angle for edging resilient sheet safety flooring at maintenance holes, trenches, grease traps and locations where new material cannot be heat welded. Allow Consultant to choose profile and colour at a later date.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Ensure concrete floors are fully cured. Verify concrete floor dryness by using test methods recommended by flooring manufacturer.
- .2 Verify curing, hardening or other admixtures have been used and if used ensure these compounds have been removed.
- .3 Installation of flooring shall be considered an acceptance of surfaces to be covered. If repair of surfaces is required after commencement of flooring work it shall be included as part of *The Work* specified herein.
- .4 Substrates shall be:
 - .1 dry and clean;
 - .2 free of depressions, raised areas or other defects which would telegraph through installed flooring;
 - .3 temperature of resilient flooring and substrate shall be within specified tolerances;
 - .4 perform moisture and adhesive bond test.
 - .5 Perform adhesive bond test in each major area, minimum 1 per 93 m²

(1000 sq ft), prior to installation. Examine after 72 hours to determine whether bond is solid and no moisture is present. Do not proceed with work until results of bond test are acceptable.

- .5 Concrete shall have dampness no greater than recommended by flooring and adhesive manufacturers when tested with moisture meter. Where floors exhibit negative alkalinity, carbonization or dusting conform to manufacturers' recommendations for removal of these elements detrimental to work.
- .6 Be responsible to report conditions contrary to requirements that would prevent proper installation. Do not commence with *Work* until unsatisfactory conditions have been corrected.
- .7 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of *Work* shall imply acceptance of substrate with regard to conditions of substrate at time of installation.
- .8 Pre-Installation Testing:
 - .1 Calcium Chloride Test:
 - .1 Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of resilient strip flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.
 - .2 Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Moisture emission from concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* in writing prior to commencement of installation.
 - .2 Acidity and Alkalinity Test:
 - .1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.
 - .2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.
 - .3 Relative Humidity Test:
 - .1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior to measuring concrete relative humidity.
 - .2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.
 - .3 Ensure relative humidity probe test results do not exceed 75%

unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* prior to commencement of installation.

3.2 PREPARATION

- .1 Do not commence sawcutting and grinding work until temporary dust screens have been properly installed.
- .2 Clean floor free of paint, oil, dirt or any other foreign matter detrimental to sheet flooring application.
- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Mix and apply concrete filler mix in accordance with manufacturer's directions.
- .4 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler has cured.
- .5 Vacuum, prime and seal substrate to safety sheet flooring manufacturer's recommendations.
- .6 Test For Compatibility of Primers and Adhesives:
 - .1 Test compatibility and suitability of primers and adhesives where applied to existing floor finishes.
 - .2 If primer and/or adhesive are not compatible, consult safety sheet flooring manufacturer for alternative solution.
- .7 Moisture Barrier:
 - .1 Apply moisture reduction barrier at following locations, where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing:
 - .1 Basement slabs, Slabs-on-grades and Suspended slabs.
 - .2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).
 - .3 Apply moisture barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.
 - .4 Do not proceed with work until unsatisfactory conditions have been resolved.
- .8 Clean floor and apply fast setting cement based compound filler mixed with high performance acrylic latex additive to form skim coat; fill low spots, cracks, joints, holes and other defects with sub-floor filler; trowel and float to leave smooth, flat hard surface ready for direct glue down installation of floor covering. Prohibit traffic until filler has cured.
- .9 Vacuum, prime and seal substrate to resilient sheet flooring manufacturer's recommendations.

3.3 INSTALLATION

- .1 Ensure floor surface is thoroughly dry and clean before commencing installation.
- .2 Laying Safety Sheet Flooring:
 - .1 Lay safety sheet flooring in full rolls where possible to minimize seams. Major seams shall be in locations shown on *Shop Drawings* with staggered end joints.
 - .2 Roll back 1/2 of each sheet longitudinally, away from seam.
 - .3 Apply primer and then adhesive to floor substrate. Apply only to areas which can be covered with safety sheet flooring during same work shift.
 - .4 Spread adhesive evenly over entire field of substrate. Use sufficient workmen to accomplish adhesive operation consistent with adhesive open time.
 - .5 Roll sheets into place, smoothing out trapped air working towards seams. Keep edges of safety sheet flooring at seams free of adhesive.
 - .6 Overlap adjacent sheets and double cut to form a tight, square, flat joint without gaps.
 - .7 Roll back unbonded half of safety sheet flooring and adhere to substrate using same method as for previously bonded half.
 - .8 After laying, roll sheet flooring with 70 kg (150 lb) roller in both directions working from centre towards seams.
 - .9 Remove surplus adhesive and joint burrs from joint faces prior to adhesive setting.
 - .10 Terminate flooring at centre line of door in openings where adjacent floor finish or colour is dissimilar. Ensure smooth transition.
 - .11 Where sheet safety flooring terminates at exterior doors with thresholds or transition trim, feather flooring as required to achieve maximum allowable distance of 13 mm (1/2") between flooring and top of threshold or transition trim. Extend sheet safety flooring a minimum of 13 mm (1/2") under threshold and apply sealant to perimeter of threshold.
 - .12 *Install* metal edge strips at unprotected or exposed edges where flooring terminates. Provide gully angle at interior edge of flooring where new material cannot be heat welded.
 - .13 Hot weld all inside and outside corners. At sunken locations include for 25 mm (1") deep saw cut chase set back about 100 mm (4") from edge. Bed 25 mm x 25 mm (1" x 1") gully edging strip in adhesive in chase. Hot weld other edge to resilient sheet safety flooring.
 - .14 *Provide* water-tight seal to all pipes and projections coming through floor, using sealing compound.
- .3 Seam Welding:
 - .1 Groove abutting edges of seams to approximately 2/3 of the thickness of the safety sheet flooring to form a uniform, continuous semi-circular groove. Weld seams continuously with welding rod using electrically powered welding gun, set at correct temperature and operate at proper speed to ensure a complete fusion weld of rod and sheet material.
 - .2 When welds have cooled, check to ensure fusion and then trim with

trimming tool to true, flat surface.

- .4 Co-ordinate and supervise Division 22 in choice and installation of suitable floor drains with integral clamping rings.

3.4 CLEANING

- .1 After installation of floor covering in each area or room, clean floor surface with machine scrubber using cleaning solution recommended by safety sheet flooring manufacturer. Remove surface water with mops.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* resilient base including but not limited to following:
 - .1 Resilient base (RB)
 - .2 surface fillers, primer and adhesive
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,

- .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:
- .1 floor flatness and floor levelness requirements for flooring and base installation and their acceptability by flooring manufacturer;
 - .2 surface texture of finished floor required for flooring and base installation;
 - .3 acceptable approaches to remediation of high moisture and high pH floors;
 - .4 adhesive application and floor covering installation.
- Scheduling:
- .3 Scheduling:
- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
 - .1 Submit data sheets for each type of resilient bases, resilient base adhesive, surface fillers and primers.
- .2 Samples: Submit samples in accordance with Division 01.
 - .1 Submit duplicate 610 mm (2'- 0") long sample of each type of resilient bases.

1.6 QUALITY ASSURANCE

- .1 **Manufacturer's Qualifications:** Manufacturer shall have 5 years' experience in successful manufacture and fabrication of flooring bases of types and quality shown and specified herein. Submit proof of experience upon request
- .2 **Applicator Qualifications:** Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified, including 2 years in heat welding of seams and with approval and training of the Product manufacturers. Upon request, submit proof of manufacturer's certificate to Consultant prior to commencement of installation.
- .3 **Single Source Responsibility:** Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers
- .4 **Mock-Up:**
 - .1 Install minimum 12'-0" (3600 mm) long sections of each type of resilient base (2 inside and 2 outside corners) as directed at the site by Consultant. Do not proceed with resilient base work until quality control Mock-Up has been reviewed and accepted by Consultant.
 - .2 Reviewed and accepted quality control Mock-Up to be retained and serve as minimum acceptable standard for the resilient base work. Incorporate quality control Mock-Up into finished resilient base work if accepted by Consultant.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in good condition to site in manufacturer's original unopened containers that bears name and brand of manufacturer, *Project* identification, shipping and handling instructions.
- .2 Store on site in designated space at minimum temperature of 20 deg C (68 deg F) for period of 48 hours immediately prior to, during and after installation. Store goods in rolls only.

1.8 PROJECT CONDITIONS

- .1 *Provide* each flooring *Product* in accordance with manufacturer's recommended tolerances for:
 - .1 Substrate moisture content.
 - .2 Temperature and ventilation.
 - .3 Maintain Relative Humidity at application to % recommended by manufacturer when tested in accordance with ASTM F2170.
- .2 **Environmental Requirements:** Air temperature and structural base temperature at base installation are shall be above 20 deg C (68 deg F) for 72 hours before, during and 48 hours after installation. Allow base materials and application adhesives to acclimatize to these temperatures for 48 hours.

1.9 WARRANTY

- .1 Warranty resilient bases for a period of 3 years from date of *Substantial Performance of the Work* against defects and/or deficiencies in accordance with General Conditions of the *Contract*. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects include but are not limited to: failure in adhesive bond and extensive colour fading.

1.10 MAINTENANCE

- .1 Extra Materials: *Supply* to *Owner* at completion of job 6000 mm (20'-0") of coil stock of each type of resilient base in colours specified for future repairs, boxed in original containers and clearly labeled. Extra stock shall be same production run as installed *Products*. Store extra stock in location as directed later by *Consultant*.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 Flexco; www.flexcoFloor.com
 - .2 Johnsonite A Tarkett Company Inc.; www.johnsonite.com
 - .3 Roppe.; www.roppe.com
 - .4 American Biltrite (Canada) Ltd; www.american-biltrite.com
- .2 Substitution Limitations: This Specification is based on *Products* from manufacturers listed herein. Comparable *Products* from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Surface burning characteristics: *Provide Product* with following flame spread rating and smoke developed rating when tested in accordance with following standards:
 - .1 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm² - Class I
 - .2 Smoke Developed (ASTM E662): ≤ 450
 - .3 CAN/ULC-S102.2-M: Maximum Flame Spread: 100.

2.3 MATERIALS

- .1 Rubber Toe Base (RB-1): ASTM F1861, PVC free, Type TS (rubber, vulcanized thermoset) or TP (thermoplastic rubber), Group 1 (solid, homogeneous); smooth surface with following characteristics:
 - .1 Styles: cove (base with toe).
 - .2 Thickness: minimum 3.2 mm (0.125") thick
 - .3 Height: 100 mm (4") or as indicated on drawings/schedules.
 - .4 Lengths: Coils in manufacturer's standard length.

- .5 Corners: pre-manufactured inside and outside corners as recommended by resilient base manufacturer.
- .6 Colours: selected by *Consultant* from manufacturer's full range including designer colours.
- .7 Acceptable *Products*:
 - .1 "Rubber Wall Base" by Johnsonite,
 - .2 "Marathon Rubber Cove Base" by American Biltrite (Canada) Ltd.,
 - .3 "Pinnacle Rubber Wall Base" by Roppe
 - .4 "Wallflowers Rubber Wall Base" by Flexco.
- .2 Surface fillers and primers: Types and brands approved, acceptable to resilient base manufacturers for applicable conditions. Use non-shrinking latex compound.
- .3 Resilient base adhesives: Best quality, waterproof, clear setting type and brands as recommended by resilient base manufacturer and meeting VOC limits stipulated herein.
- .4 Joint Sealant: Provide CAN/CGSB-19.24-M, multi-component modified urethane base chemical curing sealing material compatible with adjacent materials finish and as recommended by resilient base manufacturer.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Ensure concrete floors are fully cured. Verify concrete floor dryness by using test methods recommended by flooring manufacturer.
- .2 Verify curing, hardening or other admixtures have been used and if used ensure these compounds have been removed.
- .3 Installation of flooring shall be considered an acceptance of surfaces to be covered. If repair of surfaces is required after commencement of flooring work it shall be included as part of the work specified herein.
- .4 Substrates shall be:
 - .1 dry and clean;
 - .2 free of depressions, raised areas or other defects which would telegraph through installed flooring;
 - .3 temperature of resilient flooring and substrate shall be within specified tolerances;
 - .4 perform moisture and adhesive bond test.
 - .5 Perform adhesive bond test in each major area, minimum 1 per 93 m² (1000 sq ft), prior to installation. Examine after 72 hours to determine whether bond is solid and no moisture is present. Do not proceed with work until results of bond test are acceptable.
- .5 Concrete shall have dampness no greater than recommended by flooring and adhesive manufacturers when tested with moisture meter. Where floors exhibit negative alkalinity, carbonization or dusting conform to manufacturers' recommendations for removal of these elements detrimental

to work.

- .6 Be responsible to report conditions contrary to requirements that would prevent proper installation. Do not commence with *Work* until unsatisfactory conditions have been corrected.
- .7 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of *Work* shall imply acceptance of substrate with regard to conditions of substrate at time of installation.
- .8 Pre-Installation Testing:
 - .1 Calcium Chloride Test:
 - .1 Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of resilient strip flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.
 - .2 Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Moisture emission from concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* in writing prior to commencement of installation.
 - .2 Acidity and Alkalinity Test:
 - .1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.
 - .2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.
 - .3 Relative Humidity Test:
 - .1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior to measuring concrete relative humidity.
 - .2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.
 - .3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* prior to commencement of installation.

3.2 INSTALLATION

- .1 Resilient Base:

- .1 Resilient base work shall be performed by experienced and competent workers in strict accordance with manufacturers written instructions for material concerned.
- .2 Fill cracks or irregularities with crack filler approved by resilient base manufacturer. *Provide* a solid backing over entire area behind resilient base.
- .3 Apply primer in strict accordance with manufacturer's written instructions. Permit primer to dry.
- .4 Apply adhesive evenly and continuously with an approved notchooth spreader at the recommended rate for full base adhesion and contact. Mechanical spreader not approved. Do not apply adhesive in a manner which promotes induced waviness in resilient base. Do not spread more adhesive than can be covered before initial set takes place. Use waterproof adhesive throughout.
- .5 Mix and spread adhesive evenly, in quantities which can be covered by resilient base within the adhesive's working time. If the adhesive over-dries, completely remove it using solvents compatible with adhesive and re-apply adhesive. Do not soil walls, bases, fitments, finish carpentry work or adjacent surfaces with adhesive. Promptly remove all excess and spillage of adhesive.
- .6 Unroll coils of resilient base. Place resilient base flat to loosen coil set.
- .7 Set wall base in adhesive tightly against wall and floor surfaces. Use lengths as long as practicable and not less than 500 mm (20") long.
- .8 *Install* resilient bases to walls, columns and fitments as indicated on the *Drawings* and Room Finish Schedule, during final stages of completion of work, when ceilings and permanent partitions are finished, when prime paint coats are applied and when surface conditions are suitable for installation.
- .9 Set resilient base in adhesive to produce a positive, permanent bond without gaps, tight against vertical and floor surfaces for a uniform fit.
- .10 *Install* resilient base straight and level with maximum height variation of 1:1000, having vertical, tight and flush "hairline" butt joints with no two joints closer than 2' - 0" (610mm) apart. *Provide* mitred internal corners. External corners shall be wrapped around corners as sharp as possible by scoring the back.
- .11 *Install* pre-molded end stops where end of base is exposed or does not butt against a vertical surface in the finished work. Accurately scribe and fit resilient base to metal frames and other obstructions.
- .12 Roll resilient base with clean, polished 5 lbs. (2.27 kg) roller, against vertical and floor surfaces to ensure full bonding to surfaces.
- .13 Ensure that installation of resilient base is tight, firm, and free of bubbling and separation of any kind from surfaces. Remove defective installation as directed by *Consultant* and *Install* new resilient base as specified herein.
- .14 Resilient base work shall be handed over to *Owner* free of blemishes and in perfect condition.

3.3 CLEANING

- .1 Remove excess adhesive from floor, base and wall surfaces without damage.
- .2 Clean, seal and wax floor and base surface to flooring manufacturer's instructions.

3.4 PROTECTION

- .1 Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades or placement of fixtures and equipment.

Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* epoxy seamless flooring (trowel applied) including but not limited to following:
 - .1 Inspection and preparation of substrate surfaces and existing conditions.
 - .1 concrete substrate surface shall be sanded, deteriorated concrete removed, cleaned, and replaced to suit design requirements.
 - .2 All joint spalling, surface spalling, and crack shall be repaired prior to placement seamless flooring.
 - .3 All joints shall be sealed, and when required cracks repaired with epoxy injection method.
 - .2 underlayment.
 - .3 moisture resistant barrier.
 - .4 mixes and mixing.
 - .5 trowel applied epoxy seamless flooring.
 - .6 divider strips.
 - .7 integral coved base.
 - .8 cleaning and sealing.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:

- .1 Pre-installation Regulatory Requirement Review Meeting:
Provide pre-start environmental procedure requirements, health, safety, emergency response hospital procedure and policy requirements, infection prevention and control requirements and security requirements to all parties associated with work of this Section;
 - .2 Prior to start of work, arrange for *Project* site meeting of all parties associated with work of this Section, including *Consultant* who may attend. Include *Subcontractor* performing work of this Section, Testing Company's Representative (if applicable) and *Contractor's Consultants* of applicable discipline.
 - .3 Review *Contract Documents* for work included under trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, *Project* staffing, restrictions on areas of work and other matters affecting construction; to permit compliance with intent of this Section.
- .2 Sequencing: Coordinate installation with other related Sections.
- .1 Coordination: Coordinate work of this Section with work of other Sections affected by *Work* of this Section. Ensure compatibility of floor and wall finish *Products* in areas where they come into contact. Coordinate installation to *Provide* neatly finished overlap where floor and wall coatings meet.
 - .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.
 - .2 Cooperate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location thereof.
 - .4 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 *Product* Data:

- .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for *Project*. Data sheets shall provide all required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit manufacturer's installation instructions.
- .2 Submit manufacturer's technical data, installation instructions and general recommendations for each type of flooring material required.
- .3 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual for adhesives, sealants and other materials as designated later by *Consultant*.
- .2 Samples: Submit 300 mm x 300 mm (12" x 12") sample of flooring for approval. Submit additional samples until approval is obtained. Make changes in aggregate mix as required to secure correct colour and texture. Label sample(s) with *Project* name and number, applicator, names of material and manufacturer, area where material will be applied, date of sample, colour, gloss, texture and aggregate mix proportion.
- .3 Site Quality Control Submittals: Submit a diagram of area showing locations and results of each of the following tests as required by pre-installation testing:
 - .1 Calcium chloride test
 - .2 Acidity and alkalinity test
 - .3 Relative humidity test
- .4 Test Reports: If requested, submit test data reports indicating that system supplied and installed meets performance requirements listed herein including fungal and bacterial laboratory tests showing results using AATCC Methods specified herein.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this Section by applicator approved by flooring manufacturer, having proven record of satisfactory installations similar to that specified within last 5 years and with necessary equipment and skilled workers to perform it expeditiously. If requested, submit proof of these qualifications.
- .2 Single Source Responsibility: Materials used in application of each flooring system shall be of same manufacturer and same *Supplier*
- .3 Coordination: Coordinate work of this Section with work of Section 09 96 00. Ensure compatibility of floor and wall finish

Products where they come into contact. Coordinate installation to provide neatly finished overlap where floor and wall coatings meet.

.4 Testing:

.1 Testing for Surface Soundness and Cleanliness During surface preparation process concrete shall be tested by Shear Cup Test Method as defined by system manufacturer. One (1) test per designated area of floor surface shall be tested. Successful passing of test requires 100% concrete failure. Failure requires re-cleaning and re-testing that sector until test is passed. Submit test results to *Consultant*. No additional payment shall be made to for testing, patching of test surface area, or additional surface preparation work required.

.2 Prior to commencement of work, do test installation to ensure floor material is not affected physically or chemically by type of chemical(s) used in area.

.5 *Mock-ups*: At site, in area designated by *Consultant*, erect sample floor area 1 m² (10 sq ft) by required thickness as per *Specifications* for each type of flooring, including moisture barrier and waterproofing membrane where applicable, primer and necessary number of coats to obtain specified finish, showing colour range, bond and quality of work.

.6 Erect additional sample, if required, to obtain approval. Do no work until samples have been approved. Approved samples shall become standard of comparison for flooring work on site and shall not be destroyed or moved until authorized by *Consultant*.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original, unopened containers with manufacturer's labels and seals intact. Labels shall identify manufacturer's name, brand name of *Product*, grade and type, application directions and shelf life and/or expiry date of *Product*.

.2 Handle and store materials in accordance with manufacturer's printed directions.

.3 Store flammable materials in safe, approved containers to eliminate fire hazards and remove from site at end of each work shift.

.4 Do not use materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

.5 Protection:

.1 Protect adjacent surfaces from damage resulting from work of this Section. If necessary, cover or mask adjacent surfaces to those receiving flooring including fixtures and equipment.

- .2 Materials soiled by coatings during application and storage, and from which soil cannot be completely removed, shall be replaced by this Section at no extra cost.
- .3 Erect barriers to prevent entry and presence of workers not performing work of this Section during application of flooring and for 48 hours following completion of application.
- .4 Post "No Smoking" signs while work is in progress and curing. Ensure sparkproof electrical equipment is used in areas where inflammable materials are being applied. Prevent use of open flames or equipment that may cause sparks during this phase of work.

1.8 PROJECT CONDITIONS

.1 Environmental Requirements:

- .1 Verify concrete slab is smooth, sound, clean, free of any compounds or curing agents detrimental to topping and any materials used to correct contour of concrete slab shall be compatible with epoxy topping system.
- .2 Do not apply flooring over substrate materials that contain over 3% moisture. Obtain approval of flooring manufacturer of moisture content of subfloors before proceeding with application.
- .3 Maintain minimum air and surface temperatures at 16 deg C (60 deg F) for 24 hours before, during and for 48 hours following application, or until cured.
- .4 Maintain well-lit and well-ventilated area.
- .5 Comply with flooring manufacturer's directions for maintenance of substrate temperatures, ventilation and other conditions required to execute and protect work.

1.9 WARRANTY

- .1 Warrant work of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the *Contract*. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects include but are not limited to; discolouration, fading, pinholes, cracking, peeling and leaking. Damage due to structural failure of base, water seepage or abnormal abuse excepted.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Slip Resistance: Shall conform to slip resistance requirements, Static Coefficient of Friction Guidelines of the American with Disabilities Act and other authorities having jurisdiction. Base tests on ASTM D2047.

.2 Performance Requirements: *Provide* seamless epoxy flooring system that when cured, produces following physical properties when tested in accordance with standards specified herein:

.1 *Provide* flooring complete with antibacterial and antifungal treatment to inhibit growth of bacteria, mould, mildew and fungi for lifetime of floor. Treatment to prevent deterioration and discoloration caused by bacteria and fungi. Ensure antibacterial and antifungal treatment does not migrate and affect application properties of flooring system. *Provide* flooring system meeting following performance characteristics:

- .1 AATC Test Method 147: Pass
- .2 AATC Test Method 30: Pass

.2 Static Coefficient of Friction: Ensure floor surfaces are stable, firm and slip resistant. Ensure slip resistant surfaces provide sufficient frictional counterforce to forces exerted in walking in order to permit safe ambulation. *Provide Products* with the following minimum values as determined by ASTM D2047 unless otherwise indicated:

- .1 Level Surfaces: Minimum 0.6.
- .2 Ramp Surfaces: Minimum 0.8.
- .3 *Provide* additional grit to achieve higher slip resistance (≥ 0.7) in following areas without limitations to satisfaction of *Consultant* and to match reviewed samples: showers, tub rooms, kitchen areas and cart wash areas.

.3 Compressive Strength: minimum 41 MPa (6,000 psi) when tested to ASTM C579.

.4 Tensile Strength: minimum 10 MPa (1,500 psi) when tested to ASTM C307.

.5 Flexural Strength: minimum 15 MPa (2,200 psi) when tested to ASTM C580.

.6 Water Absorption: maximum 3% when tested to ASTM C413.

2.2 MANUFACTURERS

.1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:

.1 Epoxy Floor Coatings:

- .1 Crown Polymers LLC; www.crownpolymers.com
- .2 Duochem Inc.; www.duochem.com
- .3 General Polymers; www.generalpolymers.com
- .4 Neogard; www.neogard.com
- .5 Niagara Protective Coatings; www.niaccoat.com
- .6 Stonhard; www.stonhard.com
- .7 Sika Canada Inc.; www.sika.com
- .8 ChemRex; www.chemrex.com

.2 Underlayment and accessories

- .1 Ardex Engineered Cements; www.ardex.com
- .2 Koster American Corporation; www.koesterusa.com
- .3 Mapei Inc.; www.mapei.com
- .4 W.W. Henry Co.; www.wwhenry.com

.2 Substitution Limitations: This Specification is based on Sika Canada Inc's *Products*. Only *Products* from above manufacturers are acceptable

2.3 MATERIALS

.1 General: Materials used in application of each flooring system shall be of same manufacturer and same *Supplier*.

.2 Flooring shall have antibacterial and antifungal treatment to inhibit growth of bacteria, moulds, mildew and fungi for lifetime of floor. Treatment shall prevent deterioration and discoloration caused by bacteria and fungi. Antibacterial and antifungal treatment shall not migrate and affect application properties of flooring system.

.3 Solid Coloured Epoxy Seamless Flooring for Heavy Traffic Duty (**SR-1**): CGSB 81-GP-4M, 100% solids, no VOC, no odour; multi-coat system consisting of 2-component epoxy primer, trowel applied epoxy matrix (clear epoxy resin, solid coloured quartz silica aggregates) and 2 coats clear epoxy/epoxy grout; minimum 6 mm (1/4") total thickness; low sheen slip-resistant finish; colour to be selected by *Consultant* from manufacturer's full colour range. Acceptable *Products* are:

- .1 Duochem 9400 by Duochem Inc.; www.duochem.com
- .2 TPM 115 by General Polymers; www.generalpolymers.com
- .3 Neo-Quartz 250 by Neogard; www.neogard.com
- .4 Kromoquartz SLD by Niagara Protective Coatings; www.niaccoat.com

- .5 Stonclad GS by Stonhard; www.stonhard.com
- .6 Sikafloor 261 - System 6 by Sika Canada Inc.; www.sika.com
- .7 Selbaclad 425 by ChemRex; www.chemrex.com
- .8 Permaflor by TBS Inc.; www.tbsproducts.com
- .9 CrownShield TD by Crown Polymers LLC; www.crownpolymers.com
- .4 Primer: As recommended by manufacturer supplying flooring material for type(s) of surface to be primed.
- .5 Divider Strips: 'L' shape to required floor thickness, white alloy zinc.
- .6 Cove Strips: As recommended by flooring manufacturer.
- .7 Crack Reinforcing: Elastic 100% nylon double weave tape that only stretches in one dimensions -sideways. Tape shall be capable to impart dimensional strength with elasticity. Tape shall function to allow for crack movement. Crack Reinforcing Tape (CRT) by TBS inc. or two component, flexible epoxy membrane suitable for isolation of dynamic cracks in conjunction with fibreglass engineering fabric, "Stonproof CT5" by Stonhard.
- .8 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl with shore 'A' hardness of 20 and tensile strength between 140 kPa and 200 kPa. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Compatible with sealant, primer, epoxy flooring and substrate.
- .9 Joint Sealant: CAN/CGSB-19.24-M, Type 1, Class B, multi-component modified urethane base chemical curing; material compatible with floor finish and as recommended by flooring manufacturer. Acceptable *Products* are:
 - .1 Duopli by Duochem Inc.; www.duochem.com
 - .2 Vulkem 245 by MC Canada Ltd.
 - .3 Sikaflex 2C by Sika Canada Inc.; www.sika.com
 - .4 Stonflex MP7 by Stonhard.; www.stonhard.com
 - .5 CrownFlex Joint Sealer No.505 by Crown Polymers LLC; www.crownpolymers.com
- .10 Moisture Reduction Barrier: As recommended by epoxy floor coating manufacturer and compatible with substrate, primer and body coats indicated.
- .11 Slip Resistant Additive (SRA): Rubber aggregate, clean/washed silica sand or ground walnut chips (interior dry areas only) for use with or as a component part of paint (usually floor/porch /stair enamel) on horizontal surfaces as required to *Provide* slip resistance. Where site applied, material to either mixed into paint (and mixed constantly to keep material in suspension) or broadcast into first or prime coat as required

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify *Consultant* in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.
- .2 Ensure concrete slab has been properly cured and dry for minimum of 28 *Days*.
- .3 Ensure no curing and sealing compounds, hardeners or other chemical additives have been used on concrete.
- .4 Verify specified environmental conditions are maintained before commencing work. Be familiar with manufacturer's *Product* literature and Material Safety Data Sheets and comply with precautions, handling procedures and equipment requirements.
- .5 Pre-installation Testing: Inspect and test concrete surfaces and immediately advise to *Consultant* in writing of unsatisfactory conditions which may affect performance or appearance of finished surfaces.
 - .1 Tensile Bond Strength Test: Ensure concrete surface have minimum 1.5 MPa (210 psi) tensile bond strength when tested in accordance with ASTM C1583 prior to flooring application.
 - .2 Calcium Chloride Test:
 - .1 Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of linoleum flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.
 - .2 Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Moisture emission from concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours unless otherwise recommended by manufacturer. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* in writing prior to commencement of installation.
 - .3 Relative Humidity Test:
 - .1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior to measuring concrete relative humidity.

- .2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.
- .3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* prior to commencement of installation.
- .4 Acidity and Alkalinity Test:
 - .1 Conduct pH test in accordance with ASTM F710 to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.
 - .2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.
- .6 *Provide* acidity and alkalinity test at same frequency and at each location in which calcium chloride and relative humidity testing is performed. Do not proceed with installation until acidity problems have been corrected. *Provide* results to *Consultant* prior to commencement of installation.

3.2 PREPARATION

- .1 Surface Preparation:
 - .1 Clean subfloor free of laitance, oil, grease and other foreign matter detrimental to flooring application. Ensure concrete substrate surface is sound, with deteriorated concrete removed, cleaned, and replaced to suit design requirements. Ensure cleaned surfaces are dust free, sound and unbruised. Blow clean control joints, sawcuts and cracks with compressed air and grout with material compatible with floor coating materials.
 - .2 Repair, joint spalling, surface spalling, and cracks prior to placement seamless flooring. Seal joints and when required repair cracks with epoxy injection method.
 - .3 Use surface preparation equipment or mechanical methods recommended by system manufacturer. Prepare concrete floors over entire area with steel shot blasting or other method recommended by manufacturer. Remove uneven joints, rough areas and projections off surfaces. Ensure surface is hard, sound and roughened to irregular surface with weak concrete removed and surface holes and voids exposed. Equip dry blasting machine with vacuum to minimize dust.

- .4 Ensure shot blasting exposes cracks in concrete surface. For cracks less than 1.5 mm (1/16") employ crack reinforcing tape in accordance manufacturer's recommendations. Repair cracks, holes or other deficiencies in accordance with manufacturer's recommendations.
- .5 Fill recessed joints with recommended epoxy plaster.
- .6 Obtain *Consultant's* approval of prepared substrate prior to installation of flooring.
- .2 Moisture Reduction Barrier:
 - .1 Apply moisture reduction barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.
 - .2 Apply moisture reduction barrier at following locations:
 - .1 Suspended slabs with moisture content above levels recommended by manufacturer and specified herein.
 - .3 Redo calcium chloride and relative humidity testing on concrete surfaces with unsatisfactory moisture levels after application of moisture reduction barrier and other corrective measures to ensure moisture levels are compliant with manufacturer's requirements. Do not proceed with work until unsatisfactory conditions have been resolved.
- .3 Protection:
 - .1 Protect adjacent surfaces from damage resulting from work of this Section. If necessary, cover or mask adjacent surfaces to those receiving flooring including fixtures and equipment.
 - .2 Replace materials soiled by coatings during application and storage, and from which stains cannot be completely removed at no extra cost.
 - .3 Erect barriers to prevent entry and presence of workers not performing work of this Section during application of flooring and for 48 hours following completion of application.
- .4 Post "No Smoking" signs while work is in progress and curing. Ensure spark-proof electrical equipment is used in areas where flammable materials are being applied. Prevent use of open flames or equipment that may cause sparks during this phase of work.

3.3 INSTALLATION

- .1 Prepare, mix materials and apply each component of flooring system in accordance with CGSB 81-GP-10M and manufacturer's printed directions to produce uniform monolithic wearing surface of thickness indicated for each system, with integral cove

bases, uninterrupted except at divider strips, sawn joints or other types of joints required.

- .2 Apply flooring with care to ensure no laps, pin holes, voids, crawls, skips or other marks or irregularities are visible, and to provide uniform appearance.
- .3 Work coating into corners and other restricted areas, up and over equipment bases, and into recesses in floors to ensure full coverage.
- .4 Make clean true junctions with no visible overlap between adjoining applications of coatings.
- .5 Match approved sample for colour, sheen, texture and slip resistance.
- .6 Primer: Apply primer over prepared substrate, at manufacturer's recommended spreading rate with timing of application coordinated with subsequent application of topping mix to ensure optimum adhesion between flooring materials and substrate.
- .7 Trowel Applied Epoxy Matrix: Combine aggregate to blended epoxy resin to form trowellable mortar. Trowel apply mix over tacky primer in number of coats and at spreading rates required to produce minimum thickness specified. Allow topping to harden minimum time recommended by manufacturer before applying finish coats.
- .8 Epoxy/Epoxy Grout Top Coats: When trowelled epoxy matrix has hardened, remove imperfections by lightly abrading surface and vacuum clean. Apply 2 finish coats at spreading rate and following method recommended by manufacturer to achieve 0.254 mm (10 mils) minimum thickness per coat and to obtain specified finish to match approved samples. Allow minimum recommended drying time between coats.
- .9 Roller Applied Epoxy Flooring: *Install* in accordance with manufacturer's written instructions. Apply prime coat, wear coat, and finish coat at application rate recommended by manufacturer to obtain finish thickness specified herein and to match reviewed samples. Allow minimum recommended drying time between coats.
- .10 Cove Bases:
 - .1 *Provide* cove base struck straight to provide line for wall finish. Cap with manufacturer's recommended cove strip. *Install* at heights indicated on *Drawings*.
 - .2 At locations where bases are indicated to overlap wall materials, terminate base 150 mm (6") high, feather out and trim evenly along wall to provide smooth transition with adjacent wall finish. Ensure top coat is compatible with wall coating prior to application.
 - .3 Round interior and exterior corners.

.11 Thresholds:

- .1 Where flooring terminates at doorways and difference in height occurs between seamless flooring and other finishes, *Install* tapered aluminum thresholds not less than 25 mm (1") wide and full thickness of difference in level.
- .2 Where flooring terminates at doorways and difference in height occurs between seamless flooring and other floor finishes, cut back slab for 32 mm (1-1/4") width to allow full thickness of seamless flooring to be flush with adjacent floor finish (chasing).
- .3 Where flooring terminates at doorways and floor finishes are of same thickness, *Provide* metal divider strips flush with surfaces.

.12 Floor Drains:

- .1 Slope flooring to drains minimum of 3 mm in 300 mm (1/8" in 12") from furthest surface point.
- .2 Grind concrete around perimeter to provide 6 mm (1/4") thickness of flooring material which is flush with top of drain and slopes as indicated on *Drawings*.

.13 Ramps, Stairs and Landings: *Provide* textured slip resistant finish to surfaces of ramps stairs and landings. Finish stair nosing in accordance with manufacturer's recommendations. Match approved sample.

.14 Chasing: *Provide* chase where flooring does not abut against vertical surface by chiselling out 38 mm (1-1/2") wide chase to straight saw-cut 12 mm (1/2") depth.

.15 Control Joints: Where substrate is interrupted by isolation, control or expansion joints, *Provide* saw-cut joint in flooring after floor installation, *Install* backer rod and fill with manufacturer's recommended epoxy or urethane sealant.

.16 Site Tolerances: Finish seamless flooring surfaces to produce plumb and level floor, or straight where sloped to drains, within tolerance of 3 mm in 3 m (1/8" in 10').

3.4 FIELD QUALITY CONTROL

- .1 Inspection: In accordance with Section 01 45 00 *owner* may engage independent inspection and testing company to inspect work of this Section. Give at least 2 weeks notice of starting work and allow inspector free access. Tests may include thickness, compressive strength and chemical resistance as specified in requirements of this *Specification*.
- .2 Manufacturer's Field Services: Ensure flooring manufacturer representative's presence at pre-construction site meeting and on site *Day* flooring application is commenced and periodically thereafter, to ensure work is properly performed.

3.5 CLEANING

- .1 Touch up and refinish minor defects in work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.
- .2 Remove promptly as work progresses spilled or splattered coating materials from adjacent surfaces. Clean floors on completion of work. Do not mar surfaces while removing splatters.

3.6 PROTECTION

- .1 Protect completed work from traffic for at least 1 week to allow proper curing of floor finish. Protect work from any trades using area after completion of installation.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* acoustical panels including but not limited to following:
 - .1 suspended acoustical ceiling panels.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,

- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.
- .3 Shop Drawings: Submit Shop Drawings of The Work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
 - .1 Include plans, sections and large scale details, and indicate components and methods of assembly, materials and their characteristics, fastenings, finishes, and other fabrication information required for work of this section. Indicate assembly joint lines.
 - .2 Submit coordination Drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.
 - .3 Show relation to adjoining construction, details of outside and inside corners and door openings.
 - .4 reflected ceiling plans, sections and details.
 - .5 materials, thicknesses and finishes.
 - .6 methods of setting, sealing, securing, field connections and anchorage.

- .4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - .1 direct fastening system members minimum 300 mm (12") long
 - .2 suspension system members minimum 300 mm (12") long.
 - .3 panels minimum 300 mm (12") square and of specified thickness
- .5 Test and Evaluation Reports: Prior to submitting Shop Drawings for Work of this Section, submit following:
 - .1 Structural Performance: Independent test data and design tables for each type of insert to be employed on this Project for hanger supports.
 - .2 Acoustic Performance: Independent test data and certificate confirming system meets or exceeds specified STC, NRC and CAC ratings
- .6 Certificates:
 - .1 Obtain approval of electrical utility authorities having jurisdiction for support of light fixtures, by ceiling grid and supports, to satisfy their requirements. Adjust grid, fixing devices and support hangers as required to obtain approval.
- .7 Maintenance Instructions: Submit maintenance instructions in accordance with Section 01 70 00. Submit maintenance instructions that specify warnings of any maintenance practice or materials which may damage or disfigure the work of this Section.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials: Supply 2% surplus panel fabric from same production run as installed panels.

1.7 QUALITY ASSURANCE

- .1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
- .2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
- .3 Licensed Professionals: Employ a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design components of The Work of this Section requiring structural performance.
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - .4 be responsible for production and review of Shop Drawings.
 - .5 inspect work of this Section during fabrication and erection.
 - .6 stamp and sign each Shop Drawing.
 - .7 Provide site administration and inspection of this part of The Work.

- .8 establish seismic design criteria based on:
 - .1 Anticipated ground motion;
 - .2 Soil type in specific geographic area;
 - .3 Occupancy category (Group B2)

- .4 Mock-Ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Conform to requirements of Division 01. Ensure Mock-ups are approved and accepted prior to start of system application. Do not alter, move or destroy mock-up until work is completed and approved by Consultant. Submit transportable Mock-Ups in accordance with following requirements:
 - .1 minimum size: 450 mm x 450 mm x 450 mm (18" x 18" x 18").
 - .2 maximum size: 600 mm x 600 mm x 600 mm (24" x 24" x 24").
 - .3 Install full size panel system for direct fastening type and suspension type at designated location.

1.8 WARRANTY

- .1 Warrant work of this Section for period of 2 years against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no additional expense. Defects include but are not limited to: buckling, opening of seams, bond failure and extensive colour fading.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Acoustical Ceiling Panels:
 - .1 Decoustics; www.decoustics.com
 - .2 GWP Wallworks Group; www.wallworks.com
 - .3 Wall Technology, Inc.; www.walltechnology.com
- .2 Substitution Limitations: This Specification is based on Decoustic's Products. Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Design and Performance Requirements:
 - .1 Design suspension system to support safely and without distortion, superimposed loads of:
 - .1 Lighting fixtures;
 - .2 Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles;
 - .2 Design suspension system to support lighting fixtures according to regulations of local utility company and submit certification accordingly.

- .3 Provide ceiling panels complete with suspension systems in patterns indicated on Drawings complete with accessories required to meet design requirements.
- .4 Prepare panels for sprinkler head penetrations and suspension members of curtain tracks.
- .5 Coordinate installation and cooperate with Mechanical and Electrical Subcontractors, to accommodate mechanical and electrical items, or any other work required to be incorporated in or coordinated with the ceiling system.
- .6 Unless otherwise indicated, ceiling suspension *Products* shall be manufactured to minimum requirements of ASTM C635, for Heavy Duty, modified as required to suit grid design shown.
- .7 Fire Performance Characteristics:
 - .1 Ensure materials listed in this Section are rated as Class A, when tested in accordance with ASTM E 1264, CAN/ULC S102 and ASTM E84 for following characteristics:
 - .1 Flame Spread Rating: ≤ 25 on any surface exposed by cutting through in any direction
 - .2 Smoke Developed Index: ≤ 50
 - .2 Ensure materials provided for Work of this Section have approved product listing from organization acceptable to authorities having jurisdiction such as ULC, cUL or ITS.
- .8 Acoustic Criteria: Provide acoustical ceiling panel systems with acoustical absorption characteristics as indicated herein determined by testing fully assembled production material capable of providing minimum NRC values of 0.85 when tested in accordance with ASTM C423 by testing organization acceptable to authorities having jurisdiction.
- .9 Acoustical Performance: Ensure assemblies are capable of providing specified NRC, STC and CAC ratings specified herein when tested in accordance with ASTM C423, ASTM E90 and ASTM E1414 respectively.

2.3 MATERIALS

- .1 Acoustic Insulation: Semi rigid mineral fiberglass batt insulation in accordance with requirements of Section 07 21 00. Minimum density: 48 kg/m³ for thicknesses up to 40 mm and 40 kg/m³ for thicknesses over 40 mm.
- .2 Supplementary Steel Supports and Reinforcing: In accordance with requirements of Section 09 21 16.

2.4 MANUFACTURED UNITS

- .1 Suspended Acoustical Ceiling Panels (R-1): Provide suspended acoustical ceiling panels "Claro Nuvola" by Decoustics or approved equivalent with following characteristics:
 - .1 Edges: Square.
 - .2 Core: 25 mm (1") thick acoustically absorptive fiberglass core.
 - .3 Finish: "Claro" by Decoustics in colour selected by Consultant from manufacturer's full range.
 - .4 Shapes and Sizes: to be selected at a later date by Constultant from manufacturer's full range.
 - .5 Mounting System: Provide suspended fastening system and accessories

as recommended by system manufacturer.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions:
 - .1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Verify work above ceiling suspension system is complete and installed in a manner that will not affect layout and installation of suspension system components.
 - .2 Inspect surfaces into which work of this Section is dependent for irregularities detrimental to installation and performance of work of this Section. Confirm that conditions are satisfactory prior to proceeding. Notify Consultant in writing of conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

- .1 Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 21 deg C (72 deg F) for 72 hours prior to commencement of Work and maintain temperature until 72 hours after completion.
- .2 Ceiling Panels: Coordinate with Section 09 21 16 and Section 09 51 00.
 - .1 Do not commence installation until work above suspended ceiling has been completed, inspected and accepted. Independently support fixtures and equipment.
 - .2 Install ceiling systems into suspension systems provided under Section 09 51 00 and attach torsion-spring system in strict accordance with manufacturer's instructions
 - .3 Coordinate with Divisions 21, 22, 23 and 26 to ensure adequate provision of supports for mechanical and electrical fixtures specified in Divisions 21, 22, 23 and 26.

3.3 CLEANING

- .1 After interior finishing work has been substantially completed or when directed by Consultant, inspect wood and ceiling panel work. Replace broken, chipped or damaged work. Reset loose units or units out of place and touch up marred surfaces with matching finishes. Upon completion of Project, ensure finished surfaces are clean and free from dirt and other markings; in good condition subject to acceptance of Consultant.

3.4 SITE QUALITY CONTROL

- .1 Manufacturer's Services: Arrange for Product manufacturer's technical representative to:
 - .1 meet and discuss installation procedures and unique conditions at the

Place of The Work.

- .2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.
- .3 periodically visit and inspect installation and report unsatisfactory conditions to Contractor.
- .4 attend final inspection and to submit written certification Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.5 DEMONSTRATION AND TRAINING

- .1 Engage a factory-authorized service representative to train maintenance personnel to replace and maintain acoustical ceiling panels in accordance with requirements of Section 01 70 00.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* painting including but not limited to following:
 - .1 Exterior:
 - .1 doors and frames.
 - .2 heat and smoke vents.
 - .3 fresh air and exhaust air hoods on roof.
 - .4 steel stairs, handrails, supports, ladders and cages.
 - .5 pipe bumpers.
 - .2 Interior:
 - .1 exposed building surfaces as indicated on Room Finish Schedules.
 - .2 overhead doors and frames, tracks, brackets, fenders and supplementary steel supports.
 - .3 vertical lift doors and frames, counterweight enclosures and supplementary steel supports.
 - .4 hollow metal doors, frames and transom panels.
 - .5 edges of flush wood core doors and trim of lites in same doors, unless edges are factory painted and have not been trimmed on site.
 - .6 glazed screen frames, mullions and closures.
 - .7 exposed miscellaneous metal and steel items for *The Work* of all trades, including hangers, etc., for mechanical and electrical works.
 - .8 steel stairs, landings and railings.
 - .9 wood ceilings clear stain (CS).
 - .10 underside of metal roof deck.
 - .11 gypsum board bulkheads and enclosures.
 - .12 telephone closet backboards.
 - .13 pipe bumpers.
 - .14 access panels and doors.
 - .15 screens.
 - .16 steel supports for wood benches.
 - .17 conduit, piping, ductwork, light panels, etc. exposed to view in areas listed on the Room Finish Schedule.
 - .18 natural gas piping in all locations.
 - .19 finish painting of prime painted diffusers, registers and grilles in exposed locations.
- .2 Work Excluded:
 - .1 Do not paint pre-finished metal siding, fascia and soffit, coping cap flashing and similar components. Refer to dedicated trade Sections

for special finishes specified therein and their effects on your trade.

- .2 Do not paint chrome, stainless steel, vinyl, plastic laminate and aluminum surfaces throughout unless specified otherwise.
 - .3 Do not paint internal surfaces of steel tanks and stacks.
 - .4 Do not paint sprayed fire-resistant materials.
 - .5 Do not paint equipment furnished completely prime and finish painted by manufacturer unless required to have field painting over factory finish to have one common corporate colour as identified in finish schedule.
 - .6 Do not paint over ULC, FM or other code required labels or equipment identification plates.
- .3 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

.1 Definitions:

- .1 Exposed: This refers to items visible in completed Work. In case of closets, cabinets and drawers, it includes their interiors.
- .2 Surface Preparation: This refers to means of cleaning or treating of surface to be painted to ensure best possible bond between surface and painting applied. Surface preparation methods include but are not limited to:
 - .1 Removal of surface contaminants that will affect performance of painting including but not limited to: oil, grease, salts, dust, dirt, rust, rust scale, mill scale, and old coatings where applicable.
 - .2 Removal of surface imperfections including without limitations: weld spatter, sharp edges, burrs, silvers, laminations, pits, porosities and crevices.
 - .3 Preparation of surfaces to Provide anchor profile or surface profile to improve mechanical bonding of coating to prepared surface by increasing surface area.

.2 Reference Standards:

- .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
- .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein. In particular, read carefully other Sections of Specifications to determine extent of prime and finish coats applied by other Sections.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this

Section. As a minimum, discuss following:

- .1 environmental procedure requirements,
- .2 health, safety and emergency response procedure and policy requirements,
- .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section. Presided over by Consultant, include Contractor, Subcontractor, manufacturer's representative, sub-trades whose Work will be painted (including Mechanical and Electrical trades) or whose Work is adjacent to, or may be affected by Work of this Section.
 - .2 Determine understanding and extent of requirements and procedures specified by MPI Painting Manual; www.specifypaint.com. Notify manufacturer's representative designated to carry out inspection minimum of 1 week prior to commencement of work. Submit a copy of Project painting Specification, plans and elevation Drawings (including pertinent details) as well as a Finish Schedule to manufacturer's representative.
 - .3 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location thereof.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type

of material provided under this Section for Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

- .1 Submit copy of Master Painter's Institute "Architectural Painting Specification Manual", (MPI) latest edition on site during the performance of painting work.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and as other materials designated later by Consultant.
- .3 Proposed Materials: Submit in writing list of proposed materials prepared by paint manufacturer for approval, at least 60 Days before materials are required. Ensure list bears manufacturer's official certification that materials listed meet or exceed requirements specified herein.
- .4 Progress Reports:
 - .1 Arrange for manufacturer's representative to visit site at intervals during surface preparation and paint coating application to ensure proper specified surface preparation is being performed, specified Product are being used, appropriate number of coats are being applied and specified finishing procedures are being carried out. Ensure manufacturer's representative prepares weekly job progress reports. Submit copy of reports to Consultant.
 - .2 Upon completion of work, submit written reports and manufacturers' confirmation that materials and application methods conform to manufacturers' requirements.
- .5 Samples: Submit following samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate in sizes indicated.
 - .1 Brushouts: minimum 200 mm x 250 mm (8" x 10") of each colour required at least 30 Days prior to commencement of painting.

<u>Substrate</u>	<u>Sample, Base Material</u>
Gypsum Board	Face of typical unit
Metal	Steel Plate
Woodwork	Wood (Submit sample panels of stain and varnish finish on each species of wood specified, minimum 300 mm (12") square and of specified thickness.)
- .2 Product List: Conform to requirements of Division 01 and submit a Schedule of Finishes listing manufacturer's Product name and colour for each paint system. Upon completion, submit records of products used. List products in relation to finish systems and include the following:
 - .1 Product Name, Type and Use
 - .2 Manufacturer's Product Number

- .3 Colour Numbers
- .4 MPI Environmentally Friendly Classification System Rating
- .5 VOC Level (g/L)
- .6 Manufacturer's Material Safety Data Sheets (MSDS)

1.6 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section executed by competent installers with membership in good standing in OPCA and/or PDCA and have a minimum of 5 year's experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Ensure materials, preparation and workmanship conforms to requirements of the MPI Painting Manual requirements and inspected by local MPI Accredited Quality Assurance Association's Paint Inspection Agency inspector. Include cost of MPI inspections in Contract Price.
- .3 Single Source Responsibility:
 - .1 Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
 - .2 Provide paint and finishing materials for each procedure listed in Finish Schedule from *Products* of single manufacturer.
 - .3 Use single brand of paint chosen throughout work of this Section, except where specified otherwise.
- .4 Mock-Up: At site, Consultant will locate testing area to establish standard of workmanship, texture, gloss and coverage.
 - .1 Prepare surfaces and apply treatment to galvanized components for Consultant's review. Do no painting until samples have been approved. Approved panels become standard of comparison for painting work on site.
 - .2 Apply 300 mm x 300 mm (12" x 12") samples of each finish on each type of surface to be coated with correct material, number of coats, colour, texture and degree of gloss required or apply full size test samples in areas designated by Consultant. Provide additional samples, if required, to obtain approval.
 - .3 Correct and refinish work which does not meet quality levels established by reviewed finishes at no expense to Owner. Reviewed full size sample panels may become integral part of finished work if undisturbed at time of Substantial Performance of the Work

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Review Product literature, Material Safety Data Sheets, related safety data, proper disposal requirements and inform trades involved in work of this Section.
- .2 Deliver and store materials on site in manufacturer's sealed and labeled containers. Imprint containers with batch numbers and colour identification.

- .3 Store containers of paint, thinner and other volatile materials in well ventilated places where they will not be exposed to excessive heat or direct rays of the sun. Keep tightly closed when not in use. Remove used cloths from building at the end of every working shift and when not in use. Take precautions against spontaneous combustion by drenching with water or placing in air-tight covered metal containers.
- .4 Prevent fire or explosion caused by improper storage of paints, solvents, rags, and similar items. Store hazardous materials in location and in manner approved by local fire authority.
- .5 Post "No Smoking" signs in areas of storage and mixing. Strictly enforce this requirement. Provide and maintain CO₂ fire extinguishers of minimum 9 kg (20 lb) capacity. Repair damage to storage area or surrounding area at no cost to Owner.
- .6 Protect finished areas subject to contact during drying by posting "Wet Paint" signs and barring from traffic where necessary.
- .7 Leave storage areas clean and free from evidence of occupancy.
- .8 Collect waste paint by type and provide for delivery to recycling or collection facility. Recycle empty paint cans.

1.8 PROJECT CONDITIONS

- .1 Paint and finish work items in clean, dust-free, properly ventilated and adequately lit areas (minimum 100 lx (9.3 ft candles)).
- .2 Maintain minimum interior temperature of 18 deg C (65 deg F) during application and drying of paint and maintain until building occupancy occurs.
- .3 Do not undertake interior painting on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.
- .4 Substrate Moisture Content: Perform tests with electronic moisture meter to ensure compliance with manufacturer's recommendations. Unless otherwise recommended by substrate manufacturer, maximum moisture content for following materials is as follows:
 - .1 Gypsum Based Board and Plaster: Maximum 12 - 14%.
 - .2 Wood: Maximum 15%.
- .5 Temperature and Ventilation:
 - .1 Do not Provide paint under ambient and surface temperatures less than 15 deg C (59 deg F) in any instance for 24 hours before and during installation; and 7 Days after installation.
 - .2 Provide ventilation to remove odours, evaporating solvents and moisture. Maintain adequate ventilation at all times to control excessive humidity.
 - .3 Ensure adequate temporary ventilation is provided under Division 01 for protection of workers from toxic fumes.

1.9 WARRANTY

- .1 Warrant Work of this Section for period of 2 years against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to: material shrinkage, cracking, splitting, bubbling, blistering and delamination resulting from defective materials or poor workmanship.
 - .1 Guarantee: Provide local MPI Accredited Quality Assurance Association's two (2) year guarantee in accordance with MPI Painting Manual requirements warranting that painting work has been performed in accordance with MPI Painting Manual requirements.

1.10 MAINTENANCE

- .1 *Supply of Touch-up Paint: Supply to Owner 1-4 litre can (1-1 gal) of each different type and colour of paint used on this Project. Paint shall be boxed and in sealed, unopened cans in undamaged condition, with name of manufacturer, contents, type and colour clearly indicated on a label securely adhered to can. Submit cans to Owner in accordance with requirements of Division 01.*

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:*
 - .1 Benjamin-Moore; www.benjaminmoore.com
 - .2 General Paint; www.generalpaint.com
 - .3 PPG - Pittsburgh Paints; www.ppgpittsburghpaints.com
 - .4 Sherwin Williams; www.sherwin.com
 - .5 Dulux; www.dulux.com
- .2 *Substitution Limitations:*
 - .1 Limit material selection to Products selected from manufacturers listed herein that comply with MPI systems indicated below and listed in "MPI Approved Products List" and indicated by code numbers referred to in the Master Painter Institute Architectural Specification Manual, latest edition. Provide listed prime and finish coat materials unless otherwise recommended in writing by the paint manufacturer for each specific substrate.
 - .2 Only Products from manufacturers and lines listed herein will be considered; subject to approval by Consultant. Colour matching is not acceptable. Paint materials without manufacturer's label will not be allowed.

2.2 DESCRIPTION

- .1 Regulatory Requirements:

- .1 For temporary scaffolding, ladders and other construction accessories, conform to the Occupational Health and Safety Act, as amended.
- .2 Fire Hazard Classification: As determined by ULC testing in accordance with ASTM E84 shall not exceed following:
 - .1 Flame Spread: 0.
 - .2 Fuel Contributed: 15.
 - .3 Smoke Developed: 10.
- .3 *Provide* coatings from specified MPI designations which are in accordance with Canadian Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.
- .4 Comply with toxic trace limitations stipulated by authorities having jurisdiction in accordance with requirements of CAN/CGSB-1.500.
- .5 Conform to *the Occupational Health and Safety Act* and other requirements of local authorities having jurisdiction for storage, mixing, application and disposal of paint and related waste materials.

.2 Design and Performance Criteria:

- .1 Acceptable materials, workmanship and all items affecting the Work of this Section are to be in accordance with the Master Painter's Institute "Architectural Painting Specification Manual", (MPI) latest edition, and "Maintenance and Repainting Specification Manual", latest edition. Painting work to be in accordance with MPI Premium Grade finish requirements.
- .2 Provide paint and finishing materials of highest grade, top of line quality of manufacturer.
- .3 Provide primers in recommended dry film thicknesses per coat (DFT/coat).
- .4 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in the MPI Approved Product List are acceptable for use on this Project.
- .5 Provide other materials such as linseed oil, shellac, thinners, solvents, etc. of the highest quality Product of an MPI listed manufacturer and compatible with paint materials being used as required.
- .6 Provide paint materials with good flowing and brushing properties and dry or cure free of blemishes, sags, air entrapment, etc.
- .7 Where required, ensure paints and coatings meet flame spread and smoke developed ratings designated by local Code requirements and authorities having jurisdiction.
- .8 Paint applied on materials which from time to time will become hot, such as convector covers and similar items, to be approved by paint manufacturer for particular condition.
- .9 Use only materials having a minimum MPI "Environmentally Friendly" E2 or E3 rating based on VOC (EPA Method 24) content levels.
- .10 As far as practical, factory mix paint for immediate application without thinning or alteration at site. Do not alter or thin any paint without manufacturer's written approval.
- .11 Consultant reserves right to refuse paint or finishing material if in Consultant's opinion materials are not suitable or adequate for proposed use.

2.3 MATERIALS

.1 Topcoat and Intermediate Coat Thickness:

- .1 Latex & Acrylics (Interior): 0.03 mm (1.2 mils) DFT/coat.
- .2 Epoxies (Interior): 0.076 mm (3 mils) DFT/coat.
- .3 Urethanes (Interior and Exterior): 0.076 mm (3 mils) DFT/coat.

.2 Gloss and Sheen Ratings: Gloss terms to have following values in accordance with ASTM D523 based on MPI recommended gloss reflectance guidelines:

Gloss Term	Gloss Level	Gloss Value
Flat or Matte	G1	0 to 5 units at 60 degrees and max 10 units

			at 85 degrees
Velvet	G2		0 to 10 units at 60 degrees and max 10 to 35 units at 85 degrees
Eggshell	G3		5 to 25 units at 60 degrees and 10 to 35 units at 85 degrees
Satin	G4		20 to 35 units at 60 degrees and min 35 units at 85 degrees
Semi-Gloss	G5		35 to 70 units at 60 degrees
Gloss	G6		70 to 85 units at 60 degrees

.3 Gloss Values:

- .1 Walls: Satin
- .2 Floors: Semi-gloss
- .3 Trim and doors: Semi-gloss
- .4 Ceilings: Flat

.4 Colours: Consultant will select colours at a later date. Refer to Interior Design Finish Schedule.

.1 Colours of Latex Paint (PT):

- .1 Maximum of 50 colours, of which no more than 15 colours will be dark accent colours. No more than 3 colours will be used per room for walls and ceilings, with a different colour for painted doors and frames. Deep tint accent colours may be used on doors and similar panels scheduled for painting.
- .2 Reveals, coves and bulkheads and valances may have colour different than main colour in room.
- .3 Final colours selected will not necessarily be colours found on standard colour charts of manufacturer whose Products have been accepted for use.

.2 Colour of Epoxy Paint (PT-E): Consultant will select maximum 10 colours for epoxy paint from manufacturer's standard colour range.

PART 3 -EXECUTION

3.1 EXAMINATION

.1 Verification of Surface Conditions:

- .1 Do work only when surfaces and conditions are satisfactory for production of quality work. Report to Consultant in writing any surfaces which are found to be unsatisfactory. Commencement of work

- implies acceptance of substrate surfaces.
- .2 Ensure temperature of surfaces to be finished is between 10 deg C and 20 deg C (50 deg F and 68 deg F) and surfaces are dry and free of dirt, grease or other contaminants that may affect applied finish.
 - .3 Verify moisture content of surfaces with electronic moisture metre. Do not proceed without written directions if moisture reading is higher than 12 - 15%.
 - .4 Conform to manufacturer's requirements and those listed below for following substrates:
 - .1 Steel substrates: Do not apply coatings over moisture or when surface temperature is within 3 deg C (5 deg F) of dew point.
 - .2 Wood substrates: Do not stain or paint if moisture reading is higher than 12%. Inspect work to ensure surfaces are smooth, free from machine marks and that nailheads have been countersunk.
 - .3 Cast-in-place concrete substrates: Allow to cure for 60 to 90 Days before proceeding with priming.
 - .4 Concrete: Inspect and accept or reject filled-in surface blow holes.
 - .5 Gypsum board substrates: Inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for following defects and ensure corrective measures have been taken prior to commencing painting work:
 - .1 "nail popping".
 - .2 screw heads not recessed and taped.
 - .3 breaks in surface or other imperfections.

3.2 PREPARATION

- .1 Verify each substrate is dry and not frozen and free from tool and sandpaper marks, dust, rust, insects, grease and other foreign matter liable to impair finished work.
- .2 Prepare defective surfaces to obtain a satisfactory substrate and in accordance with paint manufacturer's instructions.
- .3 Prior to painting, sweep areas dust-free.
- .4 Clean soiled surfaces to be painted.
- .5 Protection:
 - .1 Provide scaffolding, staging, platforms and ladders, as required for execution of work. Erect scaffolding to avoid interference with work of other trades. Comply with Occupational Health and Safety Act.
 - .2 Provide drop cloths or adequate plastic sheets to protect floors in areas assigned for storage and mixing of paints.
 - .3 Protect work of other trades against paint splattering and *Make Good* at own expense any such damage.
 - .4 Remove finish hardware, electrical switch and outlet covers, receptacle plates, fittings and fastenings, to protect from paint splatter. Mask items not removable. Use sufficient drop cloths and protective coverings for full protection of floors, furnishings,

mechanical, electrical and special equipment, all other components of building which do not require painting or to be removed, from paint spotting and other soiling. Re-Install items when paint is dry. Clean any components that are paint spotted or soiled.

- .5 Keep waste rags in covered metal drums containing water and remove from building at end of each Day.
 - .6 Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured. Post "wet paint" or other warning signage during and on completion of work. Provide also warning signs at all points of entry to areas where painting is applied.
 - .7 When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapours. Dust respirators do not Provide protection from vapours.
- .6 Surface Preparation:
- .1 Remove dust, grease, rust and extraneous matter from surfaces (except rust occurring on items specified to be primed under other Sections shall be removed and work reprimed under those Sections). Vacuum (fibre acoustic tile and) insulation covering surfaces. Vacuum clean floors before painting; wipe clean adjacent surfaces and surfaces to be painted before work is commenced to prevent dust and debris damage to wet paint.
 - .2 Remove mild mildew growth by scrubbing affected area with solution of tri-sodium-phosphate (TSP) (150 g) and/or household bleach (125 g) in 3.5 L water. Rinse well with clean water and allow to dry. If condition is serious then notify Consultant and installed work shall be considered defective and shall be removed at Contractor's expense. Contractor shall be responsible to retain a qualified and experienced bio-contamination investigator acceptable to Consultant to conduct at its expense sampling and laboratory analysis and other required assessment steps to determine whether or not materials are impacted by mould amplification and follow up recommended contamination management method.
 - .3 As a minimum requirement conform to New York City Department of Health Bureau of Environmental & Occupational Disease Epidemiology 2000, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" and appropriate Levels of requirements for mould removal.
 - .4 Be responsible for surface preparation to suit surface condition and conform to level of cleaning based on SSPC, recommended metal cleaning procedures most commonly used to suit site conditions. Take measure to change rags frequently to prevent spread of contaminants. Do final water cleaning prior to water based paint applications.
 - .5 Structural Steel/Miscellaneous Steel (previously painted and exposed by alterations work): Remove oil, grease, dirt, rust scale, loose mill scale, loose paint or coating by brush-off blast cleaning to SSPC-SP7 or by water blasting at minimum 1379 kPa (200 psi) at minimum flow rate of 0.25 l/s (4 gal/min).
 - .6 Metal Stacks, Breeching, Piping: Blast clean to 0.037 mm to 0.050 mm (1.5 - 2 mil) profile using grit abrasive to SSPC-SP6.
 - .7 Decorative Metals: Blast clean removing minimum 0.037 mm to 0.050 mm

- (1.5 - 2 mil)scale, rust and other foreign matter from metal surface using grit abrasive to SSPC-SP6.
- .8 Hot Dipped Galvanized Steel (Unweathered): Allow to weather minimum of 26 weeks and Xylene clean to SSPC-SP1 specified herein prior to coating to remove dust, dirt, grease, oxides and other foreign material. Remove silicates or similar surface treatments or any deposits of white rust by sanding or similar abrasive methods (bronze wool). Use of acetic acid to prepare galvanized surfaces is not acceptable. Clean chromate passivated galvanized metal surface contamination by washing with appropriate chemical solution compatible with finish specified such as MPI #25.
 - .9 Galvanized Steel (Weathered): Remove dust, dirt, grease, oxides and other foreign material and clean to SSPC-SP1 specified herein prior to coating.
 - .10 Galvanized Steel (Pre-Treated)(Non-Crystal Appearance): Follow manufacturer's recommendations for preparation, priming and coating of pre-treated galvanized steel.
 - .1 Light Zinc Coated or Satin Coated *Products* (ZF075): mostly found in environmentally controlled areas.
 - .2 Heavy Coated Zinc (Z275): for high humidity areas and as specified
 - .11 Woodwork:
 - .1 Verify and determine wood species, grain direction and structure, properties of finish, application method and exposure to elements. Check moisture content to avoid movement of wood caused by expansion and contraction due to changes in moisture content. Verify grain cut as it may interfere with adhesion of paint.
 - .2 Obtain inspection of glue laminated beams by assigned painting inspector to ensure shop sealer has been applied. Where non specified shop sealer has been applied to beams or columns, remove and refinish in accordance with manufacturer's specification.
 - .3 Apply wood finishing Product in following order and as needed for specific appearance and application specified herein.
 - .1 Sanding sealer: to control penetration of subsequent coats to create more uniform finish.
 - .2 Stain: to colour wood and highlight grain for final finish.
 - .3 Filler: to fill pores of wood and control penetration of subsequent coats. Apply filler across grain forcing it into pores followed with rubbing and sanding when dried. For staining requirements mix stain with filler before applying for uniform finish. Finish coats to Provide protection to wood.
 - .4 Woodwork for Opaque Coating:
 - .1 Seal knots and sapwood in surfaces to receive paint with alcohol-based primer-sealer. Seal plastic laminate wood door edges and architectural woodwork door edges as indicated on Drawings.
 - .2 Sand smooth rough surfaces of woodwork to be finished using 150 grit paper followed by second sanding using 220 grit

- paper. Sand in direction of grain.
- .3 Clean surfaces free of dust before applying first coat using brush, compressed air or tack rags. Fill nail holes, splits and scratches with non-shrinking filler after first coat is dry.
 - .4 Remove salt deposits appearing on wood surfaces treated with fire retarder.
 - .5 Plywood surfaces: Remove dirt and debris. Fill screw and nail holes or minor imperfections with recommended filler and sand properly to receive finish coating. Prime plywood requiring stained or painted finish with top quality alkyd primer. Use only penetrating quality stain over plywood.
- .5 Woodwork for Clear Finish or Stain:
- .1 Sand smooth woodwork to be finished using 150 grit paper followed by second sanding using 220 grit paper and clean surfaces free of dust using brush, compressed air or tack rags before applying first coat.
 - .2 Abrade surfaces with stiff brush to remove loose fibers and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 sandpaper and remove dust.
 - .3 Remove salt deposits appearing on wood surfaces treated with fire retarder.
 - .4 Obtain inspection of glue laminated beams by assigned painting inspector to ensure shop sealer has been applied. Where non-specified shop sealer has been applied to beams or columns, remove and refinish in accordance with manufacturer's specification.
- .12 Gypsum Board:
- .1 Examine and ensure gypsum board surfaces are without defects or deficiencies and suitable to receive painting applications. Commencement implies acceptance of gypsum board work. Examine surfaces for imperfections showing through and fill small nicks or holes with patching compound and sand smooth.
 - .2 Clean surfaces dry, free of dust, dirt, powdery residue, grease, oil, wax or any other contaminants. Sand and dust as necessary prior to painting. Examine surfaces after priming for imperfections showing through.
 - .3 Ensure glass mat reinforced gypsum is prepared to receive high solid primer with minimum 40% volume solids. Ensure primer is applied with recommended roller to achieve film thickness in one coat or two coats.

3.3 MIXING

- .1 Mix and prepare paint materials in accordance with manufacturer's directions for particular material and coat to be applied. If reducing is required, do so in accordance with recommendations of manufacturer for particular material and coat.
- .2 Mix primer-sealer with a certain amount of colour coat in proportions recommended by manufacturer of material actually used. Tint undercoats and each finish coat with correct type colours, for identification of each succeeding coat.
- .3 Clean containers used for storage, mixing and application of materials free of foreign materials and residue.

3.4 APPLICATION

- .1 Paint interior and exterior exposed elements as noted on Room Finish Schedule and as required to complete design requirements. Do not paint excluded components indicated herein. Where an item or surface is not specifically mentioned in Schedules, Provide same finish as similar adjacent materials or surfaces. If color or finish is not designated, Consultant will select from standard colors or finishes available.
- .2 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.
- .3 Apply materials in accordance with manufacturer's directions and *Specifications* paying particular attention to appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer's paint *Specifications* require earlier applications. Apply subsequent coatings in accordance with manufacturer's recommended recoat "windows". Do not use adulterants. Do any reduction of coating's viscosity in accordance with manufacturer's directions.
- .4 Use up paints within the period of shelf life recommended by paint manufacturer.
- .5 Successive coatings to be harmonious chemical compositions and materials of same manufacturer.
- .6 Thoroughly mix materials before application. Apply materials evenly, under adequate illumination, free from sags, runs and other defects. Do cutting-in neatly and ensure paint is applied wet edge to wet edge.
- .7 Sand and dust between each coat to Provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .8 Ensure each coat is dry and hard as per manufacturers' recommendations for recoats before a following coat is applied.
- .9 Continue through paint finish behind wall-mounted items (e.g. markerboards and tack boards).

- .10 Finishes and number of coats specified hereinafter in Finish Schedule are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers' special tinted primers.
- .11 Apply additional paint coats, beyond number of coats specified for any surface, to completely cover and hide substrate and to produce a solid, uniform appearance.
- .12 Allow each coat of paint to cure and become dry and hard before application of succeeding coats (unless manufacturer's directions require otherwise).
- .13 Before finishing paint coats are applied, inspect and touch-up shop coats of primers previously applied by other trades or fabricators.
- .14 Provide paint coating thicknesses indicated, measured as minimum dry film thicknesses.
- .15 Obtain colour chart giving colour schemes and gloss value for various areas from *Consultant*. Colour chart shall give final selection of colours and surface textures of finishes and whether finishes are transparent (natural) or opaque (paint).
- .16 Spraying is not allowed without written permission.
- .17 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas which have been cut and patched. Patched appearance is not acceptable.
- .18 Finish paint factory primed surfaces. Do not paint baked paint surface, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory.
- .19 Advise *Consultant* when each applied paint coat can be inspected. Do not recoat without inspection. Tint each coat slightly to differentiate between applied coats.
- .20 Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.
- .21 Sand smooth paint and varnish undercoats prior to recoating.
- .22 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.
- .23 Woodwork:
 - .1 Prime woodwork designated for painting as soon as possible after delivery to site and before installation. Prime cut surfaces, whether exposed or not (i.e. all 6 edges of wood doors) before installation. Prime cut surfaces of woodwork to receive transparent finish with 1 coat of transparent finish reduced 25%.
 - .2 Fill open grain woods with filler tinted to match wood and work well

- into grain. Wipe excess from surface before filler sets.
- .3 Apply primer-sealer coats by brush or roller. Permit to dry in accordance with manufacturer's recommendations before applying succeeding coats. Touch up suction spots and sand between coats with No. 120 sandpaper.
 - .4 Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.
- .24 Ferrous Metal Surfaces: Apply primer coat to unprimed ferrous metal surfaces. Where sandblast preparation is specified, apply specified primer immediately after blast cleaning.

3.5 MECHANICAL AND ELECTRICAL SERVICES

- .1 Read Division 21, 22, 23 and Division 26 for their requirements and further instruction on painting Mechanical and Electrical work and perform such work under supervision of respective Mechanical and Electrical Divisions.
- .2 Finish paint primed mechanical equipment: heaters, convectors, radiators, wall fin perimeter induction units, fan coil units and similar items.
- .3 Prime and paint exposed, unfinished electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items.
- .4 Keep sprinkler heads free of paint.
- .5 Take steps to protect gauges, identification plates and similar items from being painted over or paint splattered.
- .6 Remove grilles, covers, access panels for mechanical and electrical systems from installed location and paint separately, if these items are not factory finished
- .7 Paint work to match surfaces they are seen against unless directed otherwise.
- .8 Paint interior surfaces of air ducts visible through grilles and louvres, with 1 coat of flat black metal paint to limit of sight line.

3.6 SITE QUALITY CONTROL

- .1 Field Tests and Inspections:
 - .1 Painting and decorating work to be inspected by a paint inspection agency acceptable to the Consultant and the local MPI Accredited Quality Assurance Association.
 - .2 If surfaces requiring painting to be inspected by paint inspection agency prior to commencement of painting work or after the prime coat show defects in substrate, paint inspection agency to notify the Consultant and Owner's representative in writing of any defects or problems.
- .2 Manufacturer's Services: Provide and coordinate site inspection service by manufacturer's representative in advance of work commencing and during

progress of work to ensure correct use and application of each specified material. Obtain in writing from manufacturer's representative approval of surface preparation methods outlined in Specifications or obtain specific recommendations for alternative methods. Report such conditions to Consultant.

3.7 CLEANING

- .1 Clean adjacent surfaces which have been painted, soiled or otherwise marred.
- .2 Remove masking and other protection provided under this Section.
- .3 During work of this Section cover finished floors, walls, ceilings and other work in vicinity and protect from paint and damage.
- .4 Painting work will not be considered complete until spatters, drippings, smears and overspray have been cleaned and removed to satisfaction of *Consultant*.
- .5 *Make Good* any damage to structure building surfaces or furnishings resulting from painting operations at no cost to *Owner*.
- .6 Disposal of Paint Waste:
 - .1 Be responsible for removal and disposal of material and waste generated by this Section.
 - .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous *Products* and are subject to regulations for disposal. Obtain information on these controls from applicable Provincial government departments having jurisdiction.
 - .3 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and *Provide* for delivery to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
 - .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
 - .5 To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into the ground adhere to following procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case clean equipment using free draining water.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Dry empty paint cans prior to disposal or recycling (where available).

- .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .6 Set aside and protect surplus and uncontaminated finish materials not required by Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

3.8 EXTERIOR FINISH SCHEDULE

- .1 Substrate: Structural Steel and Miscellaneous Ferrous Metals - WB Light Industrial Coating (EXT 5.1M as amended):
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107):
 - .1 "Pro Industrial Pro-Cryl Universal Metal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
 - .2 Finish Coats: 2 coats WB light industrial coating (MPI #163)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-Line" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Enamel" by PPG - Pittsburgh Paint
 - .4 "KP29 Super Spec HP DTM Acylic Semi Gloss" by Benjamin Moore
- .2 Substrate:
 - .1 Repair of Galvanized Metals: Touch-up damaged surfaces with zinc-rich coating.
 - .1 Primer: 1 coat organic zinc-rich epoxy primer:
 - .1 "Zinc Clad 5" by Sherwin Williams
 - .2 "Aquapon Zinc Rich Epoxy" by PPG - Pittsburgh Paint
 - .3 "Comex Zinc Rich Epoxy Primer ZR-10" by General Paint
 - .2 Galvanized Steel: WB Light Industrial Coating (EXT 5.3J as amended):
 - .1 Primer: 1 coat rust inhibitive primer (MPI #134):
 - .1 "Pro Industrial Pro-Cryl Universal Metal Primer, <100 g/L" by Sherwin Williams
 - .2 "X-terminator 2" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec HP Acrylic Metal Primer" by Benjamin Moore
 - .2 Finish Coats: 2 coats WB light industrial coating (MPI #163)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-Line" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Enamel" by PPG - Pittsburgh Paint
 - .4 "KP29 Super Spec HP DTM Acylic Semi Gloss" by Benjamin Moore
- .3 Substrate: Steel (High Heat) including heat exchangers, breeching, pipes, flues, stacks etc. - Heat Resistant Enamel - Maximum 205 deg C (400 deg F) (EXT 5.2A as amended):
 - .1 Primer: As recommended by manufacturer.

- .2 Finish Coats: Apply heat resistant enamel (MPI #21) coats in strict accordance with manufacturer's instructions:
 - .1 "Kem Hi-Temp Heat-Flex II 450" by Sherwin Williams
 - .2 "Ameron PSX Engineered Siloxane" by General Paint
 - .3 Approved equivalent by Benjamin Moore

- .4 Substrate: Aluminum - WB Light Industrial Coating (EXT 5.4G as amended):
 - .1 Primer: 1 coat rust inhibitive primer (MPI #134):
 - .1 "Pro Industrial Pro-Cryl Universal Metal Primer, <100 g/L" by Sherwin Williams
 - .2 "X-terminator 2" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec HP Acrylic Metal Primer" by Benjamin Moore
 - .2 Finish Coats: 2 coats WB light industrial coating (MPI #163)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-Line" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Enamel" by PPG - Pittsburgh Paint
 - .4 "KP29 Super Spec HP DTM Acrylic Semi Gloss" by Benjamin Moore

- .5 Substrate: Structural Steel and Miscellaneous Metals (Ferrous Metals, Galvanized Metals, Aluminum etc.) - Epoxy High Performance System (EXT 5.1E as amended):
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107):
 - .1 "Pro Industrial Pro-Cryl Universal Metal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .2 Finish Coats: 2 coats epoxy coating (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy Enamel by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Enamel" by PPG - Pittsburgh Paint

- .6 Substrate: Wood - Opaque Latex Finish:
 - .1 Dimension Lumber including but not limited to columns, beams, exposed joists, underside of decking, siding, fencing etc. (EXT 6.2M as amended)
 - .1 Primer: 1 coat exterior wood latex primer (MPI #6)
 - .1 "Exterior Latex Wood Primer, <100 g/L" by Sherwin Williams
 - .2 "Baseline Latex Wood Primer" by General Paint
 - .3 "Seal Grip Acrylic Universal Primer" by PPG - Pittsburgh Paint
 - .4 "K169 Super Spec Latex Exterior Primer" by Benjamin Moore
 - .2 Finish Coats: 2 coats exterior latex coating (MPI #10, #11, #15)
 - .1 "A-100 Exterior Latex, <50 g/L" by Sherwin Williams
 - .2 "Breeze Exterior Latex 70-Line" by General Paint
 - .3 "Speedhide Exterior 100% Acrylic" by PPG - Pittsburgh Paint
 - .4 "K448 Ultra Spec Exterior" by Benjamin Moore
 - .3 Finish: As selected by Consultant at a later date.
 - .2 Wood Paneling including but not limited to plywood siding, fascias, soffits etc. (EXT 6.4K as amended)

- .1 Primer: 1 coat exterior wood latex primer (MPI #6)
 - .1 "Exterior Latex Wood Primer, <100 g/L" by Sherwin Williams
 - .2 "Baseline Latex Wood Primer" by General Paint
 - .3 "Seal Grip Acrylic Universal Primer" by PPG - Pittsburgh Paint
 - .4 "K169 Super Spec Latex Exterior Primer" by Benjamin Moore
- .2 Finish Coats: 2 coats exterior latex coating (MPI #10, #11, #15)
 - .1 "A-100 Exterior Latex, <50 g/L" by Sherwin Williams
 - .2 "Breeze Exterior Latex 70-Line" by General Paint
 - .3 "Speedhide Exterior 100% Acrylic" by PPG - Pittsburgh Paint
 - .4 "K448 Ultra Spec Exterior" by Benjamin Moore
- .3 Finish: As selected by Consultant at a later date.
- .3 Substrate: Wood - Fire-retardant Coating:
 - .1 Primer: As recommended by manufacturer.
 - .2 Finish Coats: Apply ULC approved fire-retardant (MPI #126) coats in strict accordance with manufacturer's instructions:
 - .1 "Flame Control" by Sherwin Williams
 - .2 "Flame Control" by General Paint

3.9 INTERIOR PAINT FINISH SCHEDULE

- .1 Standard Performance Finishes (PT) - for public areas including lobbies, corridors, waiting areas, etc. not subject to high abuse (Refer to Room Finish Schedule for specific locations)
 - .1 Substrate: Concrete Vertical Surfaces (including undersides of mezzanines and stairs etc.) - Latex (Over Alkali-resistant Primer) (INT 3.1A as amended):
 - .1 Primer: 1 coat alkali-resistant primer (MPI #3)
 - .1 "Loxon Concrete & Masonry Primer, <100 g/L" by Sherwin Williams
 - .2 "Baseline 60-087 Superseal" by General Paint
 - .3 "Perma-Crete Alkali Resistant Primer" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Interior Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Interior Finish" by Benjamin Moore
 - .2 Substrate: Gypsum Board and Plaster Ceilings and Soffits - Institutional Low Odour/VOC Latex Finish (gypsum wallboards, textured plasters, etc.) (INT 9.2M as amended)
 - .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)
 - .1 Zero VOC Latex Primer:
 - .1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams

- .2 "Baseline 60-087 Superseal by General Paint
- .3 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint
- .4 "Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore
- .2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Interior Finish" by Benjamin Moore
- .3 Substrate: Gypsum Board Walls - Institutional Low Odour/VOC Latex Finish (gypsum and fiberglass faced wallboards, textured plasters, etc.) (INT 9.2M as amended)
 - .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)
 - .1 Zero VOC Latex Primer:
 - .1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams
 - .2 "Baseline 60-087 Superseal" by General Paint
 - .3 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint
 - .4 Approved equivalent by Benjamin Moore
 - .2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Interior Finish" by Benjamin Moore
- .4 Substrate: Fiberglass Mat Faced Gypsum Board Walls (Moisture resistant gypsum board, abuse resistant gypsum board, impact resistant gypsum board) (Non-MPI System)
 - .1 Primer: 1 coat high build surfacer (Minimum DFT: as recommended by manufacturer but not less than 10 mils)
 - .1 "Builders Solution, <50 g/L" by Sherwin Williams
 - .2 "Acrylitex Smooth Wall 97-530" by General Paint
 - .3 "Speedhide Maxbuild High Build Drywall Surfacers" by PPG - Pittsburgh Paint
 - .2 Sealing Coat: As recommended by Paint manufacturer.
 - .3 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Interior Finish" by Benjamin Moore

- .5 Substrate: Painted Wood (Doors, Frames, Trims, Rails etc.) - latex finish (INT 6.3V as amended)
 - .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #39)
 - .1 "Multi-Purpose Latex Primer" by Sherwin Williams
 - .2 "Baseline 60-087 Superseal" by General Paint
 - .3 "Seal Grip Acrylic Universal Primer" by PPG - Pittsburgh Paint
 - .4 "Fresh Start 100% Acrylic Superior Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint
 - .4 "Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
- .6 Substrate: Clear Stained Wood (CS): (Ceilings, Trims, Rails etc.) - polyurethane varnish (INT 6.3E as amended)
 - .1 Stain: clear stain as recommended by manufacturer for specific substrate.
 - .2 Top Coats: 2 coats clear moisture cure polyurethane varnish (MPI #56, #57):
 - .1 "Minwax Waterbased Polyurethane Varnish, <275 g/L" by Sherwin Williams
 - .2 "Old Masters Polyurethane" by General Paint
 - .3 "Olympic Oil Based Polyurethane" by PPG - Pittsburgh Paint
- .7 Substrate: Ferrous Metals
 - .1 Doors, Frames, Miscellaneous Metals etc.) - Water Based Light Industrial Coating (INT 5.1B or INT 5.1S as amended)
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153):
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-210 Waterborne Industrial Enamel" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint
 - .4 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
 - .2 Handrails (INT 5.1K as amended)

- .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
- .2 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterbased Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Cornado 1138 Line" by Benjamin Moore
- .8 Substrate: Galvanized Metal
 - .1 Doors, Frames, Miscellaneous Metals etc. (INT 5.3N or 5.3K as amended)
 - .1 Primer: 1 coat water-based galvanized primer (MPI #134)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "X-terminator 2" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "Super Spec HP Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-210 Waterborne Industrial Enamel" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint
 - .4 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
 - .2 Handrails (INT 5.1K as amended)
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterbased Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint

- .4 "Cornado 1138 Line" by Benjamin Moore
- .9 Substrate: Aluminum
 - .1 Primer: 1 coat quick dry primer (MPI #76, MPI #95, MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "QD Anti Corrosive Universal Primer 06-110" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153)
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-210 Waterborne Industrial Enamel" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint
 - .4 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
- .2 High Performance Finishes (PT-E) - for areas subject to high physical abuse (Refer to Room Finish Schedule for specific locations).
 - .1 Substrate: Gypsum Board and Plaster Ceilings and Soffits below 6096 mm (20' - 0") (gypsum and fiberglass faced wallboards, textured plasters, etc.) - Institutional Low Odour/VOC Latex Finish (INT 9.2M as amended)
 - .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)
 - .1 Zero VOC Latex Primer:
 - .1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams
 - .2 "Baseline 60-087 Superseal" by General Paint
 - .3 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint
 - .4 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore
 - .2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore
 - .2 Substrate: Gypsum Board and Plaster Ceilings and Soffits above 6096 mm (20' - 0") (gypsum and fiberglass faced wallboards, textured plasters, etc.) - Institutional Low Odour/VOC Latex Finish (INT 9.2M as amended)
 - .1 Top Coats: 2 coats water based dry fall coating (MPI #118,

- MPI#226)
- .1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams
 - .2 "Dryfall Latex" by General Paint
 - .3 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh Paint
 - .4 "Super Spec Sweep Up Latex" by Benjamin Moore
- .3 Substrate: Gypsum Board Walls (gypsum wallboards, textured plasters, etc.) - Epoxy Modified Latex (INT 9.2F as amended)
- .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #50)
 - .1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams
 - .2 "Baseline 60-051 Hi Hide Latex Primer" by General Paint
 - .3 "Speedhide Interior Latex Primer" by PPG - Pittsburgh Paint
 - .4 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore
 - .2 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint
 - .4 "Cornado 1138 Line" by Benjamin Moore
- .4 Substrate: Fiberglass Mat Faced Gypsum Board Walls (Moisture resistant gypsum board, abuse resistant gypsum board, impact resistant gypsum board) (Non-MPI System)
- .1 Primer: 1 coat high build surfacer (Minimum DFT: as recommended by manufacturer but not less than 10 mils)
 - .1 "Builders Solution, <50 g/L" by Sherwin Williams
 - .2 "Acrylatex 97-530" by General Paint
 - .3 "Speedhide Maxbuild High Build Drywall Surfacers" by PPG - Pittsburgh Paint
 - .2 Sealing Coat: As recommended by paint and board manufacturer.
 - .3 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint
 - .4 "Cornado 1138 Line" by Benjamin Moore
- .5 Substrate: Ferrous Metals
- .1 Unexposed Miscellaneous Ferrous Metals (with existing shop coat primer): No further finishing required except for touch-up of damaged surfaces. Prime with *Product* recommended by manufacturer for specific substrate.
 - .2 Doors, Frames, Miscellaneous Metals etc. - Water Based Light Industrial Coating (INT 5.1B or INT 5.1S as amended)
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L"

- by Sherwin Williams
- .2 "Comex C1811 Waterborne DTM Primer" by General Paint
- .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
- .4 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
- .2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153):
 - .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
 - .2 "Envirogard 15-210 Waterborne Industrial Enamel" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint
 - .4 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
- .3 Handrails (INT 5.1K as amended)
 - .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint
 - .4 "Cornado 1138 Line" by Benjamin Moore
- .6 Substrate: Galvanized Metal
 - .1 Repair of Galvanized Metals: Touch-up damaged surfaces with zinc-rich coating.
 - .1 Primer: 1 coat organic zinc-rich epoxy primer:
 - .1 "Zinc Clad 5" by Sherwin Williams
 - .2 "Devoe Catha-Coat 13034" by Dulux Paints
 - .3 Approved equivalent by General Paint
 - .2 Doors, Frames, Miscellaneous Metals etc. - Institutional Low Odor/VOC (INT 5.3N or 5.3K as amended)
 - .1 Primer: 1 coat water-based galvanized primer (MPI #134)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec HP Acrylic Metal Primer" by Benjamin Moore
 - .2 Top Coats: 2 acrylic Interior, Institutional Low Odor/VOC

(MPI #147)

- .1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams
- .2 "Envirogard 15-210 Waterborne Industrial Enamel" by General Paint
- .3 "PPG - Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint
- .4 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore

.3 Handrails (INT 5.1K as amended)

- .1 Primer: 1 coat rust inhibitive primer (MPI #107)
 - .1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams
 - .2 "Comex C1811 Waterborne DTM Primer" by General Paint
 - .3 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint
 - .4 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore
- .2 Top Coats: 2 coats water-based epoxy (MPI #115)
 - .1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams
 - .2 "Comex Waterborne Acrylic Epoxy E7000" by General Paint
 - .3 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint
 - .4 "Cornado 1138 Line" by Benjamin Moore

.3 Miscellaneous General Areas

- .1 Substrate: Ferrous Exposed Ceilings and Decking (including bar joists) above 6096 mm (20' - 0") - Water-based Dry Fall (INT 5.1CC as amended)
 - .1 Primer:
 - .1 Shop-applied Q.D primer (MPI #275): Refer to Section 05 12 00.
 - .2 Top Coats: 1 coat water based dry fall coating (MPI #118, MPI#226)
 - .1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams
 - .2 "Dryfall Latex" by General Paint
 - .3 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh Paint
 - .4 "Super Spec Sweep Up Latex" by Benjamin Moore
- .2 Substrate: Galvanized Exposed Ceilings and Decking (including bar joists) above 6096 mm (20' - 0") - Water-based Dry Fall (INT 5.1CC as amended)
 - .1 Top Coats: 2 coats water based dry fall coating (MPI #118, MPI#226)
 - .1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams
 - .2 "Dryfall Latex" by General Paint
 - .3 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh

Paint

- .4 "Super Spec Sweep Up Latex" by Benjamin Moore
- .3 Substrate: Non-insulated Pipes, Ducts, Conduit, Valves, Fittings and Equipment and Ancillary Items where "Exposed" in Completed Work
 - .1 Primer: As recommended by manufacturer for specific substrate.
 - .2 Top Coats: 2 coats latex coating (MPI #53)
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Speedhide Zero Interior Latex" by PPG - Pittsburgh Paint
 - .4 "K536 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore
 - .4 Substrate: Canvas and Cotton Coverings (Pipe and Duct Coverings, etc.) - Institutional Low Odor/Low VOC (INT 10.1D as amended)
 - .1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #50)
 - .1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Speedhide Interior Latex Primer" by PPG - Pittsburgh Paint
 - .4 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore
 - .2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)
 - .1 Zero VOC Latex Paint:
 - .1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint
 - .4 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore
 - .2 Zero VOC and Silica-free Latex Paint:
 - .1 "Harmony Interior Latex - Odor Eliminating Technology, 0 g/L" by Sherwin Williams
 - .2 "Z-Coat Zero VOC" by General Paint
 - .3 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore
 - .4 Approved equivalent by PPG - Pittsburgh Paint
 - .4 Substrate: Steel (High Heat) including heat exchangers, breeching, pipes, flues, stacks etc. - Heat Resistant Enamel - Maximum 205 deg C (400 deg F) (INT 5.2A as amended):
 - .1 Primer: As recommended by manufacturer.
 - .2 Finish Coats: Apply heat resistant enamel (MPI #21) coats in strict accordance with manufacturer's instructions:
 - .1 "Kem Hi-Temp Heat-Flex II 450" by Sherwin Williams
 - .2 "Ameron Engineered Siloxane PSX 892HS" by General Paint

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein

1.2 SUMMARY

- .1 Work Included: *Provide* high performance interior coatings including but not limited to following:
 - .1 high performance interior seamless chemical resistance coatings where specified in Room Finish Schedule (ERC).
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with other related Sections.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: *Provide* pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for *Project* site meeting of parties associated with work of this Section, including non-exhaustively *Subcontractor* performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. *Consultant* may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,

- .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:
- .1 floor flatness and floor levelness requirements;
 - .2 surface texture of finished floor;
 - .3 acceptable approaches to remediation of high moisture and high pH floors;
- .3 Scheduling:
- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.
 - .2 Cooperate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location thereof.
 - .4 Ensure work which may create dust does not proceed during work related to painting and final finishing.
 - .5 Follow requirements and procedures of MPI; www.specifypaint.com Notify inspector a minimum of 1 week prior to commencement of work and *Provide* a copy of the *Project* painting *Specification*, plans and elevation *Drawings* (including pertinent details) as well as a Finish Schedule.
- .4 Sequencing: Coordinate installation with other related Sections.
- .5 Coordination: Coordinate work of this Section with work of Section 09 66 23 and ensure compatibility of floor and wall finish *Products* where they come in contact. Coordinate installation to *Provide* neatly finished overlap where floor and wall coatings meet.

1.5 SUBMITTALS

- .1 **Product Data:** Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 **Material Safety Data Sheets:** Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.

- .3 Samples: Submit 300 mm x 300 mm (12" x 12") samples of each type of wall coating on specified sub-strata showing stages of application. Submit additional samples until approval is obtained. Make corrections to mix as required to secure correct colour and texture. Label sample(s) with *Project* name and number, applicator, names of material and manufacturer, area where material will be applied, date of sample, colour, texture and mix proportion.

1.6 CLOSEOUT SUBMITTALS

- .1 Maintenance Data: Submit maintenance manuals in accordance with Section 01 70 00. *Provide* specific instructions for maintenance, preservation, cleaning and adequate warning of maintenance practices or materials detrimental to finish surfaces.

1.7 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this Section by applicators approved by wall coating manufacturer having proven record of satisfactory installations similar to that specified and with proper equipment and skilled workers to perform it expeditiously. If requested, submit proof of these qualifications.
- .2 Single Source Responsibility:
- .1 Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
 - .2 Ensure materials for use within each coating system are compatible with each other, substrate and application procedures; if requested submit manufacturer's test results ensuring suitability of material.
- .3 *Mock-Ups*: At site, in area designated by *Consultant* erect sample wall area 1 m² (10 sq ft) by specified coating thickness (for each type of coating), including primer, block filler and necessary number of coats to obtain specified finish, showing colour, bond and quality of work. Erect additional sample if required to obtain approval. Do not proceed with work until samples have been approved. Approved samples shall become standard of comparison for wall coating on site and shall not be destroyed or moved until authorized by *Consultant*.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original unopened containers with manufacturer's labels and seals intact. Labels shall identify manufacturer's name, brand name of *Products*, grade and type, application directions and shelf life or expiry date of *Product*.
- .2 Handle and store materials in accordance with manufacturer's printed directions. Store in warm, dry, lockable area until surfaces are ready for application. Do not store out-of-doors, in boiler rooms, compressor rooms, refrigerated areas, near radiators, steam pipes or other hazardous materials.

- .3 Prior to mixing, store components at temperature between 10 deg C and 32 deg C (50 deg F and 90 deg F) for minimum 24 hours before use.
- .4 Store flammable materials in safe, approved containers to eliminate fire hazards. Remove from site at end of each work shift.
- .5 Do not use materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.9 PROJECT CONDITIONS

- .1 Environmental Requirements:
 - .1 Test substrate for moisture content using moisture meter. Do not apply coatings over substrate materials that contain over 3% moisture. Obtain approval of coating manufacturer of moisture content of substrate before proceeding with application.
 - .2 Test cementitious substrates for alkalinity in accordance with coating manufacturer's recommendations.
 - .3 Maintain minimum surface temperatures at 10 deg C (50 deg F) for 24 hours before, during, and for 48 hours following application, or until cured.
 - .4 Maintain well-lit, dust-free and well-ventilated area. Provide controlled ventilation to exterior of the building during application and drying by means of temporary ducting and exhaust fans
 - .5 Comply with coating manufacturer's directions for maintenance of substrate temperatures, ventilation and other conditions required to execute and protect work.

1.10 WARRANTY

- .1 Warrant work of this Section against defects and deficiencies for period of 3 years in accordance with General Conditions of the *Contract*. Promptly correct defects and deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects shall include, but not be limited to, crazing, blistering, fading, bond failure and softening. Damage due to structural failure of base, surface, water seepage or abnormal abuse is exempted from warranty.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 Amercoat, A brand of PPG Industries; www.ppgpmc.com
 - .2 Benjamin Moore & Co., Limited; www.benjaminmoore.ca
 - .3 General Polymers; www.generalpolymers.com
 - .4 Niagara Protective Coatings; www.niaccoat.com
 - .5 PPG Canada Inc.; www.ppg.com
 - .6 Sherwin-Willimas Company; www.sherwin-williams.com
 - .7 Sika Canada Inc.; www.sika.com
 - .8 Stonhard; www.stonhard.com

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Fire Hazard Classification: As determined by ULC testing in accordance with ASTM E84 shall not exceed following:

- .1 Flame Spread: 0.
- .2 Fuel Contributed: 15.
- .3 Smoke Developed: 10.

.2 Conform to the Occupational Health and Safety Act requirements and ensure that applicators wear appropriate, properly fitted organic vapour respirator during and after application.

.2 Performance Requirements:

.1 Epoxy wall coating components to form integral, seamless wall coating meeting the following performance characteristics:

- .1 Abrasion resistance: ASTM D4060, CS-17 wheel, 100 mg maximum weight loss (1000 g load).
- .2 Adhesion: ASTM D4541, Minimum 900 psi or equivalent testing demonstrating 100% substrate failure
- .3 Humidity Resistance: ASTM D2247, Minimum 750 hour exposure (no blistering, cracking or delamination)
- .4 Impact resistance: ASTM D2794, 24 in-lbs (Direct); 6 in-lbs (Reverse) or approved equivalent testing.
- .5 Hardness: ASTM D3363; Not less than HB or ASTM D2240, Shore D durometer 85-90.
- .6 Solids Content: 97% per weight and 94% per volume.
- .7 Bond Strength: Greater than 710.685 psi (4.9 MPa) at 100% concrete failure in accordance with ASTM D 4541.
- .8 Tensile Strength: 2973.274 psi (20.5 MPa) in accordance with ASTM D 638. Type IV.
- .9 Water Vapour Transmission: Maximum 0.89 perms in accordance with ASTM E 96/E 96M, Procedure B.
- .10 Water Absorption: 0.0052 oz/ft² (1.6 grams/m²) permability in accordance with ASTM D 570.
- .11 Scrubbability: Unaffected by 10000 cycles in accordance with ASTM D 4213.
- .12 Ultra-Violet Light Resistance: Unaffected by exposure to ultra-violet light for 100 hours in accordance with ASTM E 118.
- .13 Percentage Elongation: 3.5% in accordance with ASTM D 638, Type IV.
- .14 Bacteria Resistance: Resistant to bacteria, fungi and micro-organism activity in accordance with ASTM E 2180 and ASTM G 21.
- .15 Toxicity: Canadian Food Inspection Agency (CFIA) approved.
- .16 Chemical resistance: no chemical attack or discolouration when tested in accordance with ASTM D1308 at 22 deg C (72 deg F) for minimum 7 days for following chemicals:
 - .1 Ammonium hydroxide; 28%.
 - .2 Clorox.
 - .3 Ethylene Glycol.
 - .4 Gasoline.
 - .5 Household Bleach
 - .6 Hydrogen Peroxyde

- .7 Isopropyl Alcohol
- .8 Mineral spirits.
- .9 Sodium Hydroxide
- .10 Urine-synthetic

2.3 MATERIALS

- .1 High performance coating shall have built chemical provision to prevent and *Provide* resistance to graffiti and shall be of type that can be easily cleaned, maintained, repaired and re-coated.
 - .1 Epoxy Paint (PT-E): *Provide* water based epoxy coating in accordance with Section 09 91 00.
 - .2 Reinforced Epoxy Coating on Moisture Resistant Gypsum Board in Wet or Dry Areas (ECR-1): High solids, 2 component, thermosetting cold cure epoxy high build coating with high impact and abrasion resistance applied on fibreglass reinforcing mesh conforming to requirements specified herein. *Provide* coats recommended by manufacturer for minimum total DFT of 0.64 mm (25 mils) unless otherwise recommended by manufacturer and approved by *Consultant*. Acceptable *Products*:
 - .1 "Stonglaze VSD" by Stonhard Ltd.,
 - .2 "Epoxal TH Thixotropic" by Niagara Protective Coatings Ltd.,
 - .3 "Saniglass" by General Polymers, Division of Sherwin-Williams
 - .4 "Sikagard Duroplast 100 with reinforcing and Duroplast 150" topcoat by Sika Canada Inc.
 - .5 "Amerlock 2VOC" or "Amerlock 400VOC" with "Amercoat 880 Glassflake additive" by Amercoat Company, A division of PPG Industries
- .2 Sealant: Multi-component type, CAN/CGSB-19.24-M, or 1 component polysulphide type, CAN/CGSB-19.13-M. Colour as selected.
- .3 Caulking Beads: Polyethylene, urethane, neoprene or vinyl closed cell, foam rope with Shore "A" hardness of 20 and tensile strength between 140 and 200 kPa.
- .4 Primer: As recommended by wall coating manufacturer.
- .5 Block Filler: As recommended by wall coating manufacturer and suitable for anticipated conditions. In areas of high humidity, use epoxy block filler only.

2.4 MIXES

- .1 Mix coatings in accordance with manufacturer's directions.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Ensure surfaces to be coated are sound, clean, non-dusting, cured, free from oil and efflorescence and any other contaminants.
- .2 Report immediately defects and unsatisfactory conditions. Commencement of

work shall imply acceptance of existing conditions.

- .3 Ensure surface temperature and moisture content of substrate meet minimum environmental requirements outlined herein.

3.2 PREPARATION

- .1 Substrate shall be free of hydrostatic, capillary or moisture vapour pressure. Substrates in contact with grade shall have properly installed, effective vapour barrier to prevent damage resulting from hydrostatic, capillary or moisture vapour pressure. Concrete shall contain less than 3% moisture when tested in accordance with ASTM F1869.
- .2 Pre-installation Testing:
 - .1 Acidity and Alkalinity Test:
 - .1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to high performance coating manufacturer.
 - .2 If pH results are higher than acceptable to manufacturer, neutralize surfaces prior to beginning of installation. Neutralize as recommended by manufacturer. Retest to ensure pH levels have been neutralized
 - .3 Ensure acid-alkali balance that they are suitable for application.
 - .4 Testing of Surfaces: Prior to commencement of work, do test installation to ensure that wall coating material is not affected physically or chemically by type of chemicals anticipated to be used in area.
- .3 Carefully mask adjacent surfaces not scheduled to receive high performance coatings, wall openings for electrical outlets or switches and open ends of piping or conduit. Leave masking intact until application is complete. Masking shall be the type which can be readily removed without damage to the surface beneath.
- .4 Prepare existing or new surfaces and apply primer to substrate as per manufacturer's recommendations.
- .5 Apply block primer/filler to manufacturer's printed instructions.
- .6 Prepare existing painted concrete block surface by abrasive blast.
- .7 Recommended Final Coating Thickness:
 - .1 Prime Coat: 0.127 mm (5 mils) dry film thickness. Body
 - .2 Coat: 0.127 mm (5 mils) dry film thickness.
 - .3 Top coat: 0.127 mm (5 mils) dry film thickness

3.3 APPLICATION

- .1 Apply special coatings before adjacent work is painted.
- .2 Do not apply coating over non-hardening sealants or caulking materials. Coordinate with Section 07 84 00 and Section 07 92 00.

- .3 Apply coatings in accordance with manufacturer's instructions to produce monolithic wearing surface of minimum 0.33 mm (13 mils) DFT indicated to even, uniform in colour and appearance, free from marks, runs, craters or other defects detrimental to appearance or performance. Match approved samples.
- .4 Apply additional coatings to conceal mesh reinforcing without affecting decorative finish.
- .5 Allow proper cure time between coats as recommended by manufacturer. Protect surface from damage during this time. Smoothness index of completed coatings shall be at least 50% using a 60 degrees Gardner gloss-meter.
- .6 Where designated apply decorative finishes in accordance with manufacturer's instructions.
- .7 Provide water-tight seal to pipes and projections coming through wall coating, using sealant.
- .8 Firestopping and Smoke Seal: Firestopping and smoke seals around penetrations, through coating in fire separations shall be part of work of Section 07 84 00. Provide assistance as required to trade performing firestopping.
 - .1 Do not apply wall coatings over sealed control and expansion joints. Advise other trades in advance of sealant application until wall coating system is cured.

3.4 PROTECTION

- .1 Protect adjacent surfaces not scheduled to receive coatings from damage and overspray resulting from work of this Section. If necessary, cover or mask surfaces adjacent surfaces to those receiving coating including fixtures and equipment.
- .2 Replace at no extra cost, materials soiled by coatings during application and storage and from which soil cannot be completely removed.
- .3 Erect barriers to prevent entry and presence of workers not performing work of this Section during application of coating and for 48 hours following completion of application.
- .4 Post "Wet Coating" and "No Smoking" signs while work is in progress and while coatings are curing. Ensure spark-proof electrical equipment is used in areas where inflammable materials are being applied. Prevent use of open flames or equipment that may cause sparks during this phase of work.

3.5 FIELD QUALITY CONTROL

- .1 Inspection: In accordance with Section 01 40 00, Owner may engage independent inspection and testing company to inspect work of this Section. Give at least 2 weeks notice of starting work and allow inspector free access. Tests may include thickness, fire and chemical resistance as specified in requirements of this *Specifications*.

- .2 Manufacturer's Field Services: Ensure of coating manufacturer representative's presence at pre-construction site meeting and on site on Day coating application is commenced and periodically thereafter, to ensure work is properly performed

3.6 CLEANING

- .1 Upon completion, remove masking and clean adjacent surfaces free of overspray.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* visual display boards including but not limited to following:
 - .1 Tack boards (TB).
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,

- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and as other materials designated later by *Consultant*.
- .3 Samples: Submit in accordance with Division 01.
 - .1 Submit sample panels not less than 216 mm x 280 mm (8-1/2" x 11") for each type of board and indicated. Include sample panel for each color, texture, and pattern required.
 - .2 Aluminum Trim and Accessories: Samples of each finish type and color, on 6 inch long sections of extrusions and not less than 4 inch squares of sheet or plate, showing the full range of colors available.
- .4 Shop Drawings: Submit in accordance with Division 01.
 - .1 Submit Shop Drawings or catalogue sheets fully illustrating work of this Section. Ensure Shop Drawings indicate details of concealed mounting equipment, anchorage and frame detail as well as accessories.
 - .2 Provide detailed descriptions and item numbers showing quantity, colour, model numbers and installation instructions.

- .3 Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Do not fabricate work until Shop Drawings have been reviewed.
- .5 Operation and Maintenance Data: Submit manufacturer's operation and maintenance data in accordance with Division 01.
 - .1 Parts List: Submit manufacturer's parts lists; include servicing frequencies, instructions for adjustment and operation applicable to each type of component or hardware, and name, address and telephone number of nearest authorized service representative.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Approved Mock-ups may become part of completed Work if undisturbed at time of Substantial Performance of the Work
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.
- .2 Protect the work of this Section from damage. Protect other work from damage resulting from work of this Section. Replace damaged work which cannot be satisfactorily repaired, cleaned or restored.

1.8 WARRANTY

- .1 Warrant work of this Section (tack boards) for a period of 10 years against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to: fading, crazing, peeling, chipping, and surface becoming slick, glassy or otherwise unsuitable for use.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings, Schedules and Specifications*:
 - .1 Tack boards:
 - .1 Egan Visual; www.egan.com
 - .2 Architectural School Products; www.aspproducts.ca
 - .3 Forbo; www.forbo.com
 - .2 Substitution Limitations: This Specification is based on *Products* from manufacturers listed herein. Comparable *Products* from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to NBCC requirements;
 - .2 Design to enable barrier free usage in accordance with CAN/CSA B-651.

2.3 MATERIALS

- .1 Tack Boards (TB-1):
 - .1 *Provide* framed tack boards consisting of face sheet with rigid backing panel. Refer to *Drawings* and schedules for locations and sizes.
 - .1 Face Sheet: Linoleum surfacing material.
 - .2 Backing: *Provide* factory pressure laminated 6 mm (1/4") thick hardboard backing to face sheet.
 - .3 Metal Trim and Accessories: Fabricate frames and trim of not less than 1.6 mm (0.062") thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.
 - .4 Size: TB-1: 1000 mm x 1220 mm (40" x 48")
 - .5 Colour: to be selected by Consultant at a later date from manufacturer's full range.
 - .6 Acceptable *Products*: "Bulletin Board®" by Forbo or approved equivalent.

PART 3 -EXECUTION

3.1 INSTALLATION

- .1 *Install* work of this Section in accordance with manufacturer's published recommendations.
- .2 Tack boards:
 - .1 Deliver factory built units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Consultant.
 - .2 When overall dimensions require delivery in separate units, prefit

- components at factory, disassemble for delivery, and make final joints at site. Use splines at joints to maintain surface alignment.
- .3 Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
 - .4 Coordinate job site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.2 ADJUSTING AND CLEANING

- .1 Verify that accessories required for each unit have been properly installed and that operating units function properly. Clean and adjust units in accordance with the manufacturer's instructions.
- .2 Break in boards as recommended by manufacturer.

3.3 PROTECTION

- .1 Protect installed *Products* until completion of project. Touch-up, repair or replace damaged *Products* prior to Substantial Performance to satisfaction of *Consultant* and at no expense to *Owner*.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: Provide wire mesh partitions including, but not limited to, the following:
 - .1 wire mesh partitions and ceilings.
 - .2 steel framing.
 - .3 wire mesh sliding doors.
 - .4 hardware.
 - .5 anchors and fasteners.
 - .6 framed openings for duct work.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure

complete understanding of requirements and responsibilities relative to:

- .1 work included,
- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit the manufacturer's literature and data sheets for each type of material provided under this Section in accordance with the requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to the specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in the O&M Manual without limitations for adhesives, sealants and any other material later designated by the Consultant.
- .3 Shop Drawings: Submit to the Consultant for review, shop drawings for fabrication and erection of wire mesh partitions in accordance with the requirements of Division 01. Clearly show and describe in detail wire mesh partitions and door assemblies including elevations, sections, and details of partitions, doors and hardware, and relationship of wire mesh partition components to adjacent construction, dimensions, gauges, thicknesses, descriptions of materials, finishes, and other pertinent data and information.

1.6 QUALITY ASSURANCE

- .1 Qualifications:

- .1 The work of this Section shall be executed by competent installers with a minimum of 5 years of experience in the application of Products, systems and assemblies specified and with the approval and training of the Product manufacturers.
- .2 Manufacturer shall have 10 years of experience in the manufacture and fabrication of wire mesh partitions of type and quality shown and specified in this Section. Submit proof of experience upon request.
- .2 Licensed Professionals: Employ a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design the components of the work of this Section requiring structural performance in accordance with applicable codes and regulations, review design documents, and provide Site administration and inspection of this part of the Work.
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from one source by a single manufacturer and that secondary materials are obtained from sources recommended by the primary materials manufacturer.
- .4 Mock-ups: Provide mock-ups in locations designated by the Consultant and as required to demonstrate the quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in accordance with the construction schedule. Arrange ahead for strategic, off-the-ground, undercover storage location.
- .2 Handle and store materials in a manner to prevent damage to the materials.
- .3 Protect the work of this Section from damage. Protect the work of other trades resulting from work of this Section. Damaged work which cannot be satisfactorily repaired, restored or cleaned, shall be replaced to the satisfaction of the Consultant at no cost to the Owner.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Products of the following manufacturers are acceptable subject to conformance to the requirements of the Contract Documents:
 - .1 Anping HuaCheng Wire-Drawing and Mesh-Weaving Factory;
www.stainless-steel-wire-mesh.com
 - .2 TWP Inc.; www.twpinc.com
 - .3 Morningstar Industries Limited; www.morningstarwire.com
 - .4 Redirack Warehouse Systems; www.redirackwsi.com
 - .5 Amico Security Products; www.amico-securityproducts.com
 - .6 Approved equivalent.

- .2 Substitution Limitations: This Specification is based on Products from manufacturers listed herein. Comparable Products from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
- .2 Wire mesh partitions shall withstand effects of gravity and the following loads and stresses within limits and under conditions indicated according to NBC, 50 year probability for geographical location of the project site
- .3 Design and Performance Requirements:
- .1 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.3 MATERIALS

- .1 Wire mesh partitions, doors, ceilings and accessories shall be "Wire-Weld" by CSF Industries Ltd., "Redifence" by Redirack Industries, "Type M-1" by Major Wire Industries, "Screen-Wall" by Morningstar Industries Ltd. or "Security Mesh" by Amico.
- .2 Steel Reinforcement: New material conforming to the requirements of CSA G40.20 and CSA G40.21, Grade 350W, Class H. Steel Plates, Channels, Angles, and Bars or ASTM A 36/A 36M. .
- .3 Cold-Rolled Steel Sheet: In accordance with ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- .4 Metallic-Coated Steel Sheet: In accordance with ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
- .5 Steel Pipe: In accordance with ASTM A 53/A 53M, Schedule 40 unless another weight is indicated or required by structural loads.
- .6 Square Steel Tubing: In accordance with ASTM A 500, cold-formed structural-steel tubing.
- .7 Steel Welding Materials: In accordance with CSA and AWS requirements depending on alloys.
- .8 Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers as follows:
- .1 General: Supply each type and size of bolt and nut of same manufacture and of same lot.
- .2 Bolts: In accordance with ASTM A 325/A 325M, Property Class 4.6. Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
- .3 Common or Ordinary Bolts: To ASTM A 307, Grade A, unfinished bolts

- with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit the thickness of material being joined, but not projecting more than 1/4 inch (6 mm) beyond nut, without the use of washers.
- .4 Anchor Bolts: In accordance with ASTM F 1554, Grade 36. Supply anchor bolts of the lengths noted, but projecting a minimum of 1/2 inch (13 mm) beyond nut unless otherwise noted in the Contract Documents.
 - .5 Drilled Concrete Anchors: In accordance with CID A-A-1922A, externally threaded stud with full-length expanding sleeve. Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/ E488M, conducted by a qualified independent testing agency. Provide AISI Type 304 stainless steel drilled concrete anchors at exterior locations.
 - .6 Drilled Masonry Anchors: In accordance with CID A-A-1922A, externally threaded stud with full-length expanding sleeve. Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency. Provide AISI Type 304 stainless steel drilled masonry anchors at exterior locations.
 - .7 Nuts: In accordance with ASTM A 563/A 563M, heavy hexagon semi-finished nuts.
 - .8 Washers: In accordance with ASTM F 844 and ASME B18.22M, flat and smooth hardened washers, quenched and tempered to suit applications. For general use bolt, nut and stud application to provide increased bearing surfaces, spacing and to prevent galling.
 - .9 Hardened Steel Washers: In accordance with ASTM F 436/F 436M and ASME B18.22M.
 - .10 Lock Washers: In accordance with ASME B18.21.2, helical spring type steel "lock" washers to suit applications.
 - .11 Vandal Resistant Fasteners: Dual pin type, vandal resistant steel fasteners to suit applications.
 - .12 Miscellaneous:
 - .1 Galvanizing Repair Paint: In accordance with ASTM D 520, Type III, VOC compliant, high zinc-dust content paint for re-galvanizing welds in galvanized steel containing not less than 93% zinc dust by weight.
 - .2 Separator Sheet: In accordance with ASTM D 1330, 0.079 inch (2 mm) thick neoprene sheet.
 - .3 Bituminous Paint: In accordance with ASTM D 1187/D 1187M, Type I or II, VOC compliant, brush or spray grade, non-fibrated, asbestos free, liquid asphalt type emulsion.
 - .4 Butyl Tape: In accordance with AAMA 800, Sections 804.3 and 807.3, extruded, non-drying, non-skinning, non-oxidizing, reinforced, polyisobutylene butyl tape of sufficient width and minimum thickness of 1/8 inch (3 mm).
- .9 Heavy Duty Wire Mesh Partitions: Provide as indicated on Drawings.

- .1 Mesh: 0.192 inch (4.877 mm) diameter, into 2 inches (50 mm) square mesh.
 - .2 Panels: Fabricated from 4.877 mm (0.192") diameter steel wire welded or intermediate-crimp steel wire woven welded into a 50 mm x 50 mm (2" x 2") mesh and spot welded to 32 mm x 32 mm (1-1/4" x 1-1/4") angle iron frames. Heights shall be as shown on the Drawings.
 - .3 Provide non-modular size panels as required to complete the work.
 - .4 Vertical and Horizontal Panel Framing: 1-1/2-inches (38 mm) x 3/4-inch (19 mm) x-1/4-inch (6 mm) cold-rolled steel channels; with 3/8-inch (16 mm) diameter bolt holes spaced not more than 18 inches (450 mm) on centres along center of framing. Provide vertical panel stiffeners in shapes and sizes as recommended by the manufacturers.
 - .5 Horizontal Panel Stiffeners: 2 cold-rolled steel channels, not less than 1 inch (25 mm) x 1/2-inch (13 mm) x 1/8 inch (3 mm), bolted or riveted toe to toe through mesh or, 1-1/2-inches (38 mm) x 3/4-inch (19 mm) x 1/8-inch (3 mm) cold-rolled steel channels with wire woven through.
 - .6 Top Capping Bars: 3 inches (75 mm) x 4.1 lb (1.86 kg) hot-rolled steel channels.
 - .7 Posts for 90 Degree Corners: 2 inches (50 mm) x 2 inches (50 mm) x 1/8 inch (3 mm) steel angles with 3/8-inch (10 mm) diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
 - .8 Posts for Other Than 90 Degree Corners: Manufacturer's standard steel 2- inches (50 mm) OD pipe or tubing with 3/8-inch (10 mm) diameter bolt holes aligning with bolt holes in vertical framing.
 - .9 Adjustable Corner Posts: Manufacturer's standard steel pipe or tubing posts connected by steel hinges at 36 inches (914 mm) on centres, attached to posts; with 1/4-inch diameter bolt holes aligning with bolt holes in vertical framing.
 - .10 Line Posts: 3 inches (75 mm) x 4.1 lb (1.86 kg), or 3-1/2-inches (88 mm) x 1- 1/4-inches (31 mm) x 0.1265 inch (3.213 mm) steel channels with 5 inches (125 mm) x 18 inches (450 mm) x 1/4-inch (6 mm) thick steel base plates punched for attachment to the floor.
 - .11 Three and Four Way Intersection Posts: 2 inches (50 mm) x 2 inches (50 mm) tubular steel, with 3/8-inch (10 mm) diameter bolt holes aligned for bolting to adjacent panels.
 - .12 Floor Shoes: Steel, or cast iron, a minimum of 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- .10 Wire Mesh Ceilings:
- .1 Fabricated from same mesh as partitions, with perimeter framing fabricated from 1-1/2 inches (38 mm) x 1-1/2 inches x 1/8-inch (3 mm) steel angle, with 1/4-inch (6 mm) diameter bolt holes aligned for bolting to top of wire mesh partitions and to sides of wire mesh ceiling panels.
 - .2 Wall supports shall be 1-1/2 inches (38 mm) x-1-1/2 inches (38 mm) x 1/8-inch (3 mm) steel angle punched for attachment to wall and wire mesh ceiling panels.
 - .3 Intermediate supports shall be steel I-beams or C- channels as recommended by manufacturer to applications and conditions. Intermediate support posts shall be 2 inches (50 mm) x 2 inches (50

mm) x 1/8-inch (3 mm) steel pipe or tubing as recommended by manufacturer to applications and conditions.

- .11 Sliding Doors: Fabricated same as panels with addition of manufacturer's standard flat bar or angle reinforcement at corners and at intermediate points. Equip doors with box-type sliding door track, hangers/trolleys with ballbearing rollers in quantity and type to suit door size. Provide fusible link, door guides, door stops, keeper hasp for pad-lock and latching device so doors cannot open unless released. Provide secondary steel framing required for attachment and support of sliding gates, tracks and hardware.
- .12 Accessories:
 - .1 Adjustable Filler Panels: Minimum thickness of 0.0598 inch (thick, cold-rolled steel sheet; capable of filling openings from 2 inches (50 mm) to 12 inches (305 mm).
 - .2 Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch (25 mm) of adjustment.
- .13 Welding: Comply with applicable requirements of CSA W47.1, CSA W59 and AWS D1.1 standards as indicated in Section 01 40 00 - Quality Requirements. Employ only certified welders in accordance with CSA and AWS requirements.

2.4 FINISHES

- .1 Partitions and doors shall be cleaned, primed and finished with manufacturer's standard primer, and two coats enamel finish. Finish shall be manufacturer's standard colour later selected by Consultant. Touch up any damaged paint work on site.
- .2 Galvanizing:
 - .1 Hot-dip galvanize items as indicated to comply with the applicable standard listed below:
 - .2 ASTM A 123/A 123M, for galvanizing steel and iron components.
 - .3 ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - .4 Repair damaged and abraded galvanized surfaces with zinc rich primer paint in accordance with ASTM A 780/A 780M and the manufacturer's written instructions.
 - .5 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry, concrete, plaster and gypsum board. Use two coats of bituminous paint, or butyl tape, separator sheet, or other acceptable means.

PART 3 -EXECUTION

3.1 ERECTION

- .1 Erect wire mesh partitions and doors plumb and level and in accordance with the reviewed shop drawings. Erection shall be secure and rigid. Plumb system to a tolerance of 3 mm in 3 m (1/8" in 10').
- .2 Parts that extend to the underside of the structure above shall be anchored in a way as to allow for 25 mm (1") deflection in the structure. Do not anchor wire partition to steel deck.

- .3 Hang doors and mount miscellaneous hardware supplied as part of the work. Align in correct position with ample clearance. Ensure correct fit; test and adjust hardware as required for ease of operation.

- .4 Provide clean framed openings for duct work and piping penetrations. Coordinate the work with the mechanical Subcontractor.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* folding panel operable partitions including but not limited to following:
 - .1 folding panel operable partitions.
 - .2 pocket accessories and closure panels.
 - .3 Top supported, manually operated hinged panels, top and bottom retractable sealing, automatic sealing, sound control, panels having metal/gypsum board surfaces factory finished in fabric. *Install* in full width openings in location indicated on *Drawings*.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with other related Sections.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: *Provide* pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .2 environmental procedure requirements,
 - .3 health, safety and emergency response procedure and policy requirements,
 - .4 and security requirements;
 - .3 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for *Project* site meeting of parties associated with work of this Section, including non-exhaustively *Subcontractor* performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. *Consultant* may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:

- .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .4 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:
- .1 floor flatness and floor levelness requirements for rubber flooring installation and their acceptability by flooring manufacturer;
 - .2 surface texture of finished floor required for rubber sheet flooring installation;
 - .3 acceptable approaches to remediation of high moisture and high pH floors;
 - .4 adhesive application and floor covering installation.
- .2 Scheduling:
- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Cooperate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location thereof.

1.5 SUBMITTALS

- .1 **Product Data:** Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 **Material Safety Data Sheets:** Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.
- .3 **Shop Drawings:** Submit *Shop Drawings* for work of this Section in accordance with Section 01 30 00. Indicate installation requirements including head and jamb conditions, track layout, track support details, clearances, stacking arrangement, switching, hardware, finish pattern and colour, operating mechanism and location. Indicate loads to be imposed on supporting structure.

- .4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - .1 Partition finish minimum 300 mm (12") square.
- .5 Maintenance Data: *Provide* data for operation and maintenance of folding panel operable partitions, hardware and surfaces for incorporation into Maintenance Manual.
- .6 Test Data:
 - .1 Submit test data indicating compliance with design criteria regarding sound attenuation requirements.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers' Qualifications: *Provide* work of this Section, executed by competent installers with minimum of 5 years experience in application of *Products*, systems and assemblies specified and with the approval and training of *Product* manufacturers.
 - .2 Manufacturer's Qualifications: Manufacturer shall have 10 years' experience in manufacture and fabrication of operable partitions of type and quality shown and specified herein. Submit proof of experience upon request.
- .2 Licensed Professionals: Employ a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design components of The Work of this Section requiring structural performance;
 - .2 be responsible for full assemblies and connections ;
 - .3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations;
 - .4 be responsible for production and review of Shop Drawings;
 - .5 inspect work of this Section during fabrication and erection;
 - .6 stamp and sign each Shop Drawing;
 - .7 Provide site administration and inspection of this part of The Work.
 - .8 Upon request, submit welder's certificate from welders employed on this *Project*..
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers
- .4 Mock-Ups:
 - .1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Ensure Mock-ups are approved and accepted prior to start of system application. Do not alter, move or destroy mock-up until work is completed and approved by Consultant.

- .2 Submit Mockups of operable partitions required and all required related work for *Consultant's* and Inspector's review of; operable partition alignment, finish variations and to determine the level of quality of workmanship. Mockups sizes shall fully represent all applications and conditions for each type operable partition required. Co-ordinate the work required for mockup with all work of other Sections.
- .3 Additional mockups may be required to secure acceptance by *Consultant*.

1.7 PROJECT CONDITIONS

- .1 Floor underneath folding partition along its axis, shall be flat to within +/- 6 mm over entire length of folding partition. Peak to valley undulation of +/- 6 mm shall not be closer together than 610 mm and a peak to valley undulation of +/- 3 mm shall not be closer than 305 mm.
- .2 Support steel above folding partition along its axis shall be parallel to floor within +/- 12.7 mm for entire length of folding partition and inclusive of loaded deflection. Beam shall also be parallel to centre line of wall within ± 3.2 mm, left to right.
- .3 Fixed walls at either end of folding partition shall be within + 6 mm - 0, from plumb vertically.
- .4 Fixed walls at either end of folding partition shall be flat to within + 0, - 6 mm.

1.8 WARRANTY

- .1 Warrant work of this Section against defects and deficiencies for period of 10 years from certification date of Substantial Performance. Warrant that all mechanical and operating components including without limitations tracks, trolley systems, top and bottom sealing mechanism, and electrical switches shall remain free of defects in materials and quality of performance.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Product* of following manufacturers are acceptable provided they conform to requirements of these *Specifications*:
 - .1 "Delta 8500" by Moderco Partitions; www.moderco.com
 - .2 "Acousti-Seal 931 with No.17 track" by Modernfold Inc.; www.modernfold.com
 - .3 "Series 5500" by Hufcor Inc.; www.hufcor.com

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Fire Hazard Classification: Folding panel operable partitions shall be in accordance with requirements of CAN/ULC-S102-M: Maximum Flame Spread, 20; Fuel Contributed, 10; Smoke

Developed, 25.

.2 Design and Performance Requirements:

- .1 Laboratory Acoustical Performance: Performance of folding panel operable partitions shall have been tested in an independent acoustical laboratory in accordance with ASTM E90 Test Procedure, and shall have attained a Class H, STC rating of no less than 55.
- .2 Field Sound Performance: Arrange to have a test on actual field installation by independent acoustical consultant in accordance with ASTM E336 and ASTM E413 and submit test results to *Consultant*.
- .3 Design and construction of surrounding conditions shall be in accordance with requirements of ASTM E557

2.3 MATERIALS

- .1 Steel Frame: ASTM A 1008/A 1008M, structural steel, Grade 170, new material, unless another grade is required by design loads; exposed. Uncoated, cold rolled steel sheet, minimum 0.0641 inch (1.6 mm) nominal minimum thickness for uncoated steel.
- .2 Steel Face/Liner Sheets: ASTM A 1008/A 1008M, structural steel, Grade 170, new material, unless another grade is required by design loads; exposed. Tension-leveled, un-coted, cold rolled steel sheet, minimum 0.0299 inch (0.75 mm) nominal minimum thickness for uncoated steel.
- .3 Aluminum Extrusions: ASTM B 221, anodizing quality extrusions. Extruded sections shall be new and in perfect condition, formed true with clean, straight, sharply defined profiles, free from defects impairing strength or durability. Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, leave-off marks or other blemishes whether left finished or unfinished.
- .4 Aluminum Plate and Sheet: ASTM B 209, anodizing quality.
- .5 Moisture And Mold Resistant, Abuse-Resistant Gypsum Board: ASTM C 473, ASTM C 1658 and to resist growth of mold and mildew as per ASTM D 3273. Shall be 5/8 inch (16 mm) thick x 48 inches (1220 mm) wide x maximum permissible length, glass mat faced, treated core, abuse-resistant gypsum board having ends square cut, edges tapered, type X for fire rated assemblies and having exposed face to be smooth and ready for finishing like regular gypsum board.
- .6 Gypsum Board Screws: ASTM C 954, corrosion resistant gypsum board screws.
- .7 Gypsum Board Joint Tape and Joint Compound: To ASTM C 475/C 475M, as recommended by gypsum board manufacturer. Provide moisture and mold resistant joint compound and nylon mesh joint tape specially developed for use with moisture and mold resistant gypsum board as recommended by gypsum board manufacturer.
- .8 Acoustical Insulation: To CAN/ULC S702, Type1 and ASTM C 665, Type 1, flexible formaldehyde free, mineral wool bat/blanket type insulation of thickness required for design and performance acoustical

- requirements, having a nominal density of 2.8 lb/ft³ (45 kg/m³) and acoustical performance in accordance with ASTM C 423.
- .9 Acoustical Insulation Impale Clips: 1 inch (25 mm) wide strip fabricated from 0.021 inch (0.531 mm) thick galvanized sheet metal in 100 feet (30.48 metres) long rolls with punch-out insulation securement arrows which are attached with gypsum board screws to steel framing members.
- .10 Vinyl Wall Covering: As specified herein.
- .1 Vinyl Wall Covering Adhesive: VOC compliant, mildew resistant, non-staining, strippable adhesives and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) as recommended by the respective wall covering manufacturers.
- .2 Mildew-resistant, washable, vinyl-coated fabric wall covering having 20% recycled content by weight and 10% post-consumer content by weight, complying with CFFA-W- 101-D, Type II (Medium Duty), or ASTM F 793, Category V, Type II Commercial Serviceability, having Class A fire rating in accordance with ASTM E 84, and weighing not less than 15 oz/lineal yard (456 g/m²).
- .3 Colours and Textures: As selected later by *Consultant* from manufacturer's full available colour and texture ranges.
- .11 Fasteners:
- .1 General: Supply each type and size of bolt and nut of same manufacture and of same lot.
- .2 Bolts: To ASTM A325/A325M, Property Class 4.6. Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
- .3 Common or Ordinary Bolts: To ASTM A 307, Grade A, unfinished bolts with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit thickness of material being joined, but not projecting more than 1/4 inch (6 mm) beyond nut, without the use of washers.
- .4 Anchor Bolts: To ASTM F 1554, Grade 36. Supply anchor bolts of lengths noted, but projecting not less than 1/2 inch (13 mm) beyond nut unless otherwise noted.
- .5 Nuts: To ASTM A 563/A 563M, heavy hexagon semi-finished nuts.
- .6 Washers: To ASTM F 844 and ASME B18.22M, flat and smooth hardened washers, quenched and tempered to suit applications. For general use bolt, nut and stud application to provide increased bearing surfaces, spacing and to prevent galling.
- .7 Hardened Steel Washers: To ASTM F 436/F 436M and ASME B18.22M.
- .8 Lock Washers: To ASME B18.21.2, helical spring type steel "lock" washers to suit applications.
- .9 Machine Screws: To ASME B18.6.3 and ASME B18.6.7, to suit applications.
- .10 Machine Screw Nuts: To ASME B18.6.3, to suit applications.
- .11 Vandal Resistant Fasteners: Dual pin type, Type 304 stainless steel vandal resistant fasteners to suit applications.
- .12 Security Fasteners: Button head Torx® Plus R, tamper-resistant stainless steel machine screw # 10, 1 inch (25 mm) long.
- .13 Drilled Concrete Anchors: To CID A-A-1922A, externally threaded

- stud with full-length expanding sleeve. Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E488M, conducted by a qualified independent testing agency.
- .14 Drilled Masonry Anchors: To CID A-A-1922A, externally threaded stud with full-length expanding sleeve. Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- .15 Miscellaneous:
- .1 Separator Sheet: To ASTM D 1330, 0.079 inch (2 mm) thick neoprene sheet.
- .2 Bituminous Paint: To ASTM D 1187/D 1187M, Type I or II, VOC compliant, brush or spray grade, non-fibrated, asbestos free, liquid asphalt type emulsion.
- .3 Butyl Tape: To AAMA 800, Sections 804.3 and 807.3, extruded, non-drying, non-skinning, non-oxidizing, reinforced, polyisobutylene butyl tape of sufficient width and minimum thickness of 1/8 inch (3 mm).
- .12 Exposed aluminum shall be Aluminum Association alloy 6063-T5 of anodizing quality, free from defects impairing appearance, strength and durability. Aluminum finish shall be clear anodized in accordance with Aluminum Association Finish Designation AA-M12C22A31. Aluminum sheet; Alcan Utility, AA-3003 mill finished where concealed.
- .13 Sound Seals:
- .1 Furnish manufacturer's standard vertical seals between panels consisting of tongue and groove or similar configuration incorporating vinyl finger and/or bulb acoustical seals. *Provide* extruded, interlocking bulb type vertical seal on edge of end closer panels.
- .2 Horizontal stationary top and bottom extruded vinyl seals shall not be acceptable. Horizontal top and bottom seals shall be retractable seals simultaneously operated by a removable handle located approximately 1067 mm (42") from the floor in panel edge.
- .3 Operable floor seals shall be adequate to provide minimum 25 mm (1") vertical adjustment due to deflection or unevenness in floor. *Provide* for downward pressure to create and acoustical seal and to resist panel movement. Finish exposed seal channel in clear anodized aluminum.
- .14 Suspension System:
- .1 Track and trolley system as recommended by folding panel partition manufacturer.
- .2 Continuous extruded C-channel shaped heavy duty aluminum track which shall accommodate angular turns and intersections, with all intersections welded. Each panel shall have 2 steel reinforced, low friction polymer discs.
- .15 Pocket Doors and Mounting Panels:

- .1 Furnish completely finished and operating pocket doors to match operable wall panels. Doors shall be full height, complete with operating latch sets, hinges and seals, and shall be constructed to maintain sound rating of entire assembly. Provide "Pocket" by Moderco.
 - .2 Provide hinged pocket doors by preparing panels with adequate reinforcing to accept hinges and locking system or electrically operated locks for electrically controlled folding partition.
 - .3 Provide rigid electrical conduit for electronically controlled doors consisting of rigid galvanized steel of 19 mm (3/4") diameter with locknuts, bushings and fittings, and continuous nylon pull cord.
 - .4 Incorporate provisions for electrical controls and wiring for access doors by forming and welding rigid conduit to interiors of door slabs and adjacent panels only for openings so scheduled.
- .16 Operable Partitions
- .1 Description: Manually operated, hinged pair panels with expanding closure.
 - .2 Partition Weight Maximum: 12 lbs/sq ft.
 - .3 Panel Widths: Equal and maximum 1200 mm (4').
 - .4 Sound Transmission Class: 49.
 - .5 Finish: Vinyl to be selected by *Consultant* from manufacturer's standard range.

2.4 FINISHES:

- .1 Aluminum:
 - .1 Clear Anodized Coating - Architectural Class II:
 - .2 AAMA 611, 0.4 mils (0.1016 mm) minimum coating thickness, integral, clear anodic oxide coating in accordance with Aluminum Finish Designation AA-M12C22A41, Architectural Class II.
 - .3 Pre-treat aluminum with caustic etch treatment prior to applying integral, clear anodic oxide coating.
 - .4 Protect finish with removable protective film.
 - .2 Exposed Steel Finish:
 - .1 Clean exposed steel components thoroughly, spray apply 1 coat CAN/CGSB-1.81 primer and 2 coats CAN/CGSB-1.88 type2, gloss or CAN/CGSB-1.104 type2, semi-gloss paint, Colour(s) will be as selected by *Consultant* from manufacturer's standard colour selection.
 - .2 Concealed Steel: Primed painted in accordance with Division 09

PART 3 -EXECUTION

3.1 PREPARATION

- .1 Prepare opening in accordance with criteria set forth in ASTM E 557.

3.2 INSTALLATION

- .1 *Install* system using manufacturer's authorized and factory trained specialists only, in accordance ASTM E 557 and reviewed *Shop Drawings* to

-
- ensure smooth and efficient operation on operable partitions.
- .2 Provide work of this Section in accordance with manufacturer's instructions. Follow manufacturer's detailed installation instructions. Make assembly plumb, level and straight.
 - .3 Coordinate drilling of overhead structural beam flanges for support of suspension rods and fabricated track support with trade providing overhead structural members.
 - .4 Work in close co-operation with metalwork, gypsum board and ceiling trades during installation.
 - .5 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry, concrete, plaster and gypsum board. Use two (2) coats of bituminous paint, or butyl tape, separator sheet, or other acceptable means.

3.3 DEMONSTRATION, ADJUSTING AND CLEANING

- .1 Commission and adjust folding partitions, access doors and operating devices in proper operation.
- .2 Demonstrate full range of operation, control features and safety features of operable partitions in each location in the presence of *Owner* at a time and date selected by *Consultant*
- .3 Training: At times and dates selected by *Consultant*, provide competent instructors to properly train *Owner's* personnel in full range of operations, care, adjustment of controls and mechanisms to ensure smooth and efficient operations of operable partitions until *Owner* is satisfied that that training is complete. Manufacturer shall issue training certificates to each of the *Owner's* personnel who have successfully completed manufacturer's training course and submit copies to *Owner*.
- .4 Refinish damaged or defective work so that no variation in surface appearance is apparent.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions in the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* wall protection including but not limited to following:
 - .1 sheet vinyl wall protection(VWP)
 - .2 trims and mouldings
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Definitions:
 - .1 Full Height: Top of base to underside of ceiling.
 - .2 Installation:
 - .1 This includes coordination with other Sections, labour, material and equipment necessary for off-loading of equipment, handling, storing and dismantling of parts if required.
 - .2 Make provisions for transferring items to proper location in building, connections to building services, covering and protecting, final removal of covering and protection and making ready as required to form fully operative equipment.
 - .3 Install items with security fasteners and security anchoring devices in security areas.
 - .3 Purchase: This includes labour, materials and equipment necessary for purchase and delivery of equipment to site.
- .2 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:

- .1 environmental procedure requirements,
- .2 health, safety and emergency response procedure and policy requirements,
- .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 *Product Data:*
 - .1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets *Provide* required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. *Provide* adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
 - .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound and other materials later designated

later by *Consultant*.

- .2 Shop Drawings:
 - .1 Submit in accordance with Division 01 Ensure Shop Drawings indicate material characteristics, details of construction, connections and relationship with adjacent construction.
- .3 Samples: Submit in accordance with Division 01 If requested by Consultant submit samples of Products.
- .4 Test and Evaluation Reports: Submit test data substantiating that proposed materials meet performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of applicable materials.

1.6 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data Submit maintenance instructions in accordance with Division 01 for wall protection specified herein.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials: *Supply* following quantity of maintenance material in accordance with Section Division 01:
 - .1 Quantity: 5% of the *Work*.

1.8 QUALITY ASSURANCE

- .1 Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .2 Single source responsibility: Provide components of wall protection system manufactured by same company to ensure compatibility of color, texture and physical properties.
- .3 Mock-ups: *Provide Mock-ups* in locations designated by *Consultant* and as required to demonstrate quality of workmanship. Maintain *Mock-ups* during construction in an undisturbed condition as a standard for judging the completed work.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays.

1.10 WARRANTY

- .1 Warrant work of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 C/S Construction Specialties, Ltd.; www.c-sgroup.com
 - .2 InPro Corporation; www.inprocorp.com
 - .3 Koroguard Wall Protection System; www.koroguard.com
- .2 Substitution Limitations: This Specification is based on C/S *Products*. Comparable *Products* from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Design and Performance Requirements:
 - .1 Fire Performance Characteristics: Provide wall panels having ULC or UL label indicating that they are identical to those tested in accordance with CAN/ULC S102.2 or ASTM E84 for Class A characteristics with flame spread of 25 or less; and smoke development of 450 or less.

2.3 MATERIALS

- .1 Aluminum Extrusions: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063- T5 or T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.
- .2 Aluminum Sheet: ASTM B221M, Minimum thickness: 3 mm (1/8"); of type and characteristics to match finished extrusions; Concealed sheets to be Utility Aluminum mill finished; for intricate forming with decorative finishes use AA 1100 and for siding and exposed panels use AA-3003 with specified finish.
- .3 Stainless Steel:
 - .1 Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A167 or ASTM A666, Type 304 and Type 316 alloy with exposed surfaces having No. 4 polished finish. Sizes as required to meet design requirements.
 - .2 Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.
- .4 Extruded Plastic: Minimum 1.5 mm (0.06") thick, high impact cover material manufactured from PETG plastic containing no PVC in formulation with shadow

grain texture.

2.4 MANUFACTURED UNITS

- .1 PVC-Free Wall Protection Covering (VWP):
 - .1 PVC-Free Wall Protection: High impact semi-rigid sheet wall cladding.
 - .1 Thickness: 1.5 mm (0.060").
 - .2 Height: 1100 mm (43") unless otherwise indicated on Drawings.
 - .3 Colours: Allow Consultant to select minimum 5 colours from manufacturer's standard range at a later date.
 - .4 Trims and Mouldings: Provide extruded clear satin anodized aluminum trims and sealants for panels as follows:
 - .1 Inside Corner and Seams: Provide silicone sealants as recommended by manufacturer. Conform to Section 07 92 00.
 - .2 Edges, Top and Bottom Panels: Provide anodized aluminum capping "ALU2013" by Outwater Plastics Industry Inc.; www.outwater.com or approved equivalent by Nudo; www.nudo.com.
 - .3 Final moulding profiles to be selected and approved by Consultant at a later date.
 - .5 Adhesive: Provide adhesive as recommended by manufacturer.
 - .6 Provide accessories as a complete packaged system.
 - .7 Acceptable Products:
 - .1 "0.60N Acrovyn 4000" by C/S Construction Specialties Ltd or approved equivalent by InPro Corporation or Pawling Corporation.

2.5 FABRICATION

- .1 Accurately fit joints and intersecting members in true planes with adequate fastening.
- .2 Fit and assemble work of this Section in shop where possible. Execute according to details and reviewed *Shop Drawings*. Where shop fabrication is not possible, execute trial assembly in shop.
- .3 Fabricate finished work free from distortion, weld splatter and defects detrimental to appearance and performance.
- .4 Provide exposed metal fastenings and accessories of the same material, texture, colour and finish as the base metal to which they are applied or fastened, unless otherwise specified.
- .5 Do not expose trademarks or labels on finished surfaces.

2.6 ACCESSORIES

- .1 Provide accessories as a complete packaged system.
- .2 Edge, Corner and Butt Mouldings: Provide extruded clear anodized aluminum moulding in various profiles to suit *Project* requirements and as recommended by manufacturer. Division bars between panels, inside and outside corners and cap mouldings.

- .3 Sealants: *Provide* silicone sealants as recommended by manufacturer.
- .4 Adhesives: *Provide* adhesive as recommended by manufacturer.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.
- .2 Verify conditions are ready to receive work of this Section before commencing work.
- .3 Verify gypsum board substrate smooth, plumb and true, free of waves bulges and within tolerances specified in Section 09 21 16.

3.2 PREPARATION

- .1 Surface Preparation: Ensure substrate is dry, well-sealed and free of dirt, loose paint, wax and grease. Glossy surfaces may require sanding or priming before installation to help promote adhesion.

3.3 INSTALLATION

- .1 Conform to manufacturer's printed instructions for accurate, secure installation. Ensure proper operation.
- .2 *Provide* work of this Section true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.
- .3 *Provide* work of this Section tightly fitted and level and flush to adjacent surfaces and components.
- .4 *Provide* all necessary reinforcing including but not limited to steel stud backup and securely fasten components to suit design requirements. Ensure proper reinforcing has been provided as necessary.
- .5 *Provide* vinyl wall protection sheet covering materials on prime painted gypsum board walls where indicated.
- .6 Ensure application is performed by approved experienced applicators.
- .7 Use contact or waterproof adhesives in accordance with best trade practices for application to edges of wall protection covering materials, where wall protection covering materials meets other materials such as at door frames, walls and base.
- .8 *Install* wall protection covering materials in accordance with manufacturer's recommendations, and neatly and closely fit around switches, light outlets, grilles, trim and similar items. Carry wall covering into

reveals, jambs, and heads of openings.

- .9 Apply wall protection covering in maximum widths carefully matched for colour, pattern, and texture. Avoid shading.
- .10 Thoroughly wash off excess adhesive from material and adjoining surfaces as work proceeds.
- .11 Take care to ensure wall protection coverings are fully on the wall at inside corners, without coving or subsequently pulling away from the wall. Apply material to outside corners in a manner which will prevent gathering of air beneath the material on each side of the corner. No joints are allowed within 150 mm (6") of any corner.
- .12 *Install* edge mouldings as required and as shown on *Drawings*.
- .13 Remove material showing evidence of coming loose or showing any blisters, imperfect seams, wrinkles, dried adhesive, or other imperfections, and apply new material.

3.4 CLEANING

- .1 Clean adjacent surfaces, which have been soiled or otherwise marred, to completely remove evidence of material causing same.

3.5 PROTECTION

- .1 Cover finished surfaces and protect exposed corners and areas vulnerable to damage by persons or by movement of materials, tools or equipment.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* accessories including but not limited to following:
 - .1 boot rack (BR)
 - .2 clothing hooks (CH)
 - .3 electric hand dryer (EHD)
 - .4 grab bar (GRB) - including standard grab bar, L-shaped grab bar, flip-up grab bar and additional reinforcing for grab bars in bariatric areas
 - .5 janitorial unit (JU)
 - .6 mirror (MIR)
 - .7 paper towel dispenser unit (PTD)
 - .8 paper towel dispenser/disposal unit (PTDD)
 - .9 soap dispensers (SD)
 - .10 shower seats (SHT.ST)
 - .11 sanitary napkin/tampon disposal unit (SND)
 - .12 stainless steel shelf (SSS)
 - .13 toilet tissue dispensers (TTD-1)
 - .14 towel bar (TWB)
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 ASTM A167-99(09): Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .2 ASTM C1503-08: Standard Specification for Silvered Flat Glass Mirror
 - .3 CSA W59-03(08): Welded Steel Construction (Metal Arc Welding)
 - .4 CSA B651-12: Accessible Design for the Built Environment

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,

- .2 health, safety and emergency response procedure and policy requirements,
- .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 *Product Data*: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets *Provide* required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. *Provide* adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 *Material Safety Data Sheets*: Submit MSDS for inclusion in Operation and Maintenance Manual for following items without limitations: adhesives, sealants and other items designated later by *Consultant*.

- .3 *Shop Drawings*: Submit *Shop Drawings* for work of this Section in accordance with Division 01. Ensure *Shop Drawings* indicate material characteristics, details of construction, connections and relationship with adjacent construction. Submit *Shop Drawings* in form of catalogue cuts and fully illustrate specified materials with description of components, surface finishes, hardware and securement devices.
- .4 Samples: Submit complete samples of each accessory and modular unit to *Consultant* for review of construction quality, materials and finish prior to delivery of required quantities of items. Submit sample of each colour where applicable. No trademark and/or labels are acceptable on exposed finishes.
- .5 Maintenance Instructions: Submit maintenance instructions in accordance with Division 01. Submit an accessories schedule, keys and parts manual as part of *Project* closeout documents. Submit 2 sets of following items of manufacturer's literature:
 - .1 Technical Data Sheets of each item used for the *Project*.
 - .2 Service and Parts Manuals.
 - .3 Name of local representative to be contacted in the event of need of field service of consultation.

1.6 QUALITY ASSURANCE

- .1 Installers: *Provide Work* of this Section executed by competent installers with minimum of 5 years' experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers. Ensure *Products* for work of this Section are keyed alike to extent possible.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in sealed cartons and containers with manufacturer's name and *Product* description clearly marked thereon.

1.8 WARRANTY

- .1 Warrant mirrors of this Section for period of 10 years against defects and deficiencies in accordance with General Conditions of the *Contract*. Promptly correct defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects include but are not limited to: deterioration of mirror's silvering.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
- .1 ASI/Watrous, Inc. A division of ASI; www.americanspecialties.com
 - .2 Bobrick Washroom Equipment of Canada Ltd.; www.bobrick.com
 - .3 Bradley Corporation; www.bradleycorp.com
 - .4 Elcoma Barrier Free *Products*; www.elcoma.com
 - .5 Frost Washroom Accessories; www.fcfrost.com
 - .6 HealthCraft *Products* inc.; www.healthproducts.com
 - .7 Kimberley Clark; www.kimberly-clark.com
 - .8 Koala Kare; www.koalabear.com
 - .9 Securing Cosmos; www.securitycosmos.com
 - .10 Mistubishi; www.mitsubishijettowel.com
 - .11 Dyson; www.dysonairblade.com
- .2 Substitution Limitations: This Specification is based on *Products* from manufacturers listed herein. Comparable *Products* from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
- .1 Install systems in accordance with Code regulations concerning access of physically challenged and disabled persons. Comply with CAN/CSA B651.
- .2 Design/Performance Requirements:
- .1 Provide accessories as specified with options indicated. Model numbers may not reflect all options required.
 - .2 Provide stainless steel collars to accommodate semi-recessed mounting of units whose depth exceeds wall cavity depth.
 - .3 Edges of sheet metal which are accessible to users or maintenance personnel shall be pneumatically sanded to yield smooth safe edges with no sharpness.
 - .4 Mount items with concealed fasteners unless otherwise indicated or unavoidable. Where exposed fasteners are unavoidable, use tamper-resistant type.
 - .5 Where indicated, Design and manufacture suicide-resistant products in order to minimize risk of suicide in correctional facilities. Conform to suicide-resistant or anti-ligature requirements of ADAAG (Americans with Disabilities Act Accessibility Guidelines).

2.3 MATERIALS

- .1 Ensure accessories are stainless steel conforming to ASTM A167, Type 304 or Type 302, of 1 type throughout, ANSI No. 4 mechanical brushed finish, of contemporary design, with minimum material thicknesses of components as specified herein. Arrange stainless steel sheet so grain of brushed finish runs vertically in finished installation.
- .1 Minimum thickness, any location or component: 0.645 mm
 - .2 Hygienic accessory - exposed double pan doors and panels: 0.645 mm
 - .3 Hygienic accessory - exposed single pan doors: 1.26 mm

- .4 Reinforcement: 1.26 mm
- .2 Concealed Sheet Steel Reinforcing: Refer to Section 09 21 16. At bariatric locations, Provide toggle bolt fasteners as specified herein to Provide additional strength.
- .3 Provide accessories as specified with options indicated. Model numbers may not reflect all options required.

2.4 MANUFACTURED UNITS

- .1 Boot Rack (BR-1): Supply vertical surface mounted rack with 1.519 mm (16ga) steel posts and 1.214 mm (18ga) flip-up steel shelves. Steel shall be Zinc-Coated (Galvanized). 4 flip-up shelves per section unit. Provide all required hardware and accessories for complete installation.
 - .1 Size: 864 mm x 1500 mm x 355 mm (34"w x 4'11"h x 14"d)
 - .2 Provide 1 of the following:
 - .1 "48W/34W SML Wall Mounted Book Racks" by Shanahan's; www.shanahans.com or approved equivalent.
 - .3 Finish: baked enamel, colour to be selected at a later date from manufacturer's standard range.
- .2 Clothing Hook (CH-1): Supply 1 per washroom and as indicated on drawings, satin finished stainless steel, double hook type supplied with backplates and screws. Mount items at heights indicated on Drawings. Provide 1 of following:
 - .1 Model No. B-682 by Bobrick,
 - .2 Model No. 9134 by Bradley.
 - .3 Model No. 7382 by ASI/Watrous
- .3 Clothing Hook - Multiple (CHM): Supply hooks mounted on strip in locations indicated on drawings, satin finished stainless steel, double hook type supplied with backplates and screws. Mount items at heights indicated on Drawings. Provide 1 of following:
 - .1 Model No. B-232 by Bobrick
 - .2 Model No 9943 by Bradley
 - .3 approved equivalent by ASI
- .4 Clothing Hook and Handicapped Hook Strip - Multiple (CHMS and HCHMS):
 - .1 Provide hooks mounted on strip and designed to carry maximum load of 16 kg (35 lb) without failure. Ensure clothing hooks fail when loaded beyond limit stipulated above. Provide units capable of having adjustable failing point under load by means of adjusting 1-way vandal proof screws with special tool. Minimum 3 hooks per strip.
 - .2 Supply in designated mental health areas, satin finished stainless steel, multiple hook type with rear mounting system supplied with backplates and screws. Mount items at heights indicated on Drawings.
 - .3 Provide 1 of following:
 - .1 CHMS-1 and HCHMS-1:
 - .1 Model No. B-985 by Bobrick
 - .2 approved equivalent by Bradley
 - .3 approved equivalent by ASI

- .5 Safety/Suicide Resistant Clothing Hook and Handicapped Hook (CHS and HCHS):
- .1 Provide door hooks designed to carry maximum load of 16 kg (35 lb) without failure. Ensure clothing hooks fail when loaded beyond limit stipulated above. Provide units capable of having adjustable failing point under load by means of adjusting 1-way vandal proof screws with special tool.
 - .2 Supply 1 per shower stall and washroom in designated mental health areas, satin finished stainless steel, single hook type with rear mounting system supplied with backplates and screws. Mount items at heights indicated on Drawings. Provide 1 of following:
 - .1 Model No. B-983 (Stainless steel hook and bracket) by Bobrick.
 - .2 Model No. SA35 (Stainless steel hook and bracket) by Bradley.
 - .3 Model No. 123 (Stainless steel hook and bracket) by ASI/Watrous.
- .6 Wall Mounted Clock (CLK):
- .1 Refer to Division 26.
- .7 Electric Hand Dryers (EHD): ADA Compliant, Surface mounted warm air hand dryers with sensor operation. Provide high speed type with adjustable speed/temperature. Ensure units come complete with anti-microbial resistant exterior surfaces. Provide 1 of following:
- .1 Sensor Operation (High Speed Type): Ensure units come complete with anti-microbial resistant lacquer on exterior surfaces.
 - .1 "AirbladedB-AB14" by Dyson.
 - .2 "Jet Towel" by Mistubishi.
 - .3 "Tri-Umph" by ASI/Watrous.
- .8 Grab Bar (GRB): Stainless steel, 32 mm (1-1/4") outside diameter, 1.21 mm (18 ga) wall thickness with peened finish to Provide positive gripping surface unless otherwise indicated. Provide items complete with standard mounting plates, flanges and accessories. Ensure grab bars can support minimum load of 113 kg (250 lbs).
- .1 Standard Horizontal or Vertical Grab Bar (GRB-1): Mount as shown on Drawings. Provide 1 of following:
 - .1 Model No. B-5806.99x24 Series by Bobrick.
 - .2 Model No. 812x24 Series by Bradley.
 - .3 Model No. 3100-01x24 Series by ASI/Watrous.
 - .2 Vertical L-Shaped Grab Bar (GRB-2): Provide vertical L-Shaped grab bar. Mount as shown on Drawings. Provide following:
 - .1 Model No. 3100-04 (30x30) by ASI/Watrous or approved equivalent by Bobrick, Bradley or Elcoma.
 - .3 Grab Bar (GRB-3): Not Used.
 - .4 Flip Up Grab Bar (GRB-4): Ensure grab bars are capable of rotating 90° in vertical direction. Mount as shown on Drawings with columns or carriers recommended by manufacturer. Provide following:
 - .1 Model No. B-4998.99 by Bobrick
 - .2 Model No. 3413P by ASI/Watrous
 - .3 Model No. 96-2230PW05- PEENED GRIP by Elcoma; www.elcoma.com
- .9 Janitorial Unit (JU): Supply 865 mm (34") long stainless steel utility shelf complete with stainless steel hooks and spring-loaded rubber mop/broom holders:

- .1 Model No. B-223x36 by Bobrick.
 - .2 Approved equivalent by Bradley.
 - .3 Approved equivalent by ASI/Watrous.
- .10 Mirror (MIR-1): *Supply* 6 mm (1/4") polycarbonate mirror with inter-Lok stainless steel Type 304 (18-8) 1.21 mm (18 ga) No. 4 satin finish. Provide minimum 0.457 mm thick (26 ga) galvanized sheet steel backing and Tamper resistant fasteners.
- .1 Size: (MIR-1): 460 mm X 910 mm (18" X 36")
- .11 *Provide* 1 of following:
- .1 Model No. "0600 series" by ASI/Watrous.
 - .2 Model No. "B-290 series" by Bobrick.
 - .3 Model No. "780 series" by Bradley.
- .12 Paper Towel Dispenser Units (PTD-1): Compact Height (711 mm - 28"); Surface Mounted stainless steel construction with C-folded or multi-folded towel dispensing mechanism. *Provide* Type 304 (18-8) 0.8 mm (22 ga) stainless steel door complete with full length heavy duty stainless steel piano hinge. *Provide* 1 pin type tumbler lock:
- .1 Model No. B-262 by Bobrick.
 - .2 Model No. 250-15 by Bradley.
 - .3 Model No. 0210 by ASI/Watrous.
- .13 Medium Capacity Stainless Steel Combination Paper Towel Dispenser/Disposal Unit (PTDD-1): Full Length; surface mounted stainless steel construction with metal waste receptacle and C-folded, multi-folded or single folded towel dispensing mechanism. *Provide* Type 304 (18-8) 1.519 mm (16 ga) stainless steel door complete with full length heavy-duty stainless steel piano hinge. *Provide* 2 pin type tumbler locks keyed alike:
- .1 Model No B-380349 by Bobrick
 - .2 Model No 2017-11 by Bradley
 - .3 Model No 64676-9 by ASI/Watrous
- .14 Soap Dispensers (SD-1): Liquid type.
- .1 Vertically Wall Mounted Type (SD-1): minimum 1.2 L (40 oz) capacity container with soap level gauge and integral filler cap. *Provide* 1 of following::
 - .1 Model No. B-2111 by Bobrick.
 - .2 Model No. 6562 by Bradley
 - .3 Model No. 0347 by ASI/Watrous
- .15 Solid Phenolic Folding Shower Seats (SHT.ST): Solid phenolic folding shower seat manufactured from 1 piece solidly fused plastic laminate with matte finish. Frame to be Type 304 (18-8) 1.519 mm (16 ga) stainless steel with satin finish. *Provide* stainless steel piano hinge along 1 side. Other side to have 3 mm (1/8") thick 19 mm (3/4") x 19 mm (3/4") stainless steel support angle. *Provide* 1.519 mm (16 ga) retaining clip to hold seat in upright position when not in use. *Provide* 1 of following:
- .1 Model No. B-5191 by Bobrick.
 - .2 Model No. 9562 by Bradley.
 - .3 Model No. 8203 by ASI/Watrous.

- .16 Sanitary Napkin and Tampon Disposal Unit (SND): surface mounted, stainless steel construction, satin finish with self-closing door. *Provide* 1 of following:
- .1 Surface mounted Type:
 - .1 Model No. B-270 by Bobrick.
 - .2 Model No. 4781-15 by Bradley.
 - .3 Model No. 20852 by ASI/Watrous.
- .17 Stainless Steel Shelf (SSS-1): Surface mounted shelf fabricated from 1.27 mm (18 ga), Type 304 stainless steel in satin finish. *Provide* units complete with integral brackets. *Provide* 1 of following:
- .1 Model No. B-298x18 by Bobrick
 - .2 Model No. 758-18 by Bradley
 - .3 Model No. 0692-818 by ASI/Watrous
- .18 Safety Toilet Tissue Dispenser (TTD-1): Supply safety toilet tissue dispenser manufactured from impact resistant solid polymer material with collapsible dowels. *Provide* following:
- .1 Model No. 817-S15 - SafeSupport® Impact Resistant TP Holder by SecuringCosmos; www.securingscosmos.com or approved equivalent by Bobrick or Bradley or ASI/Watrous. Size: As shown on Drawings.
- .19 Towel Bar (TWB): Circular towel bar with 19 mm - 25 mm (3/4" - 1") outside diameter manufactured from Type 304 satin finished stainless steel with 1.214 mm (18 ga) wall thickness. *Provide* units complete with standard mounting plates, flanges and accessories. Mount as shown on *Drawings*.
- .1 Size: 610 mm (24")
 - .2 *Provide* 1 of following:
 - .1 Model No. B-530x24 by Bobrick.
 - .2 Model No. 9065x24 by Bradley.
 - .3 Model No. 7355-24 by ASI/Watrous.

2.5 FABRICATION

- .1 Fabricate accessories true, square, rigid, free from distortion and from defects detrimental to appearance and performance. Assemble sheet metal accessories by welding in accordance with CSA W59-M. Conceal welds, or grind smooth such as to be undetectable in finished work. Unless approved by *Owner*, assembly fastenings, hardware fixings and mounting or installation devices shall be concealed in finished work.
- .2 Use non-corrosive metal fasteners of expansion type, toggle type or other approved type of positive, mechanical anchor as required to suit construction to which accessory is to be mounted. Exposed fasteners, where permitted, shall be finished to match adjacent accessory surface, and be countersunk. Where accessories are mounted to sheet metal, *Provide* a 3 mm (1/8") thick minimum full-size metal back-up plate drilled and tapped to receive machine screws and finished to match adjacent sheet metal surface.
- .3 Ensure frameless accessories have 1 piece fronts with 90 degree formed returns at their edges and openings. Ensure returns are continuously welded and ground smooth at corners. Where accessory fronts are framed, frame

edges, both inside and outside, shall have 90 degree formed returns continuously welded and ground smooth at corners. Doors shall also have 90 degree formed returns.

- .4 Use concealed stainless steel piano hinges which extend full-length of hinged element. Ensure hinged elements have concealed, mechanically-retained, rubber bumpers for silent closing, and close flush with faces of fronts or frames. Locate hinges to afford easy and unobstructed access to interiors taking into consideration location of accessory relative to surrounding and adjacent items and finishes.
- .5 Portions of sheet metal accessory interiors which are visible in completed work shall be stainless steel. Changes in plane shall be formed or continuously welded and ground smooth. Sheet metal accessory parts concealed in finished installation shall be galvanized or stainless sheet steel. Edges of sheet metal which are accessible by users or maintenance personnel shall be hemmed for safety with no sharp edges.
- .6 Ensure lettering on accessories is silk screened with durable paint to withstand wear, or is engraved or embossed. Size, location and type face of lettering is subject to approval. Ensure edges of letters are straight and sharp.

PART 3 -EXECUTION

3.1 INSTALLATION

- .1 Provide necessary wall reinforcement conforming to ASTM F446 and capable of supporting a minimum of 1.3 kN (292 lbs) downward pull force for grab bars and any other accessories subject to human loadings to protect occupants against consequences of failure (damage, accidents, harm or any other non-desirable event) whether or not detailed on Drawings and in accordance with manufacturer's instructions. Provide additional reinforcement in bariatric areas using toggle bolt fasteners at mounting plates to support minimum load of 227 kg (500lbs) downward pull.
- .2 *Install* accessories in accordance with manufacturer's printed installation instructions.
- .3 *Provide* fastenings and mounting kits for accessories.
- .4 Verify wall opening for correct dimensions, plumbness of blocking or frames and other preparation that would affect installation of accessories.
- .5 Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.
- .6 Securely fasten accessories, level and plumb using appropriate fastenings as recommended by manufacturer.
- .7 *Provide* corrosion resistant fastenings. Where fasteners are exposed, use tamper-proof fasteners finished to match items secured.

- .8 Locate accessories where indicated on *Drawings* and where directed by *Consultant*. Obtain *Consultant's* acceptance of exact locations.
- .9 Provide manufacturer's recommended anchoring systems.
- .10 Fit flanges of accessories snug to wall surfaces.
- .11 Refer to the Schedule of Washroom Accessories included with this Section and the Room Finish Schedule.

3.2 ADJUSTING, CLEANING AND POLISHING

- .1 Remove protective coatings and paper including adhesives.
- .2 Test mechanisms, hinges, locks and latches.
- .3 Adjust and lubricate to ensure washroom accessories are in perfect working order.
- .4 Clean and polish mirrors, aluminum and stainless steel surfaces.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide non-welded lockers including but not limited to following:*
 - .1 single-tier and double tier lockers with sloped tops.
 - .2 standard and heavy duty construction.
 - .3 integral metal locker bases.
 - .4 locking devices.
 - .5 barrier free, tamper-resistant hardware.
 - .6 identification plates.
 - .7 locker benches
 - .8 other applicable locker accessories.
 - .9 metal trims, end gables, filler panels.
 - .10 screws, bolts, rivets and other items to bolt and secure lockers together and to structure.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of

parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.

- .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and other materials later designated by Consultant.
- .3 Shop Drawings:
 - .1 Submit Shop Drawings for work of this Section in accordance with Division 01. Ensure Shop Drawings clearly indicate compartment layouts, filler panels, finished ends and dimensions, materials being supplied and applicable connections, attachments, reinforcing,

- anchorage, hardware and location of exposed fastenings.
- .2 Clearly cross-reference components on Shop Drawings to Drawings indicating location, number required and name of unit. Submit 3 copies of Drawings of each locker room showing arrangement, numbering system, colour scheme and number of lockers in room for control purposes.
 - .3 Field Measurements: Verify locations of concealed framing, blocking, and reinforcements for locker support by field measurements prior to fabrication. Submit necessary templates and instructions where supports or anchors have to be built-in by other Sections. Do not fabricate work of this Section prior to confirming location of adjacent construction with related trades.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Provide work of this Section executed by competent installers with minimum of 5 year experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .2 Mock-ups:
 - .1 Provide Mock-up in location directed by Consultant, for approval, before proceeding with remainder of installation.
 - .2 Provide sections showing stile anchoring and leveling devices, concealed threaded inserts, panel and stile construction as well as edge construction.
 - .3 Make adjustments as required. After acceptance, retain approved Mock-up as standard of quality for work of this Section. Mock-up may become part of permanent installation if undisturbed at time of substantial completion.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in sequence to meet installation schedule. *Provide* protection from marring or other damage.
- .2 Carefully unload materials; handle and store in a manner to prevent damage. Remove unsatisfactory materials and replace to *Consultant's* satisfaction at no cost to *Owner*.

1.8 MAINTENANCE

- .1 Provide Owner with 2% surplus of following hardware materials matching products installed and packaged with protective covering for storage and identified with labels describing contents: Locks, Identification Plates, Hooks.

1.9 WARRANTY

- .1 Warrant Work of this Section for period of 10 years against materials defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within

warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to: warpage, hinge separation from panels, structural failure, faulty operation of hardware and delamination. Warrant work of this Section for period of 3 years against workmanship deficiencies in accordance with the General Conditions of the Contract.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Lockers and Benches:
 - .1 Anthony Steel Manufacturing; www.anthonysteel.com
 - .2 ASI Storage Solutions; www.asilockers.com
 - .3 General Storage Systems, www.generalstoragesystems.com
 - .4 Hadrian Manufacturing, Inc. www.hadrian-inc.com
 - .5 Shanahan's Ltd. www.shanahans.com
 - .2 Substitution Limitations: This Specification is based on "Traditional Plus Collection" by ASI with riveted and bolted construction and assembly. Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification. Welded lockers are not acceptable.

2.2 DESCRIPTION

- .1 Design and Performance Criteria
 - .1 Provide lockers in configurations indicated herein and on Drawings and Schedules complete with stainless steel recessed handles, continuous full length piano hinge, rubber door silences, metal trims, sloped tops, end gables, filler panels and recessed base.
 - .2 Accessible Design: Comply with accessibility requirements stipulated by ADA, Accessibility Guidelines for Buildings and Facilities and CSA B651 for location of shelves, hardware, and maximum operating forces.
 - .3 Ensure finished units are free from sharp metal edges, with welds ground smooth.

2.3 MATERIALS

- .1 Sheet steel: Commercial quality, stretcher levelled standard of flatness; plain commercial galvanized or wipe coated conforming to ASTM A653/A653M. Minimum Galvanizing Thickness: Z275 (G90).
- .2 Tubular Steel: Minimum 32 mm (1-1/4-inch) diameter steel tubing.
- .3 Bar stock: Hot rolled, CSA G40.20/G40.21, grade 350W, free from mill scale and pitting.
- .4 Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.

- .5 Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A167 or ASTM A666, Type 304 alloy with exposed surfaces having No. 4 polished finish. Sizes as required to meet design requirements.
- .6 Welding materials: CSA W59.
- .7 Bituminous Paint: Isolation Coating, alkali-resistant bituminous paint or epoxy resin solution to provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers. Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, 410-02 by Bakor Inc. or other Product and manufacturer acceptable to *Consultant*.

2.4 MANUFACTURED UNITS

- .1 Locker Configuration: Provide following locker configurations as indicated on Drawings and Schedules:
 - .1 Locker Types:
 - .1 Locker - Type 1: Single Tier.
 - .2 Locker - Type 2: Double Tier.
 - .2 Tops: Sloped as indicated on reviewed Shop Drawings.
 - .3 Doors: Manufacturer's standard louvered vents.
 - .4 Widths and Heights: As indicated on Drawings.
- .2 Locker Accessories:
 - .1 Locking Devices:
 - .1 Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
 - .2 Coat hooks: Type 304, Stainless steel. Provide 1 back hook and 2 side wall hooks for single tier and double tier lockers as indicated on reviewed Shop Drawings.
 - .3 Identification Plates: Surface mounted with permanent adhesive recommended by locker manufacturer. Fonts: Minimum of 16mm (5/8") high white font on black contrasting background.
- .3 Locker Benches: Provide locker benches fabricated by same manufacturer as metal lockers.
 - .1 Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 305 mm (12 inches) wide x 915 mm (36") long x 32 mm (1-1/4 inches) thick, with rounded corners and edges:
 - .2 Hardwood, with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
- .4 Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
 - .1 Tubular Steel: 32 mm (1-1/4-inch) diameter steel tubing, with 10 ga. (3.2 mm - 0.1265-inch) thick steel flanges welded at top and base; with powder coated finish; anchored with fasteners.
 - .1 Color: Match metal lockers unless otherwise indicated.

- .5 Police Lockers, Evidence Lockers and Gun Lockers: Refer to Section 10 51 10.

2.5 FABRICATION

- .1 Standard Locker Construction: Provide lockers from unitized bolted construction with common intermediate upright separating units. Bolt spacing not to exceed 229 mm (9") o.c.
- .1 Door Frames: Manufactured from 16 ga (1.52 mm - 0.06") channel shaped, cold-rolled steel. Provide additional flange at vertical members for continuous door strike. Manufacture cross frame members from same construction as door frames.
 - .2 Doors: Manufactured from 14 ga (1.9 mm - 0.075") cold-rolled steel as specified herein. Door to be channel shaped on lock and hinge side, with angle formations across top and bottom. Provide 16 ga. (1.52 mm - 0.0598") full height reinforcement channel for single tier and double tier lockers.
 - .3 Bottoms: Manufactured from 16 ga. (1.52 mm - 0.0598") cold-rolled steel as specified herein.
 - .4 Tops, sides, back and shelves: Manufactured from 24 gauge (0.6 mm - 0.0239") cold-rolled steel as specified herein.
 - .5 Continuous sloped tops: Manufactured from 18 gauge (0.4 mm - 0.1644") cold-rolled steel as specified herein.
 - .6 Locker toe base: Manufactured from 14 ga (1.9 mm - 0.075") cold-rolled steel as specified herein. Overhang with toe space raising lockers 100mm (4") off the floor.
 - .7 Finished end panels and filler panels: To match locker construction.
 - .8 Hinges: Provide 16 ga. (1.52 mm - 0.0598"); tamper resistant, continuous, Type 304 stainless steel hinge riveted to door and frame. Opening angle: 170°.
 - .9 Colors and Finishes: To be selected by Consultant from manufacturer's full color range at a later date.
- .2 Heavy Duty Locker Construction: Provide heavy duty locker unit consisting of minimum 14 ga. (1.9 mm - 0.075") in Overnight Exhibit Room as indicated on Drawings.

2.6 FINISHES

- .1 Clean and degrease thoroughly cold rolled steel surfaces and pretreat with iron phosphate corrosion inhibitor. Finish cleaned and degreased cold rolled steel surfaces with abrasion and graffiti resistant coating cured to ensure uniform, smooth, protective tough and durable finish.
- .2 Provide manufacturer's standard 2 mm hybrid epoxy/polyester powder, electrostatically applied coating to ensure uniform thickness and baked to cure. Colours: To be selected by Consultant at a later from manufacturer's full range.
- .3 Colour Scheme:
- .1 Doors, Trim/Filler Panels, Frame, Tops, including Exposed Sides and Interiors: 1 uniform colour and texture later selected by *Consultant*

from manufacturer's full range colour chart to provide a uniform, smooth protective finish.

PART 3 -EXECUTION

3.1 INSTALLATION

- .1 Install metal lockers on integral metal bases and to wood grounds where such lockers are alongside wall as shown on Drawings. Securely anchor lockers together in banks.
- .2 Install end gables and similar trim materials for sloping top lockers; Install trim full height at battery end and at junctions with other materials. Where required, Provide vertical full height filler panels.
- .3 Fixed Locker Benches: *Provide* no fewer than two pedestals for each bench, uniformly spaced not more than 1830 mm (72") apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- .4 Upon completion, test doors and adjust for ease of operation.

3.2 CLEANING

- .1 Clean and Make Good surfaces soiled or damaged. Polish units before final acceptance by *Consultant*.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* evidence and gun lockers for secure storage systems required for sequential handling of case evidence including but not limited to following:
 - .1 police lockers
 - .2 evidence lockers
 - .3 gun lockers.
 - .4 metal trims, end gables, filler panels.
 - .5 metal bases.
 - .6 screws, bolts and other items to bolt lockers together and to secure same to structure.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
- .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review *Contract Documents* for work included under trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be

used, installation of materials, sequence and quality control, *Project* staffing, restrictions on areas of work and other matters affecting construction; to permit compliance with intent of this Section.

- .3 Sequencing: Coordinate installation with other related Sections.
- .4 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with *Contractor* and *Consultant*, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Cooperate fully with other *Subcontractors* on *The Work* and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 *Supply* items to be built-in in ample time to be incorporated into work of other *Subcontractors*, together with measurements and other information required for location thereof.
 - .4 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.
- .3 *Shop Drawings*:
 - .1 Submit *Shop Drawings* in accordance with requirements of Section 01 30 00.
 - .2 Prepare and submit *Shop Drawings* for fabrication and erection of evidence lockers, police lockers, gun lockers and accessories in accordance with the *Contract Documents*.
 - .3 Show fabrication details, including exact sizes and description of anchorage and hardware, trim, nature of component parts and interface conditions with other work.
 - .4 Clearly cross-reference components on *Shop Drawings* to *Contract Working Drawings* indicating location, number required and name of unit.

1.6 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section executed by competent installers with minimum 5 years experience in the application of *Products*,

systems and assemblies specified and with approval and training of the *Product* manufacturers.

- .2 Welding: *Provide* welding in accordance with CSA W59-M performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau. *Provide* "resistance" or "MIG" welding where appropriate. All exposed corners shall be welded solid and smoothed prior to finishing. Base shall be welded to lockers to *Provide* solid structure.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in sequence to meet installation schedule. *Provide* protection from marring or other damage.
- .2 Carefully unload materials; handle and store in a manner to prevent damage. Remove unsatisfactory materials and replace to *Consultant's* satisfaction at no cost to *Owner*.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings, Schedules and Specifications*:
 - .1 DSM Law Enforcement *Products* www.dsmlawenforcement.com
 - .2 APC - Armour Piercing Containment
 - .3 Shannahan's Lockers; www.shanahans.com

2.2 DESCRIPTION

2.3 MATERIALS

- .1 Sheet steel: Commercial quality, stretcher levelled standard of flatness; plain commercial galvanized or wipe coated conforming to ASTM A653M or uncoated (not galvanized) cold rolled carbon steel conforming to ASTM 366M. Use galvanized coating designation Z275 for metal bases.
- .2 Bar stock: Hot rolled, CSA G40.20/G40.21, grade 350 W, free from mill scale and pitting.
- .3 Welding materials: CSA W59-M.
- .4 Primer for baked-on enamel finishes: CAN/CGSB-1.81-M, Type II.
- .5 Baked-on enamel finishes: CAN/CGSB-1.88, Type II.
- .6 Bituminous paint: To *Provide* dielectric separation and which will dry to be tack-free. Heavy duty, emulsion type paint which protects against electrolytic action on metals; recommended by the installer and accepted by *Consultant*.
 - .1 Exposed locker sheet components: 16 ga.
 - .2 Base: 14 ga.

- .3 Inner skins: 18 ga.
- .4 Fasteners: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined. For type and requirements conform to manufacturer's recommendations.

2.4 MANUFACTURED UNITS

- .1 Police Lockers: Conform to CAN/CGSB-44.40, Type 1, Class 2 - A bank of 2 or more lockers, freestanding. Size: 450 mm wide x 610 mm deep x 1829 mm high. Assembly: 16 ga. frames and hinge reinforcement. Top sloped, 20 ga. Provide following requirements:
 - .1 Doors: double doors, one piece double wall envelope construction, steel thickness - outer skin 20 ga., inner skin 24 ga., hinges 14 ga. Allow for three colours to be selected by Departmental Representative. Sides and back: 24 ga. Door handle: recessed handle steel with bright chromium nickel-plated finish with 10 ga. hasp for padlock.
 - .2 Accessories
 - .1 19 mm dia. steel hanger rods with chromium finish.
 - .2 100 mm (4") steel base.
 - .3 Steel end panels.
 - .4 Steel trim including corner angles.
 - .5 Jamb trim.
 - .6 Fillers.
 - .7 Number plates.
 - .8 Coat hooks.
 - .9 Belt hook.
 - .10 Note clip.
 - .11 BootDrip Tray: removable 528 mm wide x 558 mm deep x 38 mm high black PVC.
 - .12 Pistol Drawer: 20 ga. steel full extension pullout pistol drawer with heavy duty nylon roller tray glide, built-in cylinder cam locks, master keyed with each lock keyed differently.
 - .13 Provide duplicate keys for each locker padlock and each pistol drawer.
 - .3 Model No. "Police and Crew Lockers" by Shannahan's or approved equivalent.
- .2 Evidence Lockers:
 - .1 Construction to be the same as the Police and Crew Lockers, size 914 mm wide x 610 mm deep x 2134 mm high (36" x 24" x 84"). Number of tiers as indicated on drawings. Provide following:
 - .1 "Evidence Locker" by Shannahan's or approved equivalent.
- .3 Gun Lockers:
 - .1 Provide (13" x 26 1/8" x 6 1/2") vertical surface mounted, 4 compartment unit complete with locks. Provide following:
 - .1 DSM Wall Mounted Handgun Lockers "Model No. EDHGS04V" by Spacesaver or approved equivalent.

2.5 FINISHES

- .1 Shop Priming/Finishing:
 - .1 All exposed edges shall be smoothed and rounded to afford ease of cleaning and reduce risk of cuts or injury. Inside radiuses on front and rear panels shall be filed and rounded smooth. All sharp corners and metal edges shall be de-burred. Ensure finished units are free from sharp metal edges, with welds ground smooth.
 - .2 Two coats of high grade alkyd baked enamel or high performance epoxy powder coating baked on. Colour later selected by *Consultant* from manufacturer's standard colour chart. Finish paint shall have 60-65 percent minimum gloss and have successfully passed ASTM B117, 400 hours of salt spray resistance.
- .2 Provide dress end panels at both ends of each locker bank, false locker fronts, blank fillers and trim as required.
- .3 No manufacturer's names are allowed on the front of the lockers.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify *Consultant* in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

- .1 Assemble and install lockers in accordance with manufacturer's written instructions.
- .2 *Install* metal lockers on integral metal bases and to wood grounds where such lockers are alongside wall as shown on *Drawings*. Securely bolt lockers together in banks.
- .3 For recessed lockers, *Install* metal trim across top and down each battery end and at junctions with other materials.
- .4 *Install* end gables and similar trim materials for sloping top lockers; *Install* trim full height at battery end and at junctions with other materials. Where required, *Provide* vertical full height filler panels.
- .5 Upon completion, test doors and adjust for ease of operation.

3.3 CLEANING

- .1 Clean and *Make Good* surfaces soiled or damaged. Polish units before final acceptance by *Consultant*.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* flagpoles including but not limited to following:
 - .1 flagpoles.
- .2 Work not included: Flag(s) with their respective fittings for attaching to halyards.
- .3 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
- .3 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:

- .1 work included,
- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.4 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for flag poles and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 *Shop Drawings*:
 - .1 Submit *Shop Drawings* in accordance with Division 01. Ensure Shop drawings are stamped and signed by professional engineer registered or licensed in Territory of Nunavut.
 - .2 Indicate materials, dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.
 - .3 Submit Shop Drawings of flagpoles and bases, showing general layout, jointing and complete anchoring and supporting systems.
 - .4 Provide templates and instructions for installation of flagpoles and bases.
- .3 Samples: Submit 2 - 50 mm x 100 mm (2" x 4") samples of flagpole finish.

1.6 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section executed by competent installers with minimum of 5 years experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 Structural Design and Inspection: Employ a professional structural engineer carrying a minimum \$2,000,000.00 professional liability insurance and registered in the Territory of Nunavut in accordance with requirements of Section 01 40 00 to:
 - .1 design components of The Work of this Section requiring structural performance.
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - .4 be responsible for production and review of Shop Drawings.
 - .5 inspect work of this Section during fabrication and erection.
 - .6 stamp and sign each Shop Drawing.
 - .7 Provide site administration and inspection of this part of The Work.
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Spiral wrap each flagpole with heavy kraft paper, wood strip and steel band or polyethylene wrap and pack in tubing for shipment.
- .2 Deliver flagpole in manufacturer's wrappings and in 1 piece.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, Schedules and *Specifications*:
 - .1 All Canadian Flagpole Ltd.
 - .2 Ewing Flagpole Co. Inc. www.ewingflagpole.com
- .2 Substitution Limitations: This Specification is based on *Products* from manufacturers listed herein. Comparable *Products* from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Design and Performance Requirements:
 - .1 Design flagpole, bases and anchorage devices to resist 100 km/h (60

- mph) wind velocity minimum, flagged, or 165 km/h (100 mph) unflagged.
- .2 Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."

2.3 MATERIALS

- .1 Structural Shapes, Plates, Etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.
- .2 Hollow Structural Sections: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.
- .3 Steel Pipe: ASTM A53/A53M, Type E or S, Grade A or B, Standard Weight, Schedule 40 and Schedule 80, new material. Provide Schedule 80 pipe for steel pipe bumpers and bollards.
- .4 Concrete Base: CSA A23.1, CSA A23.2 and CSA A23.3 conforming to requirements of Section 03 30 00.
- .5 Galvanized Steel: To CAN/CSA-G164-M, minimum zinc coating of 0.610 kg/m² (2 oz/sq ft).
- .6 Aluminum: ASTM B221M, Aluminum Association alloy AA 6063-T6 seamless extruded aluminum tubing. Ensure surfaces are free from defects impairing appearance, strength and durability.
- .7 Aluminum Sheet: ASTM B209M, Minimum thickness 3 mm (1/8") of type and characteristics to match finished extrusions.
- .8 Concrete: Comply with requirements in Section 03 30 00, for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 25 MPa.
- .9 Isolation coating: alkali-resistant bituminous paint or epoxy resin solution.

2.4 ACCESSORIES

- .1 Finial: 100 mm (4") mm diameter ball of 1.6 mm (0.063") minimum thick aluminum anodized colour to match flagpole finish.
- .2 Truck Assembly: Cast aluminum, stainless steel ball bearing, non-fouling, revolving double truck assembly, (finish to match flagpole).
- .3 Swivel Snaps: 2 per halyard aluminum with neoprene or vinyl covers.
- .4 Internal Halyard System: Pole manufacturer's standard system; stainless steel cable; exposed parts to match flagpole finish.
 - .1 Cleat: Internal arrangement.
 - .2 Access Door: Keyed, removable flush mounted door in reinforced frame.
- .5 Cleats: 230 mm (9") size, 2 per halyard, cast aluminum finish to match flagpole.
- .6 Cleat Box: 1 per cleat; cast aluminum finish to match flagpole; furnish hasp for padlock, hinged cover, and tamperproof screws.

2.5 COMPONENTS

- .1 Cone Tapered Flagpole:
 - .1 Seamless, uniform, straight line tapered section above cylindrical butt section.
 - .2 Exposed Height: 7.5 m (25 ft)
 - .3 Taper: 25 mm (1") for every 1.7 m (5' - 6") of run.
 - .4 Provide internal splicing, self-aligning sleeve of same material as flagpole for snug fitting, watertight field joints.
- .2 Flags: Provide 2 nylon flags per flagpole in following sizes:
 - .1 Provincial: 1145 mm x 2290 mm
 - .2 Federal: 1145 mm x 2290 mm

2.6 FABRICATION

- .1 Supply flagpole as complete unit including base mounting brackets anchorage and fittings.
- .2 Do welding to appropriate CSA Standard, by welders certified by Canadian Welding Bureau. Finish exposed welds flush and smooth.
- .3 Shop apply isolation coating to metal surfaces of flagpole (and base) that will be (encased in concrete or below grade level).
- .4 Pole Base: Refer to Drawings.

2.7 FINISHES

- .1 Aluminum Finishes:
 - .1 Architectural Class I; Clear anodized in accordance with Aluminum Association Finish Designation AA-M12-C22-A41.

PART 3 -EXECUTION

3.1 INSTALLATION

- .1 Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- .2 Excavate ground to depth indicated on *Drawings*.
- .3 Do concrete work as follows:
 - .1 Of size and shape indicated on *Drawings*.
 - .2 Anchor bolts for flagpole support to extend minimum of 900 mm (36") into concrete base.
 - .3 Vertical exposed concrete placed into formwork and horizontal top provided with drainage channels or slopped.
 - .4 Bring exposed surfaces to smooth steel trowel finish.
- .4 Apply 1 coat of bituminous paint on steel surfaces in contact with concrete.
- .5 *Install* pole, base assemblies and fittings in accordance with *Shop Drawings* and manufacturer's instructions. Use suitable equipment to prevent scuffing and damage to pole during erection.
- .6 Erect pole plumb and true in position.
- .7 *Provide* positive lightning ground for each flagpole installation.
- .8 Check and adjust installed fittings for smooth operation of halyards.
- .9 *Install* flag and demonstrate operation.

3.2 CLEANING

- .1 On completion of work, remove protection erected under this Section. *Make Good* damage done to this work and adjoining work. Remove surplus materials, debris, tools, plant and equipment and leave site in condition satisfactory to *Consultant*.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* miscellaneous specialties including but not limited to following:
 - .1 stainless steel corner guards (CG)
 - .2 flammable cabinet
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Definitions:
 - .1 Installation:
 - .1 This includes coordination with other Sections, labour, material and equipment necessary for off-loading of equipment, handling, storing and dismantling of parts if required.
 - .2 Make provisions for transferring items to proper location in building, connections to building services, covering and protecting, final removal of covering and protection and making ready as required to form fully operative equipment.
 - .3 Install items with security fasteners and security anchoring devices in security areas.
 - .2 Purchase: This includes labour, materials and equipment necessary for purchase and delivery of equipment to site.
- .2 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy

- requirements,
- .3 and security requirements;
- .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,
 - .2 materials to be used,
 - .3 storage and handling of materials,
 - .4 installation of materials,
 - .5 sequence and quality control,
 - .6 Project staffing,
 - .7 restrictions on areas of work and other matters affecting construction.
- .3 Scheduling:
 - .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
 - .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
 - .3 Co-operate with other Sections for application of all miscellaneous specialties.
 - .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
 - .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
 - .2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.
- .2 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, connections and relationship with adjacent

- construction. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
- .3 Samples: Submit samples if requested by *Consultant* in minimum 300 mm x 300 mm (12" x 12") size.
 - .4 Test and Evaluation Reports: Submit test data substantiating that proposed materials meet performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of applicable materials.
 - .5 Certificates: Obtain certificate from Professional Engineer responsible for design which includes seismic assessment and field review of this part of the Work, validating that work substantially complies with requirements of the NBC and that requisite field reviews have been completed
 - .6 Maintenance Instructions: Submit maintenance instructions in accordance with Section 01 70 00.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .2 Licensed Professionals: Employ a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design components of *The Work* of this Section requiring structural performance
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - .4 be responsible for production and review of *Shop Drawings*.
 - .5 inspect work of this Section during fabrication and erection.
 - .6 stamp and sign each *Shop Drawing*.
 - .7 *Provide* site administration and inspection of this part of *The Work*.
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
- .4 *Mock-ups*: *Provide Mock-ups* in locations designated by *Consultant* and as required to demonstrate quality of workmanship. Maintain *Mock-ups* during construction in an undisturbed condition as a standard for judging the completed work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays.

1.8 WARRANTY

- .1 Warrant work of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

PART 2 -PRODUCTS

2.1 DESCRIPTION

- .1 Regulatory Requirements:
- .1 Fire performance characteristics: Provide wall protection system components having ULC or UL label indicating that they are identical to those tested in accordance with CAN/ULC S102.2 or ASTM E84 for Class 1 characteristics, with flame spread of 25 or less and smoke developed of 450 or less.
 - .2 Install systems in accordance with Code regulations concerning access of physically challenged and disabled persons.
 - .3 Attach labels to electrical equipment attesting to CSA or Local Utility Company's approval; provide magnetic starters for motors, transformers and overload protection.
- .2 Design and Performance Requirements:
- .1 As far as practical and unless otherwise indicated, Provide PVC-free wall and door protection materials at scheduled locations except egress corridors as required to meet fire-resistance characteristics stipulated by authorities having jurisdiction. Use minimal amounts of PVC-based wall and door protection materials at egress corridors as indicated on Drawings and Schedules.
 - .2 Wall and Door Protection:
 - .1 Impact strength: Tested in accordance with applicable provisions of ASTM F476.
 - .2 Chemical and stain resistance: In accordance with ASTM D1308.

2.2 MANUFACTURED UNITS

- .1 Stainless Steel Corner Guards:
- .1 Surface Mounted Type: manufactured from 1.6 mm (16 ga.) Type 304 stainless steel with #4 brushed finish complete with tamper-resistant fasteners or adhesive application as recommended by manufacturers. Provide height to match door frames as shown on drawings and schedules. Provide following:
 - .1 CG-1: 90° angle; 75 mm (3") wing length wing length and 3 mm (1/8") corner radius; *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 "C/S Model No. CO-8" by Construction Specialties Ltd.; www.c-sgroup.com or approved equivalent by InPro Corporation; www.inprocorp.com or Pawling Corporation;

www.pawling.com.

.2 Flammable Cabinets:

- .1 Provide 1092 mm x 457 mm x 1651 mm (43" W x 18" D x 65" H) cabinet, double wall 18 ga. steel, self-closing doors and 2 adjustable shelves capable of holding 350 lbs. Provide following:
 - .1 Model No. "H-1564S, Tag No. SE-9A - Yellow" by ULINE;
www.uline.com or approved equivalent.

2.3 FABRICATION

- .1 Accurately fit joints and intersecting members in true planes with adequate fastening.
- .2 Fit and assemble work of this Section in shop where possible. Execute according to details and reviewed *Shop Drawings*. Where shop fabrication is not possible, execute trial assembly in shop.
- .3 Fabricate finished work free from distortion, weld splatter and defects detrimental to appearance and performance.
- .4 Edges of sheet metal which are accessible to users or maintenance personnel shall be pneumatically sanded to yield smooth safe edges with no sharpness.
- .5 Provide exposed metal fastenings and accessories of the same material, texture, colour and finish as the base metal to which they are applied or fastened, unless otherwise specified.
- .6 Do not expose trademarks or labels on finished surfaces.

2.4 ACCESSORIES

- .1 Provide accessories as a complete packaged system.
- .2 Sealants: Provide silicone sealants as recommended by manufacturer.
- .3 Adhesives: Provide adhesive as recommended by manufacturer.

PART 3 -EXECUTION

3.1 INSTALLATION

- .1 Conform to manufacturer's printed instructions for accurate, secure installation. Ensure proper operation.
- .2 Provide work of this Section true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.
- .3 Provide all necessary reinforcing including but not limited to steel stud backup and securely fasten components to suit design requirements. Ensure proper reinforcing has been provided as necessary.

3.2 PROTECTION

- .1 Cover finished surfaces and protect exposed corners and areas vulnerable to damage by persons or by movement of materials, tools or equipment.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 *Work Included:* Provide window fall arrest system including but not limited to following:
 - .1 safety tie back anchors which may include cast in place roof anchor, bolt around truss anchor, roof anchor wrapping I beam and/or weld to structure roof anchor and similar items.
 - .2 securement bolts.
 - .3 steel plates and other related section.
- .2 *Related Requirements:* Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities

relative to:

- .1 work included,
- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 **Product Data:** Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 **Material Safety Data Sheets:** Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants and any other material later designated by Consultant.
- .3 **Product Data: Product and Maintenance Data:** Submit manufacturer's literature for each type of material provided for *Project*. Submit 3 copies of detailed instructions for maintaining, preserving and keeping *Products* provided under this Section. Submit manufacturer's installation instructions.
- .4 **Shop Drawings:** Indicate design, fabrication details, plans and elevations showing complete layout and configuration of system, locations, components, accessories and hardware and installation details, relationship to adjacent construction, materials, finishes, thicknesses and other pertinent data. Ensure *Shop Drawings* meet Occupational Health and Safety Act requirements. Include all necessary Restrictive and Non-restrictive working usage notes and General Safety Notes. Submit *Shop Drawings* bearing professional seal

and signature of structural professional engineer registered in the Territory of Nunavut.

- .5 Submit required safety inspection log book for yearly inspections.
- .6 Submit 2 copies of reduced as-built *Shop Drawings* laminated in clear plastic and framed, showing anchor locations and details and place inside building near roof accesses at locations directed by *Owner*.

1.6 QUALITY ASSURANCE

- .1 *Qualifications: Provide Work* of this Section executed by competent installers with minimum 5 years' experience in the application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 *Licensed Professionals: Employ* a full time professional structural engineer registered in the Territory of Nunavut, carrying minimum \$2,000,000.00 professional liability insurance to:
 - .1 design the components of the work of this Section requiring structural performance,
 - .2 be responsible for full assemblies and connections
 - .3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,
 - .4 be responsible for production and review of *Shop Drawings*,
 - .5 inspect the work of this Section during fabrication and erection,
 - .6 stamp and sign each shop drawing,
 - .7 *Provide* site administration and inspection of this part of the *Work*.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 Atlas Anchor Systems Ltd.; www.atlas-anchor.com
 - .2 Pro-Bel Enterprises Limited; www.pro-bel.cad
 - .3 Thaler Metal Industries Ltd.; www.thalermetal.com
 - .4 Ankor Engineering Systems Inc.; www.ankoreng.com

2.2 DESCRIPTION

- .1 *Regulatory Requirements:*
 - .1 Design fall arrest system in conformance to CAN/CSA-S16.1 and CSA S136.
 - .2 Engineer and design a fall protection system that meets proper window washing practices and complies with NBC in particular Part 4, Anchor Systems for Building Exterior, Nunavut Occupational Health and Safety Act, Window Cleaning Regulation 859/92, as amended by 539/92 and 213/91 as amended by 631/94 (Construction Projects) and any other local Safety regulations

.2 Design Requirements:

- .1 Design fall arrest anchor system to suit building design requirements and to provide maintenance personnel access to all exterior glazing of new addition without requirements to provide additional equipment for access.
- .2 Locate anchorages to suit suspension equipment that will be used on building with respect to items such as reach, spacing, roof edge condition and similar items.
- .3 Comply with CAN/CSA-Z91-M.
- .4 Submit letter of compliance from Structural Engineer certifying system and anchors meet performance requirements of Ministry of Labour of Nunavut. Comply with CAN/CSA-S16.1, CSA S136 and CSA W59-M, welded steel construction. Comply with CSA W117.2. Welding of steel shall be undertaken only by a fabricator fully approved by Canadian Welding Bureau to requirements of CSA W47.1, CSA W55.3 and CSA W47.2-M, as may be applicable.
- .5 Number and locations of anchors required to provide complete and comprehensive window washing capabilities shall be part of design Work of this Section.
- .6 Anchors shall be tested for full 360 degrees to absolute failure (fracture). Anchors shall be capable of resisting a minimum force of 22,000 Newtons (5,000 lbf) applied in any direction without pullout or fracture; they shall also not yield or permanently deform when subjected to a force of 8896.4 Newtons (2,000 lbf) in any direction.

2.3 MATERIALS

- .1 Stainless Steel: ASTM A167, Type 304. Flashings, coverings and casing shall be stainless steel. Stainless steel components, Type 316.
- .2 Welding Materials: CSA W48.1-M and CSA W59-M.
- .3 Material at Cast-in-Place Locations: Stainless steel.
- .4 Exposed Anchor Surfaces: Exposed structural components stainless steel.
- .5 Aluminum Components: Accurately formed, extruded alloy AA-6351-T6 free from defects impairing appearance, strength and durability. Aluminum sheet; of type and characteristics to match exposed exterior aluminum and finished systems provided under other Sections, minimum 3 mm (1/8") thick for exposed Work. Concealed sheet may be mill finished.
- .6 Galvanized Steel Components: Carbon steel to CSA G40.21, Grade 300W, hot dipped after fabrication and with zinc chromate coating to CAN/CGSB-1.132-M applied over zinc.
- .7 Steel Components: CSA G40.21, Type 300W. Hollow structural steel to CSA G40.21, Grade 350W, blast cleaned to SSPC SP6 and shop painted with primer and 2 top coats of exterior alkyd enamel to CAN/CGSB-1.59.
- .8 Reinforcing Bars: CSA G30.12M, Grade 400, deformed bars.
- .9 Bolts, Nuts and Washers: Stainless steel conforming to ASTM A325M.

- .10 Sleeve and Pipe Insulation: Sprayed-in-place polyurethane or mineral wool or fiberglass insulation. Primers for sprayed-in-place insulation as recommended by insulation manufacturers for substrate and surface conditions.
- .11 Sealant: CAN/CGSB-19.24-M, multi-component modified urethane base chemical curing. Conform to requirements of Section 07 92 00.
- .12 Bituminous Isolation Paint: Acid and alkali resistant isolation coating, best grade, quick drying, non-staining alkali resistant asphalt utility enamel by approved manufacturer to provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures
- .13 Components
 - .1 Safety anchoring eye shall be made of not less than 3/4" dia material with an eye opening of not less than 1-1/2" diameter. Anchor eye bolts and connecting hardware shall be stainless steel.
 - .1 Design may include cast in place roof anchor, bolt around truss anchor, roof anchor wrapping I beam and/or weld to structure roof anchor and similar items.
 - .2 All structural grade steel bases shall be galvanized.
 - .3 All anchors shall be configured for acceptance of correct and approved flashing details into surface in which they are applied and shall be of suitable design to accept modified bituminous membranes
 - .4 Hand Free Double Lanyard Horizontal Lifeline:
 - .1 Cable: 8 mm (5/16") diameter galvanized steel with minimum breaking strength of 40 kN (9,127lbs.), complete with matching permanently swedged or mechanically swedged cable end.
 - .2 Data Plate: Non-corrosive plate to be prominently displayed stating maximum service capacity and number of users.
 - .3 Tensioner: Steel turnbuckle, same material as cable.
 - .4 Harness: Manufacturer's standard full body harness with double lanyard and shock absorbers.

2.4 FABRICATION

- .1 Fabricate complete system including but not limited to anchoring studs, safety anchors, fastening plates, insulation, premoulded seals, flashings, counterflashings, and all other associated components.
- .2 Fabricate system to suit site dimensions, conditions, type of roofing systems, structure design and system manufacturer's recommendations. Ensure equipment and system components do not mar or damage exterior wall finishes and roofing system.
- .3 Material at cast-in-place locations shall be stainless steel. Exposed anchor surfaces and exposed structural components shall be stainless steel. *Provide* stainless steel at contact surfaces with fall arrest line anchors.
- .4 Fall arrest anchoring systems shall be suitable for roofing system and roof deck construction at respective anchor locations.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing *Work*. Inspect surfaces into which *Work* of this Section is dependent for any irregularities detrimental to installation and performance of *Work*. Confirm conditions satisfactory before proceeding. Notify *Consultant* in writing of any conditions which would be detrimental to the installation. Commencement of *Work* implies acceptance of previously completed *Work*.

3.2 INSTALLATION

- .1 *Install* fall arrest anchor system under supervision of professional engineer registered in the Territory of Nunavut.
- .2 Hand over items for casting into concrete at appropriate time. *Supply* handling requirements, instructions, anchorage information, dimensions, templates and service requirements for installation of *Work* of this Section and supervise setting of anchorage devices and construction of other *Work* incorporated with system.
- .3 *Install Work* in accordance with manufacturer's instructions, true, tightly fitted and level or flush to adjacent surfaces, as suitable for installation conditions.
- .4 *Provide* anchorage and mounting devices required for installation of system.
- .5 Fill with urethane foam insulation where required to suit design.
- .6 At anchor locations, *Provide* seamless flashings. Fabricate flashings to suit roofing conditions. Seal top of anchor with 1-piece watertight cap. Rubber gaskets, grommets and "pitch pans" are not permitted.
- .7 Coordinate fall arrest anchor system installation with roofing and flashing *Work* specified under roofing Section. Ensure integrity of roofing and flashing systems.
- .8 Seal between assemblies and adjacent materials to ensure watertight installations. Do sealing *Work* in accordance with Section 07 92 00.
- .9 Clean and touch up steel surfaces with zinc rich primer where burned by field welding or where damaged.
- .10 Protect components where contact is made between dissimilar metals and between metals and cementitious materials to prevent electrolysis.

3.3 FIELD QUALITY CONTROL

- .1 Complete inspection log book to certify system for use. Inspection of installation shall be carried out by professional engineer registered in Te.

3.4 CLEANING

- .1 Upon completion of *Work*, check anchor system and adjust appropriately.

Remove debris, equipment and excess material from site. Clean and make good surfaces soiled or otherwise damaged in connection with *Work* of this Section. Pay cost of replacing finishes or components that cannot be satisfactorily cleaned.

3.5 TRAINING OF OWNER'S PERSONNEL

- .1 Train Owner's personnel in the use of the fall arrest anchor system under Division 1 requirements.

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 *Work Included: Provide* manually operated roller window sun control shades including but not limited to following:
 - .1 Chain operated roller window shade assembly complete with translucent shades (RBL)
- .2 *Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.*

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:
 - .1 work included,

- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

- .1 **Product Data:** Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 **Shop Drawings:** Submit *Shop Drawings* for *Work* of this Section in accordance with Division 01.
 - .1 Submit *Shop Drawings* which clearly indicate shade sizes, locations, operation, methods of attachment, and description of components. Indicate each component, size, shape, material, thickness, gauge, finish, methods of joining, joint locations, fastening devices, anchorage components, methods of attachment and relationship with adjacent components and construction.
 - .2 Submit reflected ceiling plans, drawn to scale, showing following items coordinated with each other, based on input from installers of items involved:
 - .1 Ceiling suspension system members and attachment to building structure.
 - .2 Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 - .3 Shade mounting assembly and attachment.

- .4 Size and location of access to shade operator and adjustable components.
- .3 Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Do not fabricate work until Shop Drawings have been reviewed.
- .3 Samples: Submit samples in accordance with Division 01. Submit following samples in sizes indicated:
 - .1 Submit sample shade fully representing shades to be provided complete with head rail, end caps, gears, sprocket wheels, chains, brackets and similar accessories.
 - .2 Submit samples of fabrics complete with edge reinforcing and finish colours for selection and approval. Do not order material until colour samples have been approved. Fabric sample: minimum 300 mm (12") square.
- .4 Test Data: Submit test data substantiating that proposed shade fabric meets all performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of shade fabric.
- .5 Certificate: Submit written certification that materials, systems, and assemblies have been installed in accordance with manufacturer's requirements.
- .6 Maintenance Instructions: Submit maintenance instructions in accordance with Division 01. Indicate methods for maintaining roller shades and finishes; precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance and operating hardware.

1.6 QUALITY ASSURANCE

- .1 Applicator Qualifications: *Provide Work* of this Section executed by competent installers with minimum of 5 years' experience in application of *Products*, systems and assemblies specified and with approval and training of the *Product* manufacturers.
- .2 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging completed work. Reviewed *Mock-up* may form part of final installation if undisturbed at time of *Substantial Performance of the Work*
- .3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site only when work of this Section can be started.
- .2 Before delivery to site verify each assembly for proper operation. Clean

each assembly of marks and smudges prior to providing wrap up protective covering.

- .3 Provide necessary crating and bundling for shipment of components to site including protection against weather likely to impair adequacy or appearance of material in finished assembly.
- .4 Remove and replace damaged units at no additional cost to Owner.

1.8 WARRANTY

- .1 Warrant *Work* of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the *Contract*. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects include but are not limited to: deformation of members, mechanical failure, and failure of system to operate as designed.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
 - .1 Altex; www.altex.ca
 - .2 Elite Window Fashions; www.elitewf.com
 - .3 Hunter Douglas Contract; www.hunterdouglas.com
 - .4 Nysan Shading Systems Ltd.; www.nysan.com
 - .5 Solarfective *Products* Limited; www.solarfective.com
 - .6 Sun Glow; www.mysunglow.com
 - .7 SunProject Canada Inc.; www.sunProject.com
 - .8 Urban Edge Shading, Inc.; www.urbanedgeshading.com
- .2 Substitution Limitations: This Specification is based on Solarfective "Manual Teleshade" *Product*. Comparable *Products* from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

- .1 Design and Performance Requirements
 - .1 Provide factory assembled roller window shade units consisting of surface mounted roller shade units on face of mullions or at ceiling with two end brackets, complete with shade roller tube, extruded fascia, hembar, fabric, fastenings, anchorages and accessories specified and required. Ensure units comply with requirements of WCMA A100.1.
 - .2 Provide installation brackets that facilitate easy removal and replacement of blinds.
 - .3 Design manually chain operated roller window shade system for easy lifting, finger tip control, with infinite positioning so that shade is capable of stopping and holding at any position within window

- opening.
- .4 *Provide* assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. *Provide* left or right hand operative option as required to suit design requirements.
 - .5 Fabric Performance Requirements:
 - .1 *Provide* shade fabric capable of hanging flat without buckling or distortion. Ensure edge when trimmed, hangs straight without raveling with unguided roller shade cloth rolling true and straight without shifting sideways more than ± 3 mm (1/8") in either direction due to wrap distortion or weave design.
 - .2 Flammability: Ensure fabric meets British Columbia Building Code flammability requirements, NFPA-701 and CAN/ULC S109 Small Scale vertical burn requirements when tested by independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - .3 Light fastness: AATCC Method 16A exceeding 60 hours. Class 5.
 - .4 Antibacterial and antifungal resistance:
 - .1 AATC Test Method 147: Pass
 - .2 AATC Test Method 30: Pass

2.3 MATERIALS

- .1 Formed Aluminum: ASTM B209M, Aluminum alloy 6063 - T5. Ensure surfaces are free from defects impairing appearance, strength and durability.
- .2 Extruded Aluminum: ASTM B209M, Aluminum alloy 6063-XT6 for roll tube; 6060 for horizontal tracks; and 6063-T5 elsewhere
- .3 Sheet Steel: ASTM A653/A653M, Designation Z275, stretcher levelled commercial quality galvanized steel.
- .4 Chain Beads: ASTM A167, Series 300 stainless steel in ANSI No. 10 mirror finish having minimum 0.44 mm (0.017") diameter and with 47 to 48 beads for every 300 mm. (12") Chain to have pull test rating of 400 N. (90 lb.) Plastic bead chain is not acceptable.
- .5 Galvanizing of odd shaped components: ASTM A153
- .6 Shading Fabric: *Provide* vinyl coated polyester yarn. *Provide* fabric tensioned in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, non-flammable and moisture, UV, heat and fungi resistant.
 - .1 Solar Control Fabric (5% openness factor): Following types are acceptable:
 - .1 "SheerWeave Style 2390" by Phifer Wire Products or approved equivalent with following characteristics:
 - .1 Openness Factor: 5% \pm 0.0%
 - .2 UV. Blockage: 95%
 - .3 Thickness: 0.43 mm (0.017")
 - .4 Mesh Weight: 403 g/m² (11.8 oz/yd²).
 - .5 Stiffness (mg): 190 warp, 220 fill.

- .6 Composition: 35% fiberglass, 65% vinyl coated fiberglass.
- .2 Fabric Colour: Selected by *Consultant* from standard colour range of the specified manufacturer. Shade fabric on any one floor to be from the same dye lot.

2.4 MANUFACTURED UNITS

- .1 Chain Operated Single Roller Window Shades (RBL-1):
 - .1 *Provide* chain operated single roller shade system with built-in clutch mechanism complete with loaded spring to allow system to be easily raised and lowered.
 - .2 Custom trim: Extruded aluminum to shapes and profiles indicated, where adjacent finishes abut the shade assembly, and to *Provide* attachment for adjacent finish, finished to match fascia/soffit.
 - .3 Hembar: External, clear anodized aluminum type with end caps
 - .4 Acceptable *Products*: "Manual Teleshade System" by Solarfective or "UE-205" by Urban Edge Shading or approved equivalent.

2.5 COMPONENTS

- .1 Roller Window Shade Assembly:
 - .1 Design and fabricate heavy duty roller window shade assembly to keep maintenance to minimum.
 - .2 Ensure chain and sprocket operated and/or spring operated roller window shade assembly operates smoothly and has capability to control rate of fall, to adjust stop and hold at infinite number of positions as required.
 - .3 *Provide* automatic stop at highest and lowest shade position to prevent over winding or unrolling. *Provide* built-in, internal limit control winding stop contained within roller tube for shades as recommended by manufacturer. Ensure limit stop is adjustable without special tools.
 - .4 Ensure assembly allows fingertip control with built-in shock absorber system to prevent operator breakage under normal operating conditions. Factory set for size and travel of shades.
 - .5 Ensure assembly mechanism to have structural capacity to accommodate specified shades in window sizes required for this *Project*. Design assembly mechanism to suit size of windows and mass of system.
- .2 Shade Mounting Brackets:
 - .1 Fabricate from minimum 3 mm (1/8") thick sheet steel and minimum 11 mm (7/16") welded steel shaft which serves as axis for entire sprocket and spring clutch assembly. Make reversible for left or right hand operation as directed by *Consultant* on *Shop Drawings*.
 - .2 *Provide* mounting in accordance with reviewed *Shop Drawings* as required to keep mechanism and brackets totally concealed from view when fully assembled. Mechanically attach cover plates to sheet steel brackets. *Provide* means of attaching fabric without exposing hardware.
 - .3 *Provide* guides to retain gear assembly. Brackets to act as protective retainer for tube and shade assembly preventing accidental dislocation of tube and shade.

- .3 Roller Tube:
 - .1 Design extruded aluminum alloy roller tube to suit assembly design with either end of tube to engage drive system through internal or external extruded keyway. Extruded roller tube to have wall thickness to suit design requirements with minimum wall thickness of 1.39 mm (0.0547") with reinforcement for fabric to *Provide* anti-deflection support for wide span shades. Formed aluminum tube is unacceptable.
 - .2 Design tubes to be removable without removing the drive assembly, block resetting, or readjusting the pre-set stops. Shade tube to be self aligning.
 - .3 Roller tube to be sized and reinforced internally as necessary to prevent excessive deflection in span of tube. Excessive deflection is defined by observation whereby shades in their open position reveal puckering, sagging or billowing, or where the tube deflects beyond 4% of roller length.
 - .4 Identify each roller tube to its location in accordance with reviewed *Shop Drawings*.
- .4 Fabric Mounting Spline:
 - .1 Fabricate snap-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Spline to have sufficient capacity to hold shades when spline is snapped and locked into the tube. Fabric shade to be readily removable without removing the tube from the retainer brackets, or removing the brackets from wall.
 - .2 Fabric-Guide End Cap: Fit delrin end cap with steel pin which permits up to 7 mm (5/16") lateral adjustment in tube width. End cap to have 55 mm (2-5/32") outside diameter minimum fabric guide tapered disc feature to ensure alignment and protection of shade cloth. *Provide* integral stainless steel eyelet at guide cables.
- .5 Snap-In-Place Fascia:
 - .1 *Provide* rectangular formed metal fascia where shown of minimum 1.29 mm (0.0507") thick formed aluminum or extruded aluminum of minimum 2 mm (0.078") thick housing.
 - .2 *Provide* fascia that snaps onto shade bracket without any exposed fastening devices. Visible edges of ceiling brackets to be continuous. Clearance between arc of fascia and end of bracket to be minimum of 9 mm, (5/16",) a minimum reveal of 10 mm (3/8") will be permitted when two shades with fascia are butted together.
 - .3 Finished fascia to have return back at bottom to permit maximum opening of 50 mm. (2".) *Provide* in lengths of up to 3000 mm (10'-0") unsupported without visible sag or distortion.
 - .4 Where shades are face mounted to faceted window arrangement, *Provide* matching closure section and bridging clips between ends of abutting units.
 - .5 Fascia members are not required for overhead concealed application.
- .6 Shade Fabric Hem Tube:
 - .1 *Provide* full shade width, single piece, prefinished, extruded aluminum section of approximately 15 mm (5/8") od with additional non-corrosive weight to maintain a weight of 1.4 kg/m (1 lb/ft) except

for shades having a height dimension greater than the width, in which case weight to be 2.0 kg/m. (1.33 lb/ft.)

- .2 At manufacturer's option, hem tube may be extruded aluminum, rectangular in shape, designed to hang perfectly perpendicular, and to totally conceal any heat-set or sewn seams within tube. *Provide* internal spline to secure the fabric evenly across full width. *Provide* separate port within tube to allow storage of non-corrosive weight.

2.6 FABRICATION

- .1 Do necessary cutting and sewing of fabric to produce finished *Product* having neat, even appearance and meeting performance requirements specified.
- .2 Fabricate shades with no vertical seams, and with a maximum of 2 horizontal seams per shade. Furnish fabric in adequate width to avoid horizontal seams at spacings of less than 1900 mm. (75"). Seams to be straight, even and offer minimum visual obstruction.
- .3 Ensure fabric tracks perfectly straight in its movement to within $\pm 1\%$ of its width from fully open to fully closed position, and when rolled onto tube, stacks in layers to within ± 3 mm (1/8") of edge alignment.
- .4 *Provide* clear, 10-12 mm (3/8" - 1/2") wide plastic edge tape reinforcing to prevent ravelling of raw edge of shades having glass fibre cores.
- .5 Bottom edge to hang straight and true, with hem weights totally enclosed in extruded hem tube. Heat sealing alone is not acceptable.
- .6 All sewing to incorporate heavy denier polyester yarn and machine stitching to be straight and neatly finished with no loose threads visible in finished *Work*. Heat seaming is not acceptable in areas in which fabric is exposed.

2.7 FINISHES

- .1 Cleaning and Shop Painting for Concealed Steel Sheet Finishes: Hot dip galvanized, complying with ASTM A123/A123M.
- .2 Aluminum Finish:
 - .1 Architectural Class II; Clear anodized in accordance with Aluminum Association Finish Designation AA-M12-C22-A31.
- .3 Dielectric Separator: To *Provide* die-electric separation between two dissimilar metals and prevent galvanic reaction. Best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type acceptable to *Consultant*.

PART 3 -EXECUTION

3.1 EXAMINATION

- .1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify *Consultant* in

writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

- .1 Obtain corrective measures from *Consultant* prior to fabrication. Ensure suitability of adjacent building components in relationship to *Work* of this Section.

3.2 INSTALLATION

- .1 Coordinate installation and fastenings with trades providing adjacent components. Coordinate location of support framing and blocking for installation of roller window shades.
- .2 *Provide*, as part of *Work* of this Section, custom trim components including gypsum board and tee bar trim items to accommodate adjacent ceiling systems and finishes to approval of *Consultant*.
- .3 *Install* shades in accordance with manufacturer's instructions in accordance with reviewed *Shop Drawings* and as indicated, in true, flat planes.
- .4 Securely attach all installation fittings to their mounting surfaces with screws of correct length and type, and with compatible plugs or anchors where required.
- .5 Ensure penetrating fastener do not interrupt continuity of air/vapour barrier integrity.
- .6 Ensure shades and their fabrics hang flat at vertical installation without buckling or distortion. Edge when trimmed, to hang straight without curling or raveling.
- .7 Unguided roller shade cloth to roll true and straight without shifting sideways more than ± 3 mm (1/8") in either direction due to warp distortions or weave design.

3.3 ADJUSTMENT AND CLEAN-UP

- .1 Adjust shades for smooth operation and correct alignment. Perform system operation, service and replacements methods in presence of *Owner's* personnel.
- .2 Remove protective coating. Clean shades and remove finger marks and smudges from shades and adjacent surfaces.
- .3 Leave shades in raised position at completion of *Work* of this Section.
- .4 Upon completion of *The Work* of this Section, remove all *Products*, materials, debris and equipment from the site.
- .5 Leave site in a neat and tidy condition, acceptable to *Consultant*.
- .6 Do all touch-up required to satisfaction of *Consultant*.

FEDERAL BUILDING
Arviat, NU
Project #1408

MANUAL ROLLER WINDOW SHADES

Section 12 23 14
Page 10
Apr 07, 2015

END OF SECTION

PART 1 -GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 the General Conditions and Supplementary Conditions of the *Contract*;
 - .2 Division 1 requirements and documents referred to therein.

1.2 SUMMARY

- .1 Work Included: *Provide* stainless steel casework including but not limited to following:
 - .1 Stainless Steel Casework
 - .2 Stainless Steel Countertops
 - .3 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.
- .2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Latest published edition of reference standards listed herein are applicable to this Project unless otherwise indicated.
 - .2 Reference amendments adopted prior to the effective date of this Project are applicable unless otherwise indicated

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Coordinate installation with related Sections referenced herein.
- .2 Pre-Installation Meetings:
 - .1 Regulatory Requirement Review Meeting: Provide pre-start regulatory requirement review meeting to parties associated with work of this Section. As a minimum, discuss following:
 - .1 environmental procedure requirements,
 - .2 health, safety and emergency response procedure and policy requirements,
 - .3 and security requirements;
 - .2 Pre-construction Site Meeting:
 - .1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.
 - .2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities

relative to:

- .1 work included,
- .2 materials to be used,
- .3 storage and handling of materials,
- .4 installation of materials,
- .5 sequence and quality control,
- .6 Project staffing,
- .7 restrictions on areas of work and other matters affecting construction.

.3 Scheduling:

- .1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be preformed. Inspect surfaces to determine adequacy of existing and proposed conditions.
- .2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- .3 Co-operate with other Sections for application of all miscellaneous specialties.
- .4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.
- .5 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
- .2 Submit data and details for construction of the stainless steel casework as well as information regarding the name, quantity, type and construction of materials (such as hardware, gauges, etc), that will be used to complete the project.
- .3 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, and other materials as designated later by Consultant.

.2 *Shop Drawings*:

- .1 Submit *Shop Drawings* in accordance with Section 01 30 00 for fabricated items and assemblies of stainless steel casework with a detailed description, clearly indicated methods of construction, gauges, assembly, fastenings, services and similar items.
- .2 Identify and explain any variation in *Shop Drawings* which do not adhere to original details and *Specification* requirements. Advise *Consultant* in writing of any conditions that would limit or adversely effect design intent.

- .3 Ensure component parts and assemblies of each piece of equipment will support the loads anticipated without deflection detrimental to function, safety or appearance.
 - .4 Prepare fully dimensioned "Roughing-In" and final connection point *Drawings* for mechanical and electrical services. Separate mechanical and electrical, or combined *Drawings*, may be submitted. Include walk-in and fire suppression schematics and any pertinent installation diagrams including dimensioned "sleeving" drawing.
 - .5 Verify power and location requirements for any piece of equipment that is being supplied by *Owner* or is existing and being reused. Incorporate this information into the *Shop Drawings*, "Rough-in" and connection point *Drawings*.
- .3 Samples:
- .1 Submit sample in accordance with Section 01 30 00. Submit a sample of components or fabrication method, material or finish, for review and approval before proceeding with that aspect of work. Where necessary, request a shop inspection of an assembly which cannot be submitted for approval.
 - .2 Submit the following:
 - .1 One (1) 24" (600mm) wide, full-height base cabinet: Construction to consist of one (1) drawer, one (1) door, one (1) cupboard with adjustable half/full depth shelf and related hardware (pulls, hinges, drawer slides, etc.), complete with finish.
 - .2 One complete set of color chips representing the manufacturer's full range of available colors.
 - .3 Minimum sample size 2 inches by 3 inches (50mm x 76mm).
 - .4 One Countertop backsplash and finished edge.
 - .3 Samples shall be precise articles proposed to be supplied.
 - .4 Reviewed samples will become standard of workmanship and material against which installed work will be reviewed.
- .4 Test and Evaluation Reports: Submit test data and design criteria which are in compliance with the project specifications.
- .5 Maintenance Manuals: Submit maintenance instructions in accordance with Section 01 70 00, bound and labeled.

1.6 QUALITY ASSURANCE

- .1 *Manufacturers: Provide Products for Work* of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.
- .2 *Installers: Provide Work* of this Section executed by competent installers with minimum of 5 years experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .3 *Mock-ups: Provide Mock-ups* in locations designated by *Consultant* and as required to demonstrate quality of workmanship. Maintain *Mock-ups* during construction in an undisturbed condition as a standard for judging the completed work. Do not proceed with remaining work until installation is

approved by Consultant.

- .1 Install base cabinet with specified hardware.
- .2 Install wall cabinet with specified hardware.
- .3 Install countertops complete with side and backsplashes.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Co-ordinate deliveries of stainless steel casework in conjunction with millwork and other construction activity and progress at site and as designated by *Owner*.
- .2 Deliver, unpack and set in place all component in designated position, ready for final connection of services, for units with electrical or mechanical connections where applicable.
- .3 *Supply to Owner*, in sufficient time, any information or items of service, articles, components or equipment which requires building in or which may overlap or impede work of others.
- .4 *Provide* all necessary information within adequate time and in proper sequence regarding exact location of openings, chases and any attachments or other fittings required for stainless steel casework.
- .5 *Supply* and deliver to site in sufficient time all inserts, anchors, bolts, sleeves, ferrules and similar items for attaching to, or building into, masonry, concrete and other work for proper anchorage and fixing of equipment. Include necessary templates, instructions, directions and/or assistance in location and installation of all items by others.
- .6 Identify each casework cabinet with temporary labels showing location and item number for ease of installation.
- .7 After installation has been completed and all items checked and adjusted where necessary for satisfactory operation, arrange for inspection of stainless steel casework. If items are found unsatisfactory, make necessary corrections and adjustments.

1.8 PROJECT SITE CONDITIONS

- .1 Building must be enclosed (windows and doors sealed and weather-tight);
- .2 An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;
- .3 Adjacent and related work shall be complete;
- .4 Ceiling, overhead ductwork and lighting must be installed;
- .5 Site must be free of any further construction such as "wet work";
- .6 Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

1.9 WARRANTY

- .1 Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the *Contract*. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of *Consultant* and at no expense to *Owner*. Defects include, but are not limited to: ruptured, cracked, or stained coating; discoloration or lack of finish integrity; cracking or peeling of finish; slippage, shift, or failure of attachment to wall, floor, or ceiling; weld or structural failure; warping or unloaded deflection of components; failure of hardware

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- .1 *Products* of following manufacturers are acceptable subject to conformance to requirements of *Drawings*, *Schedules* and *Specifications*:
- .1 Mott Manufacturing Ltd.; www.mott.ca
 - .2 Lab Design/United *Supply* Corp.; www.lab-design.com
- .2 Substitution Limitations: This Specification is based on *Products* by Mott Manufacturing. Comparable *Products* from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 MATERIALS

- .1 Sheet Steel:
- .1 Mild steel, cold rolled furniture grade to requirements of ASTM A1008/A1008M, Grade C or higher, with smooth surfaces to furniture quality.
- .2 Galvanized Sheet Steel:
- .1 Commercial quality galvanized sheet steel to ASTM 653/A653M, Designation Z275 (G90).
- .3 Stainless Steel:
- .1 *Provide* highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. *Provide* finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.
 - .2 Sheet: ASTM A240, type 304 or 316 alloy.
 - .3 Finish: Unless otherwise indicated, AISI No. 4 brushed Finish
- .4 Sealant: Conforming to requirements of Section 07 92 00.
- .1 One component, RTV silicone sealant. Color to suit application.
- .5 Sheet Metal Thickness:
- .1 Use the following minimum steel thicknesses for furniture manufacturing:
 - .1 0.3mm (11 Ga) leveling bolt gusset plates.
 - .2 1.9mm (14 Ga) drawer slides and side suspension channels.
 - .3 1.5mm (16 Ga) for tubular rails, legs for tables, gusset plates,

- cabinet top and intermediate horizontal rails.
- .4 1.2mm (18 Ga) for door and drawer fronts, cabinet floor, cabinet sides, vertical front members, cabinet toe kick, service cover panels, table and kneehole frames, front rails, gable legs and dust caps, false panels, furring and filler panels.
 - .5 0.9mm (20 Ga) for drawer backs, door backs, vertical closure channel, removable back panels, shelves, drawer bodies, drawer dividers, bin bodies, and pull-out shelves.

2.3 MANUFACTURED UNITS

.1 Cabinet Frame:

- .1 Provide one-piece die-formed cabinet bottom construction with return side flanges turned down. Spot weld flanges to cabinet sides. Provide sink cabinets with galvanized bottom painted to match cabinet.
- .2 Cabinet bottoms shall be turned down at front to form 32mm (1-1/4") "U" channel to accept toe kick and turn down 133mm (5-1/4") at back with 16mm (5/8") return to form the back lower member of cabinet base. Provide punched 19mm (3/4") dia. corner holes for access to levelers and to accept PVC press plugs. It shall be possible to access levelers from above cabinet without removing drawers or drawer supports.
- .3 Provide additional vertical 75mm (3") "HAT" shaped channels, spot-welded to or formed with the rear vertical corner. Channel shall be provided with pre-punched holes to receive shelf clips, and slotted holes to receive drawer suspension tracks. Cabinets 762mm (30") wide and larger shall be provided with intermediate 117mm (4-5/8") "HAT" channels to brace cabinet and accept shelf clips and drawer tracks
- .4 Where applicable, the front corner posts shall be pre-punched and slotted to accept drawer suspension systems and suspension pull-out shelves. Front vertical posts shall form inboard flush front construction for doors and drawers acting as the cabinet main member side gable tying the cabinet bottom and horizontal member together to form a rigid case. Front post rear closure channels shall be "J" shaped 9mm (11/32") x 33mm (1-5/16") x 49mm (1-15/16"). Provide channel with pre-punched holes to receive shelf clips.
- .5 Doors and drawers shall overlay top intermediates and floor horizontal members.
- .6 Top horizontal front framing member shall form a "J" shaped section 75mm (3") wide, 10mm (3/8") return by 25mm (1") deep with 16mm (5/8") return.
- .7 Intermediate horizontal framing members shall form a "U" 32mm (1-1/4") high with a 25mm (1") return on top and 16mm (5/8") return on bottom.
- .9 Top rear horizontal framing member shall be 50mm (2") x 32mm (1-1/4") angle section welded to back corner lapped post and side gables with welded corner gusset plates acting as cabinet bracing and counter top material fixing member.
- .10 Enclose cabinetry toe space shall be 75mm (3") deep x 100mm (4") high and shall act as a total enclosure to bottom of cabinet. Toe space

- section shall key up into "U" shaped front floor member and act as reinforcement. Toe space, front floor of cabinet and corner post sections shall be spot welded together forming one structural member.
- .11 The toe space members, side gable returns, and back lower member shall form all welded structural corner to accept leveller gussets and 10mm (3/8") levelling bolts.
 - .12 Cabinet construction shall be electro spot-welded to form a strong well-fitted, one-piece unit.
 - .13 Exposed horizontal structural cabinet members between doors and drawers shall be unacceptable.
- .2 Cabinet Hardware:
- .1 Pulls: Provide handles for drawers and hinged doors in 100mm (4") satin finish aluminium.
 - .2 Door Hinges: Provide five knuckle-type barrel door hinges of 1.9mm (14 Ga) steel screwed into door and fastened to cabinet side stile with two counter sunk #8-32 zinc plated machine screws & captive serrated tooth washer nuts. Standard hinge finish shall be bright chrome.
 - .3 Locks:
 - .1 Removable core, 5 disc tumbler with 229 key changes on a single cut key complete with master key.
- .3 Base Cabinet Components:
- .1 Provide removable back panels for cupboard base cabinets. Provide partial back panels
 - .2 229mm (9") in height to accommodate plumbing at sink units. When requested, provide back panels and security panels on cabinets requiring locks.
 - .3 Shelving edges; turned down on all four sides 25mm (1"), and returned under on front and back 25mm (1"). Shelves 914mm (36") and longer shall be provided with "HAT" channel reinforcement at front edge.
- .4 Doors:
- .1 Fabricate doors of two telescoping metal panels, 19mm (3/4") thick, painted internally with a sound-deadening material extending continuously full-width, and top to bottom.
 - .2 Reinforce hinged side of door adequately with hinge machine screws to prevent sagging. Secure recessed hinges to cabinet posts with machine screws and concealed self-locking nuts. Provide nylon roller friction catches, mounted on horizontal top or intermediate members pull side of doors. Provide each hinged door with two rubber bumpers.
 - .3 Doors, drawers, tracks and back panels shall be replaceable in the field without requiring special tools.
 - .4 All standard double door cabinets shall be designed without center stiles to maximize access to the cabinet.
- .5 Drawers:
- .1 Fabricate drawer fronts of two telescoping metal panels painted internally, and totally filled with sound-deadening material to eliminate possible drumming effect. The exterior drawer front shall have a channel formation on the top edge with fully finished return edges telescoping together to form fully sounded-deadened drawer

- front. Removable outside panel with lip to fit over inside panel on top edge, and to lock into position at bottom with rivets to form a rigid, one-piece 19mm (3/4") thick drawer front.
- .2 Conventional drawer track systems shall be designed to eliminate metal surface-to-surface contact and reduce side play, while incorporating a self-closing action for 150mm (6") of drawer travel. Made up of custom manufactured components. Each drawer track assembly shall incorporate two nylon rimmed, plated steel ball bearing rollers.
 - .3 Provide drawer operation on full extension drawer slides, load capacity 45kg (100 pounds).
 - .4 Drawer body shall consist of one piece construction including the bottom, two sides, back and inner front flanged end which shall be welded to the interior drawer front head. Drawer bodies shall have a reinforcing bend on top edges.
 - .5 Provide built-in stops to prevent inadvertent removal of drawers, with allowance for drawer to be removed by lifting front of drawers and pulling out.
 - .6 Provide drawer pulls in central location of drawer face. Two handles shall be provided on units 762mm (30") and larger.
- .6 Service Cover Panels:
- .1 Service cover panels shall be provided, where called for, between base cabinets to enclose the pipe space. Service cover panels shall be designed in two sections. The lower section shall be fixed in place to mount cove base moulding. The upper section shall be fitted between the base cabinets and shall be removable.
- .7 Filler Panels:
- .1 Fabricate front filler panels complete with flanges on both sides and a 75mm x 100mm (3" x 4") toe space along the working face.
 - .2 Scribe filler panels shall be flanged on one side and flat on the other, to be cut on jobsite to suit wall conditions, and shall fit into double angles secured to the wall. No visible mounting screws permitted.
 - .3 Corner filler panels shall be a two-piece construction, one fixed panel and the other a variable panel to facilitate room dimensions. Each shall have flanges and an integral 75mm x 100mm (3" x 4") toe space filler to interlock with its counterpart.
 - .4 End closing filler panels shall be flanged on one side 25mm (1") and secured to back of cabinet. The edge extending to wall shall be flat and fit into a double angle secured to wall. No visible mounting screws permitted.
- .8 Floor/Wall Cabinet Components:
- .1 Materials and Thicknesses: Use the following standard steel thicknesses for this furniture manufacturing:
 - .1 1.2mm (18 Ga) leveled prime grade furniture steel for sides, top, back, bottom, false bottom, dust caps and bases on tall storage cabinets.
 - .2 3mm (11 Ga) cold rolled steel for levelling device brackets on floor storage cabinets only.

- .9 Dust Cap/Sloped Top:
- .1 Dust caps shall be fabricated from 1.2mm (18 Ga) steel, and shall mount flush with the front edge of the cabinet and extend back at an angle of 30 degrees to a point perpendicular to the rear of the cabinet. Ends shall be finished and flanged so as to allow attachment to the cabinet below.
- .10 Stainless Steel Countertops
- .1 All factory welds shall be made using the TIG process. Filler rod shall be of the same composition as the base material.
 - .2 Countertops without sinks: Form tops with 32mm (1.25") high edges with 12mm (0.5") return flange. Reinforce with veneer core plywood or metal hat channels as required or indicated on *Drawings*. Form edges, flanges, side and backsplashes integrally from one sheet of steel. Intersections between side and backsplashes and work surface shall be radiused a minimum of 9mm (0.375"). Where indicated on *Drawings*, *Provide* marine edges. Marine edges shall be 25mm (1") wide and 6mm (0.25") high.
 - .3 Countertops with sinks: Form tops with 32mm (1.25") high edges with 12mm (0.5") return flange. *Provide* marine edges at all locations. Marine edges shall integrally be formed on all edges. Marine edges shall be 25mm (1") wide and 6mm (0.25") high. Work surface shall be reinforced with wood core or metal hat channels as required or indicated on *Drawings*. Form edges, flanges, side and backsplashes integrally from one sheet of steel. Intersections between sidesplashes, backsplashes and work surface shall be radiused a minimum of 9mm (0.375").
 - .4 Sink Bowls: Sink bowls shall be made of the same material as the work surface and shall be of equal or greater thickness. Sinks bowls shall be formed from one piece of steel with all inside corners radiused. Welds shall be hammered, ground and polished to produce a smooth, invisible joint. Sinks shall be welded into the work surface and welds shall be ground and polished to produce a smooth, invisible joint.
 - .5 Joints: Factory welds shall be ground and polished to provide an invisible joint. Field connections shall be mechanical "tongue and groove" interlocking design with concealed bolts to provide a hairline seam.
 - .6 Sound Deadener: Countertops and sinks shall have sound deadening material applied as required to the underside. Nominal thickness shall be 1.5mm (0.062"). Sound deadener shall be waterborne, non flammable and shall contain no volatile organic compounds.

2.4 FINISH

- .1 All steel furniture in this section shall be constructed of stainless steel with a #4 brushed finish. Grain direction shall be horizontal except where cabinet dimensions do not permit.

PART 3 -EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

- .1 Casework will not be delivered or installed until the following conditions have been met:
 - .1 Building must be enclosed (windows and doors sealed and weather-tight);
 - .2 An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;
 - .3 Ceiling, overhead ductwork and lighting must be installed;
 - .4 Site must be free of any further construction such as "wet work."
 - .5 Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

3.2 INSTALLATION

.1 Casework Installation:

- .1 Casework shall be set with components plumb, straight and square, securely anchored to building structure with no distortion. Concealed shims shall be used as required.
- .2 Cabinets in continuous runs shall be fastened together with joints flush, uniform and tight with misalignment of adjacent units not to exceed 1/16 of an inch.
- .3 Wall casework shall be secured to solid material, not lath, plastic or gypsum board.
- .4 Top edge surfaces shall be abutted in one true plane. Joints are to be flush and gap shall not exceed 1/8 of an inch between tops.
- .5 Casework and hardware shall be adjusted and aligned to allow for accurate connection of contact points and efficient operation of doors and drawers without any warping or binding.

.2 Countertop Installation:

- .1 Countertops are to have been fabricated in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.
- .2 Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.
- .3 Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.
- .4 Joints shall be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.

3.3 CLEANING

- .1 Ensure all products are unsoiled and match factory finish. Remove or repair damaged or defective units.
- .2 Clean all finished surfaces, including drawers and cabinet shelves, and touch up as necessary.
- .3 Counter tops shall be cleaned and free of grease or streaks.

3.4 PROTECTION

- .1 Counter tops and ledges shall be protected with 1/4 inch ribbed cardboard for the remainder of the construction process.
- .2 Examine casework for damaged or soiled areas; replace, repair, and touch-up as required.
- .3 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings signed and stamped by contractor.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 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.
 - .4 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.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for fixtures, pump systems, and equipment for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative and Consultant before final inspection.
 - .2 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.
 - .3 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.
 - .4 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.
 - .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative and Consultant for approval. Submission of individual data will not be accepted unless directed by Departmental Representative and Consultant.
 - .2 Make changes as required and re-submit as directed by Departmental Representative DCC Representative Consultant.
 - .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .7 Site records:
 - .1 Departmental Representative or Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information 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.
 - .8 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 and Consultant 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.
 - .9 Submit copies of as-built drawings for inclusion in final TAB report.
-

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
-

- .1 Visually inspect substrate in presence of Departmental Representative or Consultant.
- .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 PAINTING REPAIRS AND RESTORATION

- .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.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Division 1.
- .2 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 - ACTION AND INFORMATIONAL 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.

3.5 DEMONSTRATION

- .1 Departmental Representative and Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
 - .2 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.
 - .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
-

- .4 Instruction duration time requirements as specified in appropriate sections.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

3.7 PROTECTION

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

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing pumps.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Division 1.
 - .2 Coordinate submittal requirements and provide submittals required by Division 1.
 - .3 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
 - .2 Submit WHMIS MSDS. Indicate VOC's for adhesive and solvents during application and curing.
 - .4 Shop Drawings.
 - .1 Submit shop drawings to indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
 - .2 Wiring and schematic diagrams.
 - .3 Dimensions and recommended installation.
 - .4 Pump performance and efficiency curves.
 - .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .6 Instructions: submit manufacturer's installation instructions.
 - .7 Manufacturers' Field Reports: manufacturers' field reports specified.
 - .8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Division 1, include:
-

- .8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Division 1, include:
 - .1 Manufacturers name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting in accordance with Division 1 P requirements.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Division 1 requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Materials and resources in accordance with entire Specification book.

2.2 DOMESTIC HOT WATER CIRCULATING PUMPS

- .1 Capacity: as indicated on drawings.
 - .2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 861 kPa and 105 degrees C continuous service.
 - .3 Motor: as indicated on drawings.
 - .4 Supports: provide as recommended by manufacturer.
-

2.3 DOMESTIC WATER BOOSTER SYSTEM

- .1 Packaged duplex system, factory assembled, tested and adjusted, ready for site piping and electrical connections.
 - .2 Total Capacity:
 - .1 Flow rate: as indicated on drawings.
 - .2 System pressure: as indicated on drawings.
 - .3 Available pressure at meter outlet: as indicated on drawings.
 - .4 Duplex system with 50% on lead pump and 50% on lag pump.
 - .3 Construction: in-line horizontal, end suction, closed coupled centrifugal, cast-iron casing, bronze impeller, stainless steel non-ferrous shaft sleeve, mechanical shaft seal, designed for 850 kPa suction pressure.
 - .4 Valves: to Section 22 11 16 - Domestic Water Piping. Suction and discharge gate or butterfly valves and pressure reducing and check valve for each pump connected to common suction and discharge headers.
 - .5 Motor: as indicated on drawings.
 - .6 Supports: install complete package on factory fabricated structural steelwork.
 - .7 Anchor Bolts and Templates:
 - .1 Supply for installation by other Divisions.
 - .8 Control Panel: CSA 1 enclosure complete with:
 - .1 Externally operated disconnect switch.
 - .2 Magnetic across-the-line fused starters.
 - .3 Overload protection for each phase.
 - .4 Adjustable pressure switches.
 - .5 Low pressure safety cut-out.
 - .6 Control circuit transformer with fused secondary.
 - .7 Adjustable time delay relay.
 - .8 Hand-off-automatic selector switch for pumps.
 - .9 Pressure and suction gauges, 90 mm nominal dia., range to kPa.
 - .10 Pilot lights; power on, low suction pressure.
 - .11 Lead/lag selector switch.
 - .12 Alarm: visual and audible with silencing switch for abnormal conditions.
 - .9 Operation:
 - .1 Lead pump to operate continuously during demand.
 - .2 Should operating pump fail, next pump in sequence to start automatically.
 - .3 Should system demand exceed capacity of operating pump or pumps, next pump in sequence automatically starts.
-

- .4 Adjustable 90 time delay to maintain starting pump operation and avoid "on-off " cycling.
- .5 Constant pressure control, pressure switch current transformer to cycle pump.
- .6 Low suction pressure switch to stop pumps.
- .7 Temperature control for low or no system demand to bleed to drain.
- .8 Constant pressure control valves on pumps to control pressure within kPa from design maximum to zero flow.
- .10 Standard of Acceptance: Grundfos Hydro Multi B Booster Pump Package c/w control panel and 60 litre pressure tank.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Check power supply.
 - .2 Check starter protective devices.
 - .2 Start-up, check for proper and safe operation.
 - .3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
 - .4 Adjust flow from water-cooled bearings.
 - .5 Adjust impeller shaft stuffing boxes, packing glands.
 - .6 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
 - .1 Materials and resources.
-

- .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.

3.4 START-UP

- .1 General:
 - .1 In accordance with Division 1 requirements: General Requirements, supplemented as specified herein.
 - .2 Procedures:
 - .1 Check power supply.
 - .2 Check starter O/L heater sizes.
 - .3 Start pumps, check impeller rotation.
 - .4 Check for safe and proper operation.
 - .5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
 - .6 Test operation of hands-on-auto switch.
 - .7 Test operation of alternator.
 - .8 Adjust leakage through water-cooled bearings.
 - .9 Adjust shaft stuffing boxes.
 - .10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
 - .11 Check base for free-floating, no obstructions under base.
 - .12 Run-in pumps for 12 continuous hours.
 - .13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
 - .14 Adjust alignment of piping and conduit to ensure full flexibility.
 - .15 Eliminate causes of cavitation, flashing, air entrainment.
 - .16 Measure pressure drop across strainer when clean and with flow rates as finally set.
 - .17 Replace seals if pump used to degrease system or if pump used for temporary heat.
 - .18 Verify lubricating oil levels.

3.5 DOMESTIC HW CIRCULATING PUMPS

- .1 Measure flow rate and submit with TAB report.
-

3.6 REPORTS

- .1 In accordance with Division 1 requirements: reports, supplemented as specified.
- .2 Pump performance curves (family of curves) with final point of actual performance.

3.7 TRAINING

- .1 In accordance with Division 1 requirements: Training of O&M Personnel, supplemented as specified.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .2 ASTM International Inc.
 - .1 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A 536-84(2004)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B 88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
 - .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
 - .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
 - .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02a, Butterfly Valves.
 - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
-

- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Division 1.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with manufacturer's instructions.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA , Regional and Municipal regulations.

PART 2 - PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B 88M.
 - .1 Alternate: Type 304 stainless steel in sizes larger than 2".
 - .2 Fittings to match parent pipe material.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
-

- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: welded or soldered.
- .6 NPS 1 ½ and smaller : wrought copper to ANSI/ASME B16.22; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.
- .7 Roll groove piping is not acceptable.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

2.5 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
-

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE Bunan seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, chrome plated brass, stainless steel ball, PTFE adjustable packing, brass gland and PTFE Bunan seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

2.6 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, lug:

.1 To MSS-SP-67, Class 200.

.2 Cast iron body, stainless steel disc, stainless steel stem, EPT liner.

.3 Lever operated, NPS8 and over, gear operated.

.4 Approved for use in potable water system.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with NPC, Territory Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 22 05 00 - Common Work Results for Plumbing.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Territorial and Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative and Consultant.
 - .2 Coordinate with Site Water Utility.
 - .3 Upon completion, provide laboratory test reports on water quality for Departmental Representative and Consultant approval.
-

3.8 START-UP

- .1 Timing: start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
 - .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize HWS and HWC systems for Legionella control.
 - .5 Verify performance of temperature controls.
 - .6 Verify compliance with safety and health requirements.
 - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
 - .3 Reports:
 - .1 In accordance with Division 1 requirements: Reports, using report forms specified in Division 1: Report Forms and Schematics.
-

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of system and products.

3.11 CLEANING

.1 Clean in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D 2235-04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D 2564-04e1, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800-06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, Commercial Adhesives.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Division 1.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with manufacturer requirements.
 - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
-

- .3 Store at temperatures and conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

2.2 PIPING AND FITTINGS

- .1 For above ground DWV piping use PVC to:
 - .1 CAN/CSA B1800.

2.3 JOINTS

- .1 Solvent weld for PVC: to ASTM D 2564.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code and local authority having jurisdiction.

3.3 TESTING

- .1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
-

- .2 Open, cover with linseed oil and re-seal.
- .3 Verify cleanout rods can probe as far as the next cleanout, at least.

- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
 - .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA-B139-04, Installation Code for Oil Burning Equipment.
 - .3 CAN/CSA-B140.0-03, Oil Burning Equipment: General Requirements.
 - .4 CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.
 - .5 CAN/CSA-B149.2-05, Propane Storage and Handling Code.
 - .6 CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
 - .7 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.
 - .8 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .9 CAN/CSA-C309-M90(R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
-

- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Territory of Nunavut, Canada.
 - .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Division 1.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with manufacturer requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.6 WARRANTY

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in Division 1 General Conditions.
- .2 Contractor hereby warrants domestic water heaters in accordance with Divis General Condition requirements, but for number of yearsspecified for each pr

PART 2 - PRODUCTS

2.1 COMPONENTS

- .1 Sustainable Requirements:
 - .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 GLYCOL - STORAGE

- .1 Tank:
 - .1 Vertical on steel legs; shell, stainless steel fabricated to CSA B51, and provincial regulations complete with all connections, factory applied glass nickel polymerized fluorocarbon or combination lined.
-

- .2 Heater:
 - .1 Removable double walled design wound U-tube bundle of NPS 3/4 seamless copper tubing, brass tube supports and tie rods; shell lining or 90/10 copper/nickel heat exchanger with stainless steel flanges.
 - .2 Capacity, as indicated.
- .3 Accessories: heater bundle vacuum breaker.
- .4 Acceptable material: Weil-McLain Aqua Plus 105, sizes as indicated.
- .5 Glycol control:
 - .1 3-way modulating valve, cast iron body bronze body, 860 kPa, two-ply thermostatic bellows and copper capillary tubing with bulb in well, tight shut-off, removable composition disc, temperature adjustment setting.
 - .2 Max pressure drop: as noted on design drawings.
 - .3 Acceptable material: compatible with control system provided.

2.3 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater and control valve, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

2.4 ANCHOR BOLTS AND TEMPLATES

- .1 Supply for installation by other Divisions.
-

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A 126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP).
 - .1 IPMVP 2007 Version.
- .5 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Division 1. Indicate VOC's:
-

- .3 Shop Drawings:
 - .1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Products indicated in Plumbing Fixtures.

2.2 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: cast iron, round, gasket, vandal-proof screws.
 - .3 Cover for Terrazzo Finish: polished nickel bronze or brass with recessed cover for filling with terrazzo, vandal-proof locking screws.
 - .4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
 - .5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

- .1 Copper construction, bellows or piston type: to PDI-WH201.

2.4 BACK FLOW PREVENTERS

- .1 Preventers: to CSA-B64 Series, application as indicated.

2.5 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.
 - .2 As indicated on drawings.
-

2.6 TRAP SEAL PRIMERS

- .1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

2.7 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative or Consultant.
 - .2 Inform Departmental Representative or Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada, Territorial codes, and local authority having jurisdiction.
 - .2 Install in accordance with manufacturer's instructions and as specified.
-

3.4 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.6 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain or service sink.

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative or Consultant.
- .3 Install plastic tubing to floor drain.

3.9 STRAINERS

- .1 Install with sufficient room to remove basket for maintenance.

3.10 START-UP

- .1 General:
-

- .1 In accordance with Division 1 and commissioning plan.
Requirements: General Requirements, supplemented herein.
- .2 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

3.11 TESTING AND ADJUSTING

- .1 General:
 - .1 In accordance with Division 1 commissioning requirements:
General Requirements, supplemented as specified.
 - .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority
having jurisdiction.
 - .3 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
 - .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum
and (2) 25% of maximum and while pressure is (1) maximum and (2)
minimum.
 - .5 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site
conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
 - .6 Vacuum breakers, backflow preventers, backwater valves:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test
operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
 - .7 Access doors:
 - .1 Verify size and location relative to items to be accessed.
 - .8 Cleanouts:
-

- .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .11 Hose bibbs, sediment faucets:
 - .1 Verify that flow and pressure meet design criteria.
 - .2 Check for leaks, replace compression washer if required.

3.12 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Division 1: reports, supplemented as specified.
- .2 Training: provide training in accordance with Division 1: Training of O&M Personnel, supplemented as specified.

3.13 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

3.14 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

Project: ARVIAT
Location: ARVIAT, NU
Engineer: ACCUTECH ENGINEERING
Date: 07 APRIL 2015

CO-1 CLEANOUT - FLOOR CLEANOUT

Watts #CO-200-R Cleanout, cast iron body, 5" (127 mm) round adjustable gasketed nickel bronze top, ABS plug with neoprene gasket, no hub outlet.

FD-1 FLOOR DRAIN - FINISHED AREA

Watts #FD-200-7-6-A5-1 Floor Drain - epoxy coated, cast iron body, trap primer connection with plug, vandal proof, anchor flange and weepholes, no hub outlet. **Watts -A5-1** 5" (127 mm) diameter, nickel bronze, adjustable round strainer.

FD-2 FLOOR DRAIN - FINISHED AREA

Watts #FD-100-C-7-6-FC7-1 Floor Drain - epoxy coated, cast iron body, reversible flashing clamp with primary and secondary weepholes, vandal proof, trap primer connection with plug, no hub outlet. **Watts -FC7-1** 7" (178 mm) diameter, nickel bronze, adjustable round strainer.

WC-1 WALL HUNG TOILET - VITREOUS CHINA - FOR FLUSHOMETER - CONCEALED - NO TOUCH - HARDWIRED



American Standard AFWall Millennium Flowise Elongated #3351.101.020 HET Toilet, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Wall Hung, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, 38 mm (1-1/2") dia. Top spud. Mount fixture 16" (406mm) above finished floor to rim of toilet (or as required to meet local codes). **Centoco #820STS.001 toilet seat**, extra heavy duty, for elongated bowl, open front, white solid plastic, with cover, stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan Royal Optima #153-1.6 WB ES-S, concealed Flushometer** for Top Spud toilet, 6 L (1.6 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with dual filter by-pass, infrared sensor, courtesy flush override button, bak-chek angle stop (wheel handle operated), exposed CP elbow for top spud connection, high pressure vacuum breaker, housed in 333 mm x 432 mm (13-1/8" x 17") recessed box located above the toilet, 5 VA Power Required per unit. **Sensor to clear toilet seat cover. Sloan #EL-154, box mount hard wired transformer**, 120 VAC/ 24 VAC, 50 VA. **Will operate up**

to 10 'Optima' flush valve units. **Watts #ISCA-101-M11, single horizontal, Adjustable Toilet Carrier**, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent. 305 mm (12") finished metal stud wall to back of pipe space.

WC-3

FLOOR MOUNTED TOILET - VITREOUS CHINA - FOR FLUSHOMETER - EXPOSED - MANUAL

American Standard Madera Flowise Right Height Elongated

#3461.001.020 HET Toilet, 419 mm high, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Floor Mounted, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps, 38 mm (1-1/2") dia. Top spud. **Centoco #500STSCC.001 toilet seat**, Heavy Duty, for elongated bowl, open front, white solid plastic, less cover, stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan Regal #111-XL-CP, Exposed Manual Flushometer** for Top Spud toilet, chrome plated, 6 L (1.6 US Gal) factory set flow, quiet action diaphragm type, non-hold open feature, A.D.A oscillating handle, back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, Vacuum Breaker. **Provide Floor Flange**, (same material as the connecting pipe drain), with all brass bolts and with rubber gasket.

LAV-1



WALL HUNG BASIN - SINGLE LEVER FAUCET

American Standard Murro with Everclean #0954.004EC/0059.020EC Basin, 540 mm x 520 mm x 165 mm (21-1/4" x 20-1/2" x 6-1/2") high, vitreous china, for carrier with concealed arms, rear overflow, recessed self-draining faucet ledge, **semi-pedestal P-trap cover**. **Chicago Faucets #420-E2805-ABCP Single Lever Faucet**, chrome plated, 4" (102 mm) centerset, lead free ECAST brass construction, volume control and Hot Water Limit Stop cartridge, vandal resistant 1.9 LPM (0.5 GPM) pressure compensating Econo-Flo non-aerating spray outlet, 117 mm (4-5/8") projection rigid cast brass spout, single metal lever handle. **Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.** **McGuire #155AC Open Grid Drain**, chrome plated cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece. **McGuire #LFH165LKN3RB, Faucet Supplies**, chrome plated polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper riser. **McGuire #8872C P-Trap**, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend.

Watts #WCA-411-CA-481, Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

LAV-2

WALL HUNG BASIN - TWO HANDLE FAUCET

American Standard Lucerne #0356.015 Basin, 521 mm x 464 mm x 308 mm (20-1/2" x 18-1/4" x 12-1/8") high, vitreous china, for carrier with concealed arms, front overflow, self-draining faucet ledge, contoured back and side splash shield. **Chicago Faucets #786-GN2FCXKABCP Two Handle Faucet**, chrome plated, 8" (203 mm) centerset, lead free bronze construction with one piece concealed rough body, 1/4 turn ceramic disc valve cartridges, 5.7 LPM (1.5 GPM) laminar flow control insert in spout inlet, plain end outlet, 137 mm (5-3/8") projection flow control rigid/swing gooseneck spout, 102 mm (4") metal vandal proof wristblade handles with blue and red index buttons. **Lawler #TMM-1070-REC, Point Of Use Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F), housed in 356 mm x 356 mm x 152 mm (14" x 14" x 6") recessed box. **Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.** **McGuire #155AC Open Grid Drain**, chrome plated cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece. **McGuire #LFH165LKN3, Faucet Supplies**, chrome plated polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper riser. **McGuire #8872C P-Trap**, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **Watts #WCA-411, Basin Carrier**, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

S-1

SERVICE / MOP SINK - TWO HANDLE FAUCET

Stern Williams #MTB-3624 Service / Mop Sink, 914 mm (36") x 610 mm (24") x 254 mm (10") deep, Floor Mounted, terrazzo composed of pearl gray marble chips and Portland cement ground smooth, sealed to resist stain, cast brass drain with stainless steel strainer, 3"(75 mm) outlet. **Chicago Faucets #897-XK-CP Wall Mounted Two Handle Faucet**, chrome plated, 8" (203 mm) centerset, solid brass exposed body, 1/4 turn ceramic disc valve cartridges, unrestricted hose end outlet, 203 mm (8") projection spout with atmospheric vacuum breaker and bucket hook, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons. **Stern Williams T-35 Hose and Wall Hook** 36" (914 mm) long hose with 3/4" (19 mm) chrome coupling, stainless steel wall bracket. **Stern Williams T-40 Mop Hanger** stainless steel #4 finish, 24" (610 mm) long with 3 rubber spring loaded clips. **Stern Williams BP Back**

Splash Panel 20 gauge type 304 stainless steel. **Provide P-Trap**, same material as the connecting pipe drain.

S-2

COUNTERTOP MOUNT SINK - TWO HANDLE FAUCET

Franke Commercial #LBS1306-1/1 Single Bowl Countertop Mount Sink, 1 hole, 392 mm (15-7/16") x 384 mm (15-1/8") x 152 mm (6") deep, counter mounted, backledge, grade 18-10, 20 GA. (0.9 mm) type 302 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece.

Chicago Faucets #50-GN2FC317XKABCP Two Handle Faucet, chrome plated, center hole only, lead free solid brass construction, 1/4 turn ceramic disc valve cartridges, 5.7 LPM (1.5 GPM) laminar flow control insert in spout inlet, 136 mm (5-3/8") projection flow control rigid/swing gooseneck spout, 102 mm (4") metal vandal proof wristblade handles with blue and red index buttons.

Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex.**

copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #LFH165LKN3, Faucet Supplies, chrome plated polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper riser.

McGuire #8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

S-3

Custom stainless sink - TWO HANDLE - MANUAL FAUCET

Sink: Custom fabricated stainless steel. See Architectural for details.

Chicago Faucets #919-L613AABCP Two Handle Manual Faucet, chrome plated, center hole only, lead free solid brass body, Quatern compression operating cartridges, Pre-rinse spout with 584 mm (23") riser, 1117 mm (44") flexible stainless steel hose, pipe strap and hook assembly, integrated stainless handle clip to hold handle open, one piece stainless steel spray nozzle and diffuser, rubber nozzle bumper, 3.8 LPM (1.0 GPM) @ 60 PSI pre-rinse spray valve, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons.

Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. McGuire**

#LFH165LKN3, Faucet Supplies, chrome plated polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper riser. **McGuire #8912CB P-Trap**, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

S-4**SCULLERY SINK - TWO HANDLE FAUCET**

Franke Commercial #SL2424-1/2 Single Bowl scullery sink, 2 hole, 8" (203 mm) center, 691 mm (27-3/16") x 695 mm (27-3/8") x 889 mm (35") deep, Floor Mounted, faucet on backsplash, grade 18-10, 16 GA. (1.5 mm) type 304 stainless steel, rim and bowl polished satin finish, 229 mm (9") high backsplash, radius coved corners on front and back only, rolled rim, stainless steel tubular legs with adjustable feet, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. **American Standard Heritage #7298.152 Wall Mounted Two Handle Faucet**, chrome plated, 8" (203 mm) centerset, brass, slow compression cartridge, 8.3 LPM (2.2 GPM) aerator outlet, swing spout 270 mm (10-5/8") from wall to outlet reach, metal lever handles. **McGuire #8912CB P-Trap**, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

S-5**Custom Stainless Steel Sink - TWO HANDLE FAUCET**

Sink: Custom fabricated stainless steel. See Architectural for details. **Chicago Faucets #50-GN2FC317XKABCP Two Handle Faucet**, chrome plated, center hole only, lead free solid brass construction, 1/4 turn ceramic disc valve cartridges, 5.7 LPM (1.5 GPM) laminar flow control insert in spout inlet, 136 mm (5-3/8") projection flow control rigid/swing gooseneck spout, 102 mm (4") metal vandal proof wristblade handles with blue and red index buttons. **Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.** **McGuire #LFH165LKN3, Faucet Supplies**, chrome plated polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper riser. **McGuire #8912CB P-Trap**, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

SH-1**VALVE AND HEAD**

Whitehall Best-Care #WH1741-CSH Shower Valve, panel fabricated from 14 GA. (1.9 mm) type 304 stainless steel, T/P mixing valve, ADA compliant ligature resistant tri-lever control valve handle, 5.7 L (1.5 US Gal) flow per minute fixed conical anti-ligature shower head (chrome plated). **Watts #FD-100-C-A Floor Drain**, epoxy coated cast iron, anchor flange, 5" (127 mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. **Provide P-Trap**, same material as the connecting pipe drain.

SH-2**VALVE, HEAD AND HANDSHOWER**

Chicago Faucets #SH-PB1-02-000 Shower Valve, solid brass body, pressure balancing, washerless ceramic drip-free disc valve cartridge, metal wall escutcheon, 9.5 LPM (2.5 GPM) maximum flow rate '620A' ball joint showerhead with arm and flange. **American Standard #T064.430**, metal lever handles. **American Standard #R420**, 2-Way in-wall Diverter Valve. **Chicago Faucets #151-VB-WS Commercial hand shower slide bar, 24" (610 mm)**, 9.5 LPM (2.5 GPM) maximum flow rate, spray head, 60" (1524 mm) flexible metal hose, wall supply elbow with flange, in-line vacuum breaker. **Watts #FD-100-C-A Floor Drain**, epoxy coated cast iron, anchor flange, 5" (127 mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. **Provide P-Trap**, same material as the connecting pipe drain.

WC-2**COMBINATION FIXTURE**

Acorn Penal-Ware Series #1418-AR-1-BC-04-M-1.6GPF-FV-GW-PT-PHC 14 GA. (1.9 mm) type 304 stainless steel seamless weld construction, Combination Fixture satin finish on the outside as well as inside the toilet bowl, standard oval lavatory bowl, 14 GA. (1.9 mm), blowout jet flushing action, fire-resistant and sound-deadened cabinet, toilet waste outlet is 2-3/8" (60 mm) OD plain end extending 3" (76 mm) beyond the feature for wall outlet, standard elbow waste outlet with 1-1/2" (38 mm) OD plain end, angled right, off-floor, wall outlet, bubbler, code, Hot & Cold Air-Control, metering, Mechanical flush valve, 1.6 GPF (6.0 LPF), integral contoured seat, paper holder (center), Lav. P-trap waste, gasketed toilet waste, it is manufactured with no accessible voids or crevices where contraband can be concealed, Includes mounting hardware for wall up to 8" (203 mm) thick, toilet will flush with minimum of 25 psi flow pressure when used in conjunction with a minimum of 1.6 gpf flush valve. **Fixture to be mounted on rigid wall.**

EYE-1**EYE/FACE WASH**

Haws #7360B-7460B, eye/face wash, stainless steel bowl, 'AXION MSR' single inverted directional laminar flow head with integral flow control, chrome plated brass stay open ball valve with stainless steel ball and stem, in-line mesh water strainer, flow rate of 24 LPM (6.34 GPM), 32 mm (1-1/4") waste, universal sign. **Model is certified by CSA to meet the ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment. McGuire #8872C P-Trap**, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. For thermostatic mixing valve, model # 9201EW

**EYE-1
9201EW****EMERGENCY THERMOSTATIC MIXING VALVE FOR EYEWASH OR
EYE/FACE WASH**

Haws #9201EW, Emergency Thermostatic Mixing Valve for Eyewash or Eye/Face Wash , modular brass design with one piece casting, efficient funnel design with turbulent hot water passages to improve mixing at low flow rates and enhance temperature control, 13 mm (1/2") N.P.T. Outlet, unit employ with a paraffin filled thermostatic mixing element, 26 °C (78.8 °F) factory set temperature, standard 16 °C (60.8 °F) - 32 °C (89.6 °F) temperature range, 37.9 LPM (10.0 GPM) flow capacity at 30 psi (207 kPa) pressure drop across the valve, 14.4 LPM (3.8 GPM) bypass flow rate at 30 psid. (See 9201EW)

Trap Seal**TRAP SEAL PRIMER**

P.P.P. #PT-10 Trap Seal Primer activated by a 3/4" (19 mm) normally closed solenoid valve, designed to interface with low voltage energy management systems control, 3/4" (19 mm) diameter connection anti-siphon atmospheric vacuum breaker.

**WH
Arrestors****WATER HAMMER ARRESTOR - LEAD FREE**

P.P.P. #SC-500A Water Hammer Arrestor barrel-fabricated of type "L" hard drawn copper, copper or free turning brass for cap, 1/2" Ø (13 mm) pipe size for 1-11 fixture units, machined of D69300 Eco low lead brass or polycarbonate DOW Calibre 2016-15MFR piston, EPDM o-rings, Dow-Corning Silicone Compound #111, FDA listed for use in potable water system lubricant, nickel plated for salt water application, designed to operate on all domestic and commercial systems. Normal operating pressure 0 to 200 psig, max spike pressure of 400 psig, may be installed in new or existing plumbing systems with a standard pipe tee. Maintenance free-the piston is the only moving part.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 PAYMENT PROCEDURES FOR TESTING LABORATORY SERVICES

- .1 Engage and pay for services of independent testing laboratory.

1.3 REFERENCES

- .1 Definitions:
 - .1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:
 - .1 Rigid supply and return ductwork;
 - .2 Flexible ductwork;
 - .3 Mixing plenum boxes;
 - .4 Return air plenums including ceiling plenums;
 - .5 Cooling and heating coils and compartments;
 - .6 Condensate drain pans, eliminator blades and humidifiers;
 - .7 Fans, fan blades and fan housing;
 - .8 Filter housing and frames;
 - .9 Acoustically insulated duct linings;
 - .10 Diffusers, registers and terminal units;
 - .11 Dampers and controls.
- .2 Reference Standards:
 - .1 National Air Duct Cleaners Association (NADCA)
 - .1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.
 - .2 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA 2005, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.
 - .3 United States Environmental Protection Agency (US EPA)
 - .1 US EPA 1999, 40 CFR Parts 152 and 156.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.
 - .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
-

- .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.
 - .1 Take account of elbows, bends, turning vanes, and dampers.
- .2 Scheduling: Complete work prior to occupancy and building turn over.
- .3 Project Co-ordination: assign Project Co-ordinator to oversee air
- .4 Security: Departmental Representative will pay costs and provide security escort at times requested on Contractor's submitted work schedule.
 - .1 Cancellation of security escort requires 72 hours minimum written notice.
 - .2 Failure to cancel security escort requirements 72 hours minimum before scheduled event will result in Contractor paying for security costs.
- .5 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by the Contractor.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.
 - .2 Provide two copies of WHMIS MSDS in shop drawings.
- .3 Testing Laboratory Services: submit name and address of laboratory engaged for work of this Section.
 - .1 Submit laboratory analysis report of particulate collection indicating:
 - .1 Location of collection;
 - .2 Particulate grade;
 - .3 Particulate size;
 - .4 Percentage concentration of individual particulates in each sample.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
-

- .2 Post Cleaning Inspection Report: submit 4 copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
 - .1 Name and address of facility;
 - .2 Name and address of HVAC cleaning contractor;
 - .3 Description of HVAC systems with drawings and sketches identifying systems cleaned;
 - .4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;
 - .5 Identification of points where samples were collected and type of analysis used for each collection;
 - .6 Identification of each sample collected;
 - .7 Comments complete with photographs of each sampling location and other observed system features;
 - .8 Identify systems tested, observations, actions taken and recommendations for future maintenance.

- .3 Record post cleaning video survey: submit 2 copies of video survey DVD or USB Drive media, and include on video survey following:
 - .1 Areas tested for particulate analysis or microbial growth evaluation;
 - .2 Areas of special interest and location;
 - .3 Special internal features;
 - .4 Problems such as broken or damaged controls or components;
 - .5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English and French on video using text or voice over.

- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

1.7 EXTRA MATERIALS

- .1 Extra Stock Materials:
 - .1 Supply 4 extra filters for each HVAC System cleaned.
 - .2 Ensure filters are correct match, size, type and configuration of existing HVAC Systems.

1.8 QUALITY ASSURANCE

- .1 Contractor: verification of 5 years minimum experience in work similar to or exceeding work of this Section.

 - .2 Project Co-ordinator: Air System Cleaning Specialist (ASCS) with verification of 5 years minimum experience in work similar to or exceeding work of this Section.
-

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND PANELS

- .1 Equipment Access Doors and Panels: construct from same materials as equipment panelling complete with sealing gasket and positive locking device.
 - .1 Size access doors and panels in equipment to allow for inspection and cleaning.
- .2 Ductwork Access Doors: construct access doors from 1.27 mm minimum galvanized sheet steel with gasketed seal.
 - .1 Ensure access door is 25 mm greater in every dimension than access opening.
 - .2 Access door size 200mm x 200 mm minimum.
 - .3 Secure access doors with sheet metal screws on 75 mm centres minimum. Ensure 3 screws per side minimum.
- .3 Access Doors and Panels Acoustic Lining:
 - .1 Install acoustic lining to match existing.
 - .2 Self-adhesive glass fibre tape capable of adhering to both acoustic lining and metal access door or panel materials.
 - .3 Water-based duct sealer for repairing cut acoustic lining.

2.2 ANTIMICROBIAL AGENT

- .1 Use antimicrobial agents registered with US EPA-40 CFR.

2.3 SYSTEM FILTERS

- .1 Supply and install new filters for each HVAC System cleaned.

2.4 AIR DUCT CLEANING EQUIPMENT

- .1 Manually propelled full contact brushes:
 - .1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
 - .1 Ensure brushes are sized to fit various duct sizes in HVAC system.
 - .2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.
 - .2 Brushes: manually propelled with integrally-mounted motor drive and nylon, polypropylene or other non-metallic material bristles.
 - .1 Ensure motor drive has capacity to continue to push brush after bristles are distorted.
 - .2 Replace worn and ineffective brushes when required.
-

2.5 MULTI-FUNCTIONAL ROBOTIC CLEANING SYSTEM

- .1 Self-propelled remote controlled, track wheeled drive equipped with: camera, halogen lights: rotating or reciprocating brushes, air supply nozzle, vacuum and spraying system attachment.
 - .1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
 - .2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces.
 - .3 Replace worn and ineffective brushes when required.
- .2 Camera: fully rotational pivotal remote control focus and dustproof video digital with 480 lines of resolution, capable of storing 4 hours of recorded media.
 - .1 Camera Light: 2 x 20 watt Halogen with dimmer.

2.6 HEPA VACUUM UNIT

- .1 Vacuum Unit: includes vacuum fan, integral HEPA filter, suction hose and vacuum head, capable of maintaining HVAC System debris and particulates airborne in air stream until they reach vacuum unit and maintaining system under negative pressure.
 - .1 Ensure HEPA filters are clean and maintain vacuum unit and HEPA filter to run efficiently.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Close down HVAC system.
 - .2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
 - .1 Control devices;
 - .2 Fire and smoke control dampers;
 - .3 Balancing dampers: indicate and record positions for resetting;
 - .4 Air volume control boxes: indicate and record positions for resetting;
 - .5 Fire alarm devices;
 - .6 Monitoring devices and controls;
 - .3 Cut openings in equipment panels and ductwork for access to system interior.
 - .1 Square or rectangular opening sizes: 200 mm minimum each side.
 - .2 Circular opening sizes: 200 mm minimum diameter.
-

- .4 Installation of Access Doors and Panels: install access doors and panels for equipment where required instructed by Departmental Representative and Consultant to facilitate system inspection and cleaning.
 - .1 Install access doors and panels for inspection and cleaning of equipment as required.
- .5 Installation of Access Doors in Ductwork: install access doors in ductwork where required to facilitate system inspection and cleaning.
 - .1 Access door installation is not permitted in flexible ductwork.
 - .1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.
- .6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fibre glass tape and water based duct sealer.
 - .1 Adhere new acoustic lining to match existing to inside of access panel or door to ensure continuity of acoustic properties of system.
- .7 Remove and reinstall ceiling tiles to gain access to HVAC system as required.
 - .1 Replace ceiling tiles damaged or soiled by air duct cleaning procedures.

3.2 EXAMINATION / PRE-CLEANING INSPECTION

- .1 Verification of Conditions:
 - .1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
 - .2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.
- .2 Evaluation and Assessment:
 - .1 Identify location and type of internal components.
 - .2 Identify extent of potential problems.
 - .3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative and Consultant.
 - .1 Do not proceed further with inspection operations until written approval from Consultant.

3.3 LABORATORY ANALYSIS

- .1 After duct cleaning is complete, prove it through testing at selective location.
-

3.4 DUCT CLEANING

- .1 Do duct cleaning in accordance with NADCA ACR Standard.
 - .2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.
 - .1 Isolate zone of duct using closed-cell polyurethane foam/air inflated zone bag before cleaning.
 - .3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.
 - .4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.
 - .5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
 - .6 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
 - .7 Energize brushes to travel from insertion point to evacuation fan.
 - .1 Pass brushes through sections as often as necessary to achieve required cleanliness.
 - .2 Change brush sizes as required to ensure positive contact with duct and component interiors.
 - .3 Clean corners and pockets where dirt and debris can accumulate.
 - .8 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.
 - .9 Clean diffusers, registers, louvers, and other terminal units.
 - .10 Remove perforated supply diffusers from suspended tee-bar ceiling.
 - .1 Dismantle and clean perforated plates and supply diffuser duct collars.
 - .2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.
 - .11 Advise Departmental Representative and Consultant 72 hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.
 - .1 Departmental Representative will pay for costs of deactivation of fire alarm and smoke detector system.
-

3.5 ACOUSTICALLY LINED DUCTWORK CLEANING

- .1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.
 - .1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.
 - .2 Monitor cleaning process progress by onboard camera.

3.6 COMPONENTS AND EQUIPMENT CLEANING

- .1 Brush and vacuum coils, air handling unit enclosures, , and heat exchanger surfaces to achieve required cleanliness.
- .2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Consultant for cleaning.
 - .1 Pressure wash with water and cleaning solution until required cleanliness is achieved.
 - .2 Clean equipment and components in place only if there is no hazard to adjacent materials.
- .3 Manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Departmental Representative or Consultant:
 - .1 Fan blades;
 - .2 Dampers;
 - .3 Turning vanes;
 - .4 Controls;
 - .5 Sensor bulbs;
 - .6 Fire alarms;
 - .7 Smoke detectors;

3.7 ANTI MICROBIAL APPLICATION

- .1 Apply antimicrobial agents when fungal growth is suspected where unacceptable levels of fungal contamination have been verified through visual inspection or testing.
 - .2 Apply antimicrobial agents after removal of surface deposits and debris.
 - .1 Verify air duct interiors are free from deposits and debris by visual inspection testing.
 - .2 Report findings to Departmental Representative and Consultant.
 - .3 Proceed with application of antimicrobial agents after written approval from Departmental Representative and Consultant
 - .3 Apply antimicrobial agents in accordance with manufacturer's written instructions and US EPA 40 CFR registration and listing.
-

- .4 Robotic spray antimicrobial agents directly onto interior surfaces of HVAC air duct system.
 - .1 Do not use fog mist for downstream surfaces.

3.8 FIELD QUALITY CONTROL/FINAL INSPECTIONS

- .1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.
 - .1 Carry out video survey.
 - .2 Include in final survey areas inspected by Contractor Departmental Representative and Consultant prior to cleaning.
 - .3 Identify on HVAC system record drawings access points used for inspection and cleaning.
 - .4 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.
 - .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.9 SYSTEM STARTUP

- .1 Install new system filters after cleaning operations are completed.
- .2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.
- .3 Restart each HVAC system.

3.10 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment or major components, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by Contractor.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 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.
 - .4 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.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative and Consultant before final inspection.
 - .2 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.
 - .3 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.
 - .4 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.
 - .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative and Consultant for approval. Submission of individual data will not be accepted unless directed by Departmental Representative or Consultant.
 - .2 Make changes as required and re-submit as directed by reviewer.
 - .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .7 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints 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 Transfer 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.
 - .8 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 and Consultant 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.
-

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 1 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 Not Used

- .1 Not used.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative or Consultant.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 PAINTING REPAIRS AND RESTORATION

- .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.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Division 1.
 - .2 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 - ACTION AND INFORMATIONAL 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.
-

3.5 DEMONSTRATION

- .1 Departmental Representative and Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 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.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative or Consultant will record these demonstrations on video tape for future reference.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION

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

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139, Installation Code for Oil Burning Equipment.
- .3 National Fire Code of Canada (NFCC 2010)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Adhesives: maximum VOC limit to GSES GS-36.
 - .2 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.
-

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer, National Fire Code of Canada and CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer, and as indicated, without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install manual air vents at high points in piping systems.
-

3.5 AIR VENTS

- .1 Install manual air vents at high points in piping systems.
- .2 Install isolating ball valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

- .1 Install pipework to CSA B139 and ASME B31.9 Building Services Piping.
 - .2 Screwed fittings jointed with Teflon tape.
 - .3 Protect openings against entry of foreign material.
 - .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
 - .5 Assemble piping using fittings manufactured to ANSI standards.
 - .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
 - .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
 - .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
 - .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
 - .10 Group piping wherever possible and as indicated.
 - .11 Ream pipes, remove scale and other foreign material before assembly.
-

- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where specified.
 - .7 Install butterfly valves on piping greater than 2".
 - .8 Install lug body butterfly valves between weld neck flanges to ensure full compression of liner.
 - .9 Install ball valves for glycol service for 2" and smaller.
 - .10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install triple duty valves on discharge of pumps as indicated.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
 - .2 Material: schedule 40 black steel pipe.
 - .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
 - .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
 - .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
 - .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
-

- .2 Maintain fire rating integrity.
- .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
 - .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.
 - .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
-

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative and Consultant 3 weeks minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative or Consultant.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative and Consultant to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative and Consultant.

3.13 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Division 1.
 - .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 copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Shop Drawings: submit drawings.
 - .3 Closeout Submittals
-

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Division 1.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial/Territorial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 1 phase, 240 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative and Consultant for temporary use. Work will only be accepted when specified motor is installed.
-

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 Correct size of sheave determined during commissioning.
- .5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.
- .7 Supply one set of spare belts for each set installed in accordance with Division 1.

2.5 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
 - .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
 - .3 Provide means to permit lubrication and use of test instruments with guards in place.
 - .4 Install belt guards to allow movement of motors for adjusting belt tension.
 - .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
 - .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
-

- .4 Removable for servicing.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

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.
- .2 Verification requirements: Contractor's Verification, include:
 - .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.

3.4 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.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.9-2007, Building Services Piping.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1-2000(R2006), Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
 - .3 AWS W1-2000, Welding Inspection Handbook.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-2008, Certification of Welding Inspectors.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Submit welder's qualifications to Consultant.
-

- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with manufacturer's requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 QUALITY OF WORK

- .1 Welding: in accordance with ANSI/ASME B31.9, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of territorial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
-

- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative and Consultant before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative and Consultant.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 Hydrostatically test welds to ANSI/ASME B31.1.
- .2 Visual examinations of all welds: include entire circumference of weld externally and wherever possible internally.
- .3 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative or Consultant, of total of up to 10% of welds, selected at random by Departmental Representative or Consultant by radiographic particle tests.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
-

3.7 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .3 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP)
 - .1 IPMVP 2007 Version.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

- .3 Storage and Handling Requirements:
 - .1 Store thermometers and pressure gauges off ground, indoors, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Design point to be at mid-point of scale or range.

2.2 THERMOMETERS

- .1 100 mm diameter mercury-free liquid filled vapour activated dial type: to CAN/CGSB-14.5, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting. Suitable for pipe mounting or remote reading.

2.3 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: stainless steel.

2.4 PRESSURE GAUGES

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
 - .2 Provide:
 - .1 Snubber for pulsating operation.
 - .2 Gasketed pressure relief back with solid front.
 - .3 Bronze stop cock.
 - .4 Oil filled for high vibration applications on pumps.
-

PART 3 - EXECUTION

3.1 GENERAL

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
 - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
 - .1 Heat exchangers.
 - .2 Water heating coils.
 - .3 Water boilers.
 - .4 DHW tanks.
- .3 Install wells for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

- .1 Install in locations as follows:
 - .1 Suction and discharge of pumps.
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of coils.
 - .5 Inlet and outlet of liquid side of heat exchangers.
 - .6 Outlet of boilers.
 - .7 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

- .1 Install engraved lamicaid nameplates in accordance with Section 23 05 53.01 - Mechanical Identification, identifying medium.
-

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by thermometer and gauge installation.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A 276-08, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B 283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B 505/B 505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 1.
 - .3 Shop Drawings:
 - .1 Submit shop drawings signed and stamped by contractor.
 - .2 Submit data for valves specified in this Section.
-

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Division 1.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.
 - .2 Discs: one for every 10 valves, each size. Minimum 1.
 - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
 - .4 Valve handles: 2 of each size.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
 - .2 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
 - .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
 - .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
-

- .4 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 NPS 2 and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 NPS 2 and under, swing type, bronze disc:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .4 NPS 2 and under, swing type, composition disc, Class 200:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
 - .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
 - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
 - .2 Disc: renewable, PTFE, no. 6 composition, rotating disc in disc holder having guides top and bottom, of bronze to ASTM B 62.
 - .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
 - .5 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B 62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.
 - .6 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B 62.
 - .2 Pressure rating: Class 125, 2760-kPa CWP, 4140-kPa CWP, 860 kPa steam, WOG rated.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders, solder ends to ANSI.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
-

- .6 Ball and seat: replaceable, stainless steel, hard chrome, solid ball and Teflon seats.
- .7 Stem seal: TFE with external packing nut.
- .8 Operator: removable lever handle.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

- .1 Clean in accordance with Division 1.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ASME B16.1-05, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25,125 and 250.
 - .3 ANSI/ASME B16.5-03, Pipe Flanges and Flanged Fittings: NPS ½ through 24.
 - .4 ANSI/ASME B16.11-05, Forged Fittings, Socket-Welding and Threaded.
 - .5 ANSI/ASME B16.25-07, Buttwelding Ends.
 - .6 ANSI/ASME B16.34-04, Valves - Flanged, Threaded and Welding Ends.
- .2 American Petroleum Institute (API)
 - .1 API Std. 609-04, Butterfly Valves: Double Flanged, Lug- and Wafer-Type.
- .3 ASTM International Inc.
 - .1 ASTM A 126-04), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM A 536-84(2004)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .4 ASTM B 209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS SP-67-02a, Butterfly Valves.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit data for valves specified in this section.
-

- .3 Shop Drawings:
 - .1 Shop drawings to be signed and stamped by contractor.
 - .2 Provide shop drawings for valves.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data for incorporation into manual specified in Division 1.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
- .2 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.
 - .2 Discs: one for every 10 valves, each size, minimum 1.
 - .3 Stem packing: one for every 10 valves, each size, minimum 1.
 - .4 Valve handles: 2 of each size.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
- .3 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints.

PART 2 - PRODUCTS

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG

- .1 Except to specialty valves, to be of single manufacturer.
 - .2 To be suitable for dead-end service.
 - .3 Sizes:
 - .1 Lug type: NPS 2 to 30.
-

- .4 Pressure rating for bubble tight shut-off at temperatures up to maximum for seat material.
 - .1 NPS 2 - 12: 200 psig.
- .5 Minimum seat temperature ratings to 135 degrees C.
- .6 Application: on-off operation.
- .7 Full lug body (threaded).
- .8 Operators:
 - .1 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black laquer.
- .9 Designed to comply with MSS SP-67 and API 609.
- .10 Compatible with ANSI Class 125/Class 150 flanges.
- .11 Construction:
 - .1 Body ductile iron c/w EPDM liner.
 - .2 Disc: stainless steel.
 - .3 Seat: EPDM.
 - .4 Shaft: 316 stainless steel.
 - .5 Taper pin: 316 SS.
 - .6 Key: stainless steel.
 - .7 O-Ring: Buna-N.
 - .8 Bushings: Teflon.
 - .9 Suitable for use on glycol heating systems up to 95 degrees C and on potable water.
- .12 Standard of Acceptance: Keystone figure 222 or equal.

2.2 MOUNTING FLANGES

- .1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

2.3 ELECTRIC ACTUATORS

- .1 Operation: designed to provide precise quarter turn electric operation.
 - .1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
-

- .2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.
- .2 Construction:
 - .1 Castings: heavy duty industrial grade for rugged use.
 - .2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.
 - .3 Gears and pinions constructed from hardened steel.
 - .4 Gear train to be permanently lubricated.
 - .5 Mechanical brake to ensure that gear is locked in precise position.
- .3 Electrical:
 - .1 Standard voltage: 120 VAC. 60 Hz.
 - .2 Control options: 4-20 Ma DC, 0-10 V DC .
 - .3 CSA approved.
 - .4 Electrical rating: NEMA IV.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Install butterfly valves with disc in almost closed position.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
 - .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
 - .3 Verify suitability of valve for application by inspection of identification tag.
 - .4 Mount actuator on to valve prior to installation.
 - .5 Handle valve with care so as to prevent damage to disc and seat faces.
-

- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

- .1 Electrical connections to be made by actuator manufacturer.
- .2 Cycle valve operation from fully closed to fully open then back to fully closed.
- .3 At same time, check travel stop settings for proper disc alignment.

3.4 CLEANING

- .1 Clean in accordance with Division 1.
- .2 Clean installed products in accordance to manufacturer's recommendation.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International
 - .1 ASTM A 125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop Drawings:
 - .1 Submit shop drawings, stamped and signed by contractor, for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
-

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
-

- .3 Ensure steel hangers in contact with copper piping are epoxy coated.
 - .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed, 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP 58 and MSS-SP 69
 - .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP 69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
 - .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP 69.
 - .5 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
 - .6 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black or galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
 - .7 Adjustable clevis: material to MSS SP 69, UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
 - .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.
 - .9 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563.
 - .1 Finishes for steel pipework: black, galvanized.
-

.2 Finishes for copper, glass, brass or aluminum pipework: epoxy coated.

- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized, black, carbon steel to MSS SP 58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 20% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
-

- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.10 PLATFORMS AND CATWALKS

- .1 To Section 05 50 00 - Metal Fabrications.

2.11 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

2.12 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
-

- .2 Submit structural calculations with shop drawings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
 - .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
 - .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
 - .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
 - .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
 - .6 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
 - .7 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.
-

3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code, Territorial Code, and authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within 300 mm of each elbow.

<u>Maximum Pipe Size : NPS</u>	<u>Maximum Spacing Steel</u>	<u>Maximum Spacing Copper</u>
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP 69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
 - .2 Adjust hangers to equalize load.
 - .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
-

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

- .1 Clean in accordance with Division 1.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SCOPE

- .1 The detailed design of vibrating isolation components is the responsibility of the equipment manufacturer. Seismic control is not required.

1.2 SUMMARY

- .1 Section Includes:
 - .1 Vibration isolation materials and components, and their installation.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) - 1995

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Division 1.
 - .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 copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by Contractor.
 - .2 Provide separate shop drawings for each isolated system system shop drawings complete with performance and product data.
 - .3 Instructions: submit manufacturer's installation instructions.
-

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.
-

2.4 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor 100% relative humidity installations.
- .4 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as required by manufacturer.

2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
 - .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
 - .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
 - .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
-

- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.
- .6 Performance: as required by manufacturer.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS4: first 3 points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 CLEANING

- .1 Proceed in accordance with Division 1.
-

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
 - .2 Sustainable requirements for construction and verification.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.2 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Division 1.
- .2 Product data to include paint colour chips, other products specified in this section.
- .3 Samples:
 - .1 Submit samples in accordance with Division 1.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit the following in accordance with Division 1.
 - .2 Health and Safety:
-

.1 Do construction occupational health and safety in accordance with Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Division 1.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
.2 Lettering and numbers raised or recessed.
.3 Information to include, as appropriate:
.1 Equipment: manufacturer's name, model, size, serial number, capacity.
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
.1 Hazardous: red letters, white background.
.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
.2 Construction:
.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
.3 Sizes:
.1 Conform to following table:

Size #	mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1		10 x 50	1	3
2		13 x 75	1	5
3		13 x 75	2	3
4		20 x 100	1	8
5		20 x 100	2	5

6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Oil piping to: CSA B139.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

- .6 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive, plastic-coated cloth, vinyl, with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative and Consultant.
 - .2 Colours for legends, arrows: to following table:

<u>Background colour:</u>	<u>Legend, arrows:</u>
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marked	Legend
Glycol Heating Supply	Yellow	HEATING SUPPLY
Glycol Heating Return	Yellow	HEATING RETURN
Safety Valve Vent	Yellow	STEAM VENT
Domestic Hot Water Supply	Green	DOM. HW SUPPLY
Dom. HWS Recirculation	Green	DOM. HW CIRC.
Domestic Cold Water Supply	Green	DOM. CWS
Waste Water	Green	WASTE WATER
Waste Water	Green	WASTE WATER
Sanitary	Green	SAN.
Sanitary	Green	SAN.
Plumbing Vent	Green	SAN. VENT
No. 02 Fuel Oil Suction	Yellow	# 02 FUEL OIL
No. 02 Fuel Oil Return	Yellow	# 02 FUEL OIL

2.5 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

- .1 Identification in English.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
 - .2 Provide ULC or CSA registration plates as required by respective agency.
 - .3 Identify systems, equipment to conform to PWGSC PMSS.
-

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
 - .2 Adjacent to each change in direction.
 - .3 At least once in each small room through which piping or ductwork passes.
 - .4 On both sides of visual obstruction or where run is difficult to follow.
 - .5 On both sides of separations such as walls, floors, partitions.
 - .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
 - .7 At beginning and end points of each run and at each piece of equipment in run.
 - .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
 - .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.
-

3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative or Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 CLEANING

- .1 Proceed in accordance with Division 1.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative and Consultant within 90 days of award of contract.
 - .2 Provide documentation confirming qualifications, successful experience.
 - .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
 - .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
 - .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
 - .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
 - .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
 - .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
-

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
 - .2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.
 - .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
-

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative and Consultant for verification of TAB reports.

1.9 START OF TAB

- .1 Notify Departmental Representative and Consultant 14 days prior to start of TAB.
 - .2 Start TAB when building is essentially completed, including:
 - .3 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .4 Application of weatherstripping, sealing, and caulking.
 - .5 Pressure, leakage, other tests specified elsewhere Division 23.
 - .6 Provisions for TAB installed and operational.
 - .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
-

- .4 Isolating and balancing valves installed, open.
- .5 Calibrated balancing valves installed, at factory settings.
- .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5 %, minus 5 %.
 - .2 Hydronic systems: plus or minus 10 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative and Consultant list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB.
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.
-

- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative and Consultant for verification and approval, in English, in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Consultant.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results while the technician is on-site.
- .3 Number and location of verified results as directed by Consultant.
- .4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Consultant, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative and Consultant.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, ASHRAE.
 - .2 Do TAB of systems, equipment, components, controls specified in Division 23, including the following systems, equipment, components, controls:
 - .1 All HVAC systems and components.
 - .2 All heating systems and components.
 - .3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.
-

- .4 Quality assurance: perform TAB under direction of supervisor qualified by AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions.

1.21 POST-OCCUPANCY TAB

- .1 Measure DBT, air flow patterns, in all occupied zones.
- .2 Participate in systems check during Warranty Period - #1 within 1 month of termination of Warranty Period.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.
-

FEDERAL BUILDING
Arviat, NU
Project #1408

TESTING, ADJUSTING AND
BALANCING FOR HVAC

Section 23 05 93
Page 7
Apr 07, 2015

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
 - .2 Reference Standards:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ASTM International Inc.
 - .1 ASTM B 209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C 335-05a1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C 411-05, 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 547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C 553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C 612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C 795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 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.
 - .4 Green Seal Environmental Standards (GSES)
-

- .1 Standard GS-36-00, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- .3 Shop Drawings:
 - .1 Provide drawings in accordance with Division 1.
 - .2 Shop drawings to be stamped and signed by contractor.
- .4 Samples:
 - .1 If requested by Department Representative or Consultants, Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
 - .2 Mount sample on 12 mm plywood board.
 - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards, member of TIAC.
-

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with manufacturer's recommendations.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .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 C-1: Rigid mineral fibre board to ASTM C 612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C 553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C 553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C 553.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
-

- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
- .7 Contact adhesive: quick-setting.
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.
- .12 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
-

- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork, and where identified in drawings.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.
- .7 Insulate all ductwork that penetrates exterior wall, back 3 m from exterior wall, with 50 mm thick type C-1 insulation with vapour retarder, or as noted.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts.	C-1	Yes	50
Round cold and dual temperature supply air ducts.	C-2	Yes	50
Rectangular warm air ducts.	C-1	No	25
Round warm air ducts.	C-1	No	25
Supply, return and exhaust ducts exposed in space being served.			None
Outside air ducts to mixing plenum.	C-1	Yes	75
Mixing plenums.	C-1	Yes	25
Exhaust duct	C-1	No	50

between dampers
and louvres.

Rectangular ducts C-1 Special 50
outside.

Round ducts C-1 Special 50
outside.

Acoustically None
lined ducts.

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

	TIAC Code Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Division 1.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.2 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 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
-

- .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 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.

1.3 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.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 1. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
 - .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Division 1.
 - .4 Quality assurance submittals: submit following in accordance with Division 1.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
-

.1 Departmental Representative or Consultant will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled 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.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
 - .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.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .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.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 75 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, 19mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C 449/C 449M.

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 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
-

- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type 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 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Outdoor: UV rated material at least 0.5 mm thick.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 00 - Joint Sealants.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .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 REQUIREMENT

- .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 manufacturers 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 valves, primary flow measuring elements, flanges and unions at equipment.
- .2 Design: to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: to match existing system.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturers 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 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 at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
-

- .4 TIAC Code: A-6.
 - .1 Insulation securements: to manufacturer standards.
 - .2 Seals: lap seal adhesive, lagging adhesive.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: s/s bands.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Insulation securements: s/s bands.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .7 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.
 - .3 **Table:** Application Temp TIAC Pipe sizes (NPS) and insulation degree code thickness (mm) C

Run	to 1	1.25	2.50	5-6	8 & out	to 2	to 4	over
Glycol				60-94	A-1	25	38	38
38 Heating Glycol					up to	A-1	25	25
25 38 Heating					59 Domestic	HWS	-	A-1
25 25 25 38				38	38 Domestic	CWS	-	A-3
25 25 25 25				25	with Vapour Retarder			25
- .8 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .5 Outdoors: water-proof jacket.
 - .6 Finish attachments: SS bands, at 150 mm on centre. Seals: wing, closed.
 - .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 1.

3.8 CLEANING

- .1 Proceed in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform following tests:
 - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
 - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
 - .1 Pump operation.
 - .2 Boiler operation.
 - .3 Pressure bypass open/closed.
 - .4 Control pressure failure.
 - .5 Maximum heating demand.
 - .6 Maximum cooling demand.
 - .7 Boiler failure.
 - .8 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

- .1 Perform hydronic system capacity tests after:
 - .1 TAB has been completed
 - .2 Verification of operating, limit, safety controls.
 - .3 Verification of primary and secondary pump flow rates.
-

- .4 Verification of accuracy of temperature and pressure sensors and gauges.
- .2 Calculate system capacity at test conditions.
- .3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.
- .4 When capacity test is completed, return controls and equipment status to normal operating conditions.
- .5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.
- .6 Heating system capacity test:
 - .1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:
 - .1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures to ensure that coils are not subjected to freezing conditions) or
 - .2 Reducing space temperature by turning of heating system for sufficient period of time before starting testing.
 - .2 Test procedures:
 - .1 Open fully heat exchanger, heating coil and radiation control valves.
 - .2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.
 - .3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

1.6 GLYCOL SYSTEMS

- .1 Test to prove concentration will prevent freezing to minus 40 degrees C Test inhibitor strength and include in procedural report. Refer to ASTM E 202.

1.7 FUEL OIL SYSTEMS

- .1 Environmental protection systems:
 - .1 Test oil storage tank leakage detection system using manufacturer's recommended procedures.
 - .2 Test spill protection and over-fill protection systems using manufacturer's recommended procedures.
 - .2 Fuel oil pumps:
 - .1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.
-

- .2 Verify pump performance.
- .3 Pump performance within plus 20% and minus 0% of design.
- .3 Operational Tests:
 - .1 Timing: perform at same time as 100% and 105% boiler PV tests.
 - .2 Charge system and verify operation.
 - .3 Verify adequacy of flow rates and pressure from storage facilities to burners.
 - .4 Verify accurate metering of fuel to burners.
 - .5 For further details refer to relevant sections of Division 23.
- .4 Notify authorities having jurisdiction to enable witnessing of tests as required.

1.8 POTABLE WATER SYSTEMS

- .1 When cleaning is completed and system filled:
 - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
 - .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
 - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.9 SANITARY AND STORM DRAINAGE SYSTEMS

- .1 Ensure that traps are fully and permanently primed.
- .2 Ensure that fixtures are properly anchored, connected to system.
- .3 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
- .4 Cleanouts: refer to Section 22 42 00 - Plumbing Fixtures.

1.10 REPORTS

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.
-

1.11 TRAINING

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified herein.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.
- .2 Related Requirements
 - .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 1. Include product characteristics, performance criteria, and limitations.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with legislation.

PART 2 - PRODUCTS

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
 - .2 Sodium carbonate: 0.40 kg per 100 L water in system.
 - .3 Low-foaming detergent: 0.01 kg per 100 L water in system.
-

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 CLEANING HYDRONIC SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
 - .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
 - .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete.
 - .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
 - .5 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
 - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers: clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.
 - .6 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
 - .7 Hydronic Systems:
-

- .1 Fill system with water, ensure air is vented from system.
 - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
 - .3 Use water metre to record volume of water in system to +/- 0.5%.
 - .4 Add chemicals under direct supervision of chemical treatment supplier.
 - .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
 - .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
 - .7 Add chemical solution to system.
 - .8 Establish circulation, raise temperature slowly to maximum design, 82 degrees C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).
- .8 Glycol Systems:
- .1 In addition to procedures specified above perform specified procedures.
 - .2 Test to prove concentration will prevent freezing to minus 40 degrees C. Test inhibitor strength and include in procedural report. Refer to ASTM E 202.

3.3 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .5 Clean out strainers repeatedly until system is clean.
 - .6 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .7 Repeat with water at design temperature.
 - .8 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
 - .9 Bring system up to design temperature and pressure slowly over a 48 hour period.
-

- .10 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .11 Adjust pipe supports, hangers, springs as necessary.
- .12 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .13 If sliding type expansion joints bind, or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .14 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .15 Check operation of drain valves.
- .16 Adjust valve stem packings as systems settle down.
- .17 Fully open balancing valves (except those that are factory-set).
- .18 Check operation of over-temperature protection devices on circulating pumps.
- .19 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 1.

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.

PART 1 - GENERAL

1.1 SCOPE

- .1 Provide a fully electric control system for the mechanical systems installed within this building. A DDC system is not permitted. Use single stand-alone electric controllers. Electrically interlock components as required. A pneumatic control system is not permitted.
 - .2 Submit shop drawings for all components and control strategies. Include wiring diagrams, component selection, show interlocks and describe all operating and control strategies as well as failure modes.
 - .3 All controls are to fail safe. Fail to full heat and prevent injury to personnel.
 - .4 All wiring 50V and less is to be completed by the mechanical contractor or their sub-contractor using electricians licensed in Nunavut. Follow electrical specifications for wiring means and methods. Coordinate all power wiring required, higher than 50V with the electrician on site. No extras will be allowed for any power or control wiring under the controls scope. It is the responsibility of the controls contractor to provide a fully functional system.
 - .5 Where possible, use components from a single manufacturer for similar components. All components used are to be fully compatible with connected systems and related controls components.
 - .6 Components within this scope of work include, and are not limited to:
 - .1 All control valves for all hydronic heating appliances as required to achieve the specified control strategy. Maximum pressure drop through the control valves 15 kPA unless otherwise noted. Design flows are noted on the drawings. Select control valves to provide the required quality of control with no hunting or excessive swings in the parameter being controlled. Control valves are shown on the design drawings.
 - .2 All thermostats and temperature controllers. This includes low temperature alarms as specified. All components to be free of hazardous materials (mercury free) and suitable for installation in this type of building (high security in a remote location). Provide lockable thermostat covers for occupied non-secure space. Provide for adjusting the differential and control parameter to work with the in-floor heating systems.
 - .3 Provide local alarms and sirens as specified to alert on system failure. Enunciate an alarm at the Secure Guard Area in the area where the alarm is present. Provide indicator lights for control point that is in alarm. Provide "Alarm silent" buttons to silence the alarm condition.
-

- .4 Level switches - mercury free and suitable for their intended purposes.
- .5 Flow switches - mercury free and suitable for their intended purposes.
- .6 Pump controls - pre-fabricated duplex pump controllers to permit automatically starting the lag pump on failure of the primary pump. Provide for alternating operating of the lead pump based on an operational schedule.
- .7 Coordinate the design and installation with the electrical engineer, the electrical sub-contractor, and the mechanical engineer. All wiring greater than 50 V dedicated to the control system is to be completed by the electrical sub-contractor on the project, with costs included in the controls sub-contractor pricing.
- .8 Testing - Upon completion of a system, fully test all modes of operation to prove that the systems operate as intended. Document the testing and provide written confirmation to the consultant and the Owner of the testing procedures, and test results observed. Adjust final operating conditions to practically eliminate false alarms.
- .9 Operation and Maintenance manual - Include all Operation and Maintenance information for all components. Include an overall system trouble-shooting guide.
- .10 Spare Parts - Provide one spare part of each model of component used on the project. Cross reference the spare parts list with the shop drawings and the Operations and Maintenance manual. This includes as a minimum, one or more of each specific:
 - .1 Thermostat.
 - .2 Temperature controller.
 - .3 Flow switch.
 - .4 Valve actuator.
 - .5 Control valve packing and seals (minimum two sets of each size control valve).
 - .6 Damper motor and linkages.
 - .7 Pressure controls.
 - .8 Relay and contactor.
- .11 Standard of Acceptance - Honeywell controls, Johnson Controls, and Siemens controls.

1.2 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
-

- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

- .1 Line voltage, wall-mounted thermostat, for heating with:
 - .1 Full load rating: 16 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.
 - .3 Thermometer range: 5 degrees C to 30 degrees C.
 - .4 Markings in 5 degree increments.
 - .5 Differential temperature adjustable.

2.2 THERMOSTAT (HEAVY-DUTY, LINE VOLTAGE, HEATING AND COOLING)

- .1 Heavy-duty line voltage thermostat for heating with:
 - .1 Full load rating: 16 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.
 - .3 Thermometer range: 5 degrees C to 30 degrees C.
 - .4 Markings in 5 degree increments.
 - .5 Differential temperature adjustable.
-

- .2 Use for unit heaters.

2.3 THERMOSTAT (LOW VOLTAGE)

- .1 Low voltage wall thermostat:
 - .1 For use on 24 V circuit at 1.5 A capacity.
 - .2 With heat anticipator adjustable 0.1 to 1.2 A.
 - .3 Temperature setting range: 10 degrees C to 25 degrees C.
 - .4 With sub-base, use insulated sub-base if mounted on an outside wall.

2.4 THERMOSTAT (REMOTE BULB)

- .1 Line voltage remote bulb type thermostat with:
 - .1 8 30 A rating on 120 V.
 - .2 Copper capillary tube nylon coated, length as required.
 - .3 Moisture and dust-resistant enclosure.

2.5 THERMOSTAT (FAN COIL)

- .1 Line voltage fan coil heating-cooling thermostat with:
 - .1 Full load rating: 6 A at 120 V.
 - .2 Four position fan switches for "Low- Medium-High-Off" fan switch.
 - .3 "Heat-Cool" switch and fan "Off" switch. Fan "Off" switch to break all circuits except heating.
 - .4 Two rocker switches for "Heat-Off-Cool" and "Low-Medium-High" fan switching. Isolate heating and cooling circuits. "Off" switch to break power to fan and thermostat.

2.6 THERMOSTAT GUARDS

- .1 Thermostat guards: lockable, clear, plastic. Slots for air circulation to thermostat.

2.7 LOW LIMIT TEMPERATURE ALARM

- .1 Low limit temperature alarm with:
 - .1 Rating: 10.2 A at 120 V or 6.5 A at 240 V.
 - .2 Sensing bulb and 6 m long capillary tube.
 - .3 Switching action: manual.
 - .4 Temperature setting range: 0 degrees C to 15 degrees C.
-

2.8 HIGH LIMIT TEMPERATURE ALARM

- .1 High limit temperature alarm with:
 - .1 Rating 10 A at 120 V or 6 A at 240 V .
 - .2 Positive lock-out.
 - .3 Manual reset only after 14 degrees C drop-in temperature.
 - .4 Cutout setting: 50 degrees C.

2.9 FLOW SWITCH

- .1 Flow switch for 82 degrees C glycol, pipe size as indicated, CSA Enclosure rated at 16 A at 120 V. Maximum liquid temperature: 121 degrees C. Maximum liquid gauge pressure of 1034 kPa ambient temperature range 0 degrees C to 82 degrees C.

2.10 PRESSURE SWITCH

- .1 Pressure switch for glycol at range to gauge pressure of 1034 kPa with auto and manual reset. Maximum allowable gauge pressure of 1.2 MPa. Full load 16 A at 120 V, ULC rated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative and Consultant.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative and Consultant.

3.2 INSTALLATION

- .1 Install control devices.
 - .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
-

- .3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-B16.3-2006, Malleable-Iron Threaded Fittings: Classes 150 and 300.
 - .2 ASME-B16.9-2007, Factory-Made Wrought Steel Buttwelding Fittings.
 - .2 ASTM International
 - .1 ASTM A 47/A 47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B 61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B 75M-99(2005), Standard Specification for Seamless Copper Tube Metric.
 - .3 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
 - .4 CSA International
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
 - .2 CSA-B140.0-03, Oil Burning Equipment: General Requirements.
 - .3 CSA-C282-05, Emergency Electrical Power Supply for Buildings.
 - .5 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Paints and Coatings.
 - .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .7 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 - .1 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
 - .8 National Association of Corrosion Engineers (NACE)
 - .1 NACE SP0169-2007, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
-

- .9 National Fire Code of Canada (NFCC 2005)
- .10 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S603.1-03, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.
 - .2 ULC ORD-C107.12-1992, Line Leak Detection Devices for Flammable Liquid Piping.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Indicate on manufacturer's catalogue literature the following: valves.
 - .2 Provide two copies of WHMIS MSDS.
- .3 Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturers' Instructions: provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and engineering data for incorporation into manual specified in Division 1.

1.5 QUALITY ASSURANCE

- .1 Ensure piping is installed by individual authorized by authority having jurisdiction.
-

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 FILL VENT AND CARRIER PIPE

- .1 Materials as per CSA-B139.
- .2 Steel: to ASTM A 53/A 53M, Schedule 40, continuous weld or electric resistance welded, screwed.
- .3 Copper: type K, soft copper tubing, to ASTM B 75M, in long lengths.

2.2 STEEL PIPE COATING

- .1 Bituminous paint: in accordance with manufacturer's recommendations.
- .2 Primers, Paints, Coating: in accordance with manufacturer's recommendations for surface conditions.
 - .1 Primer: maximum VOC limit to Standard GS-11.
 - .2 Paints: maximum VOC limit to Standard GS-11.

2.3 JOINTING MATERIAL

- .1 Screwed fittings: Teflon tape.
- .2 Soldered fittings: 95/5.

2.4 FITTINGS

- .1 Steel:
 - .1 Malleable iron: screwed, banded, Class 150 to ASME-B16.3.
 - .2 Welding: butt-welding to ASME-B16.9.
 - .3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A 47/A 47M.
 - .4 Nipples: Schedule 40, to ASTM A 53/A 53M.
 - .2 Copper:
 - .1 Piping: soldered type.
-

.2 Connections to equipment: compression.

2.5 BALL VALVES

- .1 NPS 2 and under: bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG as specified under Section 23 05 23.01 - Valves - Bronze.

2.6 SWING CHECK VALVES

- .1 NPS 2 and under, screwed: to MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, renewable composition disc suitable for oil service, screw in cap, regrindable seat as specified under Section 23 05 23.01 - Valves - Bronze.

2.7 LUBRICATED PLUG COCKS

- .1 NPS 2 and under, screwed: to ASTM B 61, Class 150, 1 MPa, bronze body.

2.8 FUEL OIL TRANSFER PUMPS

- .1 Two positive displacement self-priming, rotary gear type, direct driven from TEFC motor, mounted on common base. Complete with mechanical seal, permanently sealed ball bearings, relief valve, compound gauge on inlet, pressure gauge on discharge.
- .2 Capacity:
 - .1 Pumped fluid: number 2 fuel oil.
 - .2 Flow rate: as indicated.
 - .3 Motor: as indicated.

2.9 OIL FILTER

- .1 Duplex type replaceable cartridge type as recommended by oil burner manufacturer.
- .2 Furnish spare filter cartridge.

2.10 CATHODIC PROTECTION

- .1 Supply cathodic protection in accordance with Section 26 42 00.01 - Telethermics - Cathodic Protection.
-

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PIPING

- .1 Install piping in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified.
 - .2 Install oil piping system in accordance with CSA-B139.
 - .3 Slope piping down in direction of storage tank unless otherwise indicated.
 - .4 Above ground piping to be protected from physical damage due to impact.
 - .5 Piping inside building:
 - .1 Ensure piping in solid flooring is installed to CSA-B139, and authority having justification.
 - .2 Use approved fitting to CSA-B139 for steel, copper piping.
 - .3 Install filter and gate valve at burners.
 - .6 Fill, vent, suction and return piping outside building:
 - .1 Steel piping welded throughout except at tanks where electrically isolating fittings are used.
 - .2 Grading: slope piping at 1% minimum back to tanks.
 - .7 Piping at tanks:
 - .1 Suction: terminate 150 mm from bottom of tank with foot valve and strainer.
 - .2 Return: terminate 150 mm from bottom of tank with return bend.
 - .3 Comply with CSA-B139 and authority having jurisdiction for piping for venting at tanks, including venting whistle.
 - .4 Fill pipes: install to comply with CSA-B139.
 - .1 Include vapour tight tamperproof cover.
 - .5 Dipstick: extend tube to within 150 mm from bottom of tank. Terminate at grade with lockable cap and chain, and watertight cover.
 - .8 Clearly label piping runs in legible form indicating;
 - .1 Piping product content.
 - .2 Direction of flow.
 - .3 Identify transfer points in piping systems to CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification
-

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless approved otherwise by Departmental Representative or Consultant.
- .2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.
- .3 Install swing check valves on discharge of pumps, and as indicated.
- .4 Install plug cocks as indicated.

3.4 OIL TRANSFER PUMPS

- .1 Equip pumps with check valve installed below suction pump to permit contents of pipe to drain back to storage tank if suction is broken.
- .2 Install as indicated.
- .3 Install ball valves on inlet and discharge connections.
- .4 Install pressure gauge at pump discharge, compound gauge on pump inlet connection.
- .5 Install relief valve in pump discharge piping with relief valve discharge pipe to return line to tank.

3.5 OIL FILTERS

- .1 Install ULC approved, as indicated in supply line to pumps and boiler.
- .2 At time of acceptance, replace filter cartridge with new.

3.6 OVERFILL AND SPILL PROTECTION

- .1 To CSA B139.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system to CSA-B139 and CSA-B140.0 and authorities having jurisdiction.
 - .2 Isolate tanks from piping pressure tests.
 - .3 Maintain test pressure during backfilling.
 - .2 Performance Verification:
-

.1 Refer to Section 23 08 01 - Performance Verification Mechanical Piping System.

3.8 CLEANING

- .1 Clean in accordance with manufacturer's written recommendations, supplemented as follows:
 - .1 Flush after pressure test with number 2 fuel oil for a minimum of two hours. Clean strainers and filters.
 - .2 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.
 - .3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.
 - .4 Ensure entire installation is approved by authority having jurisdiction.
 - .5 Clean in accordance with Division 1.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C111/A21.11-06, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .2 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.1-10, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - .2 ASME B16.3-06, Malleable Iron Threaded Fittings: Classes 150 and 300.
 - .3 ASME B16.5-09, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.
 - .4 ASME B16.9-07, Factory-Made Wrought Butt welding Fittings.
 - .5 ASME B18.2.1-10, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series).
 - .6 ASME B18.2.2-10, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
 - .3 ASTM International
 - .1 ASTM A 47/A 47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A 53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A 536-84(2009), Standard Specification for Ductile Iron Castings.
 - .4 ASTM B 61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM E 202-10, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
 - .4 CSA International
 - .1 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
 - .1 MSS-SP-67-2002a, Butterfly Valves.
 - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
-

- .3 MSS-SP-71-05, Gray Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-02, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings stamped and signed by contractor.
 - .2 Indicate on drawings:
 - .1 Components and accessories.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.
 - .1 Include special servicing requirements.

1.5 EXTRA STOCK MATERIALS

- .1 Supply spare parts as follows:
 - .1 Valve seats and seals: 1 minimum for every ten valves, each size. Minimum one.
 - .2 Stem packing: 1 minimum for every ten valves, each size. Minimum one.
 - .3 Valve handles: 2 minimum of each size.
 - .4 Gaskets for flanges: 1 minimum for every ten flanges.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hydronic systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PIPE

- .1 Steel pipe: to ASTM A 53/A 53M, Grade B, as follows:
 - .1 To NPS 6: Schedule 40.

2.2 PIPE JOINTS

- .1 NPS 2 and under: screwed fittings with PTFE tape and lead-free pipe dope.
- .2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.
- .3 Flanges: Class 150, raised face, slip-on to ANSI/AWWA C111/ A21.11.
- .4 Orifice flanges: slip-on raised face, 2100 kPa.
- .5 Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .6 Pipe thread: taper.
- .7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
 - .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ASME B16.1, Class 125.
 - .2 Steel: to ASME B16.5.
 - .3 Butt-welding fittings: steel, to ASME B16.9.
 - .4 Unions: malleable iron, to ASTM A 47/A 47M and ASME B16.3.
-

2.4 VALVES

- .1 Connections:
 - .1 NPS 2 and smaller: screwed ends.
 - .2 NPS 2-1/2 and larger: flanged ends.
- .2 Butterfly valves: as specified in Section 23 05 23.05 - Butterfly Valves:
 - .1 NPS 2-1/2 and over: lug type.
 - .1 Acceptable material: Keystone Fig. 222.
- .3 Balancing, for TAB:
 - .1 Sizes: calibrated balancing valves, as specified this section.
 - .2 NPS 2 and under:
 - .1 Use Armstrong balancing valves and Griswold balancing valves, as indicated.
- .4 Drain valves: Ball, Class 125, as specified below.
- .5 Ball valves:
 - .1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

3.2 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Remove handwheel after installation and when TAB is complete.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 CLEANING, FLUSHING AND START-UP

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.
-

3.4 TESTING

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.
- .2 For glycol systems, retest with ethylene, propylene glycol to ASTM E 202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 GLYCOL CHARGING

- .1 Include mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E 202 after cleaning.

3.7 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 - Performance Verification Mechanical Piping Systems.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.

3.9 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by hydronic systems installation.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASME
 - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.
- .2 ASTM International
 - .1 ASTM A 47/A 47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 278/A 278M-01(2011), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
 - .3 ASTM A 516/A 516M-10, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A 536-84(2009), Standard Specification for Ductile Iron Castings.
 - .5 ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 CSA Group
 - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.
-

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hydronic specialties from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DIAPHRAGM TYPE EXPANSION TANK

- .1 Vertical steel pressurized diaphragm type expansion tank.
- .2 Capacity: as indicated.
- .3 Size: as indicated.
- .4 Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.
- .5 Working pressure: 860 kPa with ASME stamp and certification.
- .6 Air precharged to 84 kPa (initial fill pressure of system).
- .7 Saddles for horizontal installation Base mount for vertical installation.
- .8 Supports: provide supports with hold down bolts and installation templates.
- .9 Renewable diaphragm.

2.2 AUTOMATIC AIR VENT

- .1 Standard float vent: brass body and NPS 1/8 connection and rated at 620 kPa working pressure.
-

- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
- .3 Float: solid material suitable for 115 degrees C working temperature.

2.3 AIR SEPARATOR - BOILER MOUNTED

- .1 Complete with dip tube.
- .2 Working pressure: 860 kPa.

2.4 AIR SEPARATOR - EXPANSION TANK FITTING

- .1 Complete with adjustable vent tube and built-in manual vent valve.
- .2 Working pressure: 860 kPa.

2.5 AIR SEPARATOR - IN-LINE

- .1 Working pressure: 860 kPa.
- .2 Size: NPS 1 1/2 as indicated.

2.6 COMBINATION SEPARATORS/ STRAINERS

- .1 Steel, tested and stamped in accordance with ASME BPVC, for 860 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.7 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

- .1 Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing.
- .2 Low inlet pressure check valve.
- .3 Removable strainer.

2.8 PIPE LINE STRAINER

- .1 NPS 1/2 to 2: bronze body to ASTM B 62, solder end screwed connections, Y pattern.
 - .2 NPS 2 1/2 to 12: cast steel body to ASTM A 278/A 278M, Class 30, cast iron body to ASTM A 278/A 278M, Class 125 flanged connections.
-

- .3 Blowdown connection: NPS 1.
- .4 Screen: stainless steel with 1.19 mm perforations.
- .5 Working pressure: 860 kPa.

2.9 SUCTION DIFFUSER

- .1 Body: cast iron with flanged or screwed connections.
- .2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 blowdown connection.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tappings.
- .6 Adjustable support leg.

2.10 PROPYLENE GLYCOL SOLUTION

- .1 Provide high grade (minimum 99.9% pure by weight) industrial inhibited propylene glycol. Also provide two additional drums of the heat transfer fluid over and above quantity required to fill systems. Glycol to be pre-mixed solution of propylene glycol, 50% glycol/50% water.
 - .1 Use pre-mixed solution of 50/50 propylene glycol/water for burst protection to below -45° C.
 - .2 Use Dowfrost HD pre-mixed at Dow's factory.
 - .3 Alternatives will not be considered.
 - .2 Pure glycol shall have following physical properties:
 - .1 Molecular wt = 76.10
 - .2 Specific Gravity at +20 deg.C = 1.0381
 - .3 Boiling Point at 760mm Hg = 187.4 deg.C
 - .4 Freezing Point = -60 deg.C
 - .5 Viscosity at +20 deg.C = 60.5 centipoises
 - .6 Specific Heat at 20 deg.C = 0.593 Btu/lb./deg.F
 - .3 50% aqueous solution by volume shall be made from glycol specified using distilled water, deionized water, or soft water containing less than 25 ppm each of chloride and sulfate ions and 50 ppm each of hard water ions (calcium and magnesium as calcium carbonate) with total hardness not to exceed 100 ppm. Solution shall have freezing point of -32.2 deg. C and viscosity of 8 centipoises at 0°C.
-

- .4 Glycol shall contain such inhibitors as deemed necessary by manufacturer to provide maximum corrosion protection to system. Manufacturer shall ensure that the glycol used to manufacture the heat transfer fluid is of high quality grade and is not recycled or reclaimed material. The manufacturer of the fluid must provide written documentation stating the fluid passes ASTM D1384 standards (less than 0.5 mil penetration per year for all system metals).
- .5 Provide Consultant with written report indicating methodology and type of treated water used prior to mixing solution.
- .6 After the solution has been circulated for 24 hours, a sample shall be tested by the manufacturer and a written report submitted to Consultant.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 GENERAL

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's and Consultant's directive.
- .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

- .1 Install in horizontal or down flow lines.
 - .2 Ensure clearance for removal of basket.
 - .3 Install ahead of each pump.
 - .4 Install ahead of each automatic control valve larger than NPS 1 and radiation, and as indicated.
-

3.4 AIR VENTS

- .1 Install at high points of systems.
- .2 Install ball valve on automatic air vent inlet.

3.5 EXPANSION TANKS

- .1 Adjust expansion tank pressure as indicated to suit design criteria.
- .2 Install lockshield type valve at inlet to tank.

3.6 PRESSURE SAFETY RELIEF VALVES

- .1 Run discharge pipe to terminate above nearest drain.

3.7 SUCTION DIFFUSERS

- .1 Install on inlet to pumps having suction size greater than 50.

3.8 GLYCOL FILL

- .1 After hydronic system has been thoroughly flushed and cleaned, fill hydronic heating system with the 50/50 mix of propylene glycol/water.
- .2 Vent all air from the system over a one month (minimum) period.
- .3 Prove all air has been purged from the system.
- .4 Train the Owner's Representatives how to vent air from the hydronic system.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IES Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 CSA Group
 - .1 CAN/CSA-B214-12, Installation Code for Hydronic Heating Systems.
- .3 Electrical Equipment Manufacturers Association of Canada (EEMAC)
- .4 National Electrical Manufacturers' Association (NEMA)
 - .1 NEMA MG 1-2011, Motors and Generators.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pump, circulator, and equipment and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.
 - .2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for hydronic pumps for incorporation into manual.
-

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hydronic pumps from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Size and select components to: CAN/CSA-B214.

2.2 IN-LINE CIRCULATORS

- .1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.
 - .2 Impeller: cast bronze.
 - .3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.
 - .4 Seal assembly: mechanical for service to 135 degrees C.
 - .5 Coupling: self-aligning.
 - .6 Motor: resilient mounted, drip proof, sleeve bearing, 1800 r/min.
 - .7 Capacity: as indicated.
 - .8 Design pressure: 860 kPa.
 - .9 Standard of Acceptance: Armstrong, Bell & Gossett or Grundfoss.
-

2.3 VERTICAL IN-LINE CIRCULATORS

- .1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.
- .2 Impeller: brass or bronze.
- .3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.
- .4 Seal assembly: mechanical for service to 135 degrees C.
- .5 Coupling: self-aligning.
- .6 Motor: resilient mounted, drip proof, sleeve bearing, 1800 r/min.
- .7 Capacity: as indicated.
- .8 Standard of Acceptance: Armstrong, Bell & Gossett or Grundfos.

2.4 SINGLE SUCTION CENTRIFUGAL PUMP

- .1 General: bronze fitted, all stainless steel pump complete with motor.
 - .2 Base: common fabricated steel with drip rim and tapping for drain connection.
 - .3 Volute: cast iron radially split, end suction, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tappings.
 - .4 Impeller: bronze keyed drive with locking nut or screw.
 - .5 Shaft: stainless steel with two point support, machined shoulders for ball bearing mounting.
 - .6 Seal assembly: mechanical seal.
 - .7 Coupling: flexible self-aligning.
 - .8 Motor: squirrel cage induction, 1,725 r/min., continuous duty, drip proof, ball bearing, maximum temperature rise 50 degrees C.
 - .9 Capacity: as indicated.
 - .10 Design pressure: 1200 kPa.
 - .11 Standard of Acceptance: Armstrong or Bell & Gossett.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic pump installation in accordance with manufacturer's written instructions.

3.2 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install hydronic pumps to: CAN/CSA-B214.
- .2 In line circulators: install as indicated by flow arrows.
 - .1 Support at inlet and outlet flanges or unions.
 - .2 Install with bearing lubrication points accessible.
- .3 Base mounted type: supply templates for anchor bolt placement.
 - .1 Include anchor bolts with sleeves. Place level, shim unit and grout.
 - .2 Align coupling in accordance with manufacturer's recommended tolerance.
 - .3 Check oil level and lubricate. After run-in, tighten glands.
- .4 Ensure that pump body does not support piping or equipment.
 - .1 Provide stanchions or hangers for this purpose.
 - .2 Refer to manufacturer's installation instructions for details.
- .5 Pipe drain tapping to floor drain.
- .6 Install volute venting pet cock in accessible location.
- .7 Check rotation prior to start-up.
- .8 Install pressure gauge test cocks.

3.4 START-UP

- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements; supplemented as specified herein.
-

- .2 In accordance with manufacturer's recommendations.
- .2 Procedures:
 - .1 Before starting pump, check that over-temperature and other protective devices are installed and operative.
 - .2 After starting pump, check for proper, safe operation.
 - .3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
 - .4 Check base for free-floating, no obstructions under base.
 - .5 Run-in pumps for 12 continuous hours minimum.
 - .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
 - .7 Eliminate air from scroll casing.
 - .8 Adjust water flow rate through water-cooled bearings.
 - .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
 - .10 Adjust alignment of piping and conduit to ensure true flexibility.
 - .11 Eliminate cavitation, flashing and air entrainment.
 - .12 Adjust pump shaft seals, stuffing boxes, glands.
 - .13 Measure pressure drop across strainer when clean and with flow rates as finally set.
 - .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
 - .15 Verify lubricating oil levels.

3.5 PERFORMANCE VERIFICATION (PV)

- .1 General:
 - .1 Verify performance.
 - .2 Verify that manufacturer's performance curves are accurate.
 - .3 Ensure valves on pump suction and discharge provide tight shut-off.
 - .4 Net Positive Suction Head (NPSH):
 - .1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
 - .2 Measure using procedures prescribed in Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .5 Multiple Pump Installations - Series and Parallel:
 - .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
 - .6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
-

- .7 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements reports supplemented as specified herein. Reports to include:
 - .1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
 - .2 Use Report Forms specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
 - .3 Pump performance curves (family of curves).

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
 - .1 ASTM A 480/A 480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A 635/A 635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
-

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal ducts from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:
 - .1 Use SMACNA Class A seal on all ductwork.
- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

2.2 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.
- .3 Standard of Acceptance: Duro Dyne WB-S-2.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
 - .2 Standard of Acceptance: Duro Dyne FT-2.
-

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: short radius with single thickness turning vanes or centreline radius: 1.5 times width of duct, as indicated on drawings.
 - .2 Round: smooth radius five piece, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct, 45 degrees entry on branch.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
-

- .2 Thickness, fabrication and reinforcement: to SMACNA for a +2" WC pressure rating.
- .3 Joints: to SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

- .1 Hangers and Supports:
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to ASHRAE and SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp steel plate washer.
 - .3 For steel beams: manufactured beam clamps:

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA, as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

<u>Duct Size</u>	<u>Spacing</u>
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 Fresh air intake.
 - .2 As indicated.
 - .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Solder joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.
 - .3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging to open floor drain.
-

3.5 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.6 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 3 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².
- .3 Standard of Acceptance: Duro Dyne Metal Fab c/w Canflex fabric.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .2 301 to 450 mm: four sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.
 - .6 300 x 300 mm glass viewing panels.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness with trailing edge, to recommendations of SMACNA and as indicated.
-

2.5 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
 - .2 Access Doors and Viewing Panels:
-

- .1 Size:
 - .1 in accordance with SMACNA.
- .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Elsewhere as indicated.
- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Departmental Representative or Consultant.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning Vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for dampers, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height, as indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon, bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
 - .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
 - .3 Maximum blade height: 100 mm.
 - .4 Bearings: pin in bronze bushings.
-

- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for dampers, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 MULTI-LEAF DAMPERS

- .1 Opposed or parallel blade type as indicated.
- .2 Structurally formed steel or Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: to be failsafe design and have adequate torque to actuate dampers from any position during airflow.
- .6 Performance:
 - .1 Leakage: in closed position less than 5.6 l/s/m² of air flow at 250 Pa differential across damper.
- .7 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.
 - .3 Standard of Acceptance: TAMCO 9000 c/w thermal break in frame and sever cold option.
 - .4 Locate at:
 - .1 All fresh air intakes and exhausts.
 - .2 Any location where one side of damper will be exposed to ambient conditions.
 - .3 As indicated.
- .8 Standard of Acceptance: Tamco 9000 ECT.

2.2 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi or single leaf, aluminum or steel construction with nylon bearings, centre pivoted spring assisted or counterweighted, as indicated.

2.3 RELIEF DAMPERS

- .1 Automatic multi-leaf steel or aluminum dampers with ball bearing centre pivoted and counter-weights set to open at static pressure, as indicated.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S112-10, Standard Test Method of Fire Test of Fire Damper Assemblies.
 - .2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
 - .3 ULC-S505-1974, Standard for Fusible Links for Fire Protection Service.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for fire and smoke dampers, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.
 - .6 Design details of break-away joints.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for fire and smoke dampers for incorporation into manual.
-

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Division 1.
 - .2 Provide:
 - .1 6 fusible links of each type.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect fire and smoke dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type C, listed and bear label of ULC, UL Warnock Hersey, meet requirements of Territorial fire authority, Fire Commissioner of Canada (FCC), NFPA 90A, and authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
 - .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .3 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
 - .4 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
 - .5 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
-

- .6 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .7 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .8 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness, unless otherwise indicated.
- .9 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

- .1 Smoke Dampers: to be ULC or UL listed and labelled.
- .2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, as indicated. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.
- .3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel to provide required constant sealing pressure. Provide stainless steel negator springs with locking devices to ensure positive closure for units mounted horizontally in vertical ducts.
- .4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.
- .5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74 degrees C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

- .1 Damper: similar to smoke dampers specified above.
 - .2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied, and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 INSTALLATION

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99-2010, Standards Handbook.
 - .2 ANSI/AMCA Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.
 - .2 Provide:
 - .1 Fan performance curves showing point of operation, bhp kW and efficiency.
 - .2 Sound rating data at point of operation.
 - .3 Indicate:
 - .1 Motors, sheaves, bearings, and shaft details.
 - .2 Minimum performance achievable with variable speed controllers, as appropriate.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Provide:
 - .1 Matched sets of belts.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

- .1 Bearings and seals.
- .2 Addresses of suppliers.
- .3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 1.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect HVAC fans from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
 - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
 - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
 - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 FANS GENERAL

- .1 Motors:
 - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment Æsupplemented as specified herein.
-

- .2 For use with variable speed controllers.
- .3 Sizes as indicated.

- .2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards, fan inlet and or outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.
- .8 Standard of Acceptance: Cook, NY Blower, Greenheck or approved equal. All fans to be suitable for remote harsh environments, heavy construction.

2.3 CENTRIFUGAL FANS

- .1 Fan wheels:
 - .1 Welded steel construction.
 - .2 Maximum operating speed of centrifugal fans not more than 40% of first critical speed.
 - .3 Air foil or forward curved blades, as indicated.
- .2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
- .3 Housings:
 - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel or aluminum, for smaller wheels, braced, and with welded supports.
 - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
 - .3 Provide bolted and latched airtight access doors with handles.

2.4 CABINET FANS - GENERAL PURPOSE

- .1 Fan characteristics and construction: as centrifugal fans.
-

- .2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, variable speed V-belt drive and guard inside or outside casing.
- .3 Fabricate casing of zinc coated or phosphate treated steel of reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation, pinned and cemented, complete with perforated metal liner, complete with metal nosings on exposed edges.

2.5 UTILITY SETS

- .1 Characteristics and construction: for centrifugal fans.
- .2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents, and automatic spring loaded back draft dampers and 12 mm mesh birdscreens.
- .3 Provide belt driven sets with adjustable motor bed plate and variable pitch driver sheave.

2.6 IN-LINE CENTRIFUGAL FANS

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and belt drive.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

PART 3 - EXECUTION

3.1 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
 - .2 Provide sheaves and belts required for final air balance.
 - .3 Bearings and extension tubes to be easily accessible.
 - .4 Access doors and access panels to be easily accessible.
-

3.2 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Division 1.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board, and as specified.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: standard, as directed by Consultant.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

- .1 As indicated.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 As indicated.

2.6 DIFFUSERS

- .1 As indicted.
-

2.7 LINEAR GRILLES

- .1 As indicated.

2.8 RESIDENTIAL GRILLES, REGISTERS AND DIFFUSERS

- .1 As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with oval head , stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.

3.3 BALANCING

- .1 Provide volume control dampers at each branch take-off or grille to balance the ventilation system.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
-

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM E 90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .4 Society of Automotive Engineers (SAE)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
-

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

- .1 As indicated.
- .2 Birdscreens:
 - .1 As indicated.

2.3 GOOSENECK HOODS

- .1 As indicated.

2.4 FIXED LOUVRES - ALUMINUM

- .1 As indicated.

2.5 FIXED LOUVRES

- .1 As indicated.

2.6 ADJUSTABLE LOUVRES

- .1 As indicated.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 1.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for chimneys and stacks and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.
 - .2 Indicate following:
 - .1 Methods of sealing sections.
 - .2 Methods of expansion.
 - .3 Details of thimbles.
 - .4 Bases/Foundations.
 - .5 Supports.
 - .6 Guy details.
 - .7 Rain caps.
 - .8 Size/capacity calculations based on boiler served and final boiler capacity. Confirm boiler manufacturer agrees with stack size and design.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial regulations.
 - .2 Certifications:
-

.1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect chimneys and stacks from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREECHINGS

- .1 Shop fabricated 3.5 mm thick, stainless steel, galvanized steel welded, with sweep bends from boiler outlet to thimble or chimney as indicated.

2.2 FUELS: PRESSURE CHIMNEY AND BREECHING

- .1 ULC labelled, 760 degrees C rated.
- .2 Sectional, prefabricated, double wall 2" thick mineral wool insulation with mated fittings and couplings.
 - .1 Liner: mm thick, type 304 stainless steel.
 - .2 Shell: mm thick, type 304 stainless steel.
 - .3 Outer seals between sections: to suit application.
 - .4 Inner seals between sections: to suit application.
 - .5 Standard of Acceptance: Type CIX by Security Chimney.

2.3 ACCESSORIES

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as indicated.
-

- .2 Barometric dampers: single acting, 70% of full size of breeching area.
- .3 Hangers and supports: in accordance with recommendations SMACNA and manufacturer.
- .4 Rain cap rated for extreme wind speeds.
- .5 Expansion sleeves with heat resistant caulking, held in place as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels as indicated and required by manufacturer.
- .4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
- .5 Install flashings on chimneys penetrating roofs, as indicated.
- .6 Install rain caps and cleanouts, as indicated.

3.2 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 American Boiler Manufacturers Association (ABMA)
- .2 ASME
 - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.
- .3 CSA Group
 - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B139-09, Installation Code for Oil Burning Equipment.
 - .3 CSA B140.7-05(R2010), Oil Burning Equipment: Steam and Hot-Water Boilers.
- .4 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for heating boilers, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor:
 - .1 General arrangement showing terminal points, instrumentation test connections.
 - .2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
 - .3 Foundations with loadings, anchor bolt arrangements.
 - .4 Piping hook-ups.
 - .5 Equipment electrical drawings.
 - .6 Burners and controls.
 - .7 All miscellaneous equipment.
 - .8 Flame safety control system.
 - .9 Breeching and stack configuration.
 - .2 Engineering data to include:
 - .1 Boiler efficiency at 25%, 50%, 75%, 100%, and 110% of design capacity.
 - .2 Radiant heat loss at 100% design capacity.
-

- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for heating boilers for incorporation into manual.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial regulations.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra materials:
 - .1 Submit maintenance materials in accordance with Division 1.
 - .1 Special tools for burners, access opening, handholes and Operation and Maintenance.
 - .2 Spare parts for 1 year of operation.
 - .3 Spare gaskets.
 - .4 Spare gauge glass inserts.
 - .5 Probes and sealants for electronic indication.
 - .6 Spare burner tips.
 - .7 Spare burner gun.
 - .8 Safety valve test gauge.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect boiler and equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Packaged boiler:
 - .1 Complete with burner and necessary accessories and controls.
 - .2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with applicable standards.
 - .3 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
 - .4 Designed and constructed to ASME Boiler and Pressure vessel Code.
 - .5 CRN (Canadian Registration Number), to CSA B51.
 - .6 Boiler/burner package to bear ULC label.
 - .2 Performance:
 - .1 In accordance with American Boiler Manufacturers Association (ABMA) testing procedures.
 - .2 Hot water: minimum 92 kW gross output. 82 degrees C supply. 71 degrees C return. 550 kPa maximum operating pressure.
 - .3 Firing rate: #2 oil; 10.65 L/h.
 - .4 Boiler efficiency: 80% minimum at 100% firing rates.
 - .5 Flue gas temperature leaving boiler:
 - .1 Not to exceed 260 degrees C.
 - .2 Above dewpoint conditions at minimum firing rate.
 - .3 Electrical:
 - .1 Power: 120 V, 1 phase, 60 Hz.
 - .2 Controls: 120 V, 1 phase, 60 Hz.
 - .3 Electrical components: CSA approved.
 - .4 Controls: factory wired. Enclosed in EEMAC 1 steel cabinet.
 - .5 Thermal insulation:
 - .1 50 mm thick mineral fibre. Seal insulation at handholes, access opening, mudholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.
 - .6 Jackets: heavy gauge metal, finished with heat resisting paint.
 - .7 Mounting:
 - .1 Structural steel base, lifting lugs.
 - .8 Anchor bolts and templates:
 - .1 Supply for installation by other Divisions. Anchor bolts to be sized to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
 - .9 Start-up, instruction, on-site performance tests: 3 days per boiler.
-

- .10 Trial usage:
 - .1 Departmental Representative or Consultant may use boilers for test purposes prior to acceptance and commencement of warranty period.
 - .2 Supply labour, materials and instruments required for tests.
- .11 Temporary use by contractor:
 - .1 Contractor may use boilers only after written approval from Departmental Representative.
 - .2 Monitor and record performance continuously. Keep log of maintenance activities carried out.
 - .3 Refurbish to as-new condition before final inspection and acceptance.
- .12 Standard of Acceptance: Weil Mclain Model 480 or De Dietrich GT 334A.

2.2 CAST IRON BOILER

- .1 Sectional forced natural draft firing, waterwall design, complete with site assembled water cooled sections, front plate and removable panels.
- .2 Design of sections to provide balanced water circulation and flue gas travel. Make sections gas-tight and water-tight through use of high temperature rope, nipples, pull-up bolts.
- .3 Flue passages: readily accessible without use of special tools.
- .4 Provide supply and return headers, elbows to manufacturers recommendations and to suit installation.
- .5 Include mudholes, inspection and cleanout handholes.

2.3 AUXILIARIES

- .1 Provide auxiliaries for each boiler and to meet ASME requirements.
 - .2 Hot water boilers:
 - .1 Relief valves: ASME rated, set at 250 kPa, to release entire boiler capacity.
 - .2 Pressure gauge: 90 mm diameter complete with shut-off cock.
 - .3 Thermometer: 115 mm diameter range 10 to 150 degrees C.
 - .4 Low water cut-off: with visual and audible alarms.
 - .5 Auxiliary low water cut-off: with separate cold water connection to boiler.
 - .6 Isolating valves: on supply and return connections.
 - .7 Drain valve: NPS 2.
 - .8 Stack thermometer: range 65 to 400 degrees C.
 - .9 Outdoor controller: to reset operating temperature controller.
-

.10 One set of cleaning tools.

2.4 OIL BURNERS

.1 General:

.1 Pressure-mechanical atomizing forced draft with:

.1 Built-in blower to supply combustion air, complete with motor, silencer and damper.

.2 Single stage oil pump driven by blower motor and complete with integral relief valve.

.3 Oil filter.

.4 Pressure gauge.

.5 High voltage ignition transformer.

.6 Flame observation port.

.7 Easy access to nozzles and electrodes.

.8 Oil and air metering controls for maximum burner efficiency throughout operating range.

.9 Provide control panel by Boiler manufacturer so that boiler can be staged, sequenced, and controlled for maximum efficiency.

.2 ON-OFF operation.

.3 Controls:

.1 Electronic combustion control relay with scanner for combustion control and flame supervision.

.2 Control to shut off fuel within 5 seconds upon flame failure or upon signal of safety interlock and to ensure, when restarted, in sequence, ignition and resumption of supervision of burner operation.

.3 Burner operation to include:

.1 Pre-purge.

.2 Pilot ignition and supervision.

.3 Burner operation.

.4 Post-purge upon burner shut-down.

.4 Immersion controllers:

.1 Operating: to start and stop burner, and operating between adjustable setpoints.

.2 High limit: manual reset, set at 91 degrees C.

.3 Controller range: 30 to 121 degrees.

.5 Visual and audible alarms: to indicate burner shutdown due to flame failure, low water level, high temperature, low air pressure, low fuel pressure.

.6 Selector switch: to permit manual and automatic firing at any rate between low and high fire.

.7 Pilot lights: to indicate:

.1 Normal burner operation.

.2 All stages of burner operation.

.8 Provide auxilliary low wated cut out.

.9 Standard of Acceptance: Riello.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heating boiler installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative or Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

- .1 Install in accordance with ASME Boiler and Pressure Vessels Code, regulations of Territory having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Mount unit level on 100 mm high concrete housekeeping pad.
- .5 Pipe hot water relief valves full size to nearest drain.
- .6 Oil fired installations - in accordance with CSA B139.

3.4 MOUNTINGS AND ACCESSORIES

- .1 Safety valves and relief valves:
 - .1 Run separate discharge from each valve.
 - .2 Terminate discharge pipe as indicated.
 - .3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.
-

- .2 Blowdown valves:
 - .1 Run discharge to terminate as indicated.

3.5 FIELD QUALITY CONTROL

- .1 Commissioning:
 - .1 Manufacturer to:
 - .1 Certify installation.
 - .2 Start up and commission installation.
 - .3 Carry out on-site performance verification tests.
 - .4 Demonstrate operation and maintenance.
 - .2 Provide Departmental Representative at least 2 weeks notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.6 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 Definitions:
 - .1 Catalogued or published ratings: ratings obtained from tests carried out by manufacturer or manufacturer's designated independent testing agency which signify adherence to codes and standards in force.
- .2 Reference Standards:
 - .1 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers/Illuminating Engineering Society (ANSI/ASHRAE/IES)
 - .1 ANSI/ASHRAE 52.2-2012, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - .2 ANSI/ASHRAE/IES 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .4 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-11, Architectural Coatings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for insulation, filters, and paints and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.
 - .2 Indicate on drawings:
 - .1 Actual heating fluid entering and leaving conditions for stated air side requirements.
 - .2 Fan design conditions.
 - .3 Construction details.
-

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for air handling equipment for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air handling equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Field assembled components to form units supplying air at design conditions as indicated.

2.2 FANS

- .1 In accordance with Section 23 34 00 - HVAC Fans.
-

2.3 CASING

.1 General:

.1 Factory manufactured, Field fabricated, galvanized phosphate treated steel casing of 1.3 mm thick steel reinforced and braced for rigidity and flanged for bolted sub-assemblies, to withstand a pressure differential as indicated.

.2 Provide inspection doors to allow access to internal parts and component removal.

.1 Inspection doors: insulated factory manufactured complete with latches, two handles and neoprene gaskets of sizes as indicated. Hinge doors to open against air pressure complete with hold open devices.

.3 Paint over steel, where steel is not galvanized, or where galvanized steel sheet is cut, with corrosion resistant paint to MPI #18.

.1 Finish inside and out, over prime coat, with enamel paint to Section 09 91 23 - Interior Painting.

.4 Internally insulate casing with 25 mm thick, 72 kg/m³ density, neoprene coated rigid acoustic duct liner with metal nosings at edges, pinned and cement in place.

.1 Ensure expanded polystyrene and polyurethane insulation materials are not produced using ozone depleting substances.

.5 Openings and bolted sections gasketed.

.2 Acoustic panels:

.1 Factory manufactured with Sound Transmission Coefficients and Acoustical Absorption Coefficients as indicated.

.2 Cut and frame openings or panel penetrations greater than 150 mm (diameter or length and width) at factory. Openings or penetrations less than 150 mm (pipe, conduit and instrument holes) may be field cut. Installer to provide filler sheets between equipment and casing.

.3 Standard of Acceptance: Trane, Engineered Air.

2.4 COILS

.1 General:

.1 Cleanable tube type: copper or steel headers and straight tubes.

.2 Plate fin type: tubes mechanically bonded to fins.

.3 Spiral wound fin type: mechanically bonded to tubes.

.4 Non-ferrous tubes and headers: brazed assembly.

.5 Maximum tube length: 3.6 m unless specified otherwise.

.6 Factory tested with air under water.

.2 Capacities: as indicated.

.3 Ratings: AHRI Certified. Submit with shop drawings actual heating fluid entering and leaving conditions for stated air side requirements.

- .4 Do not use removable headers.
 - .1 Unless indicated, dehumidifying coils rated for 2.5 m/s face velocity.
 - .2 Unless indicated, preheat coils rated for 3.5 m/s.
 - .3 Pressure drop through heating coils: 23 kPa maximum.
 - .4 Water velocity: 1.2 m/s maximum. Under 0.6 m/s, turbulators may be used if manufacturer's standard practice.

- .5 Coil casings:
 - .1 Mounting: designed for bolting to other sections duct mounting.
 - .2 Steel: die formed 1.6 mm thick galvanized, zinc coated, steel sheet.
 - .3 Tube supports: allow for expansion and contraction.
 - .4 Supports: steel channel or double angle frames or other approved support. Provide brass supports for copper coils.
 - .5 Blank-off plates: of similar material as casing to prevent air bypass. Seal openings where pipes pass through casing using methods recommended by SMACNA.

- .6 Hot water coils: cleanable fins.
 - .1 Tubes: copper.
 - .2 Fins: aluminum, plate.
 - .3 Headers: steel.
 - .4 Pressure tests: 1.7 MPa.

2.5 MIXING BOX

- .1 Provide as indicated.
- .2 Material: to match casing.
- .3 Design: provide internal baffles and other devices, as required, to produce mixed air temperature to within plus or minus 3 degrees C of design across face of outlet.
- .4 Factory manufactured assembly to include frame, dampers, operating linkages, drive shafts of minimum 12 mm diameter carbon steel and access door on each side.
- .5 Dampers for mixing boxes: Section 23 33 15 - Dampers - Operating.

2.6 FILTER BOX

- .1 Material to match casing complete with flat or V type filter arrangement using disposable type filters. Provide access to filter through hinged door.
 - .2 Filters: in accordance with Section 23 44 00 - HVAC Air Filtration.
-

- .1 Minimum Efficiency Reporting Value (MERV) value 11 filtration media to ANSI/ASHRAE 52.2, to be used on return air section of air handling unit.
- .2 Immediately prior to occupancy, replace filtration media with new filtration media with Minimum Efficiency Reporting Value (MERV) of 13 in accordance with ANSI/ASHRAE 52.2.
- .3 Provide blank off plates around filters.

2.7 VIBRATION ISOLATION

- .1 Flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Vibration isolators on each fan section in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air handling equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Provide appropriate protection apparatus.
 - .2 Fabricate to provide smooth air flow through components.
 - .1 Limit air leakage to 1% of rated air flow at 2.5 kPa suction pressure.
 - .3 Apply sealer into seams prior to assembly.
 - .1 Secure toe angles on 300 mm centres for full length of casing continuous along entire length of assembly.
 - .4 Paint inside casing surfaces with zinc coating, mastic, corrosion resistant paint to MPI #18, 0.075 mm minimum thickness when dry. Prime coat outside surfaces.
-

3.3 FANS

- .1 Provide sheaves and belts required for final air balance.
- .2 Suspension for hung units: install four part hanger type, ceiling flange, top hanger, bottom hanger and vibration isolator with takeup for levelling.
- .3 Install flexible connections at fan inlets and outlets as indicated.
 - .1 Ensure metal bands of connectors are parallel and not touching.
 - .2 Ensure that fan outlet and duct are aligned when fan is running.

3.4 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM E 84-11a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .2 ASTM C 916-1985(R2007), Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C 1071-05e1, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2012, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
- .3 Underwriters' Laboratories (UL) Inc.
 - .1 UL 2021-1997, Fixed and Location-Dedicated Electric Room Heaters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Division 1.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
 - .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by contractor.
 - .2 Indicate on drawings:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
-

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect unit heaters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 HORIZONTAL UNIT HEATERS

- .1 Horizontal Unit Heaters: to UL 2021.
 - .2 Casing: 1.6 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.
 - .3 Coils: hydrostatically test to 1 MPa.
 - .1 Hot water coil: copper tube, mechanically bonded aluminum fins spaced 25 mm maximum rated 1378 kPa minimum working pressure and 104 degrees C maximum entering-water temperature. Include manual air vent and drain.
 - .4 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.
 - .5 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor explosion proof supports.
 - .6 Air outlet: four-way adjustable louvres.
-

- .7 Capacity: as indicated, base hot water heating capacity on 82 degrees C E.W.T., and 11 degrees C temperature drop
- .8 Control room thermostat: electric, low voltage, cover, set point locking device, concealed adjustment, brushed aluminum cover and guard.
- .9 Standard of Acceptance: Trane, Engineered Air.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
 - .2 Include double swing pipe joints as indicated.
 - .3 Check final location with Consultant if different from that indicated prior to installation.
 - .1 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's and Consultant's directive.
 - .4 Hot water units: for each unit, install ball valve on inlet and calibrated balancing valve on outlet of each unit. Install drain valve at low point c/w isolation ball valve.
 - .1 Install manual air vent at high point.
 - .5 Clean finned tubes and comb straight.
 - .6 Provide supplementary suspension steel as required.
 - .7 Install thermostats in locations indicated.
 - .8 Before acceptance, set discharge patterns and fan speeds to suit requirements.
-

3.3 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by unit heaters installation.

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-[2000], The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .4 Government of Nunavut's Good Building Practices Guideline (GBPG) 2005
- .5 Government of Nunavut - Office of the Fire Marshall (OFM) Technical Bulletins
- .6 Government of Nunavut - Electrical/Mechanical Safety Section Electrical Bulletins
- .7 International Electrical Testing Association Standard for Acceptance Testing Specifications for Electrical Power, Equipment, & System (ANSI/NETA ATS-2010)

1.2 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit drawings stamped.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 If changes are required, notify of these changes before they are made.

1.4 CERTIFICATES

- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Consultant.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals
- .2 Operation and Maintenance Data: submit operations and maintenance date for incorporation into manuals.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment and fixtures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English
- .4 Ensure to design, provide and install Seismic Resistance System for the electrical distribution system equipment as defined in National Building Code of Canada in Section 4.1.2.1; intended to prevent systems and equipment from causing personal injury and moving from original position.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with all sections.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - CERTIFICATES.
- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:

- .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .2 Sizes as follows:
- | NAMEPLATE SIZES | | | |
|-----------------|-------------|---------|--------------------|
| Size 1 | 10 x 50 mm | 1 line | 3 mm high letters |
| Size 2 | 12 x 70 mm | 1 line | 5 mm high letters |
| Size 3 | 12 x 70 mm | 2 lines | 3 mm high letters |
| Size 4 | 20 x 90 mm | 1 line | 8 mm high letters |
| Size 5 | 20 x 90 mm | 2 lines | 5 mm high letters |
| Size 6 | 25 x 100 mm | 1 line | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters |
- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Engineer prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Enclosed Breakers, Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green."

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.6 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1200 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1200 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells: 2100 mm.

- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2100 mm.
- .10 Door bell pushbuttons: 1200 mm.
- .11 Intercomm Call Switches: 1200mm.
- .12 Clocks: 2100mm

3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Conduct following tests in accordance with manufacturers requirements.
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Megger Tests in accordance with IEEE/CEC/NETA testing standards
 - .6 All phase to ground readings should be performed with the other phases grounded
 - .7 System function tests for:
 - .1 Fire Alarm System
 - .2 Security System
 - .3 Classroom Sound Systems
 - .4 PA System
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.8 PERMITS

- .1 Apply for an electrical permit with the Electrical Inspection Department prior to commencement of work.
 - .1 Pay associated fees.
- .2 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificate of Acceptance from authorities having jurisdiction on completion of work to Consultant.

3.9 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Provide a Coordination and Short Circuit Study sealed by a Professional Engineer licensed in Nunavut.
 - .1 The study shall evaluate the entire distribution system including all panelboards, CDPs and splitters.
 - .1 Branch circuit breakers and/or fuses feeding mechanical equipment loads shall not be included in the study.
 - .2 Branch circuits breakers and/or fuses with a capacity under 60A, unless feeding a panelboard, CDP or splitter, shall not be included in the study.
 - .2 The study shall indicate breaker/relay trip settings and provide recommendations on any equipment changes that should be considered and/or may be required.
- .2 Submit Coordination and Short Circuit Study to Engineer prior to OR along with submission of distribution equipment shop drawings.
- .3 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings, as per the Short Circuit and Coordination Study results.

3.10 SYSTEM STARTUP

- .1 Instruct Departmental Representative, Consultant and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.11 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65-03(R2008), Wire Connectors. (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 National Electrical Manufacturers Association (NEMA)
- .3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .4 Insulated Cables Engineers Association (ICEA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals
- .2 Operation and Maintenance Data: submit operations and maintenance data for incorporation into manuals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment and fixtures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 32 - outlet boxes, conduct boxes and fittings.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 and RWU90.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Type: ethylene propylene rubber.
 - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole malleable iron steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 300 mm centers.

- .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, explosion-proof approved for TECK cable.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: anti short connectors.

2.4 MINERAL-INSULATED CABLES

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless copper sheath, Type M1 rated 600V, 250 degrees C.
- .4 Two hour fire rating.
- .5 Connectors: field installed approved for MI cable.
- .6 Termination kits: field installed approved for MI cable.

2.5 CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, number as indicated, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 25 05 20.

3.4 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Install cable exposed, securely supported by straps.
- .2 Support 2 hour fire rated cables at 1 m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable terminations: use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.
- .6 Do not splice cables unless indicated.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 25 05 20.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-[1989(R1996)], Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 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.
- .3 Divert unused metal materials from landfill to metal recycling facility.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.
- .3 Rod electrodes: galvanized steel 19mm dia by 3 m long.
- .4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, soft annealed, sized as indicated.
- .6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

- .13 Ground secondary service pedestals.

3.2 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 4/0 AWG copper conductors for connections to electrodes.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, intercommunication systems as indicated.
 - .3 Install #6AWG copper bonding conductor from main building ground bus to each Data/LAN Rack.
 - .4 Install #6 copper bonding conductors from main building ground bus to each intercommunications system racks and audio system racks.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

- .1 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .2 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 Two-hole steel straps for conduits and cables larger than 25 mm.
- .3 For surface mounting of two or more conduits use channels at 3 m on centre spacing.
- .4 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .5 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .6 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .7 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .8 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.

- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .4 CSA C22.2 No.45-M1981(R2003), Rigid Metal Conduit

Part 2 Products

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

2.2 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum and liquid-tight flexible metal.
- .4 Rigid metal conduit: to CSA C22.2 No.45 galvanized steel threaded.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits NPS 2 24 mm and smaller.
 - .1 Two hole steel straps for conduits larger than NPS 2 25 mm.
- .2 Beam clamps to secure conduits to exposed steel work.

- .3 Channel type supports for two or more conduits at 1 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for NPS 1 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are acceptable.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.
- .3 Use electrical metallic tubing (EMT) except in cast concrete.
- .4 Use rigid pvc conduit underground.
- .5 Use rigid galvanized steel threaded conduit where specified.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .7 Minimum conduit size for lighting and power circuits: 19 mm.
- .8 Bend conduit cold:

- .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Run 2-25mm spare conduit up to ceiling space and 2-25mm spare conduits down to ceiling space from each flush panel.
 - .1 Terminate these conduits in junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .13 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible on suspended or surface channels.
- .4 Do not pass conduits through structural members except as indicated. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 28 16.02 - Moulded Case Circuit Breakers

1.3 REFERENCES

- .1 CAN/CSA-C22.2 No.31-10 Switchgear Assemblies.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate on shop drawings.
 - .1 Floor anchoring method and foundation template .
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth.
 - .5 Dimensioned layout of internal and front panel mounted components.
- .3 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

- .1 Submit 3 copies of certified test results.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Submit required number of copies of maintenance data for complete assembly including components.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:

- .1 1x 3P-15A spare breaker.
- .2 1x 3P-60 spare breaker
- .3 1x 3P-100A spare breaker

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

- .1 Service Entrance Board: to CAN/CSA-C22.2 No.31.
- .2 Rating: per drawings with minimum, short circuit current 42 kA (rms symmetrical).
- .3 Cubicles: wall-mounted, or free standing, dead front, size as indicated.
- .4 Barrier metering section from adjoining sections.
- .5 Provision for installation of power supply authority metering in barriered section.
- .6 Distribution section.
- .7 Hinged access panels with captive knurled thumb screws.
- .8 Bus bars and main connections: 99.3% copper.
- .9 Bus from load terminals of main breaker via metering section to main lugs of distribution section.
- .10 Identify phases with colour coding.
- .11 Acceptable Manufacturers:
 - .1 Siemens
 - .2 Eaton/Cutler-Hammer
 - .3 Square-D
 - .4 GE

2.2 MOULDED CASE CIRCUIT BREAKERS

- .1 Breakers: Sizes as indicated on drawings to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 LSIG Solid State Adjustable Breaker for Service Entrance Breaker.
- .3 LSI Solid State Adjustable Breaker for all other breakers over 400 Amps.

2.3 GROUNDING

- .1 Copper ground bus extending full width of cubicles and located at bottom.

- .2 Lugs at each end for size 250 mcm grounding cable.

2.4 GROUND FAULT UNIT

- .1 Provided for all services 600A Amps and larger. (LSIG)

2.5 POWER SUPPLY AUTHORITY METERING

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Mounting accessories and wiring for metering supplied by power supply authority:
 - .1 3 potential transformers.
 - .2 3 current transformers.

2.6 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - Electrical .
 - .1 Service entrance board exterior: gray.

2.7 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size7 .
 - .2 Complete board labelled: "120/208V."
 - .3 Main disconnect labelled: "Main Breaker".
 - .4 Branch disconnects labelled: "Feeder No1", "Feeder No.2", "Feeder No.3", as indicated.

PART 3 Execution

2.8 INSTALLATION

- .1 Locate service entrance board and fasten to wall.
- .2 Connect main secondary service to line terminals of main breaker.
- .3 Connect load terminals of distribution breaker's to feeders.
- .4 Check factory made connections for mechanical security and electrical continuity.
- .5 Run one RWU 90 grounding conductor 250MCM bare copper in conduit from ground bus to building ground.

- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components. Refer to section 26 05 00. Study shall be certified by Electrical Engineer Registered in Nunavut.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.
- .3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29-11 Panelboards and enclosed Panelboards.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 78 00 - Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 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.
- .3 Divert unused metal and wiring materials from landfill to metal recycling facility.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panelboard.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating as mains.
- .8 Mains: suitable for bolt-on breakers.
 - .1 Plug-on type breakers will not be accepted.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked grey enamel.
- .11 Acceptable Manufacturers:
 - .1 Siemens
 - .2 Eaton/Cutler-Hammer
 - .3 Square-D
 - .4 GE

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

- .4 Lock-on devices for all breakers feeding fire alarm, emergency equipment, intercom, stairway lighting circuits, exit lighting circuits and night lighting circuits.
- .5 LSI Solid State Adjustable Breaker for all other breakers over 400 Amps.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components. Refer to section 26 05 00. Study shall be certified by Electrical Engineer Registered in Nunavut.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55-M1986(R2008), Special Use Switches.
 - .4 CSA-C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SWITCHES

- .1 15 A, 120 V, single pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
 - .6 Commercial Grade
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

- .4 Switches of one manufacturer throughout project.
- .5 Acceptable materials: Leviton # CSB1-15, CSB2-15, CSB3-15 and CSB4-15

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R or 5-20R, 125 V, 15 A or 20A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Commercial Grade
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.
- .4 Receptacles located with kindergarten classrooms or daycare areas and where noted on drawings shall be tamperproof type.
- .5 Acceptable materials: Leviton # BR15, BR20, TBR15, TBR20

2.3 SPECIAL WIRING DEVICES

- .1 Duplex GFCI receptacles, CSA type 5-15 R or 5-20R(T-Slot), 125 V, 15 A or 20A, U ground,with following features:
 - .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Eight back wired entrances, four side wiring screws.
 - .4 Reset and Test Pushbuttons
 - .5 Indicator light
 - .6 Acceptable materials: Leviton # 7599 and 7899
- .2 Lighting Control Devices:
 - .1 As noted in drawings and specifications.

2.4 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Premium Stainless Steel cover plates for flush mounted devices.

- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles in outdoor applications.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical as indicated.
- .2 Lighting Control Devices:
 - .1 Install as per drawings and in accordance with manufacturer's requirements.
 - .2 Mount switch-type devices at same height as toggle switches in accordance with Section 26 05 00 Common Work Results for Electrical.
- .3 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical as indicated.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .4 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 Labels:
 - .1 Label all wiring devices (switches and receptacles) with respective circuit numbers w/clear p-touch labels with black letters.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 24 02 - Service Entrance Board.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 100 A.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 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.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters: to CSA C22.2 No. 5
 - .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
 - .3 Common-trip breakers: with single handle for multi-pole applications.
 - .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
-

- .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips.
- .6 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating or as required to meet minimum specified panelboard interrupting capacity.
- .7 Acceptable Manufacturers:
 - .1 GE
 - .2 Square-D
 - .3 Siemens
 - .4 Eaton/Cutler Hammer

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SERIES RATED THERMAL MAGNETIC BREAKERS

- .1 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
 - .1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit to provide inverse time current trip under overload condition, including long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.6 OPTIONAL FEATURES

- .1 Include:
 - .1 Shunt trip where noted on drawings.
-

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data and shop drawings.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single pole ground fault circuit interrupter, sized as indicated c/w test and reset facilities.
- .2 Acceptable Manufacturers:
 - .1 Siemens
 - .2 Eaton/Cutler-Hammer
 - .3 Square-D
 - .4 GE

Part 3 Execution

3.1 INSTALLATION

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
 - .2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures .

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible, and non-fusible, horsepower rated disconnect switch in CSA Enclosure , to CAN/CSA C22.2 No.4 size as indicated or required.
- .2 Provision for padlocking in on or off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated.
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Acceptable materials: Square D, Cutler-Hammer, Siemens, GE or equivalent

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14-10, Industrial Control Equipment.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 CONTACTORS

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .4 Mount in CSA Enclosure 1 unless otherwise indicated.
- .5 Include following options in cover:
 - .1 Red indicating lamp.
 - .2 Hand-Off-Auto selector switch.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

- .2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 International Electro technical Commission (IEC)
 - .1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials.
 - .2 Provide listed spare parts for each different size and type of starter:
 - .1 3 contacts, stationary.
 - .2 3 contacts, movable.
 - .3 1 contacts, auxiliary.
 - .4 1 control transformer[s].
 - .5 1 operating coil.
 - .6 2 fuses.
 - .7 2 indicating lamp bulbs used.
-

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

- .1 Starters: to IEC 947-4 with AC4 utilization category.
- .2 Acceptable materials: Square D, Cutler-Hammer, Siemens, GE or equivalent.

2.2 MANUAL MOTOR STARTERS

- .1 Single or Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 Overload heaters to suit, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch: standard, labelled as indicated.
 - .2 Indicating light: standard type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Electronic adjustable motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .2 Combination type starters to include motor circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:
-

- .1 Locking in "OFF" position with up to 3 padlocks.
- .2 Independent locking of enclosure door.
- .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Selector switches: Hand-Off-Auto (H-O-A), oil tight labelled as indicated.
 - .2 Indicating lights: oil tight type and color as indicated.
 - .3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and secondary voltage to match control system requirements, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
 - .2 Ensure correct breaker sizes and overload devices elements installed.
 - .3 Confirm motor nameplate and adjust overload device to suit.
-

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-04, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.
 - .2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM F1137-00(2006), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices
- .6 Underwriters' Laboratories of Canada (ULC)
- .7 Illuminating Engineering Society (IES)
 - .1 Lighting Handbook, 10th Edition
- .8 Nation Energy Code of Canada for Buildings (NECB), 2011

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Include detailed shop drawings for all lamp and ballast types to be used
 - .2 Include detailed shop drawings for all light fixtures.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 LAMPS

- .1 Fluorescent lamps.
 - .1 Low Mercury
 - .2 Acceptable Product: Philips Alto/Alto II Series

Lamp Design	Bulb shape Wattage	Base	Type	Initial Lumens	Life h (12hr Start)	Descrip.	Colour [k]
F14T5	T5-14W	Min. Bipin	Long Life	1350	35,000	Cool White	4100
F28T5	T5-25W	Min. Bipin	Energy Reduced	2900	40,000	Cool White	4100
F54T5	T5-49W	Min. Bipin	High Output-Energy Reduced	5000	40,000	Cool White	4100

2.2 BALLASTS

- .1 Fluorescent ballast: CSA certified, energy efficient type, programmed start.
 - .1 Rating: 120-277V, 60 Hz, for use with lamps as indicated.
 - .2 Totally encased and designed for 40 EC ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .4 Harmonics: 10 % maximum THD, including 49th for electronic discrete ballasts.
 - .5 Operating frequency of electronic ballast: 42 kHz minimum.
 - .6 Ballast Factor: greater than 0.85.
 - .7 Sound rated: Class A.
 - .8 Mounting: integral with luminaire.
 - .9 Lamp Striation Reduction Circuitry
 - .10 Acceptable Product: Advance# Optanium Series

2.3 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:

- .1 For corrosion resistance conversion coating to ASTM F1137.
- .2 For paint base, conversion coating to ASTM F1137.
- .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.

2.4 LUMINAIRES

- .1 As noted on drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Verify luminaire Voltage with branch circuit supplying power to the luminaire prior to ordering.
- .3 Verify and coordinate all ceiling types with luminaire locations.
- .4 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Provide switching where required or indicated for a complete lighting installation.

3.3 LUMINAIR SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling and in accordance local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-10, Unit Equipment for Emergency Lighting.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2006, Life Safety Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141.
- .2 Housing: Extruded aluminum housing, white finish.
- .3 Face and back plates: extruded aluminum
- .4 Lamps: LED-2.5W, 25 year life expectancy , 10 year warranty.
- .5 Operation: designed for over 100,000 hours of continuous operation without re-lamping.
- .6 Face:
 - .1 Illuminated Polycarbonate panel w/ pictogram indicating Left, Straight and Right Directions as required.
 - .2 White & Green Colour to ISO 3864.1, Graphical Symbols - Safety Colours and Safety Signs - Part 1: Design Principals for Safety Signs in Work places and public areas.

- .3 Single or Dual Sided as required.
- .4 Pictograms to ISO 7010, Graphical Symbols - Safety Colours and Safety Signs - Safety Signs used in Workplaces and Public Areas.
- .7 Batteries shall be sealed nickel-cadmium type sized to provide minimum 120 minutes of illumination time upon AC power failure.
- .8 Suitable Product: Emergi-Lite# EA Series

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Every exit sign shall be installed so that it is visible on approach to the exit.
- .3 Connect fixtures to exit light circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 31 - Splitters, Junction Boxes, Pull Boxes and Cabinets.
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

1.2 REFERENCES

- .1 Government of Nunavut Community and Government Services (CGS-IPS) Structured Cabling Guidelines Version 1.5, 2012.

1.3 SYSTEM DESCRIPTION

- .1 Empty telecommunications raceways system consisting of outlet boxes, cover plates, conduit, pull boxes, cable tray, sleeves, caps and fish wires to facilitate the installation of communications system as specified.

Part 2 Products

2.1 MATERIALS

- .1 Conduit: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Junction Boxes: in accordance with Section 26 05 31 - Splitters, Junction Boxes, Pull Boxes and Cabinets.
- .3 Outlet Boxes, conduit and fittings: in accordance with Section 26 05 31 - Splitters, Junction Boxes, Pull Boxes and Cabinets.
- .4 Fish Wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

- .1 Install empty raceway systems, including distribution system, fish wires, outlet boxes, pull boxes, cable tray, cover plates, conduit, sleeves and caps, miscellaneous and positioning material to constitute a complete system.
- .2 Install cabling for communications system as specified.

- .3 Installation must conform to Government of Nunavut Community and Government Services (CGS-IPS) Structured Cabling Guidelines Version 1.5, 2012.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for fire alarm systems.
 - .2 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
 - .3 Trouble signal devices.
 - .4 Power supply facilities.
 - .5 Manual alarm stations.
 - .6 Automatic alarm initiating devices.
 - .7 Audible signal devices.
 - .8 End-of-line devices.
 - .9 Annunciators.
 - .10 Visual alarm signal devices.
 - .11 Ancillary devices.
 - .12 Digital Alarm Communicator Transmitter(DACT)to provide dial out communications to monitoring stations.

1.2 REFERENCES

- .1 Government of Canada
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-2006, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-1999, Audible Signal Device for Fire Alarm Systems.
 - .3 CAN/ULC-S526-2002, Visual Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527-1999, Control Units.
 - .5 CAN/ULC-S528-1991, Manual Pull Stations for Fire Alarm Systems.CAN/ULC-S529-2002, Smoke Detectors for Fire Alarm Systems.
 - .6 CAN/ULC-S530-M1991, Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S531-2002, Standard for Smoke Alarms.
-

- .8 CAN/ULC-S536-S537-2004, Burglar and Fire Alarm Systems and Components.
 - .4 National Fire Protection Agency
 - .1 NFPA 72-2002, National Fire Alarm Code.
 - .2 NFPA 90A-2002, Installation of Air Conditioning and Ventilating Systems.
 - 1.3 ACTION AND INFORMATIONAL 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 copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include:
 - .1 Device, Equipment, Module Cutsheets and Specifications.
 - .2 Wiring diagrams, including schematics of modules.
 - .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.
 - 1.4 CLOSEOUT SUBMITTALS**
 - .1 Submit maintenance and engineering data for incorporation into manual.
 - .2 Submit following:
 - .1 Manufacturer's Data for:
 - .1 Control panel and modules.
 - .2 Storage batteries.
 - .3 Battery charger.
 - .4 Manual pull stations.
 - .5 Heat detectors.
 - .6 Open-area smoke detectors.
 - .7 Duct smoke detectors.
 - .8 Alarm bells.
 - .9 Alarm horns.
-

- .10 Visible appliances.
- .11 Main annunciator.
- .12 Remote annunciator panel.
- .13 Graphic annunciator panel.
- .14 Electro-magnetic door holder-releases.
- .15 Trouble bell or buzzer.
- .16 Projected beam smoke detector.
- .17 DACT Unit
- .18 Mark data which describe more than one type of item to indicate which type will be provided.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire alarm system installations with 5-years documented experience and approved by manufacturer.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .3 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .4 Maintenance Service:
 - .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 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 and Disposal.
-

Part 2 Products

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to CAN/ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Control unit: to CAN/ULC-S527.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.
- .9 DACT: ULC Approved.
- .10 Colour Coded Fire Alarm Zone Maps (Passive):
 - .1 Located at both the main fire alarm control panel and remote annunciator locations.
 - .2 All fire alarm zones shall be clearly shown:
 - .1 Each zone shall be indicated by a separate and distinct colour along with text reading "Zone XX", as appropriate.
 - .3 Maps to indentify location by leader and "Your Are Here" notation.
 - .4 Sized minimum 279mm x 433mm and to ensure proper legibility of text.
 - .5 Securely mounted to the wall at 1500mm above ground and behind a Plexiglas protective cover.
- .11 Acceptable Manufacturers:
 - .1 Edwards/GE
 - .2 Notifier
 - .3 Siemens
 - .4 Simplex

2.2 SYSTEM OPERATION

- .1 Provide complete, electrically supervised, zoned, annunciated, fire alarm system.
 - .2 Provide separate circuits from control panel to each zone of initiating devices. Transmission of signals from more than one zone over common circuit to control panel is prohibited.
 - .3 Single stage operation. Operation to actuation following:
-

- .1 Manual station.
- .2 Heat detector.
- .3 Smoke detector.
- .4 Automatic fire sprinkler system.
- .5 Fire extinguishing system.
- .6 Fire standpipe system.
- .4 Actuation of single operation device to initiate following:
 - .1 Building evacuation alarm devices to operate continuously.
 - .2 Transmit signal to fire department through DACT via monitoring station.
 - .3 Zone of alarm device to be indicated on control panel and remote annunciator.
 - .4 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
 - .5 Fire doors and smoke control doors if normally held open, to close automatically.
 - .6 Electro-magnetic door holders to de-energize.
 - .7 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

2.3 CONTROL PANEL

- .1 Class A.
 - .2 Single stage operation.
 - .3 Addressable
 - .4 Zoned.
 - .5 Non-coded.
 - .6 Enclosure:
 - .1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
 - .2 Provide modular type panel installed in surface mounted steel cabinet with hinged door and cylinder lock.
 - .3 Mount with panel centerline 1.5m above finished floor elevation.
 - .4 Switches and other controls: not accessible without use of key.
 - .5 Design of control panel: neat, compact assembly containing parts and equipment required to provide specified operating and supervisory functions of system.
-

- .6 Control panel components: CSA approved and approved by control panel manufacturer for use in control panel.
 - .7 Panel cabinet: finished on inside and outside with factory-applied enamel finish.
 - .8 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.
 - .9 Provide audible trouble signal.
 - .10 Provide identification plates for lamps and switches.
 - .11 Provide 1 set of Form C dry alarm contacts per zone, common system Form C dry alarm contact, and common system Form C dry trouble contact.
 - .12 Permanently label switches.
 - .13 Provide panel with following switches:
 - .1 Trouble silencing switch which silences audible trouble signals including remote trouble devices without extinguishing trouble indicating lamp(s).
 - .1 For non-self-resetting type switch: Upon correction of trouble condition, audible signals will again sound until switch is returned to its normal position.
 - .2 For silencing switch of momentary action self-resetting type: trouble signal circuit automatically restored to normal upon correction of trouble condition.
 - .2 Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of system and zone trouble signals.
 - .3 Reset switch which when activated will restore the system to normal standby status after cause of alarm has been corrected, and activated initiating devices reset.
 - .1 Operation of reset switch to restore activated smoke detectors to normal standby status.
 - .4 Lamp test switch.
 - .5 Drill switch which will enable test of notification appliances and restoration to normal.
 - .6 HVAC shutdown bypass switch. Operation of the switch to allow HVAC system to operate with detectors in alarm and cause operation of system trouble signals.
 - .7 Supervised, modular design with plug-in modules:
 - .1 Alarm receiver with provision for remote supervised annunciation, for class A initiating circuit.
-

- .2 Spare zones: compatible with smoke detectors and open circuit devices.
- .3 Space for future modules.
- .4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.
- .8 Components:
 - .1 Single stage alarm pulse rate panels:
 - .1 Single stroke control type for output to signal control panel continuously.
 - .2 Audible signal control panel with control circuits complete with terminals for wiring and plug-in modules for dc signals up to 2.0 A load with trouble indication with class A connections.
 - .3 Common control and power units:
 - .1 Control panel containing following indications and controls:
 - .1 LCD Screen
 - .2 "Power on" LED (green) to monitor primary source of power to system.
 - .3 "Power trouble" indication.
 - .4 "Ground trouble" indication.
 - .5 "Remote annunciator trouble" indication.
 - .6 "System trouble" indication.
 - .7 "System trouble" buzzer and silence switch c/w trouble resound feature.
 - .8 System reset switch.
 - .9 "LED test" switch if applicable.
 - .10 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
 - .11 "Signals silenced" indication.
 - .2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.
 - .4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.
 - .1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.
 - .2 Contact terminal size: capable of accepting 22-12 AWG wire.

2.4 POWER SUPPLY

- .1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of
-

gel cell batteries minimum expected life of 4 years, sized in accordance with NBC.

2.5 MANUAL ALARM STATIONS

- .1 Provide non-coded single action type with mechanical reset features.
 - .1 Non-coded single pole normally open contact for single stage.
- .2 Stations: surface mounted and interior type as indicated.
 - .1 For surface mounting provide station manufacturer's approved back box.
 - .2 Back box finish to match station finish.
- .3 Equip each station with terminal strip with contacts of proper number and type to perform functions required.
- .4 Stations: type not subject to operation by jarring or vibration.
 - .1 Break-glass-front stations are not permitted; pull-lever break-rod type is acceptable provided presence of rod is not required to reset station.
- .5 Station colour: red.
- .6 Provide station with visible indication of operation.
- .7 Restoration to require use of key.
 - .1 Keys: identical throughout system for stations and control panel(s).
- .8 Mount stations with operating lever not more than 1.2m above finished floor.
- .9 Where weatherproof stations are required, provide stations with cast metal, weatherproof housings with hinged access doors.
 - .1 Finish housings with red enamel paint and provide signage indicating "FIRE ALARM" with white letters of 19mm high.

2.6 AUTOMATIC ALARM INITIATING DEVICES

- .1 Heat detectors: provide heat detectors designed for detection of fire by combination fixed temperature rate-of-rise principle.
 - .2 Combination Fixed Temperature Rate-Of-Rise Detectors (Spot Type): designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.
 - .1 Contacts: self-resetting after response to rate-of-rise actuation
-

- .2 Operation under fixed temperature actuation to result in external indication.
 - .3 Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes to operate on fixed temperature principle only.
 - .3 Rate Compensating Detector (Spot Type): designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.
 - .1 Detectors: hermetically sealed and automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise.
 - .2 Detector operation: not be subject to thermal time lag.
 - .4 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by ionization photoelectric principle.
 - .1 Detectors: 2-wire type.
 - .2 Provide necessary control and power modules required for operation integral with control panel.
 - .3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.
 - .4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
 - .5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
 - .6 Provide remote indicator lamps for each detector that is located [above suspended ceilings, beneath raised floors, concealed from view.
 - .7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
 - .8 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.
 - .9 Screen each detector to prevent entrance of insects into detection chamber(s).
 - .5 2-Wire Smoke Detectors: detector circuits of 2-wire type capable of transmitting detector operating power over initiating circuit are permitted, provided detectors used are approved by control panel manufacturer for use with
-

control panel provided and are ULC listed as being compatible with control panel.

- .1 Total number of detectors on any detection circuit: not exceed 80% of maximum number of detectors allowed by control panel manufacturer for that circuit. Provide additional zones if required to meet this requirement.
- .6 Ionization Detectors: multiple chamber type responsive to both invisible and visible particles of combustion.
 - .1 Detectors: not susceptible to operation by changes in relative humidity.
- .7 Photoelectric Detectors: operate on light scattering principle using LED light source.
 - .1 Detector: respond to both flaming and smoldering fires.
- .8 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72.
- .9 Mount detectors at underside of ceiling or deck above unless otherwise indicated.
- .10 Temperature rating of detectors: in accordance with NFPA 72.
- .11 Locate detectors minimum 300mm from lighting fixtures and not closer than 600mm to air supply or return diffuser.
- .12 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.
- .13 Provide detectors with terminal screw type connections.
- .14 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.7 DUCT SMOKE DETECTORS

- .1 Provide detectors installed in ducts of photoelectric type and listed by ULC duct installation.
 - .2 Provide integral control and power modules required for operation with main control panel.
 - .3 Ensure detectors and associated modules are compatible with main control panel and suitable for use in supervised circuit.
 - .4 Provide duct detectors with approved duct housing, mounted exterior to duct, with perforated sampling tubes extending across width of duct.
-

- .5 Activation of duct detectors to cause shutdown of associated air handling unit, annunciation at control panel and sounding of building evacuation alarms.
- .6 Provide detectors with visible indicator lamp that flashes when detector is in normal standby mode and glows continuously when detector is activated.
- .7 Provide remote indicator lamp for each detector.
- .8 Permanently label remote indicator with description of associated air handling unit(s).
- .9 Provide each detector with remote test switch. Mount switch not more than 1.2m above finished floor.
- .10 Permanently label test switch with description of associated air handling unit(s).

2.8 AUDIBLE SIGNAL DEVICES

- .1 Audible device(s):
 - .1 Horns: 99 db, surface mounting, 24 V dc.
- .2 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.
- .3 Provide appliances specifically listed for outdoor use in locations exposed to weather.
- .4 Finish appliances in red enamel.
- .5 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.9 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit.

2.10 REMOTE ANNUNCIATOR PANELS

- .1 Provide panel[s] where indicated mounted 1.5m above finished floor elevation.
 - .2 Panels: duplicate requirements for control panel annunciator, with exception of individual trouble lamps are not required.
 - .3 LCD Screen
 - .4 Wired in multiple with main control panel and with other remote annunciator panels.
 - .5 Supervised.
-

- .6 Test button.

2.11 VISUAL ALARM SIGNAL DEVICES

- .1 Surface-mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuit[s].
- .2 Appliances: minimum of 30 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location shown.
- .3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12mm high.
- .4 Visible appliances may be part of audio-visual assembly.

2.12 CONDUIT

- .1 Electrical Metallic Tubing (EMT)

2.13 WIRING

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor. Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .2 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.
- .3 Insulation 75 degrees C minimum with nylon jacket.
- .4 Colour code wiring.

2.14 SURGE SUPPRESSION

- .1 Provide line voltage and low voltage surge suppression devices to suppress voltage transients which might damage control panel components.

2.15 SPARE PARTS

- .1 The following parts shall be turned over to the owner at completion of the project for maintenance purposes:
 - .1 12x spare glass rods for manual pull stations.
 - .2 5x heat detectors
 - .3 5x smoke detectors
 - .4 1x duct smoke detector
 - .5 2x manual pull stations
 - .6 2x horns
 - .7 1x horn/strobe
 - .8 5x zone cards
 - .9 2x horn/strobe/bell circuit cards
-

- .10 5x control panel fuses, as applicable
- .11 1x replacement CPU for Control Panel

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .2 Install main control panel and connect to ac power supply.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 Connect alarm circuits to main control panel.
- .6 Locate and install horns and visual signal devices and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.
- .10 Locate and install door releasing devices.
- .11 Locate and install remote relay units to control fan shut down.
- .12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .13 Connect fire suppression systems to control panel.
- .14 Connect and Program DACT.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - for Electrical and CAN/ULC-S537.
 - .2 Fire alarm system:
-

- .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm.
- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
- .4 Class A circuits.
 - .1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .2 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 TRAINING

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

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

Contents

- 1. Telecommunications Cabling 2
- 2. Telecommunications Cabling - General Requirements 2
- 3. Telecommunications Cabling – Specifications 3
- 4. Preferred Component Manufacturer and Installer Certification 6
- 5. Shop Drawings 7
- 6. Warranty 7

1. Telecommunications Cabling

The Treasury Board of Canada provides a list of specifications for telecommunications cabling in government (Federal) owned or leased premises. This section provides specifications that are to be used in this project and are considered a proprietary enhancement of those in TBITS 6.9, and those listed in Annex II.

TBITS 6.9.1.1 reads "Occupants' security requirements, particularly in multi- organization buildings, should be determined by referring to information technology security standards published by the Departmental Security Section and by completing a Threat and Risk Assessment."

Departmental Security policy indicates that voice and data cable terminations are not to be housed in the same room, thus overriding the concept of shared telecommunication spaces described in TBITS.

In locations where the servers are housed in the same room as the LAN cabling Termination, pursuant to the Property Management Fit-Up Standards, the LAN (Server) Room cannot be the same as the Telephone Room.

2. Telecommunications Cabling - General Requirements

- a. All new installations of data cabling for Managed LANs:
 - i. Must be Category 6 (UTP) certified installation.
 - ii. Will be installed based on a zoned system.
 1. The zone must not exceed 55.7 square meters (600 square feet).
 - a. Must be installed on a "home-run" basis from the user area to the telecommunication closet or the area assigned by Network Services.
 - iii. Which is run overhead, must be supported by either meshed-basket type data cable trays, or "J-hooks", installed in accordance with Category 6 specifications. The use of ladder-style or electrical cable trays is not permitted.
 1. If conduits or trays are required, the bidder will provide a detailed design plan, including the physical layout, size, length, and type.
 - iv. Where necessary to bundle cables together, use hook and loop style strapping of a width no less than one (1)cm (3/8in). **Plastic wire ties must not be utilized.**
- b. If solid walls cannot be accessed then surface mount wire mold may be used.

- i. The wire mold run must be continuous from the termination box to the floor or ceiling. At no point during the run must the cable be exposed.
- c. All cables must be clearly labeled with self-laminating ID labels at no more than 0.2 meters from the user area termination point of the cable.
- d. All cable not installed in conduit, wire mold and/or trays must be supported by J-hooks attached to the structure of the building every two meters or less.
- e. All network cabling installations must comply with:
 - i. Municipal By-Laws and Building Codes
 - ii. Provincial Building and Electrical Codes
 - iii. The National Building Code
 - iv. The Canadian Labor Code
 - v. The National Fire Code
 - vi. The Canadian Electrical Code

3. Telecommunications Cabling – Specifications

- a. Each identified workspace shall have a minimum of three (two Data and one Voice/Data) Unshielded Twisted Pair ports (RJ45) installed.
- b. All structured cabling shall consist of Belden/CDT Category 6 rated infrastructure.
- c. Unless physical limitations prevent it, the terminations will all be in the same wall port at the user area end, with a flush mounted wall port.
- d. All drops will:
 - i. Terminate in the LAN room at the LAN equipment cabinet.
 - 1. In the event that termination inside the LAN cabinet is not physically attainable, the termination strip can be mounted in a common-facilities cabinet or similar implement.
 - a. This situation can only exist if approved by the Network Services representative, and is on an exception basis.
 - b. Electronic floor/as-built plans of all new construction, including the location and identification number of the data ports, will be provided to the Network Services representative upon completion of the project.
 - ii. Be punched down using the TIA-568-A jack format.

- iii. Terminate in high capacity patch panels with a density of 48 ports per 2U of rail space, supplied by the contractor.
 - 1. There shall be one patch panel per functional grouping i.e. One panel for user data drops, one panel for user telephone drops and one panel for telephone trunk lines.
 - a. Refer to appendix for diagram indicating required patch panel locations.
 - b. Install 2U horizontal cable manager below every patch panel.
 - 2. Termination jacks at the patch panel should be colour matched to patch panel.
 - a. The preferred colour is black or dark brown.
 - 3. Drops in patch panels will be labeled consecutively in the patch panel, starting with the top left port and ending with the bottom right port.
 - a. Must be labeled using a professional labeler. They cannot be hand written.
 - b. Numbering starts at port 1 and ends at port 48, per panel.
 - c. Each panel will have a prefix label to denote its function.
 - i. All **user data patch panels** will be terminate data wiring drops running to the user data ports.
 - 1. The labeling scheme for user data patch panels will be D-A-01 through D-A-48 for the first panel, and D-B-01 through D-B-48 for the second panel, etc.
 - ii. All **user telephone patch panels** will terminate telephone wiring drops running to the user telephone ports.
 - 1. The labeling scheme for user telephone patch panels will be V-A-01 through V-A-48 for the first panel, and V-B-01 through V-B-48 for the second panel, etc.
 - iii. All **telephone trunk patch panels** will terminate category 6 telephone trunk lines running to the telephone backer board.
 - 1. The labeling scheme for telephone trunk patch panels will be VT-A-01 through VT-A-48 for the first panel and VT-B-01 through VT-B-48 for the second panel, etc.

- iv. Have a **minimum of five (5) meter cable reserve on the user end and three (3) meter reserve on the distribution end**, for future relocation. The cable reserves must not be coiled on the distribution end. For sites with more than 240 ports, the distribution end can be scaled back. All slack at the distribution end must be bundled in an “S” or “U” format.
 - v. Be tested by the installer to comply with the Category 6 specifications noted in TIA-568-B.2, with soft copies of the test results provided to the Regional Network Services representative for the project.
 - vi. Terminate at the user area in a wall plate or furniture mounted MUTOA.
 - vii. Have user end jacks colored:
 - 1. Beige or White for data (colour matches faceplate).
 - 2. Blue for phone.
 - viii. Be labeled with a professional labeler at the user area end. Drop labels cannot be hand written.
 - 1. Identification will be the same as used in the patch panel end of run.
 - ix. Be located and identified on electrical page of as-built drawings.
- e. Supply Patch Cables
- i. Of the same manufacturer as the horizontal cabling.
 - ii. Of the same specification as the horizontal cabling.
 - iii. Which are bootless and snag less with strain relief (UTP).
 - iv. Of lengths and quantities consisting of:
 - 1. A quantity of 3.04 meter (10 foot) Category 6 white or grey patch cable equal to $\frac{2}{3}^{\text{rd}}$ the total user are drops.
 - 2. A quantity of 0.6 meter (2 foot) Category 6 white or grey patch cables equal to $\frac{2}{9}$ ths the total user area drops.
 - 3. A quantity of 0.9 meter (3 foot) Category 6 white or grey patch cables equal to $\frac{2}{9}$ ths the total user area drops.

4. A quantity of 1.2 meter (4 foot) Category 6 white or grey patch cables equal to (2/9ths) of the total user area drops.
 5. A number of 0.6 meter (2 foot) Category 5 blue patch cables equal to 1/9th the total user area drops.
 6. A number of 0.9 meter (3 foot) Category 5 blue patch cables equal to 1/9th the total user area drops.
 7. A number of 1.21 meter (4 foot) Category 5 blue patch cables equal to 1/9th the total user area drops.
- f. Install one Category 6 voice trunk line per voice circuit installed by the telephone services provider plus add 25% more drops for future expansion.
- i. Terminate trunks at LAN cabinet in voice trunk patch panels.
 1. Use TIA-568-A jack format.
 - ii. Run cables from LAN cabinet to telephone services backer board via overhead cable tray.
 - iii. Leave enough slack to reach any location on telephone services backer board.
 - iv. Label un-terminated ends of cable with id number of the run using a self-laminating label.
 - v. Tie back un-terminated ends to plywood backer board using suitable hardware such as d-rings.
 - vi. Install a 2U horizontal cable manager below each patch panel.

4. Preferred Component Manufacturer and Installer Certification

- a. Belden/CDT structured cabling products must be used. Belden has a proven track record with the owner and by using Belden products, maintains uniformity throughout the organization.
- b. The Contractor shall be a Belden Certified System Vendor (CSV) experienced and trained by the manufacturing company, in all aspects of the placement, terminating, connecting and testing of products described herein and provide certificate of proof

prior to start of work.

- c. The Contractor shall have a minimum of one (1) RCDD “Registered Communications Distribution Designer” recognized by BICSI “Building Industry Consulting Services International” on staff at local offices (the term “Local offices” as applied to RCDD, Registered Communications Distribution Designers, refers to anywhere in the Province of Manitoba) and provide certificate of proof prior to start of work.
- d. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall demonstrate proven expertise in the implementation of network cabling. Expertise can be illustrated through the inclusion of details of at least three projects involving the design and installation of a Category 5e, Category 6, or Augmented Category 6 (Cat 6A) balanced twisted-pair cabling system within the past two-year period. Names and contact information for each of the three projects shall be included. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and proposed Category 6 metallic premise distribution systems and have personnel who are adequately trained in the uses of such tools and equipment.

5. Shop Drawings

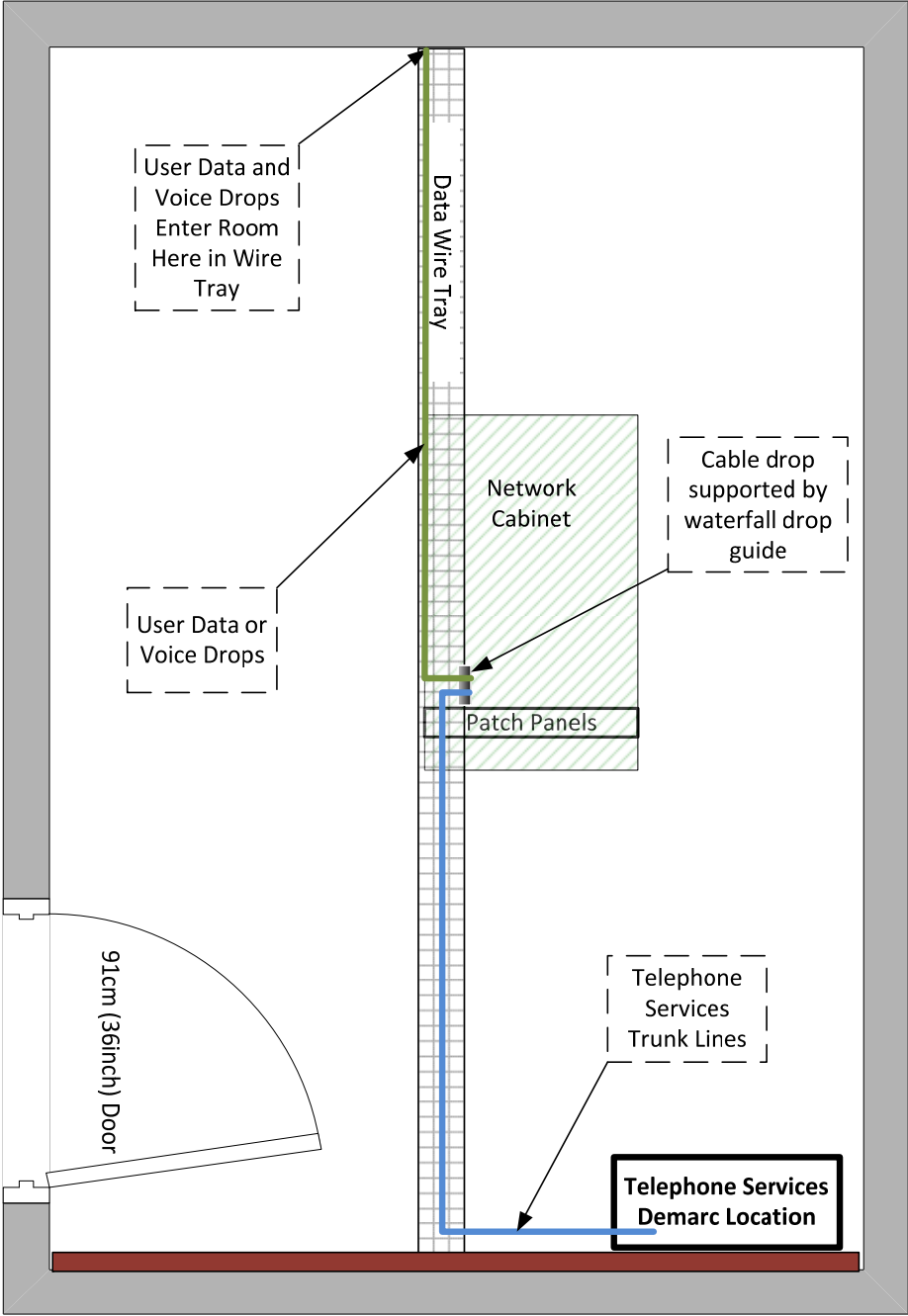
- a. Submit shop drawings and product data, for:
 - i. UTP communication câble.
 - ii. Cable management.
 - iii. Patch panels and patch cords.
 - iv. Communication Outlets.
 - v. Bix mounts, connectors, adapters.

6. Warranty

- a. The warranty period with regard to the project is for 25 years from the date of Substantial Performance of the Work or those periods specified in the Contract Documents for certain portions of the Work of Products.
- b. The Contractor shall be responsible for the proper performance of the work.
- c. The Contractor shall correct promptly, at the Contractor’s expense, defects or deficiencies in the Work which appear prior to and during the warranty periods specified in the Contract Documents.

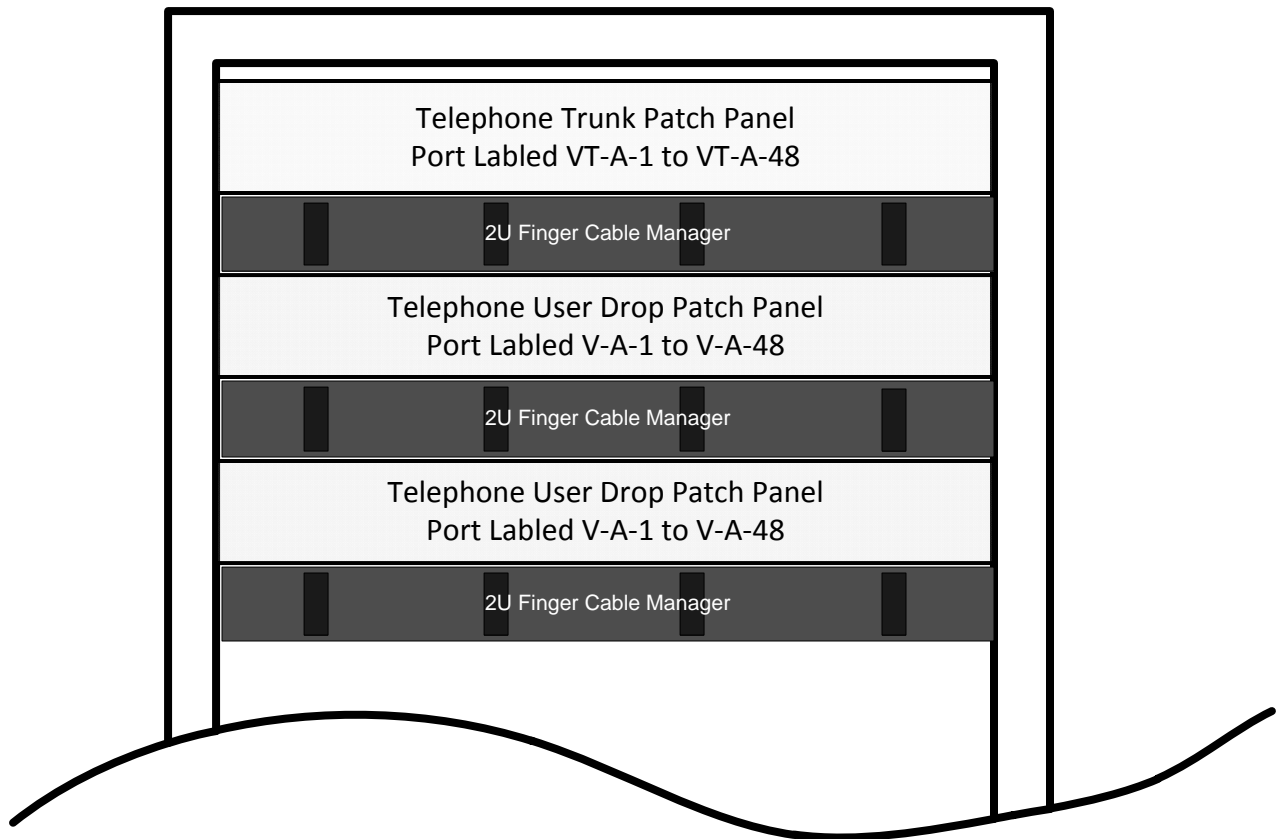
- d. The Owner, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.
- e. The Contractor shall correct or pay for damages resulting from corrections made under the requirements of paragraph 1.8.3.
- f. The Contractor shall be responsible for obtaining Product warranties in excess of one year on behalf of the Owner from the manufacturer. These product warranties shall be issued by the manufacturer to the benefit of the Owner.
- g. The Contractor shall provide a twenty-five (25) year Extended Product Warranty and Lifetime Application Assurance Warranty for the Communications Network. This warranty shall be backed up by the manufacturer and taken over by the manufacturer or his representative if the Contractor fails to follow through with the requirements of the warranty.
- h. The Communications Network is defined as all required passive equipment and cabling, including hardware, terminations, and jacks, configured to provide data and voice connectivity from each data or voice outlet provided by the Contractor in this Contract.
- i. The System Assurance shall cover the applications that the installed system is designed to support for a twenty-five (25) year period.
- j. The Extended Product Warranty and the Systems Assurance together comprise the Structured Cabling System Quality Assurance Program.
- k. Upon successful completion of the Structured Cabling System installation and subsequent testing by certified technical personnel the Contractor shall provide to the Owner a numbered certificate registering the installation.

Appendix A: LAN Room Layout and Cabling route



Appendix B: LAN Cabinet Patch Panels

Top of LAN Cabinet Viewed from patch panel end.



PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Entire Specification Book.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D 698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A3000-08, Cementitious Materials Compendium.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
 - .1 Pay costs of relocating services.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples: submit to designated testing agency, 23 kg sample of backfill for unshrinkable fill material proposed for use, no later than 1 week before backfilling or filling work.
- .3 Site Quality Control Submittals: submit in accordance with Section 01 45 00 - Quality Control.
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article.
 - .2 Submit testing results and report as described in PART 3 - FIELD QUALITY CONTROL.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Type 1 fill:
 - .1 Crushed, pit run or screened stone, gravel or sand.
-

.2 Graduations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 **Table:**

Sieve Size	Pit-Run Gravel (AT D6-C80)	Fill Sand
80 mm	100	-
50 mm	55 - 100	-
25 mm	38 - 100	100
16 mm	32 - 85	-
5 mm	20 - 65	75-100
630 µm	-	45-80
315 µm	6 - 30	-
80 µm	2 - 10	2-10

.3 **Table:**

Sieve Size	20 mm Crush (AT D2-C20)	40 mm Crush (AT D2-C40)
40 mm	-	100
25 mm	-	70 - 94
20 mm	100	-
16 mm	84 - 94	55 - 85
10 mm	63 - 86	44 - 74
5 mm	40 - 67	32 - 62
1.25 mm	20 - 43	17 - 43
630 µm	14 - 34	12 - 34
315 µm	9 - 26	8 - 26
160 µm	5 - 18	5 - 18
80 µm	2 - 10	2 - 10

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Evaluation and Assessment:

- .1 Examine soil report available at Consultant's office.
- .2 Before commencing work verify establish locations of buried services on and adjacent to site.

3.2 PREPARATION

- .1 Temporary erosion and sedimentation control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Consultant's approval.
 - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
 - .5 Protect buried services that are required to remain undisturbed.
- .3 Removal:
 - .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Territorial regulations whichever is more stringent.
 - .2 Perform blasting in accordance with Territorial regulations: repair damage as authorized by Consultant.
 - .1 Do not blast within 3 m of building and where damage would result.
 - .3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .1 Stockpile topsoil on site for later use.
-

- .4 Excavate as required to carry out work.
 - .1 Do not disturb soil or rock below bearing surfaces.
 - .2 Notify Consultant when excavations are complete.
 - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .4 Excavation taken below depths shown without Consultant's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .5 Excavate for slabs and paving to subgrade levels.
 - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and unshrinkable fill will be carried out by testing laboratory designated by Consultant.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Do not begin backfilling or filling operations until material has been approved for use by Consultant.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify Consultant to allow compaction tests to be carried out by designated testing agency.

3.5 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of the following:
 - .1 Consultant has inspected and approved installations.
 - .2 Consultant has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil materials.
 - .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
 - .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
-

- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
 - .1 Fill excavated areas with gravel and sand compacted as specified for fill.
- .5 Placing:
 - .1 Place backfill, fill and base course material in 150 mm lifts: add water as required to achieve specified density.
- .6 Compaction: compact each layer of material to following densities for material to ASTM D 698:
 - .1 To underside of base courses: 95%.
 - .2 Base courses: 100%.
 - .3 Elsewhere: 90%.
- .7 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .8 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material
- .9 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 75 mm diameter within 600 mm of structures.
- .10 Underground tanks: use sand to bottom of granular base courses or to bottom of topsoil, as applicable.

3.6 GRADING

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Consultant.
 - .1 Grade to be gradual between finished spot elevations shown on drawings.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

