

NMS Sections

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Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for demolishing, salvaging, recycling and removing sitework items designated to be removed in whole or in part.
- .2 Related Sections.
 - .1 Section 02 61 33 - Hazardous Materials.

1.2 REFERENCES

- .1 Canadian Council of Ministers of the Environment (CCME).
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

1.3 DEFINITIONS

- .1 Demolition: rapid destruction of building following removal of hazardous materials.
- .2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being or environment if handled improperly.
- .3 Waste Audit (WA): detailed inventory of materials in building. Indicates quantities of reuse, recycling and landfill.
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
 - .2 Indicates quantities of reuse, recycling and landfill.
- .4 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .5 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.4 SUBMITTALS

- .1 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.
- .2 Shop drawings.
- .3 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.

1.5 QUALITY ASSURANCE

- .1 Site Meetings.
 - .1 Arrange for site visit with Contract Administrator to examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .2 Ensure key personnel attend.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection.
 - .1 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to Contract Administrator.
 - .2 Remove and store materials to be salvaged, in manner to prevent damage.
 - .3 Store and protect in accordance with requirements for maximum preservation of material.
 - .4 Handle salvaged materials as new materials.
- .2 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling.
 - .2 Divert excess materials from landfill to site approved by Contract Administrator.
 - .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.
 - .4 Label location of salvaged material's storage areas and provide barriers and security devices.
 - .5 Ensure emptied containers are sealed and stored safely.
 - .6 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt, and gypsum.
 - .7 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

1.7 SITE CONDITIONS

- .1 Site Environmental Requirements.
 - .1 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout the project.

- .2 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Contract Administrator.
- .4 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .2 Existing Conditions.
 - .1 Remove contaminated or hazardous materials listed as hazardous as defined by authorities having jurisdiction as directed by Contract Administrator from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance with TDGA and other applicable regulatory requirements and Section 02 61 33 - Hazardous Materials.
 - .2 List of hazardous materials:
 - .1 Asbestos has been identified on various pipes and may be present in wall penetration sleeve insulation, and other locations.

1.8 SCHEDULING

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 Notify Contract Administrator in writing when unforeseen delay[s] occur.

Part 2 Products

2.1 EQUIPMENT

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

- .1 Inspect site with Contract Administrator and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition as required.
- .4 Disconnect and Cap Designated Mechanical Services.
 - .1 Natural Gas Supply Lines: remove as shown on the drawings.
 - .2 Domestic Cold Water Lines: remove as shown on the drawings.
 - .3 Drain Lines: remove as shown on the drawings.
 - .4 Exhaust piping: remove as shown on the drawings.
 - .5 Combustion Air Piping: remove as shown on the drawings.

- .6 Disconnect all other mechanical devices as may be required for the engine and base plate (base frame) removal and replacement.
- .5 Disconnect electrical services and controls:
 - .1 As indicated on the drawings
 - .2 As may be required for the engine and base plate (base forms) removal and replacement.

3.2 REMOVAL OF HAZARDOUS WASTES

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 REMOVAL OPERATIONS

- .1 Remove items as indicated.
- .2 Do not disturb items designated to remain in place.

3.4 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to [conditions that existed prior to beginning of Work.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.5 CLEANING

- .1 Remove debris, trim surfaces and leave work site clean, upon completion of Work
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

1.2 REFERENCES

- .1 Export and Import of Hazardous Waste Regulations SOR/2002-300.
- .2 National Fire Code of Canada 2005.
- .3 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).
- .4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.3 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): a Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section CW1110 General Instructions.
- .2 Submit to Contract Administrator current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.
- .3 Submit hazardous materials management plan to Contract Administrator that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.5 STORAGE AND HANDLING

- .1 Co-ordinate storage of hazardous materials with Contract Administrator and abide by internal requirements for labelling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

- .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Contract Administrator.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
- .11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements. Report spills or accidents immediately to Contract Administrator. Submit a written spill report to Contract Administrator within 24 hours of incident.

1.6 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
- .3 If hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Contract Administrator.
 - .2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label container[s] with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Contract Administrator.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Contract Administrator.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Contract Administrator and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials required to perform work.
- .2 Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Removal as specified of trowel-applied asbestos-containing material located at site except where removal is considered impracticable by the Contract Administrator.
- .2 Removal (other than defined minor amounts) of friable materials containing asbestos.
- .3 Removal of amosite or crocidolite asbestos-containing materials.
- .4 Use of power tools that are fitted with dust collectors equipped with HEPA filter to cut, shape, grind, drill, scrape, or abrade manufactured products containing asbestos.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos-Fibre-Releasing Materials.
- .2 Canadian Standards Association (CSA International).
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, (CEPA), 1999.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .6 Underwriters' Laboratories of Canada (ULC).
- .7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH).
 - .1 NIOSH 94-113-August 1994, NIOSH Manual of Analytical Methods (NMAM), 4th Edition.
- .8 U.S. Department of Labour – Occupational Safety and Health Administration – Toxic and Hazardous Substances.
 - .1 29 CFR 1910.1001-2001, Asbestos Regulations.

1.3 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

- .3 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions Article, including fallen materials and settled dust.
- .4 Asbestos Work Area: Area where actual removal and sealing and enclosure of spray or trowel-applied asbestos-containing materials takes place.
- .5 Authorized Visitors: Departmental Representative[s], [Engineer[s], Contract Administrator or designated representatives, and representatives of regulatory agencies.
- .6 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .7 Occupied Area: any area of building or work site that is outside Asbestos Work Area.
- .8 Polyethylene sheeting sealed with tape: Polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.
- .9 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm polyvinyl-chloride bag.
 - .2 Integral 0.25 mm thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double-pull double throw zipper on top.
 - .4 Straps for sealing ends around pipe.
 - .5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.
- .10 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.
- .11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.
 - .1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.
- .13 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.
- .14 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

- .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
- .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
- .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

1.4 SUBMITTALS

- .1 Before beginning work:
 - .1 Obtain from appropriate agency and submit to Contract Administrator necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Contract Administrator that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .2 Submit proof satisfactory to Contract Administrator that employees have had instruction on hazards of asbestos exposure, respirator use, dress, use of showers, entry and exit from work areas, and aspects of work procedures and protective measures. Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by the Contract Administrator. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.
 - .3 Submit layout of proposed enclosures and decontamination facilities to the Contract Administrator for review.
 - .4 Submit documentation including test results for sealer proposed for use.
 - .5 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
 - .6 Submit proof of Contractor's Asbestos Liability Insurance.
 - .7 Submit proof satisfactory to Contract Administrator that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with respirator that is personally issued.
 - .8 Submit Worker's Compensation Board status and transcription of insurance.
 - .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:
 - .1 encapsulants;
 - .2 amended water;
 - .3 slow-drying sealer.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:

- .1 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
 - .1 Respirator equipped with HEPA filter cartridges or supplied-air type, personally issued to worker and marked as to efficiency and purpose, and acceptable to Authority having jurisdiction as suitable for type of asbestos and level of asbestos exposure in Asbestos Work Area. If disposable type filters are used, provide sufficient filters so that workers can install new filters following disposal of used filters and before re-entering contaminated areas.
 - .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.
 - .2 Requirements for each worker:
 - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
 - .2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated worksuits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.
 - .3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.
 - .4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.
 - .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

- .4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
- .5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

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 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .7 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.7 SCHEDULING

- .1 Not later than ten (10) days before beginning Work on this Project notify required Authorities. This may include:
 - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
 - .2 Regional Office of Labour Canada.
 - .3 Provincial/Territorial, Department of Labour.
 - .4 Disposal Authority.

- .2 Inform sub-trades of presence of friable asbestos-containing materials identified in Existing Conditions.
- .3 Submit to Contract Administrator copy of notifications prior to start of Work.

1.8 OWNER'S INSTRUCTIONS

- .1 Before beginning Work, provide to Contract Administrator satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

Part 2 Products

2.1 MATERIALS

- .1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Contract Administrator, mixed with water in concentration to provide adequate penetration and wetting of asbestos-containing material.
- .5 Asbestos waste containers: Metal or fibre - type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.
 - .1 Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001.
- .6 Encapsulants : Type 1 penetrating] type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.
- .7 Glove bag: acceptable materials include safe-T-strip products in configuration suitable for Work, or alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.

- .1 Equip glove bags intended for use in more than one location with reversible, double-pull, double-throw zipper on top and at approximately mid-section of bag.
- .8 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

Part 3 Execution

3.1 PREPARATION

- .1 Work Areas:
 - .1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.
 - .2 Preclean fixed casework, plant, and equipment within proposed work area[s], using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
 - .3 Clean proposed work area[s] using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.
 - .4 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument.
 - .5 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
 - .6 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use one layer[s] of FR polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.
 - .7 Build airlocks at entrances to and exits from work area[s] so that work area[s] are always closed off by one curtained doorway when workers enter or exit.
 - .8 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used : "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".
 - .9 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Contract Administrator. Use localized water spraying during fixture removal to reduce fibre dispersal.
 - .10 Maintain emergency and fire exits from work area[s].

- .11 Where application of water is required for wetting asbestos-containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .12 After preparation of work area[s] and Decontamination Enclosure Systems remove plaster ceilings, including lath, furring, channels, hangers, wires, clips, and dispose of as contaminated waste in specified containers. Spray ceiling debris and immediate work area with amended water to reduce dust, as work progresses.
- .2 Worker Decontamination Enclosure System:
 - .1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:
 - .1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work area[s], with two curtained doorways, one to Shower Room and one to work area[s]. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work area[s]. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.
 - .2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Contract Administrator before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
 - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .3 Container and Equipment Decontamination Enclosure System:
 - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.
 - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.
 - .2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding

- Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.
- .3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
 - .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.
- .4 Construction of Decontamination Enclosures:
- .1 Build suitable framing for enclosures, and line with polyethylene sheeting sealed with tape. Use one layer of FR polyethylene on floors.
 - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .5 Separation of Work Areas from Occupied Areas:
- .1 Separate parts of building required to remain in use from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:
 - .1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.
 - .2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.
- .6 Maintenance of Enclosures:
- .1 Maintain enclosures in tidy condition.
 - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
 - .3 Visually inspect enclosures at beginning of each working period.
 - .4 Use smoke methods to test effectiveness of barriers when directed by Contract Administrator.
- .7 Do not begin Asbestos Abatement work until:
- .1 Arrangements have been made for disposal of waste.
 - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
 - .3 Work area[s] and decontamination enclosures [and parts of building required to remain in use, are effectively segregated.
 - .4 Tools, equipment, and materials waste containers are on hand.
 - .5 Arrangements have been made for building security.
 - .6 Warning signs are displayed where access to contaminated areas is possible.

.7 Notifications have been completed and other preparatory steps have been taken.

3.2 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.3 ASBESTOS REMOVAL

- .1 Before removing asbestos:
 - .1 Prepare site.
 - .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brushed and wet-sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .5 Where Contract Administrator decides complete removal of asbestos-containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos-containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:
 - .1 Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25 mm minimum.
- .6 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos-containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. [After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by Contract Administrator apply continuous coat of slow-drying sealer to surfaces of work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.

3.4 ASBESTOS ENCAPSULATION

- .1 Before encapsulating asbestos:
 - .1 Prepare site.
 - .2 Vacuum surfaces in work areas except those to be sealed, using HEPA vacuum to remove loose debris and dust particles.
 - .3 Repair damaged and missing areas of existing sprayed asbestos to obtain suitable base for sealing and to restore continuity of fireproofing. Use specified asbestos-free fireproofing material. Prepare surfaces and apply fireproofing in accordance with manufacturer's printed instructions.
 - .4 Remove loose asbestos and pack in sealable plastic bags 0.15 mm minimum thick and place in labelled waste containers for transport.
 - .5 Seal filled waste containers. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination washroom. Wash waste containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that waste containers are removed from holding areas by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .2 Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniform depth of 25 mm minimum.
- .3 After sealing asbestos surfaces wet clean the entire work area including Equipment and Access Room, and equipment used in the process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning.
- .4 Install warning signs in both official languages in 25 mm sans serif letters worded as follows: **WARNING - SEALED ASBESTOS/ATTENTION AMIANTE ENCAPSULÉ.** Install signs as directed by Contract Administrator.

3.5 ASBESTOS ENCLOSURE

- .1 Before enclosing asbestos:
 - .1 Prepare site.
 - .2 Vacuum surfaces in work areas, except asbestos surfaces, using HEPA vacuum equipment to remove loose debris and dust particles.
 - .3 Spray areas to be disturbed while securing hangers and other fixing devices. Use water containing specified wetting agent. Keep asbestos material damp to prevent release of airborne fibres.
 - .4 Remove loose asbestos and pack in sealable plastic bags 0.15 mm minimum thickness and place in labelled containers for transport.
 - .5 Seal filled waste containers. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination washroom. Wash waste containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to

Unloading Room and outside. Ensure that waste containers are removed from holding areas by workers who have entered from uncontaminated areas dressed in clean coveralls.

- .2 After installation of hangers and other fixing devices and before enclosing asbestos, repair damaged and missing areas of existing sprayed-on material using specified asbestos-free fireproofing material. Prepare surfaces and apply fireproofing or thermal insulation in accordance with manufacturer's printed instructions.
- .3 After enclosing asbestos surfaces, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning.
- .4 Install warning signs at locations directed by Contract Administrator in both official languages in 25 mm sans serif letters worded as follows: WARNING: ENCLOSED ASBESTOS/ATTENTION: AMIANTE ENCOFFRÉ.

3.6 PIPE INSULATION REMOVAL USING GLOVE BAG

- .1 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
- .2 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
- .3 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.
- .4 When glove bags are intended for use at more than one location: after wash-down and application of sealer, seal off waste in lower section of bag using zipper at mid-section of bag. Remove air from top section of bag through elasticized valve using HEPA vacuum. Remove bag from pipe, reinstall in new location, and reseal to pipe prior to opening lower section of bag. Repeat stripping operation.
- .5 If bag is to be moved along pipe, first remove air from top section through elasticized valve using HEPA vacuum. Next loosen straps, move bag, re-seal to pipe using double-pull zipper to pass hangers. Repeat stripping operation.
- .6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.
- .7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow-drying sealer to seal in any residual fibres.

- .8 Upon completion of work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

3.7 FINAL CLEANUP

- .1 Following cleaning and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by membrane filter method at 400-500X magnification phase contrast illumination, as described in NIOSH 94-113 or equivalent, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos-containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.
- .5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air-monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.8 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 When cleanup is complete:
 - .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
 - .2 Re-secure mounted objects removed in course of Work in their former positions.
 - .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
 - .4 Repair or replace objects damaged in the course of Work, as directed by Contract Administrator.

3.9 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Contract Administrator to take air samples on daily basis outside of work area enclosure in accordance with Health Canada recommendations.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
 - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
 - .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.
- .3 During course of Work, Contract Administrator to measure fibre content of air outside work areas by means of fibrous aerosol monitors (FAM).
 - .1 When FAM readings exceed 0.25 f/cc adopt more stringent work procedures immediately and carry out PCM test.
 - .2 Stop Work when PCM measurements exceed 0.01 f/cc and correct procedures.
- .4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Contract Administrator will perform air monitoring within Asbestos Work Area.
 - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
 - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
 - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

3.10 INSPECTION

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation[s] from these requirements that have not been approved in writing by Contract Administrator may result in Work stoppage , at no cost to Owner.
- .2 Contract Administrator will inspect Work for:
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Contract Administrator may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D1751-99, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-A23.2-00, Methods of Test for Concrete.
 - .3 CAN/CSA-A3000-98-A5-98, Portland Cement.
 - .4 CAN/CSA-G30.5-M1983(R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
 - .5 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.

1.2 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
 - .2 Submit drawings showing formwork and falsework design to: CAN/CSA-A23.1.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 Use trigger operated spray nozzles for water hoses.
- .5 Designate cleaning area for tools to limit water use and runoff.

Part 2 Products

2.1 MATERIALS

- .1 Portland cement with 40% fly ash replacement: to CAN/CSA-A3000-A5, Type [10].
- .2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
- .3 Welded steel wire fabric: to CAN/CSA-30.5.

- .4 Premoulded joint filler:
 - .1 Bituminous impregnated fibreboard: to ASTM D1751.
- .5 Joint sealer/filler: grey to CAN/CGSB-19.24, Type 1, Class B.
- .6 Sealer: boiled linseed oil, mixed with mineral spirits 1:1, proprietary poly-siloxane resin blend.
- .7 Other concrete materials: to CAN/CSA-A23.1.

2.2 MIXES

- .1 Proportion concrete in accordance with CAN/CSA-A23.1.
- .2 Minimum compressive strength at 28 MPa as specified by Engineer, Contract Administrator.
- .3 Class of exposure: N to CAN/CSA-A23.1.
- .4 Nominal maximum size of coarse aggregate: to CAN/CSA-A23.1.
- .5 Slump: to CAN/CSA-A23.1.
- .6 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1, Table 10.
- .7 Admixtures: to CAN/CSA-A23.1.

Part 3 Execution

3.1 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

3.2 INSERTS

- .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Contract Administrator.

3.3 FINISHES

- .1 Formed surfaces exposed to view: [sack rubbed finish] in accordance with CAN/CSA-A23.1.
- .2 Equipment pads: provide smooth trowelled surface.

3.4 CONTROL JOINTS

- .1 Cut and form control joints in slabs on grade at locations indicated, in accordance with CAN/CSA-A23.1 and install specified joint sealer/filler.

3.5 EXPANSION AND ISOLATION JOINTS

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.

3.6 CURING

- .1 Cure and protect concrete in accordance with CAN/CSA-A23.1.
 - .1 Do not use curing compounds where bond is required by subsequent topping or coating.

3.7 SITE TOLERANCES

- .1 Concrete floor slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.8 FIELD QUALITY CONTROL

- .1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Contract Administrator. Accelerated test methods will apply.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section CW1110 – General Instructions.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A36/A36M-01, Specification for Structural Steel.
 - .2 ASTM A193/A193M-01b, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - .3 ASTM A307- 00, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - .4 ASTM A325- 02, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M- 00, Specification for High-Strength Bolts for Structural Steel Joints Metric .
 - .6 ASTM A490M- 00, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10- 99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA 1- 73b , Quick-Drying, One-Coat Paint for Use on Structural Steel.
 - .2 CISC/CPMA 2- 75, Quick-Drying, Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA G40.20/G40.21- 98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164- M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16- 01, Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136- 94(R2001), Cold Formed Steel Structural Members.
 - .5 CSA-S136.1- 95(R2001), Commentary on CSA Standard S136.
 - .6 CSA W47.1- 92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .7 CSA W48- 01, Filler Metals and Allied Materials for Metal Arc Welding.
 - .8 CSA W55.3- 1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .9 CSA W59- M1989(R2001) , Welded Steel Construction (Metal Arc Welding) Metric .
- .5 Master Painters Institute

- .1 MPI-INT 5.1- 98, Structural Steel and Metal Fabrications.
- .2 MPI-EXT 5.1- 98, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC)
 - .1 SSPC SP-6/NACE No. 3- 00, Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Manitoba, Canada for non standard connections.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section CW1110 – General Instructions.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of Manitoba, Canada.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused metal materials from landfill to metal recycling facility approved by Contract Administrator.
- .3 Divert unused paint material from landfill to official hazardous material collections site approved by Contract Administrator.
- .4 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel: to CAN/CSA-G40.20/G40.21, Grade 300W as indicated.
- .2 Anchor bolts: to CAN/CSA-G40.20/G40.21, Grade 300W, ASTM A36/A36M or as indicated.
- .3 Bolts, nuts and washers: to ASTM A307 A490/A490M .
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer: to CISC/CPMA1, SSPC SP-6 .
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².
- .7 Shear studs: to CSA W59, Appendix H.

2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal members by continuous welds where indicated. Grind smooth.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6.
- .3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 2 to 4 mils, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of friction-type connections.
 - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 MARKING

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Contract Administrator.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 23 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section CW1110 – General Instructions.
- .2 Section 05 12 23 - Structural Steel.
- .3 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .3 CSA W59-1989(R2001), Welded Steel Construction (Metal Arc Welding) (Imperial Version).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section CW1110 – General Instructions.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section CW1110 – General Instructions.
 - .1 For finishes, coatings, primers and paints.
- .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Section CW1110 – General Instructions.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

- .1 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Steel pipe: to ASTM A53/A53M standard weight finish.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.
- .5 Bolts and anchor bolts: to ASTM A307.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

- .1 Shop coat primer: to CAN/CGSB-1.40.
- .2 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

- .2 Concrete, mortar and masonry.
- .3 Wood.

2.5 SHOP PAINTING

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .3 Clean surfaces to be field welded; do not paint.

Part 3 Execution

3.1 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AA)
 - .1 Aluminum Sheet Metal Work in Building Construction-2000.
 - .2 AA DAF45-[97], Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A240/A240M-02, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating [Mass] Applications.
 - .4 ASTM A606-01, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .5 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .6 ASTM A792/A792M-02, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .7 ASTM B32-00, Standard Specification for Solder Metal.
 - .8 ASTM B370-98, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .9 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
 - .10 ASTM D822-01, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 1997.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .3 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-98, Asphalt Saturated Organic Roofing Felt.
 - .2 CSA-A440-00/A440.1-00 - A440-00, Windows / Special Publication, A440.1-00, User Selection Guide to CSA Standard A440-00, Windows.
 - .3 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

1.2 SAMPLES

- .1 Submit shop drawings in accordance with Section CW1110 – General Instructions.
- .2 Submit 50 x 50 mm samples of each type of sheet metal material, colour and finish.

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 for recycling.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.
- .5 Unused paint and sealant material must be disposed of at an official hazardous material collections site as approved by Contract Administrator.
- .6 Unused paint and sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.3 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of 1 mm thick galvanized steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details, FL.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock standing seams forming tight fit over hook strips, as detailed.
- .5 Lock end joints and caulk with sealant.
- .6 Insert metal flashing under cap flashing to form weather tight junction.
- .7 Caulk flashing at cap flashing with sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 07 92 10 - Joint Sealing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
 - .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
 - .3 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-98, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
- .4 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09300, 2000, Tile Installation Manual.
 - .2 Tile Maintenance Guide 2000.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section CW1110 – General Instructions.
- .2 Include manufacturer's information on:
 - .1 Chemical resistant mortar and grout (Epoxy).
 - .2 Leveling compound.

1.4 SAMPLES

- .1 Floor tile: submit sample tile of each colour, texture, size, and pattern of tile.
- .2 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- .2 Store material so as to prevent damage or contamination.

- .3 Store materials in a dry area, protected from freezing, staining and damage.
- .4 Store cementitious materials on a dry surface.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Unused adhesive, sealant and coating materials must be disposed of at an official hazardous material collections site as approved by the Contract Administrator.
- .3 Unused adhesive, sealant and coating materials must not be disposed of into the sewer system, into streams, lakes, onto the ground or in other location where it will pose a health or environmental hazard.

1.7 ENVIRONMENTAL CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 h before, during, and 48 h after, installation.
- .2 Do not install tiles at temperatures less than 12 °C or above 38 °C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 °C or above 25 °C.

1.8 EXTRA MATERIAL

- .1 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
- .2 Maintenance material to be of same production run as installed material.

Part 2 Products

2.1 FLOOR TILE

- .1 Ceramic tile: to CAN/CGSB-75.1, to match existing and as approved by Contract Administrators.

2.2 BASE TILE

- .1 Base: coved; type, size, colour and texture to match adjacent flooring material.

2.3 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Internal and External Corners: Provide trim shapes as follows where indicated.
 - .1 Bullnose shapes for external corners including edges.
 - .2 Coved shapes for internal corners.

- .3 Special shapes for:
 - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
 - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
 - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
 - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.
- .3 Provide cove and bullnose shapes for countertops, stools, and where indicated and required to complete tile work.

2.4 MORTAR AND ADHESIVE MATERIALS

- .1 Polymer modified thin set mortar. Acceptable products: Ultraflex II, Versabond.

2.5 GROUT

- .1 Chemical-Resistant Grout:
 - .1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer. Acceptable product: Mapei Kerapoxy.

2.6 PATCHING AND LEVELING COMPOUND

- .1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
 - .1 Compressive strength - 25 MPa.
 - .2 Tensile strength - 7 MPa.
 - .3 Flexural strength - 7 MPa.
 - .4 Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

2.7 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2000 , "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Make internal angles square, external angles rounded.
- .9 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .10 Allow minimum 24 h after installation of tiles, before grouting.
- .11 Clean installed tile surfaces after installation and grouting cured.

3.2 FLOOR TILE

- .1 Install in accordance with TTMAC detail.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 02 61 33 - Hazardous Materials.
- .2 Section 09 91 23 - Painting of Interior Surfaces.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for exterior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.
- .7 Standard of Acceptance:
 - .1 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 SCHEDULING OF WORK

- .1 Submit work schedule for various stages of painting to Contract Administrator for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Contract Administrator for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.5 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used in accordance with City of Winnipeg CW 111- General Instructions.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number[s].
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.6 EXTRA MATERIALS

- .1 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.7 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with manufacturer's recommendations.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.

- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well ventilated area with temperature range 7⁰C to 30⁰C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove paint materials from storage only in quantities required for same day use.
- .12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .13 Fire Safety Requirements:
 - .1 Provide one 9 kg, Type ABC, dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.8 SITE REQUIREMENTS

- .1 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by applied product manufacturer, perform no painting work when:
 - .1 ambient air and substrate temperatures are below [10] ⁰C.
 - .2 substrate temperature is over [32] ⁰C unless paint is specifically formulated for application at high temperatures.
 - .3 substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 the relative humidity is above [85]% or when dew point is less than [3] ⁰C variance between air/surface temperature.
 - .5 rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .2 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.

- .4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.
- .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10 °C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
- .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
- .9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of the Contract Administrator such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .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. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .3 Material which 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 the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .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 Empty paint cans are to be dry prior to disposal or recycling (where available).

- .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .7 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.
- .8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the latest edition of the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .2 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .3 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0⁰C or greater.
- .7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

- .8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" [E2] rating.

2.2 COLOURS

- .1 Contract Administrator will provide Colour Schedule after Contract award.
- .2 Selection of colours will be from manufacturers full range of colours.
- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Contract Administrator.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category/	Units @ 60E/	Units @ 60E/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on drawings.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 Structural Steel and Metal Fabrications exposed to less than 95°C:

- .1 Universal non-lift primer, semi-gloss.
- .2 Alkyd, semi-gloss finish.
- .2 Steel: combustion air, exhaust, guards, pipe brackets, and components exposed to temperatures of 95°C or greater.
 - .1 Inorganic zinc rich coating: Ameron Dimetcote 9 or equivalent.
 - .2 High heat resistant coating: Ameron PSX 892 HS or equivalent.

Part 3 Execution

3.1 GENERAL

- .1 Perform preparation and operations for exterior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Contract Administrator damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Contract Administrator.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .5 Removal of light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.
- .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Contract Administrator.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare exterior surfaces in accordance with coating manufacturer's recommendations and MPI Painting Specification Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by brushing, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent (and bleach where applicable) and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning.
- .4 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .5 Do not apply paint until prepared surfaces have been accepted by the Contract Administrator.

3.5 APPLICATION

- .1 Method of application to be as approved by Contract Administrator. Apply paint by brush, roller, air sprayer, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.

- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Contract Administrator.
- .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray Application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Contract Administrator.
- .5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.

3.7 FIELD QUALITY CONTROL

- .1 Advise Contract Administrator when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .5 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .6 ASTM C921-03a, 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 SUBMITTALS

- .1 Submittals: in accordance with Section CW1110 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section CW1110 – General Instructions. 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 CW1110 – General Instructions.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section CW1110 – General Instructions.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with CW1110 – General Instructions.
- .5 Quality assurance submittals: submit following in accordance with Section CW1110 – General Instructions.
 - .1 Instructions: submit manufacturer'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 of TIAC.

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.
 - .2 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 C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 or ASTM C547.
 - .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 or ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 or ASTM C547.

2.3 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.4 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: by Contract Administrator.
 - .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 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- .3 Stainless steel:
 - .1 Type: 304.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

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 expansion joints, valves, flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum, SS, PVC.

3.5 PIPING INSULATION SCHEDULES

- .1 Refer to drawings.
- .2 TIAC Code: A-1.
 - .1 Securements: SS bands 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 bands at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation as listed on the drawings.
- .5 Finishes:

- .1 Refer to drawings.
- .2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .3 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.
- .4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.6 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

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 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 for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Contract Administrator.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 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.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 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. Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 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.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .9 Group piping wherever possible and as indicated.
- .10 Ream pipes, remove scale and other foreign material before assembly.
- .11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .12 Provide for thermal expansion as indicated.

- .13 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate, ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Install ball valves for glycol service.

- .14 Check Valves:
 - .1 Install swing check valves as indicated.

3.6 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .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 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: Provide space for firestopping. 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.

3.7 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.8 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Contract Administrator 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: Test as specified in relevant sections of Division 23.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 23.
- .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 Contract Administrator.
- .6 Pay costs for repairs or replacement, retesting, and making good. Contract Administrator to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Contract Administrator.

3.9 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Contract Administrator.
- .2 Be responsible for damage to existing plant by this work.
- .3 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-1998, Power Piping.
 - .2 ANSI/ASME B31.3-2000, Process Piping Addenda A.
 - .3 ANSI/ASME B31.3-2001, Process Piping Addenda B.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1-2000, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R1998), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-02, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-01, Certification of Welding Inspectors.

1.2 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 Furnish welder's qualifications to Contract Administrator.
 - .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.

1.3 QUALITY ASSURANCE

- .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.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.1, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 23 applicable requirements of provincial authority having jurisdiction.

3.2 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.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Contract Administrator before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Contract Administrator.
- .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.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General
 - .1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Contract Administrator.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
- .2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

3.5 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-04, Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125-1996(R2001), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

1.3 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 SP58.
 - .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 SP58.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section CW1110 – General Instructions.
- .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Quality assurance submittals: submit following in accordance with CW1110 – General Instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual.

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.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: painted with zinc-rich paint after manufacture.

- .2 Ensure steel hangers in contact with copper piping are copper plated, epoxy coated.
- .2 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 FM approved to MSS SP69.
- .3 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies:
 - .2 Steel brackets:
 - .3 Sway braces for seismic restraint systems: to Section.
- .4 Hanger rods: threaded rod material to MSS SP58:
 - .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.
- .5 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel black.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework as shown on drawings.
 - .4 Oversize pipe hangers and supports.
- .6 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .7 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .8 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: black.
- .9 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:

- .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, 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 SP69 or as indicated on drawings.

2.5 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.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 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.

2.8 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 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 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, 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, Provincial Code, authority having jurisdiction.
- .2 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .3 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

- .4 Pipework greater than NPS 12: to MSS SP69.

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.

END OF SECTION

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.

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 SUBMITTALS

- .1 Product Data:
- .2 Submittals: in accordance with Section CW1110 – General Instructions.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
 - .1 Submit samples in accordance with Section CW1110 – General Instructions.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 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 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:

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.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

2.5 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 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 Contract Administrator.
 - .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:		
Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Sanitary	Green	SAN
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Hydraulic oil	Yellow	HYDRAULIC OIL
Natural gas	to Codes	
Gas regulator vents	to Codes	
Compressed air (<700kPa)	Green	COMP. AIR [] kPa
Compressed air (>700kPa)	Yellow	COMP. AIR [] kPa
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Instrument air	Green	INSTRUMENT AIR

2.6 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.

2.7 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.

2.8 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.

2.9 LANGUAGE

- .1 Identification in English and French.
- .2 Use one nameplate and label for each language.

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 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.

3.4 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 equipment rooms, 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, 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 Contract Administrator. 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 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 GASEOUS FUEL SYSTEMS

- .1 Operation tests:
 - .1 Measure gas pressure at gas meter outlet.
 - .2 Verify details of temperature and pressure compensation at meter.
 - .3 Verify settings, operation, venting of high and low pressure cut-outs, alarms.
 - .4 Check terminals of vents for gas pressure regulators.

1.4 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 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202-00, 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 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .2 Quality assurance submittals: submit following in accordance with Section CW1110 – General Instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle 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 19 - Construction/Demolition Waste Management and Disposal.

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

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for piping, valves and fittings for gas fired equipment.
- .2 Related Sections:
 - .1 Section 01 32 17 - Construction Progress Schedule - Critical Path Method (CPM).
 - .2 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Section 02 61 33 - Hazardous Materials.
 - .4 Section 23 05 01 - Installation of Pipework.
 - .5 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
 - .6 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22-01, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - .4 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B75M-99, Standard Specification for Seamless Copper Tube Metric.
 - .4 ASTM B837-01, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CSA B149.1HB-05, Natural Gas and Propane Installation Code Handbook.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .2 Indicate on manufacturers catalogue literature following: valves.
 - .3 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials.
- .2 Instructions: submit manufacturer's installation instructions.
 - .3 Closeout Submittals: submit maintenance and engineering data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
 - .1 NPS 1/2 to 2, screwed.
 - .2 NPS 2 1/2 and over, flanged.

2.2 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
 - .3 Welding: butt-welding fittings.
 - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
 - .5 Bolts and nuts: to ASME B18.2.1.
 - .6 Nipples: schedule 40, to ASTM A53/A53M.

2.4 VALVES

- .1 Provincial Code approved, lubricated ball type.

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 PIPING

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial Codes, CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.
- .2 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless otherwise approved by Contract Administrator.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.
- .2 Performance Verification:
 - .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

3.5 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

3.6 CLEANING

- .1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems CAN/CSA B149.1, supplemented as specified.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
 - .1 Section 02 61 33 - Hazardous Materials.
 - .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .5 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section CW1110 – General Instructions.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section CW1110 – General Instructions.
 - .1 Sealants.
 - .2 Tape.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store and manage hazardous materials.
- .3 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 for recycling.
 - .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.
 - .3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape, or combination thereof. Longitudinal seams unsealed.
 - .4 Unsealed seams and joints.

2.2 SEALANT

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

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: standard radius, short radius with single thickness turning vanes, Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius, five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single, double, 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 Full, short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA or as shown on drawings.
- .3 Joints: to SMACNA.

2.7 STAINLESS STEEL

- .1 To ASTM A480/A480M, Type 304.
- .2 Finish: No. 4.
- .3 Thickness, fabrication and reinforcement: to SMACNA or as indicated.
- .4 Joints: to SMACNA, be continuous inert gas welded.

2.8 ALUMINUM

- .1 To SMACNA. Aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to SMACNA or as indicated.

- .3 Joints: to SMACNA.

2.9 BLACK STEEL

2.10 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

Part 3 Execution

3.1 GENERAL

- .1 Do work as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA or as indicated.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA.

3.3 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, weld joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.

3.4 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for duct accessories including flexible connections, access doors.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section CW1110 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
- .3 Instructions: submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling.
 - .4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

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 5 mm (24 G.) thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, silicon rubber coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, minimum density of 0.8 kg/m².
 - .2 Acceptable product: Durodyne Metal Fab with Thermafab.

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 Piano hinge and minimum two sash locks.

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 Flexible Connections:
 - .1 Install in following locations:
 - .1 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.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 As indicated.
 - .2 Locations:
 - .1 As indicated.

3.3 CLEANING

- .1 Perform cleaning operations as specified in accordance with manufacturer's recommendations.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 260520, 260521, 260534.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
- .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.

1.3 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.

1.4 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 and French.
- .4 Use one nameplate or label for each language.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section CW1110 – General Instructions.
- .2 Product Data: submit WHMIS MSDS in accordance with Section CW1110 – General Instructions.
- .3 Submit for review single line electrical diagrams.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section CW1110 – General Instructions.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians [who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling..

1.8 SYSTEM STARTUP

- .1 Instruct Contract Administrator 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.

1.9 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems and as shown on drawings.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Contract Administrator.
- .2 Lamacoid or decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, black face, white 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

NAMEPLATE SIZES

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 to be approved by Contract Administrator prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "EQUIPMENT NO." as directed by Contract Administrator.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered 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.

2.7 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
Other Communication Systems	Green	Blue
Other Security Systems	Red	Yellow

2.8 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 indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe or plastic, 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.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 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 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section CW1110 – General Instructions.
 - .1 Power 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 Systems: communications.
- .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Contract Administrator.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 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.

3.6 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.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

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 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:

- .1 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.
- .2 Install fixture type connectors and tighten. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

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.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

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.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V.

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, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:

- .1 One hole 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 400 mm centers.
- .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight 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 Type: ACWU90 - PVC jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

2.4 CONTROL CABLES

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type, TW with shielding of braid over each pair and overall covering of interlocked armour of aluminum strip.

Part 3 Execution

3.1 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.2 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit or cable troughs.
- .2 Ground control cable shield at control cabinet only.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 260520, 260521, 260534.

1.2 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. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

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.
- .4 Reel and mark shielded cables rated 300 volts and above.

2.2 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 2 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 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 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 unfinished areas.
- .3 Surface mount conduits.
- .4 Use rigid galvanized steel threaded conduit except [where specified otherwise.
- .5 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .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 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .13 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 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 IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION