

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1      Section Includes:
  - .1      Materials and installation for plumbing specialties and accessories.

**1.2**            **RELATED SECTIONS**

- .1      Section 01 33 00 – Submittal Procedures.
- .2      Section 01 35 29.06 – Health and Safety Requirements.
- .3      Section 01 45 00 – Quality Control.
- .4      Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .5      Section 01 78 00 – Closeout Submittals.
- .6      Section 01 91 13 – Commissioning (Cx) Requirements.

**1.3**            **REFERENCES**

- .1      American Society for Testing and Materials International (ASTM)
  - .1      ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2      ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .2      Canadian Standards Association (CSA)
  - .1      CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
  - .2      CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
  - .3      CAN3-B79, Floor Drains and Trench Drains.
- .3      Health Canada/Workplace Hazardous Materials Information Systems (WHMIS).
  - .1      Material Safety Data Sheets (MSDS).
- .4      Plumbing and Drainage Institute (PDI)
  - .1      PDI-WH201, Water Hammer Arresters Standard.
- .5      The American Society of Safety Engineers (ASSE).
- .6      Food and Drug Administration (FDA).

- .7 Factory Mutual Insurance Company (FM).
- .8 American Society of Mechanical Engineers (ASME).

#### 1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
  - .2 Indicate dimensions, construction details and materials for specified items.
  - .3 Submit WHMIS MSDS data sheets. Indicate VOCs for adhesive and solvents during application and curing.
- .3 Shop Drawings:
  - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals. Include:
  - .1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

#### 1.5 QUALITY ASSURANCE

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .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 materials in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.
- .5 Fold up metal and plastic banding flatten and place in designated area for recycling.

**PART 2**      **PRODUCTS**

**2.1**            **FLOOR DRAINS**

- .1 Floor drains and trench drains: to CSA B79.
- .2 See Schedule on Drawings.
- .3 Acceptable Product: Zurn, MIFAB, or approved equal.

**2.2**            **CLEANOUTS**

- .1 Cleanout ferrule with plug: heavy cast iron male ferrule with brass screws and threaded bronze plug.
  - .1 Acceptable Product: Zurn Z-1440-BP cleanout ferrule, Jay R. Smith, MIFAB, or approved equal.
- .2 Access covers:
  - .1 Wall access: as per Section 10 44 16.20 – Access Doors for Mechanical Systems.
  - .2 Floor access: Acid resisting epoxy coated round cast iron body and frame with adjustable secured Duresist top and:
    - .1 Plugs: threaded bronze.
    - .2 Cover for unfinished concrete floors: Duresist, round, vandal-proof screws.
      - .1 Acceptable Product: Zurn Z-1400-BP-VP-AR-DC Level-Trol, Jay R. Smith, MIFAB, or approved equal.
    - .3 Cover for tile and linoleum floors: Duresist with recessed round cover for tile and linoleum infill, complete with vandal-proof locking screws.
      - .1 Acceptable Product: Zurn Z-1400-BP-VP-X-AR-DC, Jay R. Smith, MIFAB, or approved equal.

**2.3**            **WATER HAMMER ARRESTORS**

- .1 Type 18-8 stainless steel construction, bellows type: to PDI-WH201. Arrestor to be the nesting bellows type with a casing sized with sufficient volume to dissipate the kinetic

energy generated in the piping system. See Mechanical drawings for water hammer arrestor sizing.

- .1 Acceptable Product: Zurn Shoktrol Z-1700 Series, Jay R. Smith, MIFAB, Precision Plumbing Products, or approved equal.

## 2.4 5 MICRON WATER FILTER

- .1 Application:
  - .1 Drinking fountain DF-1 supply.
- .2 5 Micron Water Filter complete with cartridge and stainless steel wall bracket.
- .3 Acceptable Product: Watts W10CPH12CBPR and WBKT-RCS-SS, Pentair, or approved equal.

## 2.5 VACUUM BREAKERS

- .1 To CSA-B64 Series.
- .2 Hose connection vacuum breaker:
  - .1 DN 20 female hose thread inlet, DN 20 male hose thread outlet, brass finish.
  - .2 Provide on all hose bibs throughout the building.
  - .3 Acceptable Product: Watts 8A, Hoffman #62, Jay R. Smith, MIFAB, Apollo Valves, or approved equal.

## 2.6 PRESSURE REGULATORS

- .1 Application: drinking fountain DF-1.
  - .1 Capacity:
    - .1 Inlet pressure: 413 KPa.
    - .2 Reduced no flow pressure: 208 kPa.
    - .3 Fall-off pressure:
      - .1 DN 15: 103 KPa @ 0.82 L/s.
  - .2 Size:
    - .1 DF-1: DN 15.
  - .3 Lead Free Bronze body construction, sweat union inlet connections, renewable stainless steel seat, built-in thermal expansion bypass feature, low pressure range.
  - .4 Acceptable Product: Watts Regulator LFU5B-Z3, Wilkins, Zurn, or approved equal.

## 2.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

- .1 Acceptable Product: Watts No. HB-1, EMCO, Cambridge, Zurn, or approved equal.

## **2.8 PIPE WALL AND FLOOR PENETRATION SEAL**

- .1 Application:
  - .1 Pipes penetrating concrete floors above grade.
  - .2 Seal material to be EPDM.
  - .3 Pressure plates to be glass-reinforced plastic.
  - .4 Bolts and nuts to be stainless steel 18-8.
  - .5 Suitable temperature range to be -40°C to 121°C.
  - .6 Floor sleeves to be Schedule 40 black iron pipe. Core drill existing concrete floors above grade.
  - .7 Sleeves:
    - .1 Concrete floors above grade: terminate 75 mm AFF.
  - .8 Acceptable Product: Metraseal MS Series, Link Seal, or approved equal.

## **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 Install in accordance with Canadian Plumbing Code, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.3 CLEANOUTS**

- .1 In addition to those required by code, and as indicated, install at base of soil and waste stacks.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

**3.4 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to fixtures or group of fixtures where indicated.

**3.5 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

**3.6 TRAP SEAL PRIMERS**

- .1 Install PEX tubing to floor drains. Tubing to be continuous without joints.
- .2 Reference drawings for traps to be primed by each respective priming assembly.

**3.7 VACUUM BREAKERS**

- .1 Install on all hose bibbs and sediment faucets.

**3.8 PRESSURE REGULATORS**

- .1 Install in accordance with manufacturer's instructions.
- .2 Field set to design pressures indicated.

**3.9 PIPE WALL AND FLOOR PENETRATION SEAL**

- .1 Co-ordinate location of floor pipe sleeves with General Contractor before core drilling.

**3.10 START-UP AND COMMISSIONING**

- .1 General:
  - .1 In accordance with Section 01 91 13 – Commissioning (Cx) Requirements: supplemented as specified herein.
- .2 Timing: Start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
- .3 Provide continuous supervision during start-up.

**3.11 TESTING AND ADJUSTING**

- .1 General:
  - .1 In accordance with Section 01 91 13 - Commissioning (Cx) Requirements: supplemented as specified herein.
- .2 Timing:

- .1 After start-up deficiencies rectified.
- .3 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removeability of strainer.
  - .5 Clean out baskets.
- .4 Vacuum breakers, backflow preventers:
  - .1 Test tightness, accessibility for O&M of cover and of valve.
- .5 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .6 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
  - .2 Verify cleanout probe can probe as far as next cleanout.
- .7 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .8 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .9 Hose bibbs, sediment faucets:
  - .1 Verify operation and at all low points.
- .10 Pipe floor and wall penetration seals:
  - .1 Coordinate location of core drilling with General Contractor.
- .11 Commissioning Reports:
  - .1 In accordance with Section 01 91 13 - Commissioning (Cx) Requirements: supplemented as specified herein.
- .12 Training:
  - .1 In accordance with Section 01 91 13 - Commissioning (Cx) Requirements: supplemented as specified herein.
  - .2 Demonstrate full compliance with Design Criteria.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1      Section includes:
  - .1          The supply and installation of washroom fixtures and trim.
- .2      Products installed but not supplied under this section as indicated elsewhere in the contract:
  - .1          Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
  - .2          Equipment installed by others.
    - .1              Connect with unions.
  - .3          Equipment not installed
    - .1              Capped for future connection by others.

**1.2**            **RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 35 29.06 – Health and Safety Requirements.
- .3      Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4      Section 01 78 00 - Closeout Submittals.
- .5      Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

**1.3**            **REFERENCES**

- .1      Canadian Standards Association (CSA)
  - .1          CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2          CAN/CSA-B125, Plumbing Fittings.
  - .3          CAN/CSA-B651, Barrier-Free Design.
- .2      Province of Newfoundland and Labrador Building Accessibility Act Regulations.

**1.4**            **SUBMITTALS**

- .1      Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2      Product Data: Submit WHMIS MSDS – Material Safety Data Sheets.
- .3      Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

- .4 Indicate fixtures and trim:
  - .1 Dimensions construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 For water closets, urinals: minimum pressure required for flushing.
  - .4 Installation procedures.
- .5 Closeout Submittals:
  - .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 – Closeout Submittals.
  - .2 Include:
    - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
    - .2 Details of operation, servicing, maintenance.
    - .3 List of recommended spare parts.

## 1.5 QUALITY ASSURANCE

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

## 1.6 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .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 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## 1.7 ACCEPTABLE PRODUCT

- .1 Fixtures:
 

American Standard	Architectural Metal Industries	Kohler
Crane	ELKAY	Willoughby Industries Inc.
Eljer	Acorn	Zurn
Franke Kindred	Aristaline	
- .2 Trim:
 

Cambridge Brass	Olsonite	Acorn	Zurn
Chicago Faucet	Centoco	Bradley	Jay R. Smith
Powers Crane	MIFAB	Powers	Willoughby Industries Inc.
Sloan	PPP	Nepitek	

**PART 2      PRODUCTS**

**2.1            MANUFACTURED UNITS**

- .1      Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2      Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3      Exposed plumbing brass to be chrome plated.
- .4      Number, locations: Architectural drawings to govern.
- .5      Fixtures to be product of one manufacturer and of same type.
- .6      Trim to be product of one manufacturer and of same type.

**2.2            WATER CLOSETS**

- .1      Water closet types:
  - .1      WC-1:
    - .1      See schedule
    - .1      Acceptable Product: American Standard, Crane, Eljer, Kohler, Zurn, or approved equal.
  - .2      WC-2:
    - .1      See schedule
    - .1      Acceptable Product: American Standard, Crane, Eljer, Kohler, Zurn, or approved equal.
  - .3      Water closet infrared sensor flushing system (WC-1/WC-2):
    - .1      See schedule
    - .1      Acceptable Product: Cambridge Brass / Delta, Nepitek, Sloan, Zurn, Acorn, Bradley, Powers Crane, or approved equal.
  - .4      Water closet backrests:
    - .1      Provided by Architectural.
  - .5      Water closet flexible hoses:
    - .1      Provide each wall mounted water closet with flexible stainless steel braided water supply hose as specified in Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping to facilitate removal of water closets for maintenance purposes.
  - .6      Wall mounted access doors:
    - .1      As an alternative to flexible hoses provide hard type L Copper connection to fixture and provide 300 mm x 300 mm stainless steel access door in wall beside fixture to enable fixture removal.

**2.3            URINALS**

- .1      Urinal types:

- .1 UR-1: refer to schedule.
  - .1 Acceptable Product: American Standard, Crane, Eljer, Kohler, Zurn, or approved equal.
- .2 Urinal infrared sensor flushing system (UR-1):
  - .1 See schedule.
    - .1 Acceptable Product: Cambridge Brass/Delta, Nepitek, Sloan, Zurn, Acorn, Bradley, Powers Crane, or approved equal.
- .3 Urinal flexible hoses:
  - .1 Provide each urinal with flexible stainless steel braided water supply hose as specified in Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping to facilitate removal of urinals for maintenance purposes.
- .4 Wall Mounted Access Door:
  - .1 As an alternative to flexible hoses provide hard type L Copper connection to fixture and provide 300 mm x 300 mm stainless steel access door in wall to enable fixture removal.

## 2.4 WASHROOM LAVATORIES

- .1 Lavatory types:
  - .1 L-1 / L-2:
    - .1 See schedule
      - .1 Acceptable Product: American Standard, Crane, Eljer, Kohler, Zurn, or approved equal.
- .2 Lavatory trim:
  - .1 L-1 / L2:
    - .1 See schedule
      - .1 Acceptable Product: Cambridge Brass/Delta, Nepitek, Powers Crane, Chicago Faucets, Zurn, or approved equal.

## 2.5 FIXTURE PIPING

- .1 Supplies:
  - .1 L-1 / L2: Hot and cold water supplies to each fixture:
    - .1 Provide ceiling mounted isolation valves to serve each lavatory.
    - .2 For outlet of wall box to connection to faucet provide stainless steel, braided, flexible supply.
- .2 Waste:
  - .1 Brass P trap with cleanout on fixtures not having integral trap.
  - .2 Chrome plated in exposed places and elsewhere as noted.
  - .3 Waste:
    - .1 L-1 / L2:

- .1 See schedule
- .1 Acceptable Product: Cambridge Brass, PPP, Chicago Faucets, Powers Crane, Zurn, or approved equal.
- .4 Trap:
  - .1 L-1 / L2:
    - .1 See schedule
    - .1 Acceptable Product: Cambridge Brass, PPP, Chicago Faucets, Powers Crane, Zurn, or approved equal.

## 2.6 CHAIR CARRIERS.

- .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.
- .2 Water closet wall carrier for WC-1 / WC-2: Dura coated cast iron adjustable vertical syphon jet non-hub series chair carrier. Provide to suit configuration on drawings.
  - .1 Acceptable Product: Zurn, MIFAB, Jay R. Smith, or approved equal.
- .3 Urinal wall carrier for UR-1: Dura coated rectangular steel uprights with welded feet, adjustable support plates and mounting fasteners and hardware. See drawings.
  - .1 Acceptable Product: Zurn, MIFAB, Jay R. Smith, or approved equal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 For barrier-free washrooms: to comply with most stringent of either NBCC or CAN/CSA B651, or Provincial Building Accessibility Act and Regulations.

### 3.2 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
  - .1 Adjustments.
    - .1 Adjust water flow rate to design flow rates.
    - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
    - .3 Adjust flush valves to suit actual site conditions.
    - .4 Adjust urinal and water closet flushing timing mechanisms.
  - .2 Checks.
    - .1 Water closets, urinals: flushing action.
    - .2 Aerators: operation, cleanliness.
    - .3 Overflow operation.

.4 Electric trim operation.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section includes:
  - .1 The supply and installation of plumbing fixtures and trim.
- .2 Products installed but not supplied under this section as indicated elsewhere in the contract:
  - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
  - .2 Equipment installed by others.
    - .1 Connect with unions.
  - .3 Equipment not installed.
    - .1 Capped for future connection by others.

**1.2**            **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 01 35 29.06 – Health and Safety Requirements
- .4 Section 01 78 00 – Closeout Submittals.

**1.3**            **REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2 CAN/CSA-B125, Plumbing Fittings.
  - .3 CAN/CSA-B651, Barrier-Free Design.
- .2 Province of Newfoundland and Labrador Building Accessibility Act Regulations.

**1.4**            **SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS – Material Safety Data Sheets.
  - .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
    - .1 Indicate, for all fixtures and trim:
      - .1 Dimensions, construction details, roughing-in dimensions.

- .3 Closeout Submittals:
  - .1 Submit maintenance data in accordance with Section 01 78 00 – Closeout Submittals
  - .2 Include:
    - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
    - .2 Details of operation, servicing maintenance.
    - .3 List of recommended spare parts.

## 1.5 QUALITY ASSURANCE

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

## 1.6 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Waste Management and Disposal.
  - .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 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## 1.7 ACCEPTABLE PRODUCT

- .1 Fixtures:
 

American Standard	Aristaline
Crane	Acorn
Eljer	Stern Williams
Franke	
Architectural Metal Industries	
ELKAY	
- .2 Trim:
 

Cambridge Brass	T. and S. Brass
Chicago Faucet	PPP
Powers Crane	Watts
Sloan	MIFAB
Zurn	Nepitek

**PART 2**      **PRODUCTS**

**2.1**            **MANUFACTURED UNITS**

- .1      Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2      Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3      Exposed plumbing brass to be chrome plated.
- .4      Number, locations: Architectural drawings to govern.
- .5      Fixtures in any one location to be product of one manufacturer and of same type.
- .6      Trim in any one location to be product of one manufacturer and of same type.

**2.2**            **SERVICE SINKS**

- .1      MS-1:
  - .1      Mop Sink:
    - .1      See schedule
      - .1      Acceptable Product: Acorn, Zurn, Fiat, Stern Williams, or approved equal.
  - .2      Supply fitting:
    - .1      See schedule
      - .1      Acceptable Product: Cambridge Brass / Delta, Chicago Faucets, T. and S. Brass, Power Crane, Zurn, Stern Williams, or approved equal.
  - .3      Mop holder:
    - .1      See schedule
      - .1      Acceptable Product: Cambridge Brass / Delta, Chicago Faucets, T. and S. Brass, Power Crane, Zurn, Stern Williams, or approved equal.
  - .4      Hose and hose holder
    - .1      See schedule
      - .1      Acceptable Product: Cambridge Brass / Delta, Chicago Faucets, T. and S. Brass, Power Crane, Zurn, Stern Williams, or approved equal.

**2.3**            **FIXTURE PIPING**

- .1      Hot and cold water supplies to each fixture:
  - .1      Provide ceiling mounted isolation valves to serve mop sinks.
- .2      Waste:
  - .1      Brass P trap with cleanout on each fixture not having integral trap.

- .2 Chrome plated in all exposed places.

**PART 3**      **EXECUTION**

**3.1**            **INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651, or Provincial Buildings Accessibility Act and Regulations.

**3.2**            **ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Do adjustments prior to pre-commissioning.
- .3 Adjustments.
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .4 Checks.
  - .1 Aerators: operation, cleanliness.
- .5 Report verification checks in Commissioning Manual.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section includes:
  - .1 The supply and installation of bottle filling stations and drinking fountains.
- .2 Products installed but not supplied under this section:
  - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
  - .2 Equipment installed by others.
    - .1 Connect with unions.
  - .3 Equipment not installed.
    - .1 Valved and capped for future connection by others.

**1.2**            **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 01 78 00 - Closeout Submittals.

**1.3**            **REFERENCES**

- .1 Air Conditioning and Refrigeration Institute (ARI)
  - .1 ARI 1010, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
- .2 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
  - .2 CAN/CSA-B125, Plumbing Fittings.
  - .3 CAN/CSA-B651, Barrier-Free Design.
- .3 Province of Newfoundland and Labrador Building Accessibility Regulations.

**1.4**            **SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit WHMIS MSDS – Material Safety Data Sheets.
- .3 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

- .4 Indicate for all fixtures:
  - .1 Dimensions, construction details, roughing-in dimensions.
- .5 Closeout Submittals:
  - .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 – Closeout Submittals.
  - .2 Include:
    - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
    - .2 Details of operation, servicing, maintenance.
    - .3 List of recommended spare parts.

## 1.5 QUALITY ASSURANCE

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

## 1.6 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .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 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## **PART 2** **PRODUCTS**

### 2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern.

### 2.2 BOTTLE FILLING STATIONS

- .1 DF-1: wall mounted, filtered, semi recessed, wheelchair accessible bottle filler / drinking fountain:

- .1 See schedule.
- .1 Acceptable Product: Franke, Haws, Elkay, Oasis, or approved equal.

### 2.3 **FIXTURE PIPING**

- .1 Cold water supplies to each fixture:
  - .1 Shut off valve in cold water supply pipe.
- .2 Waste:
  - .1 Brass P trap with cleanout on each bottle filler / drinking fountain.

## **PART 3 EXECUTION**

### 3.1 **INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 Physically handicapped: to comply with most stringent of either NBCC, CAN/CSA B651 or Provincial Building Accessibility Act and Regulations.
  - .3 DF-1 to be installed at barrier-free mounting height.
- .2 Install in accordance with manufacturer's recommendations.

### 3.2 **ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments.
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust flow stream to ensure no spillage.
- .3 Checks.
  - .1 Report checks and verifications in Commissioning Manual.

### 3.3 **LEAD-FREE**

- .1 Entire assembly shall be deemed lead-free as defined by NSF/ANSI Standard 61 Section 9, NSF/ANSI Standards 42 and 53, NSF/ANSI 372, and CSA Standard B483.1.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 35 29.06 - Health and Safety Requirements.
- .3      Section 01 45 00 - Quality Control.
- .4      Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .5      Section 01 78 00 - Closeout Submittals.
- .6      Section 09 91 23 - Interior Painting.
- .7      Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

**1.2**            **SUBMITTALS**

- .1      Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.
- .3      Shop drawings to show:
  - .1      Mounting arrangements.
  - .2      Operating and maintenance clearances.
- .4      Shop drawings and product data accompanied by:
  - .1      Detailed drawings of bases, supports, and anchor bolts.
  - .2      Acoustical sound power data, where applicable.
  - .3      Points of operation on performance curves.
  - .4      Manufacturer to certify current model production.
  - .5      Certification of compliance to applicable codes.
- .5      In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6      Closeout Submittals:
  - .1      Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2      Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.

- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.
  - .2 Make changes as required and re-submit as directed by Owner's Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Owner's Representative will provide 1 set of mechanical drawing AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour for each service.
  - .4 Make available for reference purposes and inspection.

- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Owner's Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed Mechanical AutoCAD as-built drawings CD with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.4 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Provide one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

**PART 3**      **EXECUTION**

**3.1**            **PAINTING, REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2**            **CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts.

**3.3**            **FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
  - .1 Submit tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4**            **DEMONSTRATION**

- .1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Owner's Representative may record these demonstrations for future reference.

**3.5 PROTECTION**

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

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1      Use of HVAC systems during construction.

**1.2**            **RELATED SECTIONS**

- .1      Section 01 51 00 - Temporary Utilities.

**1.3**            **USE OF SYSTEMS**

- .1      Use of new and/or existing permanent heating and/or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:
  - .1      Entire system is complete, pressure tested, cleaned, flushed out.
  - .2      Specified water treatment system has been commissioned, water treatment is being continuously monitored.
  - .3      Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
  - .4      There is no possibility of damage from any cause.
  - .5      Supply ventilation systems are protected by 60 % filters, which shall be inspected daily, changed every week or more frequently as required.
  - .6      Return systems have approved filters over all openings.
  - .7      All systems will be:
    - .1      operated as per manufacturer's recommendations or instructions.
    - .2      operated by Contractor.
    - .3      monitored continuously by Contractor.
  - .8      Warranties and guarantees are not thereby relaxed.
  - .9      Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Owner's Representative.
  - .10     Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, and replace filters in air systems.
- .2      Filters specified in this section are over and above those specified in other sections of this project.
- .3      Exhaust systems are not included in any approvals for temporary heating ventilation.

**PART 2**      **PRODUCTS (NOT USED)**

**PART 3**      **EXECUTION (NOT USED)**

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **GENERAL INSTRUCTIONS**

- .1 All ductwork and equipment indicated in this specification section is to be cleaned. Open ended ducts are to be protected during construction. This includes ductwork incorporated into the work and ductwork stored which has yet to be incorporated into the work. Tests will be carried out to determine if the cleaned ductwork meets the cleanliness requirements of the contract. If it doesn't additional NADCA tests as specified will be required. Duct cleaning will be considered defective if the cleanliness tests fail and the duct will have to be cleaned over again.

**1.2**            **CONTRACTOR'S QUALIFICATION**

- .1 Cleaning work shall be carried out by a firm specialized in cleaning of ventilation equipment and accessories. The Contractor shall provide a list of the five (5) latest cleaning projects carried out, indicating clients' names and contacts.
- .2 The HVAC system cleaning contractor shall be a certified member of a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems. (National Air Duct Cleaners Association (NADCA), or approved equal.)
- .3 The HVAC system cleaning contractor shall have a minimum of one (1) air system cleaning specialist (ASCS) on staff, certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems (NADCA, or approved equal.)

**1.3**            **CONNECTED WORK**

- .1 The HVAC cleaning contractor shall include in his quotation all related work such as dismantling or removal of ceilings, installation of access doors, moving and covering furniture, protecting floors or equipment, unless otherwise directed by the Engineer.
- .2 Provide architectural access doors in solid walls and ceilings as required by cleaning operations.
- .3 Provide architectural work (demolition/repair/painting) required for the installation of the new access doors. Repair finish to match existing.
- .4 Provide access doors in ductwork as required by cleaning operations.

**1.4**            **DEFINITIONS**

- .1 ASCS: Air systems cleaning specialist.
- .2 NADCA: National Air Duct Cleaners Association.

- .3 SMACNA: Sheetmetal and Air Conditioning Contractors National Association.

## **1.5 INFORMATIONAL SUBMITTALS**

- .1 Qualification Data: For an ASCS.
- .2 Strategies and procedures plan.
- .3 Cleanliness verification report.

## **1.6 QUALITY ASSURANCE**

- .1 ASCS Qualifications: A certified member of NADCA.
  - .1 Certification: Employ an ASCS certified by NADCA on a full-time basis.
  - .2 Supervisor Qualifications: Certified as an ASCS by NADCA.
- .2 UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.
- .3 Cleaning Conference: Conduct conference at Project site.
  - .1 Review methods and procedures related to HVAC air-distribution system cleaning including, but not limited to, review of the cleaning strategies and procedures plan.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
- .2 Perform inspection of systems and components according to NADCA ACR 2013.
- .3 Prepare written report listing conditions detrimental to performance of the Work.
- .4 Proceed with work only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- .1 Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:
  - .1 Supervisor contact information.
  - .2 Work schedule including location, times, and impact on occupied areas.

- .3 Methods and materials planned for each HVAC component type.
- .4 Required support from other trades.
- .5 Equipment and material storage requirements.
- .6 Exhaust equipment setup locations.
- .2 Use the existing service openings for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.
- .3 Provide service openings and service panels in accordance with NADCA ACR 2013.

### 3.3 CLEANING

- .1 Comply with NADCA ACR 2013. Maintain ductwork during construction in accordance with SMACNA "DUCT CLEANLINESS FOR NEW CONSTRUCTION GUIDELINES", latest edition thereof, and maintain Advanced Cleanliness Level as defined in the guideline.
- .2 Remove visible surface contaminants and deposits from within the HVAC system.
- .3 Systems and Components to Be Cleaned:
  - .1 Air devices for supply, return and exhaust air.
  - .2 Air-terminal units.
  - .3 Ductwork and Plenums:
    - .1 Supply-air ducts and plenums and all components in the airstream.
    - .2 Return-air ducts and plenums and all components in the airstream.
    - .3 Exhaust-air ducts and plenums and all components in the airstream.
  - .4 Air-Handling Units:
    - .1 Interior surfaces of the unit casing.
    - .2 Coil surfaces compartment.
    - .3 Condensate drain-pans.
    - .4 Fans, fan blades, and fan housings.
    - .5 Filter section.
- .4 Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
- .5 Particulate Collection:
  - .1 For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
  - .2 HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building.
- .6 Control odors and mist vapors during the cleaning and restoration process.

- .7 Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
- .8 System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
- .9 Clean all air-distribution devices, registers, grilles, and diffusers.
- .10 Clean supply, return, and exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
- .11 Clean return and exhaust air ducts, dampers, actuators, and turning vanes.
- .12 Clean supply air ducts, dampers, actuators, and turning vanes.
- .13 Clean visible surface contamination deposits according to NADCA ACR 2013 and the following:
  - .1 Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
  - .2 Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
  - .3 Clean coils and other airstream components.
- .14 Duct and Plenum Systems:
  - .1 Create service openings and service panels in the HVAC system to accommodate cleaning.
  - .2 Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2013).
  - .3 Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
  - .4 Disconnect and reconnect flexible ducts for cleaning and inspection.
  - .5 Remove and reinstall ceiling to gain access during the cleaning process.
  - .6 Mechanically clean duct and plenum systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2013).
- .15 Debris removed from the HVAC system shall be disposed of according to applicable Federal, Provincial, and local requirements.
- .16 Mechanical Cleaning Methodology:

- .1 Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
  - .1 Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
  - .2 Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.
- .2 Cleaning Mineral-Fiber Insulation Components:
  - .1 Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2013.
  - .2 Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2013).
  - .3 Fibrous materials that become wet shall be discarded and replaced.
- .17 Coil Cleaning:
  - .1 Measure static-pressure differential across each coil.
  - .2 See NADCA ACR 2013, "Coil Surface Cleaning" section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2013).
  - .3 Coil drain pans shall be subject to NADCA ACR 2013, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
  - .4 Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
  - .5 Rinse thoroughly with clean water to remove any latent residues.
- .18 Antimicrobial Agents and Coatings:
  - .1 Apply antimicrobial agents and coatings if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
  - .2 When used, antimicrobial treatments and coatings shall be applied after the system is rendered clean.

- .3 Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.
- .4 Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.

### 3.4 CLEANLINESS VERIFICATION

- .1 Verify cleanliness according to NADCA ACR 2013, "Cleanliness Verification and Documentation" section.
- .2 Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents, coatings and sanitizers.
- .3 Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness as identified in "Additional Verification" paragraph below.
- .4 Additional Verification (only where visible contaminants are evident):
  - .1 Perform NADCA Surface Comparison Testing. Ductwork is considered clean if there is no significant visible difference in the surface characteristics. If Surface Comparison Testing test is inconclusive perform NADCA Vacuum Test. To be considered clean according to the NADCA Vacuum Test, the net weight of the debris collected on the filter media shall not exceed 0.75 mg/100 cm<sup>2</sup>.
  - .2 Conduct NADCA vacuum gravimetric test analysis for nonporous surfaces.
- .5 Verification of Coil Cleaning:
  - .1 Measure static-pressure differential across each coil.
  - .2 Coil will be considered clean if cleaning restored the coil static-pressure differential within 10 percent of the differential measured when the coil was first installed and if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.
- .6 Prepare a written cleanliness verification report. At a minimum, include the following:
  - .1 Written documentation of the success of the cleaning.
  - .2 Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
  - .3 Surface comparison test results if required.
  - .4 Gravimetric analysis (nonporous surfaces only).
  - .5 System areas found to be damaged.

**3.5**

**RESTORATION**

- .1 Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2013, "Restoration and Repair of Mechanical Systems" section.
- .2 Restore service openings capable of future reopening. Comply with requirements in Division 23. Include location of service openings in Project closeout report.
- .3 Replace damaged insulation according to Division 23.
- .4 Ensure that closures do not hinder or alter airflow.
- .5 New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section Includes:
  - .1 Electrical motors, drives and guards for mechanical equipment and systems.

**1.2**            **RELATED SECTIONS:**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 61 00 - Common Product Requirements.
- .5 Section 01 74 11 – Cleaning.
- .6 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .7 Section 01 78 00 - Closeout Submittals.

**1.3**            **REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 National Energy Code for Buildings (NECB).
- .3 National Electrical Manufacturers Association (NEMA).
- .4 U.S. Department of Energy (DOE) Energy Policy Act EPACT.

**1.4**            **SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .2 Shop Drawings: Submit drawings stamped and signed for approval by Owner's Representative.
  - .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.

- .1 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## 1.5 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 PRODUCTS

### 2.1 GENERAL

- .1 Motors 1 HP and above shall be NEMA premium efficiency.
- .2 Motors below 1 HP shall be standard efficiency in accordance with EPACT and the requirements of ASHRAE 90.1.

### 2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors shall be NEMA design B unless otherwise noted.
- .3 Motors shall be insulation Class B unless otherwise noted. Class B insulated motors shall have a motor insulation temperature rating of 130°C with an allowable temperature rise at full load with 1.0 service factor of 80°C and an allowable temperature rise at service factor of 90°C. The reference ambient temperature shall be 40°C. The 10°C temperature differential between the allowable maximum temperature shall provide a "hot spot" allowance for the interior of the motor winding.

- .4 Motors controlled by variable frequency drives shall have insulation Class 'H', phase insulation and a winding thermostat in the motor. These motors shall be wound with inverter spike resistant (ISR) wire and shall be inverter duty rated.
- .5 All motors shall be suitable for variable torque application unless otherwise noted.
- .6 All motors to have minimum 1.15 service factor unless otherwise noted.
- .7 See mechanical schedules for motor HP and voltage.
- .8 All motors to be squirrel cage induction motors unless otherwise noted.
- .9 All motors to be continuous duty rated.
- .10 All motor enclosures to be TEFC unless otherwise noted.
- .11 Motors shall be regreaseable and shall have bearings with a minimum L10 life of 20,000 hrs.

### 2.3 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Owner's Representative for temporary use. Work will only be accepted when specified motor is installed.

### 2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min. Provide sheave of correct size to suit balancing.
- .4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave to be determined during commissioning. The Mechanical Contractor shall be responsible for all costs associated with providing sheaves of correct size if those that were originally shipped with the equipment are unsuitable for the application.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.

- .8 Supply one set of spare belts for each set installed.

## 2.5 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
- .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  - .3 38 mm dia. holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.

## **PART 3** EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

### 3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .1 As specified in other sections of this specification.

- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.4 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**            **SECTION INCLUDES**

- .1      Materials and installation for flexible connections, expansion joints, anchors and guides for building services piping.

**1.2**            **RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 35 29.06 - Health and Safety Requirements.
- .3      Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .4      Section 01 78 00 - Closeout Submittals.
- .5      Section 23 08 01 - Performance Verification Mechanical Piping Systems.

**1.3**            **REFERENCES**

- .1      American Society for Testing and Materials International, (ASTM).
  - .1      ASTM A 53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .2      ASTM A 105/A105M, Standard Specification for Carbon Steel Forgings, for Piping Applications.

**1.4**            **SUBMITTALS**

- .1      Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit product data and indicate for items as applicable:
  - .1      Manufacturer, model number, line contents, pressure and temperature rating.
  - .2      Movement handled, axial, lateral, angular and the amounts of each.
  - .3      Nominal size and dimensions including details of construction and assembly.
- .3      Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .4      Data to include:
  - .1      Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

## 1.5 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect, separate and place in designated containers for reuse and recycling, paper, plastic, polystyrene, corrugated cardboard packaging, steel, metal, in accordance with Waste Management Plan.
- .4 Unused sealant materials 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.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 PRODUCTS

### 2.1 FLEXIBLE CONNECTION

- .1 Applications: provide at following locations:
  - .1 Wall mounted water closets and urinals utilizing hands free electronic trim.
- .2 Material:
  - .1 Hose: 321 L stainless steel.
  - .2 Braid: 300 series stainless steel.
- .3 Construction: annular butt welded hydro formed closed pitch hose.
- .4 Performance: 50,000 cycle rated and pressure rated per ISO 10380.
- .5 Connections:
  - .1 One end stainless steel male threaded to suit connection size of electronic trim and the other end stainless steel tubing 70 mm in length to suit spud size connection on fixture.
- .6 Length: minimum of 900 mm.

- .7 Operating conditions:
  - .1 Domestic water:
    - .1 Service temperature range to be 4.4°C to 35°C.
    - .2 Maximum required working pressure: 1033 kPa.
  - .8 Acceptable Product: American BOA PARRAP custom made hose, Railmex, Senior Flexonics, Mason, Proco, or approved equal.

### **PART 3      EXECUTION**

#### **3.1            INSTALLATION**

- .1 Install flexible connections in accordance with manufacturer's instructions.

#### **3.2            PERFORMANCE VERIFICATION**

- .1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SECTION INCLUDES**

- .1            Materials and installation for thermometers and pressure gauges in piping systems.

**1.2**            **RELATED SECTIONS**

- .1            Section 01 33 00 – Submittal Procedures
- .2            Section 01 35 29.06 – Health and Safety Requirements
- .3            Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4            Section 23 05 53.01 – Mechanical Identification

**1.3**            **REFERENCES**

- .1            American Society of Mechanical Engineers (ASME)
  - .1            ASME B40.100, Pressure Gauges and Gauge Attachments.
  - .2            ASME B40.200, Thermometers, Direct Reading and Remote Reading.
- .2            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

**1.4**            **SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2            Submit shop drawings and product data.
- .3            Submit manufacturer's product data for following items:
  - .1            Pressure Gauges
  - .2            Ball Valves
  - .3            Snubbers

**1.5**            **HEALTH AND SAFETY**

- .1            Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

**1.6**            **WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

- .2 Collect, separate and place in designated containers for reuse and recycling, paper, plastic, polystyrene, corrugated cardboard packaging, steel, metal, in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.

## **PART 2      PRODUCTS**

### **2.1      GENERAL**

- .1 Design point to be at mid point of scale or range.
- .2 Ranges: dual imperial and metric.

### **2.2      PRESSURE GAUGES FOR POTABLE WATER SERVICE**

- .1 100 mm, dial type: to ASME B40.100, stainless steel case, lead free brass internals, NSF-61-372 certified for potable water use, 1.5% accuracy full scale, dual scale, DN 6 NPT bottom connection.
  - .1 Acceptable product: Winters PFQ-LF Series, Marsh, Wika, Trerice, or approved equal.
  - .2 Provide:
    - .1 Lead free snubber for pulsating operation (all gauges).
    - .2 Gasketed pressure relief back with solid front (all gauges).
    - .3 Glycerin filled for high vibration applications (all gauges).
    - .4 Lead free mini ball valve of brass body construction with stainless steel ball and Teflon gaskets. Valve to be equipped with DN 6 NPT female x DN 6 NPT male end connections (all gauges).

## **PART 3      EXECUTION**

### **3.1      GENERAL**

- .1 Install so they can be easily read from floor or platform.
- .2 Install in locations indicated.

**3.2 PRESSURE GAUGES**

- .1 Use extensions where pressure gauges are installed through insulation.

**3.3 NAMEPLATES**

- .1 Install engraved lamicoid nameplates as specified in Section 23 05 53.01 - Mechanical Identification, identifying medium.

**END OF SECTION**

**Part 1**

**General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Bronze – valves.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 01 78 00 – Closeout Submittals.
- .5 Section 23 05 05 – Installation of Pipework.

**1.3 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch.)
  - .2 ANSI/AMSE B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A 276, Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B 283, Specification for Copper and Copper Alloy Die Forgings (Hot Pressed)
  - .4 ASTM B 505/B505M, Specification for Copper-Base Alloy Continuous Castings.
  - .5 ASTM B124/B124M, Specification for Copper and Copper Alloy Forging Rod, Bars and Shapes.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B242, Groove and shoulder type Mechanical couplings.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves

- .3 MSS SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

#### 1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
  - .2 Submit data for valves specified this section.
- .3 Closeout Submittals
  - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

#### 1.5 QUALITY ASSURANCE

- .1 Health and Safety
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

#### 1.6 DELIVERY, STORAGE AND DISPOSAL

- .1 Waste Management and Disposal
  - .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .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.

### **PART 2** **PRODUCTS**

#### 2.1 CANADIAN REGISTRATION NUMBERS

- .1 All hydronic piping and components DN 25 and larger carrying fluid at temperatures exceeding 66°C shall be required to carry C.R.N. for the Province of Newfoundland and Labrador. Submit shop drawings of pressure piping components clearly showing applicable C.R.N.

#### 2.2 MATERIALS

- .1 Except for specialty valves, to be single manufacturer.
- .2 All quarter turn ball valves shall be provided with handle extensions to enable valve operation while valve body is insulated.

### 2.3 END CONNECTIONS

- .1 Connection into adjacent piping/tubing:
  - .1 Copper tube systems: Solder ends for piping up to and including DN 50.
  - .2 Grooved copper connection system for piping DN 65 and above.
  - .3 Permanent push to connect system for piping DN 15 and DN 50.

### 2.4 BALL VALVES

- .1 DN 50 and under, soldered:
  - .1 Body and cap: brass.
  - .2 Pressure rating: Class 150, 1.03 MPa steam, WP = 4.13 MPa WOG.
  - .3 Connections: soldered ends.
  - .4 Stem: brass tamperproof ball drive.
  - .5 Packing: PTFE.
  - .6 Ball and seat: replaceable chrome plated brass ball and PTFE seats.
  - .7 Gland: brass.
  - .8 Operator: removable lever handle.
  - .9 Two-piece construction, full port.
  - .10 Acceptable Product: Jenkins Figure 202J, Milwaukee, Newman Hattersley, Kitz, Toyo, Crane, Apollo, NIBCO, or approved equal.
- .2 DN 50 and under, permanent push to connect.
  - .1 Acceptable Product: Victaulic PermaLynx, Star, Gruvlok, Shurjoint, or approved equal.
- .3 DN 50 and under, threaded.
  - .1 Body and cap: brass.
  - .2 Pressure rating: Class 150, 1.03 MPa steam, WP = 4.13 MPa WOG.
  - .3 Connections: screwed ends to ANSI B1.20.1 and with hex shoulders.
  - .4 Stem: brass tamperproof ball drive.
  - .5 Packing: PTFE.
  - .6 Ball and seat: replaceable chrome plated brass ball and PTFE seats.
  - .7 Gland: brass.
  - .8 Operator: removable lever handle.
  - .9 Two-piece construction, full port.
  - .10 Acceptable Product: Jenkins Figure 201J, Milwaukee, Newman Hattersley, Kitz, Toyo, Crane, Apollo, NIBCO, or approved equal.

**PART 3**      **EXECUTION**

**3.1**            **INSTALLATION**

- .1      Install valves in upright position with stem above horizontal.
- .2      Remove internal parts before soldering.
- .3      Utilize ball valves for purposes of isolation unless otherwise noted.
- .4      Adjoining tube, coupling, and fittings with grooved joint valves shall be copper-tube dimensioned. Flaring tube or fitting ends to accommodate IPS sized valves is not permitted.
- .5      Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.
  - .1      Unions are not required in installations using grooved mechanical couplings. The couplings shall serve as unions.

**3.2**            **COMMISSIONING**

- .1      As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, normal position, manufacturer and model number.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section includes:
  - .1 Requirements for cast iron and ductile iron butterfly valves.

**1.2**            **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements
- .3 Section 01 45 00 - Quality Control
- .4 Section 01 61 00 - Common Product Requirements
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .6 Section 01 78 00 - Closeout Submittals.

**1.3**            **REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
  - .2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .2 ASTM A563, Standard Specification for Ductile Iron Castings.
- .3 Manufacturer's Standardization Society: For the Valves and Fittings Industry, Inc. (MSS).
  - .1 MSS SP-67, Butterfly Valves.
- .4 Province of Newfoundland and Labrador
  - .1 Boiler Pressure Vessel and Compressed Gas Regulations.

**1.4**            **SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings: Submit drawings stamped and signed for approval by Owner's Representative.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## 1.5 QUALITY ASSURANCE

- .1 Quality Assurance: In accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 PRODUCTS

### 2.1 CANADIAN REGISTRATION NUMBERS

- .1 All hydronic piping and components DN 25 and larger carrying fluid at temperatures exceeding 66°C shall be required to carry C.R.N. for the Province of Newfoundland and Labrador. Submit shop drawings of pressure piping components clearly showing applicable C.R.N.

### 2.2 BUTTERFLY VALVES

- .1 DN 65 and over, flanged, wafer style:
  - .1 To MSS SP-67, Class 200.
  - .2 Cast iron body, aluminum bronze disc, stainless steel stem, EPDM liner.

- .3 Operator: lever handle with memory stop up to DN 125, manual gear operator with handwheel DN 150 and above
- .4 Acceptable Product: Jenkins figure 2222 ELJ, Milwaukee, Newman Hetttersley, Kitz, Toyo, Crane or approved equal.
- .2 DN 65 and over, grooved end:
  - .1 Body: ductile iron to ASTM A-536.
  - .2 Body coating: black alkyd enamel.
  - .3 Disc: nickel coated ductile iron.
  - .4 Seat: EHP rubber with full 360° continuous contact.
  - .5 Stem: 416 stainless conforming to ASTM A-582
  - .6 Operator: lever handle with memory stop up to DN 125, manual gear operator with handwheel DN 150 and above.
  - .7 Maximum rated working pressure: 2067 kPa. (Bi-directional and dead end service capable of full rated pressure.)
  - .8 Acceptable Product: Victaulic Series 300 master Seal Butterfly Valve (#761), NIBCO, or approved equal.

### 2.3 VALVE OPERATORS

- .1 Install valve operators as follows:
  - .1 Lever handle up to DN 125.
  - .2 Manual gear operated handwheel DN 150 and above.
  - .3 Provide chain operator on all valves mounted 2400 mm or more above floor in mechanical rooms.

### 2.4 MOUNTING FLANGES

- .1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

## PART 3 EXECUTION

### 3.1 PREPARATION

- .1 Valve and mating flange preparation:
  - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
  - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
  - .3 Install butterfly valves with disc in almost closed position.
  - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

### 3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Mount actuator on to valve prior to installation.
- .5 Handle valve with care so as to prevent damage to disc and seat faces.
- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize lines and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example, to pipe wall thickness, taper bore adjacent piping to remove interference.
- .8 Grooved end valves to be supplied by the same manufacturer of the grooved fittings.
- .9 Grooved end valves shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations and projections. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.

**END OF SECTION**

**PART 1**

**GENERAL**

**1.1 SUMMARY**

- .1 Section includes:
  - .1 Hangers and supports for mechanical piping and equipment.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .5 Section 01 78 00 - Closeout Submittals.
- .6 Section 22 07 19 – Plumbing Pipe Insulation.
- .7 Section 23 31 13.01 - Metal Ducts - Low Pressure to 2500 Pa.

**1.3 REFERENCES**

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
  - .2 ANSI/ASME B31.3, Pressure Piping.
  - .3 ANSI/ASME B31.9, Building Service Piping.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.
- .3 Canadian Standards Association (CSA)
- .4 Factory Mutual (FM)
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

- .6 Underwriter's Laboratories of Canada (ULC)

#### 1.4 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, B31.3, B31.9 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 all 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 to be in accordance with MSS SP58.

#### 1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed for approval by Owner's Representative.
- .3 Submit shop drawings and product data for following items:
- .1 Hangers and supports.
  - .2 Connections to equipment and structure.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Instructions: submit manufacturer's installation instructions.
- .5 Closeout Submittals:
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

#### 1.6 QUALITY ASSURANCE

- .1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2      PRODUCTS**

### **2.1      GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.
- .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: galvanized painted with zinc-rich paint after manufacture.
  - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
- .2 Clamps: manufactured from steel with electro-galvanized finish. Cushion to be manufactured from a thermoplastic elastomer, oil and chemical resistant and suitable from service temperatures from 10C to 149C.
  - .1 Acceptable Product: Unistrut Cush-A-Clamp, or approved equal.
- .3 Upper attachment Unistrut: suspension from ceiling mount Unistrut channel.
  - .1 Channel: cold formed from low-carbon strip steel. Channel shall be pre-galvanized, of 12 ga. Material thickness and 41.3 mm x 41.3 mm dimensions.
    - .1 Acceptable Product: Unistrut P1000 or approved equal.
  - .2 Channel nuts: manufactured from mild steel bars and case hardened after machining. Channel nuts shall have electro-galvanized finish, ½" -13 nut size thread, for use with Unistrut P1000 Series channel.
    - .1 Acceptable Product: Unistrut P1010 or approved equal.
- .4 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping DN 50 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, 12 mm diameter rod.
    - .1 Acceptable Product: Myatt Fig. 586, Hunt, Grinnell, or approved equal.

- .2 Cold piping DN 65 or greater, all hot piping: malleable iron beam clamp, eye rod, jaws and exterior with carbon steel retaining clip, tie rod, nuts and washers, 12 mm diameter rod.
  - .1 Acceptable Product: Myatt Fig. 510 or 511, with Myatt Fig. 480 weldless eye nut, Hunt, Grinnell, or approved equal.
- .5 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping DN 50 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, 12 mm diameter rod.
    - .1 Acceptable Product: Myatt Figure 586, Hunt, Grinnell, or approved equal.
  - .2 Cold piping DN 65 or greater, all hot piping: malleable iron top-of-beam hook, nut and washer, 12 mm diameter rod.
  - .3 Acceptable Product: Myatt Figure 506, Hunt, Grinnell, or approved equal.
- .6 Upper attachment structural: suspension from bottom chord of open web steel joints:
  - .1 All piping: malleable iron plate washer with maximum 9 mm diameter rod.
    - .1 Acceptable Product: Myatt Figure 545, Hunt, Grinnell, or approved equal.
- .7 Upper attachment structural: suspension from structural steel support channel or angle:
  - .1 All piping: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, 12 mm diameter rod.
    - .1 Acceptable Product: Myatt Fig. 586, Hunt, Grinnell, or approved equal.
- .8 Hanger rods: continuous threaded rod material to MSS SP-58.
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Acceptable Product: Myatt Fig. 434, Hunt, Grinnell, or approved equal.
- .9 Shop and field-fabricated assemblies.
  - .1 Trapeze hanger assemblies: MSS SP-89.
  - .2 Steel brackets: MSS SP-89.
- .10 Pipe attachments: material to MSS SP-58.
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .2 Use insulation shields for cold pipe work below 65°C, DN 15 and above and for hot pipe work 66°C and over, up to and including DN 50. In addition use insulation shields on cold piping 65°C and below in conjunction with high density insulation at pipe stanchion saddle supports and pipe stanchion saddle anchors regardless of pipe size.
    - .1 Acceptable product: Myatt Fig. 251 or 251S as applicable, Hunt, Grinnell, or approved substitute.
  - .3 Use pipe covering insulation saddles for all hot piping 66°C and over, DN 65 and above. In addition use pipe covering insulation saddles on all hot piping 66°C

- and over at pipe stanchion saddle supports and pipe stanchion saddle anchors, regardless of pipe size.
- .1 Acceptable Product: Myatt Fig. 210-240 as applicable, or approved substitute.
  - .4 Oversize pipe hangers and supports for insulated pipes.
  - .11 Adjustable clevis: material to MSS SP-69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
    - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
    - .2 Acceptable Product: Myatt Fig. 124L, Hunt, Grinnell, or approved equal.
  - .12 Standard roller hanger: carbon steel yoke with cast iron roll. Provide complete with hanger rod and nuts for vertical height adjustment.
    - .1 Acceptable product: Myatt Fig. 258, Hunt, Grinnell, or approved substitute.
  - .13 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.
    - .1 Finishes for steel pipework: galvanized.
    - .2 Acceptable Product: Myatt Fig 402, Hunt, Grinnell, or approved equal.
  - .14 Pipe stanchion saddle supports:
    - .1 Pipe stanchion saddle: to be used to support piping from the floor or ground. Provide complete with U-bolt for pipe securement.
      - .1 Acceptable Product: Myatt Fig. 306S, Hunt, Grinnell, or approved equal.
    - .2 Pipe stanchion saddle support pipe: Schedule 40 black iron primed pipe supplied and installed by the Mechanical Contractor. Cut to length in field as required.
    - .3 Pipe stanchion saddle floor mounting plates: 150 mm x 150 mm x 6 mm primed steel plate drilled to accept 6.4 mm bolt head sleeve anchors.
      - .1 Acceptable Product: Hilti HLC bolt head sleeve anchors, or approved equal.
  - .15 Rigid base support: to be used to provide a rigid support at base of pipe elbows. Support to consist of vertical stanchion support factory welded to a steel base plate. Stanchion support member to be field welded to the piping being supported. Horizontal support plate shall be factory drilled to accept bolt head sleeve anchors in the field.
    - .1 Acceptable Product: Myatt fig. 703 complete with Hilti HLC bolt head sleeve anchors, Hunt, Grinnell, or approved equal.
  - .16 Heavy duty support clip: Designed to secure pipe tight against any surface. Carbon steel construction.
    - .1 Acceptable Product: Myatt Fig. 162, Hunt, Grinnell, or approved equal.
- 2.3 RISER CLAMPS**
- .1 Steel pipe or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42.
  - .2 Bolts: to ASTM A307.

- .3 Nuts: to ASTM A563.
- .4 Acceptable Product: Myatt Figure 182, Hunt, Grinnell, or approved equal.

#### **2.4 INSULATION PROTECTION SHIELDS AND SADDLES**

- .1 Use insulation shields for cold pipe work below 65°C and for hot pipe work 66°C and over, up to and including DN 50. In addition use insulation shields on cold piping 65°C and below in conjunction with high density insulation at pipe stanchion saddle supports and pipe stanchion saddle anchors regardless of pipe size.
  - .1 Acceptable Product: Myatt Fig. 251 or 251S as applicable, Hunt, Grinnell, or approved equal.
- .2 Use pipe covering insulation saddles for all hot piping 66°C and over, DN 65 and above. In addition use pipe covering insulation saddles on all hot piping 66°C and over at pipe stanchion saddle supports and pipe stanchion saddle anchors, regardless of pipe size.
  - .1 Acceptable Product: Myatt Fig. 210-240 as applicable, Hunt, Grinnell, or approved equal.

#### **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. The supply of material and the fabrication labour required to construct these equipment supports shall be the responsibility of the Mechanical Contractor.
- .2 All fabricated equipment supports shall be primed before installation in the field.
- .3 All galvanized equipment supports shall be touched up with cold galvanizing as required to maintain the integrity of the finish.

#### **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

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

#### **2.7 DUCT HANGERS**

- .1 See specification Section 23 31 13.01 - Ductwork - Metallic to 2500 Pa.

### **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 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 be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
- .3 Provide supplementary structural steelwork where structural bearing does not exist.

### 3.3 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code.
- .2 Steel screwed or flanged pipes: in accordance with table below.

Maximum Pipe Size: DN	Maximum Spacing: Steel
up to 32	2.1 m
40	2.7 m
50	3.0 m
65	3.6 m
80	3.6 m
90	3.9 m
100	4.2 m
125	4.8 m
150	5.1 m
200	5.7 m
250	6.6 m
300	6.9 m

- .3 Rigid, joint roll groove pipe: in accordance with manufacturer of rigid joint system or table below, whichever is more stringent, but not less than one hanger at joints.
- .4 Within 300 mm of each elbow.

### 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, provide supplementary structural steel members, comprised of angel iron or c-channel.

### 3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 5 degrees from vertical.
- .2 Where angularity of rod hanger resulting from horizontal pipe movement is less than 5 degrees, offset pipe hanger and support so that rod hanger is vertical in the hot position.
- .3 Where angularity of rod hanger resulting from horizontal pipe movement is greater than 5 degrees, utilize yoke style pipe roll.

### 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 to flanges of beams and channels.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section includes:
  - .1 Vibration isolation materials and components, seismic control measures and their installation.

**1.2**            **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 11 – Cleaning.
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .6 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

**1.3**            **REFERENCES**

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS)
- .2 National Building Code of Canada (NBC)
- .3 American Society of Civil Engineers (ASCE/SEI)
  - .1 ASCE/SEI-7, Minimum Design Loads for Buildings and Other Structures.

**1.4**            **SUBMITTALS**

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

- .1 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.
- .2 Provide separate shop drawings for each isolated system, system shop drawings complete with performance and product data.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.

## 1.5 QUALITY ASSURANCE

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 PRODUCTS

### 2.1 GENERAL

- .1 Size, shape and performance of vibration isolation to be as indicated.

### 2.2 HANGERS

- .1 To be utilized to isolate suspended sources of audible and inaudible sound and vibration such as fan coils, unit heaters, piping and ductwork.
- .2 Shipped to site fully assembled and ready for installation in threaded metal rod suspension systems.
- .3 Free standing, large diameter, laterally stable steel springs in series with an elastomer-in-shear insert, assembled into a stamped or welded bracket.

- .4 Hanger shall incorporate a high deflection, colour coded spring element with load transfer plate and a 10 mm deflection elastomeric isolator.
- .5 Minimum lateral stiffness of 1.2 times the rated vertical stiffness.
- .6 Specially designed spring load plate shall prevent the possibility of short circuiting.
- .7 Hangers shall allow a support rod misalignment through a 30° arc without short circuiting.
- .8 Hanger brackets shall be capable of carrying a 500% overload without failure.
- .9 Rated hanger deflection shall be 25 mm.
- .10 Hanger bracket and spring element to be epoxy powder coated.
- .11 Acceptable Product: Vibron Model SRH, Korfund, Vibro-Acoustics, or approved equal.

### **PART 3**      **EXECUTION**

#### **3.1**      **MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2**      **INSTALLATION**

- .1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Support fan coils and unit heaters with spring hangers.
- .4 Support piping connected to vibrating equipment such as fan coils and unit heater, with 25 mm minimum deflection as follows:
  - .1 Up to DN 100: first three (3) points of support.
  - .2 DN 125 to DN 200: first four (4) points of support.
  - .3 DN 250 and over: first six (6) points of support.
- .5 Support ductwork connected to mechanical equipment with isolation hangers with 25 mm minimum static deflection as follows:
  - .1 All ductwork within 3 meters of connection to rotating equipment.

- .6 All duct connections to mechanical equipment shall be made with flexible duct connectors, unless otherwise noted.

### 3.3 SYSTEM DESIGN

- .1 The isolation materials manufacturer shall be responsible for the proper submission of isolators to accomplish the specified minimum static deflections, for all isolators, based on the actual weight distribution of equipment to be isolated.
- .2 The Mechanical Contractor shall furnish a complete set of approved shop drawings of all mechanical equipment to receive vibration isolation devices to the vibration isolation materials manufacturer, based upon which the selection of vibration isolators will be completed. The shop drawings to be furnished shall include operating weights of the equipment to be isolated and the distribution of weight at support points.
- .3 The Mechanical Contractor shall furnish a complete layout of ductwork and piping to be isolated, showing size or weight and support points of the ductwork and piping systems, to the vibration isolation materials manufacturer, for selection and layout of isolation hangers.

### 3.4 SUBMITTALS

- .1 Shop drawings:
- .1 The Mechanical Contractor shall have prepared by the isolation materials manufacturer, and shall submit to the Engineer for approval, drawings showing the construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project, and shall include a tabulation of the design data for each isolator, including spring O.D., free operating, and solid heights, and ratio of horizontal to vertical stiffness, and other required data to clearly indicate that the specified isolator types and minimum static deflections are provided for the system submitted.

### 3.5 CLEANING

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

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1 Section Includes:
  - .1 Materials and requirements for the identification of piping systems, duct work, valves and controls, including the installation and location of identification systems.
  - .2 Sustainable requirements for construction and verification.

**1.2**            **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Section 09 91 23 - Interior Painting.
- .6 Section 25 05 54 - EMCS: Identification.

**1.3**            **REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.

**1.4**            **SUBMITTALS**

- .1 Product Data:
  - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

**1.5**            **QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 PRODUCTS

### 2.1 GENERAL

- .1 MUN has a computerized maintenance software program that the mechanical and electrical equipment labeling will be linked to. MUN identifies equipment in the field using a unique equipment identification tag linked back to their TMA software program. MUN also uses a bar code system to identify their mechanical and electrical equipment which is also linked to their TMA maintenance software system. MUN maintenance staff personnel use iPads equipped with bar code scanning software to provide them with information on each piece of mechanical and electrical equipment in the field. Hence the mechanical and electrical equipment labeling methodology to be utilized must include the unique equipment identification tag as well as a unique bar code.
- .2 Lamacoid labels shall not be used on equipment in the field. The unique equipment tag and bar code for each piece of equipment shall be on vinyl stickers which are to be placed on each piece of equipment in the field. This provides for flexibility to update the equipment tag over time and simply stick the new label on over the old label.
- .3 The lettering and bar code shall be applied to the vinyl label through a printer made for these types of labels. MUN uses a Brother P-Touch Pro label maker. The mechanical contractor shall procure this model or one like it for the purposes of preparing the equipment labels for this project.
- .4 The mechanical contractor shall prepare a complete list of project mechanical equipment to be labeled in an Excel spreadsheet. Each individual piece of equipment shall be included on this list. The equipment list shall be submitted for review as a shop drawing. The equipment tag shall include a "Building Prefix", an "Equipment Prefix", and a "Sequential Number". The "Building Prefix" for this building is CSF. The appendix document includes a list of "Equipment Prefix" identifiers. If any equipment is utilized on this project that is not included in the list, please contact the engineer for direction on the proper "Equipment Prefix" to use.
- .5 The equipment list shall include:
  - .1 Location

- .2 Drawing Identification
  - .3 TAG ID
  - .4 Service
  - .5 Description
  - .6 Manufacturer
  - .7 Model #
  - .8 Serial #
  - .9 Barcode
- .6 Following acceptance of the contractor's equipment list. The equipment labels shall be converted to a bar code utilizing Microsoft Excel. The labels shall be batch produced in an Excel spreadsheet. This link provides additional information on how barcodes are generated:  
[https://secureweb.cisco.com/1jw5nhTcX5Q7XvsWblwQM54XKgWqEtDrrGsM3zWJqGp5nhZoXZLftLhOiR2kCDCMBY-f2aCf4TMdtmjZkPFiV8O0IJpWUBGb3OrOzAOJLS1RWojkjD0WuqOYvWpKK4KmqbWd9GLv587lh06yJTVOnD0gCeuas8o8p-mz2t9g4fZxqBWAD\\_Sh9NZva\\_xSrcPXrrbl0vCoY2cifzlm26I2aCCRLQMrvLWDv56j55FZbwgbdPQtUZCpxWDdT0x3ZAKxeBQ0D3ZebYUI9I85PhM4ptr2Lpu8aieI4Kj\\_1WI\\_ckbKku24vFB2TAQQZkgm5ldAIST8yhR8UzzKA4BqDixqsQ/https%3A%2F%2Fwww.barcoderesource.com%2Fbarcodeappforoffice.shtml](https://secureweb.cisco.com/1jw5nhTcX5Q7XvsWblwQM54XKgWqEtDrrGsM3zWJqGp5nhZoXZLftLhOiR2kCDCMBY-f2aCf4TMdtmjZkPFiV8O0IJpWUBGb3OrOzAOJLS1RWojkjD0WuqOYvWpKK4KmqbWd9GLv587lh06yJTVOnD0gCeuas8o8p-mz2t9g4fZxqBWAD_Sh9NZva_xSrcPXrrbl0vCoY2cifzlm26I2aCCRLQMrvLWDv56j55FZbwgbdPQtUZCpxWDdT0x3ZAKxeBQ0D3ZebYUI9I85PhM4ptr2Lpu8aieI4Kj_1WI_ckbKku24vFB2TAQQZkgm5ldAIST8yhR8UzzKA4BqDixqsQ/https%3A%2F%2Fwww.barcoderesource.com%2Fbarcodeappforoffice.shtml)



**2.2 EQUIPMENT LABELS**

- .1 Plastic Labels for Equipment:
  - .1 Material and Thickness: minimum 160 micrometers thick laminated tape with adhesive. Labels are to withstand any type of scrape or abrasion, and be resistant to water, oil, chemicals and fading from UV rays. Labels shall be intended for indoor and outdoor use.
  - .2 Basis of Design and Acceptable Products: Basis of design is 1 inch thick "Brother P-touch TZE tape - TZeS-251 extra strength adhesive" or approved equal or better. Alternative product shall contain manufacturer's literature to declare labels can withstand any type of scrape or abrasion, and are resistant to

water, oil, chemicals and fading from UV rays and are intended for indoor and outdoor use.

- .3 Letter Colour: Black.
- .4 Background Colour: White.
- .5 Maximum Temperature: Able to withstand temperatures up to 356 deg. F (150 deg. C)
- .6 Minimum Label Size: The width shall be 1 inch and width to vary for required label content, but not less than 3 inch.
- .7 Minimum Letter size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering. Information to include MS Excel applied barcode 39 as shown below. Where larger than 1/4 inch lettering used, barcode to be place adjacent to the letters.
- .8 Adhesive: Factory applied permanent adhesive, compatible with substrate.

### 2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Sprinklers: to NFPA-13.

### 2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required, to 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 Peel and stick markers and arrows held in place with pressure sensitive tape.

- .1 Acceptable Product: Seton OPTI-Code pipe markers and arrows held in place with Seton 59653 40 mm wide pressure sensitive tape, Brady, or approved equal.
- .7 Colours and Legends:
- .1 Where not listed, obtain direction from Owner's Representative.
- .2 Colours for legends, arrows, to following table:

Background colour	Legend, arrows
Yellow	BLACK
Blue	WHITE
Green	WHITE

- .3 Background colour marking and legends for piping systems:

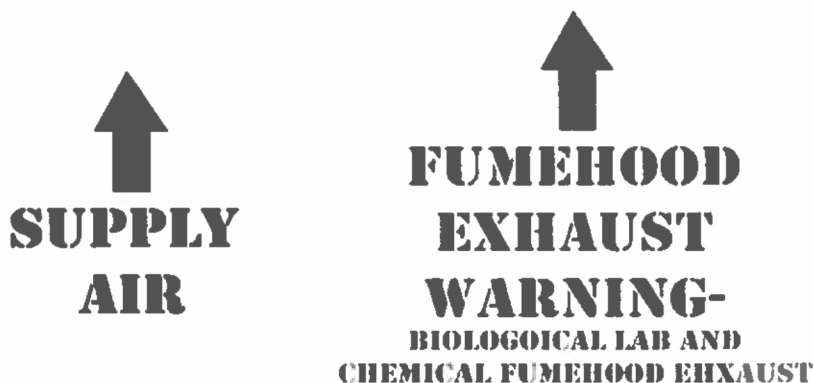
<u>Contents</u>	<u>Background colour marking</u>	<u>Legend</u>
Chilled water supply 14	Yellow	CWS 14
Chilled water return 14	Yellow	CWR 14
Sprinkler	Red	SPRINKLER
Hot water supply 43	Yellow	HWS 43
Hot water return 43	Yellow	HWR 43
Hot water supply 83	Yellow	HWS 83
Hot water return 83	Yellow	HWR 83
Domestic hot water supply	Green	Dom HWS
Domestic cold water supply	Green	Dom CWS
Domestic hot water recirc	Green	SAN
Sanitary Sewer	Green	SAN
Sanitary Vent	Green	SAN Vent
Storm	Green	SD

## 2.5 IDENTIFICATION DUCTWORK SYSTEM

- .1 Install plastic-laminated duct labels with permanent adhesive on air ducts in the color, stencil and size described below.
- .2 Stenciled Duct Label Option: Stenciled labels, showing service and flow direction can be provided instead of plastic-laminated duct labels, at installer's option, if lettering larger than 25 mm high is needed for proper identification because of distance from normal location of required identification.
- .3 Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 17 meters in each space where ducts are exposed or concealed by removable ceiling system.
- .4 Color Codes / Stencil / Size:

System	Stencil	Letter Size	Stencil Paint Colour
Supply Air	SUPPLY AIR	100 mm	Blue
Return Air	RETURN AIR	100 mm	Green

Fume Hood Exhaust	FUME HOOD EXHAUST	100 mm	Green
Washroom Exhaust	WASHROOM EXHAUST	100 mm	Green
Lab General Exhaust	LAB EXHAUST	100 mm	Green



**2.6 MANUAL VALVE IDENTIFICATION**

- .1 Applies to manually activated valves only. Control valves, pressure relief valves, pressure reducing valve, sprinkler valves, etc. are identified as equipment and fall under the equipment label procedure identified above. This section applies to manual isolation valves only.
- .2 The mechanical contractor shall prepare a valve tag schedule. The mechanical contractor shall prepare a complete list of valves to be labeled in an Excel spreadsheet. Each individual valve shall be included on this list. The valve tag schedule shall be submitted for review as a shop drawing. The valve tags shall include a "Sequential Number". The "Sequential Number" shall be based on the following ranges. If any valves are utilized on this project that are not included in the list, please contact the engineer for direction on the proper "Sequential Number" to use.

Numbering Range	System
0000-1999	Hydronic Heating & Cooling

- .3 The valve tag schedule shall include the following headings:
  - .1 Tag #: Valve Tag Number
  - .2 Level: Level that the valve is located on
  - .3 Location: Indicates if valve is located at equipment, overhead in an open ceiling space or above ceiling. Room number that valve is located in.
  - .4 System: System that valve belongs to.
  - .5 Equipment Tag: System tag that valves serves
  - .6 Type: Type of valve – butterfly, ball, etc.
  - .7 Size: Diameter of valve
  - .8 Model: Valve model number
  - .9 Manufacturer: Valve manufacturer

- .10 Service: Purpose of valve
- .11 NO/NC: Normal valve position – open or closed
- .4 Physical tags with label and barcode to be prepared in same manner as equipment tags described herein.

## 2.7 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors in accordance with the above described systems. The controls components are part of the scope of the equipment labels.
- .2 Control system component identification shall be the responsibility of the Controls Contractor. Reference Section 25 05 54 – EMCS: Identification.

## 2.8 LANGUAGE

- .1 Identification to be in English.

## PART 3 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 TIMING

- .1 Provide identification only after all painting specified in Section 09 91 23 - Interior Painting has been completed.

### 3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

### 3.4 EQUIPMENT LABEL INSTALLATION

- .1 Preparation:
  - .1 Clean piping and equipment surface of substances that could impair bond of identification devices, including moisture, dirt, oil, grease, release agents, and incompatible primers, paints and encapsulants.
- .2 Installation:
  - .1 Where installation of label is restricted, such as valves, place the label on 1/16 inch thick clear plexiglass and fasten with #10 (4.5 mm) ball chain. Ensure:

- .1 Clear plexiglass to be 8 mm larger in width and 10 mm larger in length than the label.
- .2 Center the label vertically and horizontally on the plexiglass.
- .3 Bullnose the corners and clean any sharp edges.



- .2 Labels are to be placed on the front of the equipment in a location where it can be visible.
- .3 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .4 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .5 Protection
  - .1 Do not paint, insulate or cover in any way.

### 3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.








- .1 Position of identification to be 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 SCHEDULE

- .1 Install one copy of valve schedule mounted in frame behind non-glare glass in water entry room. Provide one copy (reduced in size if required) in each operating and maintenance manual.

### 3.7 IDENTIFICATION ON CEILINGS

- .1 Where valves, fire dampers, or similar system component that require access are located above ceilings the mechanical contractor shall provide indicators for these locations.
- .2 A 20 mm colored adhesive vinyl indicator shall be used to identify the location of equipment above the ceiling. The indicator shall be located on the underside of the acoustic ceiling tile or on the access hatch in the case of gypsum board ceilings.
- .3 The color coding and shape for the indicator is noted below. If any equipment or systems are not included in the below list, please contact the engineer for direction on the proper color and shape to use.

Service	Indicator	
Hydronic Heating Valves		Yellow
Chilled Water Valves		Green
HVAC – VAV / Reheat Coils		Yellow
Fire / Smoke Dampers		Red
Fire Suppression Valves		Red
VAV / Exhaust / Air Valves		Orange
Domestic Water Valves		Blue

### 3.8 CLEANING

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

**END OF SECTION**

**Equipment Listing**  
*Types, Prefixes, Definitions*

Updated: February 09, 2015

## Creating an Equipment Tag

“BUILDING PREFIX” – “EQUIPMENT PREFIX” – “NUMBER”

FM            -            AC            -            01

Facilities Management - Air Conditioner - Number in Building

Example: FM-AC-01

This is the first air conditioner tagged in the Facilities Management Building

Example: SN-CV-27

This is the 27<sup>th</sup> control valve tagged in the Science Building

Notes: The equipment prefixes come from the equipment listing document

## Index

<b>No.</b>	<b>Type</b>	<b>No.</b>	<b>Type</b>
1	Aftercooler	44	Heat Exchanger
2	Air Conditioner	45	Heat Pump
3	Air Door	46	Heat Recovery Unit
4	Air Dryer	47	Heater
5	Air Handling Unit	48	HUB-FA Fibre Optics
6	Air Separator	49	Humidifier
7	Air Vent	50	Ladder
8	Anchor Point	51	Level Control
9	Battery Power Pack	52	Lighting
10	Blower, Soot	53	Load Bank
11	Boiler	54	Manhole
12	Burner, Fuel	55	Meter
13	Buss Bar	56	Motor
14	Card Access	57	Motor Control Centre
15	Charger, Battery	58	Motorized Basket Lift
16	Chiller	59	Panel
17	Clock	60	Pipe Section
18	Coils	61	Pipe Slider
19	Compressor	62	Pipe Support
20	Condensing Unit	63	Platform
21	Contactator	64	Pot Cooler
22	Controls	65	Pump
23	Conveyor	66	Radiation Emitting Equipment
24	Cooling Tower	67	Radiator
25	Custodial Equipment	68	Refrigerated Unit
26	Damper	69	Regulator, Pressure
27	Detectors	70	Relays, Electric Heating
28	Diesel Generator	71	Sensor
29	Disconnects (Switches)	72	Snow Melting
30	Door	73	Sprinkler System
31	Electrical Equipment	74	Stack
32	Elevator	75	Switchgear, High Voltage
33	Elevator Controls	76	Switchgear, Low Voltage
34	Emergency Wash Station	77	System Header Parent
35	Evaporator	78	Tank
36	Fan	79	Transformer
37	Filter	80	Trap
38	Fire Hydrant	81	UPS
39	Fire Suppression System	82	Valve
40	Fuel Tank	83	Washer, Cage and Rack
41	Fume Hood	84	Water Column
42	Grounds Equipment	85	Water Fountain
43	Hand Dryer	86	Water Main

## Equipment Listing

No.	Type	Equipment	Prefix	Definition
1	Aftercooler	Aftercooler	AFC	A device for cooling a fluid between successive heating stages
2	Air Conditioner	Air Conditioner	AC	A system that keeps air cool and dry
3	Air Door	Air Door	ADR	A downward-facing blower fan mounted over an opening, blowing air across the surface of the opening
4	Air Dryer	Air Dryer	AD	A device for removing water vapor from compressed air
5	Air Handling Unit	Air Handling Unit	AHU	A device used to circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system
6	Air Separator	Air Separator	AS	A device that uses an air current to separate a material from another of greater density or particles from others of greater size
6	Air Separator	Oil and Water Separator	SEPR	A device that allows oils mixed with water to become trapped in a holding section for removal, while the water is allowed to pass through for disposal
7	Air Vent	Air Vent	AV	An opening through which air can escape from an enclosed space, out of a hydronic system
8	Anchor Point	Anchor Point	AP	A secure point of attachment for lifelines
9	Battery Power Pack	Battery Pack	BP	A set of any number of identical batteries or individual battery cells. DC (direct current)
10	Blower, Soot	Soot Blower	SB	A system for removing the soot that is deposited on the furnace tubes of a boiler during combustion
11	Boiler	Heating Boiler	FUR	An enclosed structure in which material can be heated to very high temperatures
11	Boiler	High Pressure Boiler	HPB	A boiler in which steam or other vapor is generated at pressure exceeding 15 PSI
11	Boiler	Low Pressure Boiler	LPB	A boiler in which steam is generated at pressures not exceeding 15 PSI
11	Boiler	Steam Boiler	STBR	A vessel in which water is heated to generate steam
11	Boiler	Wind Box	WBX	A plenum chamber that supplies combustion air from the draft fan to the furnace for combustion
11	Boiler	Wind Box Pressure Transmitter	WBPT	A device that measures the air pressure in the windbox and transmits an output signal to a secondary device such as a monitoring or control device
12	Burner, Fuel	Atomizing Air/Steam Transmitter	ASPT	A device that senses the atomizing air/steam pressure in the space to which it is connected. The device transmits this signal to a secondary monitoring or control device
12	Burner, Fuel	Burner Low Fire Position Switch	LFFY	A switch for selecting a low fire option for a burner. This allows the burner to operate at a low fire rate and hence low heat output for periods of low demand

No.	Type	Equipment	Prefix	Definition
12	Burner, Fuel	Burner Low Oil Pressure Switch	FOPS	A device that senses when the burner fuel oil pressure is below a pre-determined set point and transmits this signal to a secondary monitoring or control device
12	Burner, Fuel	Burner Oil Flow Transmitter	FOFT	A device that senses the burner fuel oil flow in the pipe to which it is connected. The device transmits this signal to a secondary monitoring or control device
12	Burner, Fuel	Burner Oil Pressure Transmitter	FOPT	A device used to transmit a measured burner oil pressure measurement for further use by a monitoring or control device
12	Burner, Fuel	Fuel Burner	BURN	A device, as in a furnace, stove, or heater that is lighted to produce heat
12	Burner, Fuel	High Propane Pressure Switch	PHSW	A device that senses when the propane pressure is above a pre-determined set point and send a signal to a secondary device advising of the high pressure
12	Burner, Fuel	Low Atomizing Steam Flow Switch	ASFS	A device that measures the flow of atomizing steam to a burner and shuts down the burner when the flow is reduced to a pre-determined set point
12	Burner, Fuel	Low Atomizing Steam Pressure Switch	ASPS	A device that senses when the atomizing steam pressure is below a pre-determined set point and sends a signal to a secondary device advising of the low pressure
12	Burner, Fuel	Low Propane Pressure Switch	PLSW	A switch that measures the propane pressure in a vessel or line to which it is connected. This measurement is then transmitted to a secondary device for monitoring or control
12	Burner, Fuel	Propane Pressure Transmitter	PPT	A device that senses the propane pressure in the space to which it is connected. The device transmits this signal to a secondary monitoring or control device
13	Buss Bar	Buss Bar	BUSS	An electric conductor, often a metal bar, that serves as a common connection for two or more circuits
14	Card Access	Card Reader Door	CACR	A door that requires a card to gain access
14	Card Access	Door Control Device	DCD	A device used to control each door
14	Card Access	Site Controller	CASC	A device that controls every card access door in a building
15	Charger, Battery	Battery Charger	BC	A device for charging or recharging batteries
16	Chiller	Chiller	CHL	A device that generates a cold liquid that is circulated through an air-handling unit's cooling coil to cool the air supplied to the building
17	Clock	Clock	CL	A mechanical or electrical device for measuring time
17	Clock	Master Clock	MC	A precision clock that provides timing signals to synchronize slave clocks as part of a clock network

No.	Type	Equipment	Prefix	Definition
18	Coils	Chilled Water Coils	COIL	A coil containing water that is chilled to below ambient temperature over which air is passed by mechanical means. This cool air is forced into occupied spaces for climate control
19	Compressor	Compressor	COMP	An instrument or device for compressing air
19	Compressor	Excess Pressure Pump	EPP	Intended for installation on wet pipe sprinkler systems as a means of establishing excess pressure for suppression of false alarms due to water surges
19	Compressor	Refrigerant Compressor	RC	A compressor that is a component of a vapor-compression refrigerating machine and is used to draw the refrigerant vapor from the evaporator and deliver it to the condenser
19	Compressor	Sprinkler Jockey Pump	JP	A device that works in conjunction with a fire pump as part of a fire-protection sprinkler system
20	Condensing Unit	Condensing Unit	CON	A device or unit used to condense a substance from its gaseous to its liquid state
21	Contactors	Contactors	CONT	A device for making and breaking an electric circuit
22	Controls	Boiler Control Panel	BCP	Provide controls as required for the proper operation of the boiler
22	Controls	Boiler Feedwater Pressure Transmitter	BFWPT	A device that senses and transmits an output signal proportional to the pressure in the feedwater system at its installed location. The output signal from the transmitter is used by a secondary device for monitoring or control purposes
22	Controls	Boiler Steam Pressure Transmitter	BSPT	A device that measures the steam pressure in the boiler and transmits an output signal to a secondary device such as a monitoring or control device
22	Controls	Combustion Air Flow Transmitter	CAFT	A device that measures and transmits an output signal proportional to the flow of combustion air. The output signal from the transmitter is used by a secondary device for monitoring or control purposes
22	Controls	Control Panel	PANL	An electrical device consisting of a flat insulated surface that contains switches and dials and meters for controlling other electrical devices
22	Controls	Controller	CTRL	An electrical, electronic, pneumatic, or mechanical device designed to regulate an operation or function
22	Controls	Controller - Feedwater	FWC	A device used to control the flow of feedwater into a boiler to automatically maintain the desired water level
22	Controls	Damper Control - Forced Draft Fan	DCF	A series of controls intended to control the dampers on the outlet of the forced draft fan to regulate the flow of combustion air into the windbox of the boiler
22	Controls	Damper Control - Outlet	DCO	A series of vanes or blades whose position can be controlled to vary the flow on the outlet of a fan or air handler

No.	Type	Equipment	Prefix	Definition
22	Controls	Damper Control - Windbox	DCW	A series of blades or vanes that control the flow of combustion air from the windbox into the boiler furnace
22	Controls	FD Damper I/P and Positioner	FDPOS	A control device that converts the current (I) signal to a pneumatic (P) signal and operates the positioner to position the dampers on the forced draft fan in response to the controller output
22	Controls	Feedwater Valve Actuator	CVACT	A valve used to control a motor that uses a 4 to 29ma signal and moves the positioner
22	Controls	Feedwater Valve Positioner	CVPOS	A valve used to control water flow in piping
22	Controls	HTHW Flow Transmitter	HTHWFT	A device that measures the flow of HTHW and transmits that a signal proportional to that flow. That signal is often used by a secondary monitoring or control device
22	Controls	Liquid Level Controller	LLC	An electrical device with contacts that open and close in response to liquid levels sensed by the probes to activate or deactivate pumps, alarms or pressure switch devices
22	Controls	Low Instrument Air Switch	LAPS	
22	Controls	Medium Air Flow Switch	MAFS	A switch connected to a unit through piping and senses the unit is on
22	Controls	Purge Air Flow Switch	PAPS	A switch used on boilers to insure there are no fumes or un-burnt gases in a fire box
23	Conveyor	Conveyor	CONV	Mechanical handling equipment that moves materials from one location to another
24	Cooling Tower	Cooling Tower	CTR	A tall, open-topped tower, used for cooling water or condensing steam from an industrial process
25	Custodial Equipment	Custodial Equipment	CE	Equipment that is used by custodians, such as motorized floor scrubbers
26	Damper	Fire Damper	FD	Fire protection products used in heating, ventilation, and air conditioning ducts to prevent the spread of fire inside the ductwork
27	Detector	Gas Detection Panel	GD	A device which detects the presence of various gases within an area, usually as part of a safety system
28	Diesel Generator	Air System (Diesel Generators)	AIR	This is the system that controls the supply of ambient outside air to the diesel engine
28	Diesel Generator	Cooling System (Diesel Generators)	COOL	A system consisting of a circulating pump, radiator, thermostat and coolant that is circulated through the diesel engine cooling jackets to keep the engine from overheating during operation
28	Diesel Generator	Coupler System (Diesel Generators)	COUP	The system that provides the mechanical connection between the output shaft of the diesel engine and the input shaft of the electrical generator
28	Diesel Generator	Electrical System (Diesel Generators)	ELECT	The system of electrical devices used to provide power to the starter for the engine and to provide power for other control and monitoring functions

No.	Type	Equipment	Prefix	Definition
28	Diesel Generator	Engine (Diesel Generators)	ENG	A diesel fuel combustion engine that is used as the prime mover to drive an electric generator
28	Diesel Generator	Filer (Diesel Generators)	FLTR	A system of chambers containing porous or cloth media designed to remove any particulate impurities from the lubricating oil or fuel before it is delivered to the engine
28	Diesel Generator	Fuel System (Diesel Generators)	FUEL	The system that receives fuel from the fuel storage tank and pumps, filters and delivers the fuel to the diesel engine for combustion to drive the engine
28	Diesel Generator	Generator (diesel and mobile electric)	GEN	A machine used to generate electricity at the desired voltage and frequency and is most often driven by a diesel or gasoline engine
28	Diesel Generator	Generator System (Diesel Generators)	GENR	A system consisting of diesel engine driven electrical generators that provides power to the electrical distribution system as required
28	Diesel Generator	Lube System (Diesel Generators)	LUBE	The lubrication system for the diesel engine portion of the diesel engine-generator set. This system stores, filters and cools the lubricating oil for distribution to the various point requiring lubrication within the engine
28	Diesel Generator	Rotor System (Diesel Generators)	ROTR	This is the system of components that is driven from the output shaft of the diesel engine and rotates within the stationary stator of the electric generator
28	Diesel Generator	Stator System (Diesel Generators)	STAT	The stationary portion of the electric generator. It contains a series of coils in which current is induced by the movement of the rotor relative to the stator
29	Disconnects (Switches)	Disconnect Switch	DSW	Ensures that an electrical circuit is completely de-energised for service or maintenance
30	Door	Motorized Folding Door	MFD	A door with hinged or pleated sections that fold together when the door is opened, controlled by a motor
30	Door	Multi-leaf Door	MLD	A vertical lift paneled door with one leaf overlapping with the next to open and close it
30	Door	Overhead Door	OVHD	A door that rotates on a horizontal axis and is supported horizontally when open
30	Door	Roll-Up Shutter	RUSS	A type of door or window shutter consisting of many horizontal slats hinged together. It is raised to open and lowered to close
31	Electrical Equipment	Electrical Equipment	EE	Various equipment used by electricians (Scissors lift)
32	Elevator	Elevator	EDO	A platform or compartment housed in a shaft for raising and lowering people or things to different floors or levels
32	Elevator	Wheel Chair Lift	WCL	A powered device designed to raise a wheelchair and its occupant in order to overcome a step or similar vertical barrier
33	Elevator Controls	Elevator Controls	ELV	A control panel for operating and controlling an elevator

No.	Type	Equipment	Prefix	Definition
34	Emergency Wash Station	Emergency Shower	ESWR	A shower for the purpose of emergencies in which the body must be quickly washed with water
34	Emergency Wash Station	Emergency Shower/Eye Wash Station	SHWR	A combination unit of a shower and cleansing receptacle for emergencies in which the body or eye must be washed
34	Emergency Wash Station	Eye Wash Station	EWS	A cleansing receptacle for the purpose of emergencies in which the eyes must be quickly flushed with water
35	Evaporator	Evaporator	EVAP	A device used to turn the liquid form of a chemical into its gaseous form used in a refrigeration system
36	Fan	Cooling Tower Fan	CTF	A fan, typically mounted on top of the cooling tower unit to pull air through the fill media
36	Fan	Exhaust Fan	EF	A fan that moves air out of an enclosure
36	Fan	Fan (Condenser)	FAN	The fan that circulates air over the air-cooled condenser and moves air out of an enclosure
36	Fan	Forced Draft Fan	FDL	A fan supplying air under pressure to the furnace and fuel burning equipment of the boiler
36	Fan	General Ventilation Unit	GVU	A system for circulating fresh air throughout a confined space while removing contaminated or stale air
36	Fan	HVAC Unit	HVAC	Control the ambient environment (temperature, humidity, air flow, and air filtering)
36	Fan	Lab Makeup Air Unit	LMU	A unit to supply conditioned air to a lab to replace air that has been removed by an exhaust system or by combustion
36	Fan	Lab Ventilation Unit	LVU	Fan blowing air into a lab creating positive pressure that is equalized to static pressure by exhaust openings or outlets
36	Fan	Makeup Air Unit	MUA	A unit to supply conditioned air to a building to replace air that has been removed by an exhaust system or by combustion
36	Fan	Pressurization Fan	PFS	A fan that forces fresh air into an area as distinguished from one that exhausts air from the area
36	Fan	Return	RF	A fan which withdraws air from an air-conditioned space and returns it (or part of it) to the central air-conditioning system
36	Fan	Strobic Fan	STR	A fan that exhausts air from fumehoods at a high velocity
36	Fan	Supply Fan	SF	A fan that delivers supply air
37	Filter	Drum Filter	DRFL	A cylindrical drum that rotates through thickened ore pulp, extracts liquid by a vacuum, and leaves solids, in the form of a cake, on a permeable membrane on the drum end
37	Filter	Oil Filter	OF	A filter that removes impurities from the oil used to lubricate an internal-combustion engine

No.	Type	Equipment	Prefix	Definition
37	Filter	Sand Filter	SANDF	A filter used in water purification and consisting of layers of sand arranged with coarseness of texture increasing downward
37	Filter	Water Filter	WF	A filter to remove impurities from the water supply
38	Fire Hydrant	Fire Hydrant	HYD	An upright hydrant for drawing water to use in fighting a fire
39	Fire Suppression System	Fire Suppression System	FSS	A system to either put out a fire or stop it from propagating, often used together with fire alarms and smoke or heat detectors to safeguard people and physical structures
40	Fuel Tank	Fuel Tank	FTNK	A safe container for flammable fluids, typically applying to part of an engine system in which the fuel is stored and propelled (fuel pump) or released (pressurized gas) into an engine
41	Fume Hood	Fume Hood	FH	A type of local ventilation device that is designed to limit exposure to hazardous or toxic fumes, vapors or dusts
42	Grounds Equipment	Grounds Equipment	GE	Various equipment used by grounds workers, such as grass trimmer, lawn mowers, etc.
43	Hand Dryer	Hand Dryer	HD	Electric devices found in public washrooms that are used to dry hands
44	Heat Exchanger	Economizer	ECON	A heat exchanger used to transfer heat from the boiler exhaust gas to the incoming feedwater before the exhaust gas is released to the boiler stack. The use of an economizer increases the thermal efficiency of the boiler
44	Heat Exchanger	Heat Exchanger	HEX	A device for transferring heat from one medium to another
45	Heat Pump	Heat Pump	HP	A device that transfers heat from a colder area to a hotter area by using a refrigeration system
46	Heat Recovery Unit	Heat Recovery Unit	HRU	Use waste heat from your air conditioning system to heat domestic hot water
46	Heat Recovery Unit	Heat Recovery Ventilator	HRV	Air to air heat exchanger
47	Heater	Electric Heater	EH	A device for heating rooms that converts electric current to heat by means of resistors that emit radiant energy
47	Heater	Force Flow Heater	FFH	Air blowing across a heating coil (could have electric or hydronic coil)
47	Heater	Heater	HTR	A device for warming the air or water
47	Heater	Unit Heater	UH	A heating element that is installed in a space to be heated, and uses a fan to direct room air over a heat exchanger that is heated by gas, oil, or other fuel fire, or by electrical resistance
48	HUB-FA Fibre Optics	HUB FA Fibre Optics	HUB	The use of thin flexible fibers of glass or other transparent solids to transmit light signals
49	Humidifier	Humidifier	HU	A device for maintaining proper humidity levels in a room

No.	Type	Equipment	Prefix	Definition
49	Humidifier	Reverse Osmosis Unit	RO	A unit for purifying water, in which pressure is applied to force liquid through a semipermeable membrane in the opposite direction to that in normal osmosis
49	Humidifier	Steam Humidifier	SH	A humidifier where water is brought to boiling point and is turned into pure sterilized, odourless steam
50	Ladder	Ladder	LADR	A structure consisting of a series of bars or steps between two upright lengths of wood, metal, or rope, used for climbing up or down something
51	Level Control	Drum Level Transmitter	DLLT	Measures and transmits the fluctuating water level or changing rate of water inflow and steam outflow
51	Level Control	Low Water Cutoff	LWCO	A device used to shut down a boiler in the event a low water condition exists
52	Lighting	Emergency Light Pack	EL	A battery-backed lighting device that comes on automatically when a building experiences a power outage
53	Load Bank	Load Bank	LB	A device which develops an electrical load, applies the load to an electrical power source and converts or dissipates the resultant power output of the source
54	Manholes	High Voltage Access (Man holes)	HVA	A manhole for high voltage cable
54	Manholes	High Voltage Junction (Man holes)	HVJ	A manhole with high voltage cables on termination racks
54	Manholes	High Voltage Pull Box	HVPB	A high voltage metal box with a blank cover that is installed in an accessible place in a run of conduit to facilitate the pulling in of wires or cables
54	Manholes	Sanitary		A opening providing access to a sanitary sewer
54	Manholes	Storm		A opening providing access to a storm sewer
55	Meter	Electrical Meter	ELE	A device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device
55	Meter	Flow Meter	FM	An instrument for monitoring, measuring, or recording the rate of flow, pressure, or discharge of a fluid
55	Meter	Meter (fuel, gas monitor, Cathodic Protection Rectifier)	METR	A device that measures and records the quantity, degree, or rate of something, esp. the amount of electricity, gas, or water used
55	Meter	Parking Meter	PM	A machine next to a parking space in a street, into which the driver puts money so as to be authorized to park the vehicle for a particular length of time.
55	Meter	Test Meter	METER	A meter used for testing voltage
56	Motor	Motor	MTR	A machine, esp. one powered by electricity or internal combustion, that supplies motive power for a vehicle or for some other device with moving parts

No.	Type	Equipment	Prefix	Definition
57	Motor Control Centre	Motor Control Centre	MCC	Enclosure containing starters, switching, and overload protection devices for electric motors which are utilized to operate various motors on different devices and machines
58	Motorized Basket Lift	Motorized Basket Lift	MBL	An aerial work platform that comprises of a bucket or a platform at the end of a hydraulic lifting system often mounted at the back of trucks
59	Panel	Emergency Power	DPE	Electrical distribution panels on the emergency power system
59	Panel	Annunciator Panel	ANP	A group of lights used as a central indicator of status of equipment or systems in an aircraft, industrial process, building or other installation
59	Panel	Distribution Panel	DP	An electric switchboard or panel used to distribute electricity within a building. The switchboard is enclosed in a box and contains circuit breakers, fuses, and switches
59	Panel	Emergency Panel	EMG	Electrical panel board separate from main panel board and wired to incoming power supply with purpose to provide power to emergency type equipment or systems
59	Panel	Fire Alarm Central Control System	CCS	The controlling component of a fire alarm system
59	Panel	Fire Alarm Panel	FAP	The controlling component of a Fire Alarm System
59	Panel	Flexlab Power Panel	XP	A distribution panel that provides correct voltage for accessories like glow-plug clips, fuel pumps and electric starters
59	Panel	Garage Heating Control Panel	GHCP	An electrical device consisting of a flat insulated surface that contains switches and dials and meters for controlling garage heating
59	Panel	Heating Panel	HTP	A power panel that controls heat
59	Panel	Light Dimming Panel	DIM	A device used to vary the brightness of a light
59	Panel	Lighting Panel	LP	An electric panel housing fuses and circuit breakers that serves to protect the branch circuits of lighting fixtures
59	Panel	Lighting Relay Panel	LRP	A panel that controls lighting through relays
59	Panel	Load Bank Panel	LBP	A panel to control a device which develops an electrical load, applies the load to an electrical power source and converts or dissipates the resultant power output of the source
59	Panel	Power Panel	PP	A panel used for circuits, supplying motors and other heavy power-consuming devices
59	Panel	Studio Lights Panel	STUDIO	A panel that controls lighting for a studio
60	Pipe Section	Return Pipe Length	RPL	A pipe that connects a device or piece of equipment to the return main
60	Pipe Section	Supply Pipe Length	SPL	A pipe that connects a device or piece of equipment to the supply main
61	Pipe Slider	Pipe Slider	SLID	A device consisting of a pipe attachment and a slide plate, to accommodate horizontal pipe movement

No.	Type	Equipment	Prefix	Definition
62	Pipe Support	Pipe Support	PS	A device designed to carry the weight of the pipe, any in-line equipment and the material in the pipe over a defined span
63	Platform	Platform	PLAT	A raised level surface on which people or things can stand
64	Pot Cooler	Pot Cooler	POTC	A chemical feed pot
65	Pump	Air Blower	AIBL	A mechanical device that is used to create or produce a current of air
65	Pump	Chemical Feed Pump	CFP	Used to transfer chemicals and are designed to be resistant to corrosive and abrasive industrial liquids
65	Pump	Chilled Water Pump	CWP	A pump that is used to circulate chilled water throughout a building
65	Pump	Chlorine Pump	CHP	A device that pumps chlorine
65	Pump	Circulator Pump	CIRP	A pump used to circulate fluids in a closed circuit
65	Pump	Condensate Pump	CONP	A pump used to return condensate produced in a steam system to a condensate tank
65	Pump	Cooling Tower Pump	CTP	The pump that runs water throughout the cooling tower
65	Pump	Domestic Hot Water Pump	DHWP	A pump used to continually circulate water in the domestic hot water system so as to ensure consistent flow of hot water to all fixtures
65	Pump	Feedwater Pump	FWP	A pump used to pump feedwater into a steam boiler
65	Pump	Fuel Pump	FP	A pump used to deliver and recirculate fuel as required
65	Pump	Glycol Pump	GP	A pump used for circulating glycol within a dehydration system
65	Pump	Main Pump	MP	Circulating pump used to circulate water through a building (heating or ventilating)
65	Pump	Makeup Water Pump	MUP	A pump that pumps water that is added to a system to replace water that has been lost through evaporation or leaking
65	Pump	Oil Pump	OP	A pump that keeps a supply of oil on moving parts
65	Pump	Pond Water Pump	PWP	A device used to pump water out of a pond
65	Pump	Primary Pump	PRP	This is a pump that pumps HTHW from the return header through the heat exchanger on the HTHW boiler and out into the supply header for distribution to the various main loops
65	Pump	Pump - Main Heating Water	HWP	Circulating pump used to circulate water through the secondary heating system
65	Pump	Pump (gland seal)	GSP	A pumped used to distribute water on the gland seal to keep it cool
65	Pump	Pump (recirc of high/low pressure boilers)	LUP	This is a pumps that circulates HTHW or secondary system water to either absorb heat or release heat in a heat exchanger or other heat transfer device
65	Pump	Purge Pump	PUP	A compressor that removes noncondensibles from a refrigeration system
65	Pump	Salt Water Pump	SWP	A pump used to pump salt water from the ocean to storage tanks or for use in the process
65	Pump	Submersible Pump	WP	A water pump with an electric motor in the same housing with the pump, designed to operate while submerged in water

No.	Type	Equipment	Prefix	Definition
65	Pump	Sump Pump	SP	A suction pump for removing liquid from a sump
65	Pump	Vacuum Pump	VAP	A pump used for creating a vacuum
65	Pump	Vent Pump	VP	Circulating pump used to circulate water through a heating coil
65	Pump	Well Water Pump	WWP	A device used to pump water out of a well
66	Radiation Emitting Equipment	X-Ray Emitting Device/Equipment	REE	Devices or equipment that emit electromagnetic radiation
67	Radiator	Radiator	RAD	A radiator used in the cooling system of a combustion system (i.e. diesel generator)
68	Refrigerated Unit	Refrigerated Unit	RU	A cooling system for chilling or freezing
69	Regulator, Pressure	Pressure Regulator	PR	A valve that reduces the pressure of a fluid and maintains a desired output pressure
70	Relays, Electric Heating	Electric Heating Relays	ELRP	Electrical device such that current flowing through it in one circuit can switch on and off a current in a second circuit
71	Sensor	Transmitters, Switches, Sensors	SEN	Devices that detect, measure, transmit, or witch a physical property and records, indicates, or otherwise responds to it
72	Snow Melting	Snow Melting Control	SM	Equipment such as heat trace controls and de-icing controls, used to melt snow
73	Sprinkler System	Complete Building Sprinkler System	SPKR	An apparatus for automatically extinguishing fires in a building, consisting of a system of pipes in or below the ceilings, with valves or sprinklers usually made to open automatically at a certain temperature
74	Stack	Smoke Stack	STACK	A chimney or funnel connected to the outlet of the combustion section of a boiler. Its purpose is to convey the combustion gases to the atmosphere and in the case of a natural draft boiler to create a draft through the boiler
74	Stack	Strobic		
75	Switchgear, High Voltage	Air Circuit Breaker	ACB	Used to interrupt circuits while current flows through them
75	Switchgear, High Voltage	Automatic Transfer Switch	ATS	An electrical switch that switches a load between two sources when they sense one of the sources has lost or gained power
75	Switchgear, High Voltage	Control Panel	PANL	Electrical device consisting of a flat insulated surface that contains switches and dials and meters for controlling other electrical devices
75	Switchgear, High Voltage	Fused Disconnect Switch	FDS	A disconnecting switch in which a fuse unit forms a part of the blade
75	Switchgear, High Voltage	High Voltage Cubical / Feeder	HVC	Part of high voltage switchgear that contains metering equipment

No.		Type	Equipment	Prefix	Definition
75	Switchgear, High Voltage	High Voltage Switchgear	HVSG	The combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment above 600V	
75	Switchgear, High Voltage	Main Switchgear	MSG	The combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment	
75	Switchgear, High Voltage	Metering Cubical	PTS	Part of high voltage switchgear that contains metering equipment	
75	Switchgear, High Voltage	Switch Gear / High Voltage Switch	HVSW	Switching equipment used in the transmission of electricity	
75	Switchgear, High Voltage	Transfer Switch	TRSW	An electrical switch that switches a load between two sources	
76	Switchgear, Low Voltage	Low Voltage Switchgear	LVSG	Switching and interrupting devices designed to protect power circuits. 600V and below	
77	System Header Parent	Air System Components	ASC	A series of components including compressors, receivers and connecting piping and fittings that make up the compressed air system	
77	System Header Parent	Air System transmitters and switches	ASCS	A series of transmitters and switches that are installed in the compressed air system that sense and transmit air pressure and/or air flow values to various secondary devices such as controllers or displays. This transmitted signal may also operate various switches to stop/start equipment or provide protective shutdown functions	
77	System Header Parent	Chemical System	CHSY	A series of metering pumps, chemical tanks/reservoirs, connecting piping and fittings that supply chemicals to water systems for various treatment processes	
77	System Header Parent	Economizer System transmitters and switches	ECONS	A series of switches and transmitters installed at strategic locations within the Economizer Loop to measure and transmit pressure, temperature or flow. The output from these transmitters is used by a secondary device for monitoring or control. The switches are set to change position on a pre-determined set point (i.e. open/close or on/off etc.)	
77	System Header Parent	Exhaust System Components	ESC	A series of components including fans, ductwork and dampers etc that make up the exhaust system	
77	System Header Parent	Exhaust System transmitters and switches	ESCS	A series of transmitters and switches that are installed in the exhaust system that sense and transmit exhaust pressure and/or exhaust flow values to various secondary devices such as controllers or displays. This transmitted signal may also operate various switches to stop/start equipment or provide protective shutdown functions	
77	System Header Parent	Fuel System Components	FSC	A series of tanks, pumps, piping and fittings that convey fuel at the required pressure and temperature to satisfy the necessary process requirements	

No.	Type	Equipment	Prefix	Definition
77	System Header Parent	Fuel System transmitters and switches	FSCS	A series of transmitters and switches that are installed in the fuel system that sense and transmit fuel pressure and/or fuel flow values to various secondary devices such as controllers or displays. This transmitted signal may also operate various switches to stop/start equipment or provide protective shutdown functions
77	System Header Parent	HTHW System Components	HSC	This is a high level definition of the HTHW system components associated with the HTHW System Header
77	System Header Parent	HTHW System transmitters and switches	HTHWS	A series of switches and transmitters installed at strategic locations within the HTHW distribution system to measure and transmit HTHW pressure, temperature or flow. The output from these transmitters is used by a secondary device for monitoring or control. The switches are set to change position on a pre-determined set point (i.e. open/close or on/off etc.)
77	System Header Parent	Propane Pressure transmitters and switches	PROP	A series of transmitters and switches that are installed in the propane system that sense and transmit propane pressure and/or propane flow values to various secondary devices such as controllers or displays. This transmitted signal may also operate various switches to stop/start equipment or provide protective shutdown functions
77	System Header Parent	Steam System Components	SSC	This is a high level definition of the steam system components associated with the Steam System Header
77	System Header Parent	Steam System transmitters and switches	SSCS	A series of switches and transmitters installed at strategic locations within the steam distribution system to measure and transmit steam pressure, temperature or flow. The output from these transmitters is used by a secondary device for monitoring or control. The switches are set to change position on a pre-determined set point (i.e. open/close or on/off etc.)
77	System Header Parent	Water System Components	WSC	A series of tanks, pumps, piping and fittings that convey water at the required pressure and temperature to satisfy the necessary process requirements
77	System Header Parent	Water System transmitters and switches	WSCS	A series of transmitters and switches that are installed in the water system that sense and transmit water pressure and/or water flow values to various secondary devices such as controllers or displays. This transmitted signal may also operate various switches to stop/start equipment or provide protective shutdown functions
78	Tank	Air Receiver	AR	An air storage tank used with pneumatic systems that balances the air compressor capacity and airflow demand
78	Tank	Blow Down Tank	BDT	A tank used to retain the blowdown water volume from one bottom blow after the flash steam has been vented to the atmosphere and to allow the water to cool down by natural convection

No.	Type	Equipment	Prefix	Definition
78	Tank	Booster Tank	BT	The built-in tank on a pumper or quint that supplies booster lines and hand lines at a fire until a connection with a water source can be made
78	Tank	Chemical Tank	CT	Storage containers for chemicals that are used for static storage, processing, mixing, and transport of both raw materials and finished chemical products
78	Tank	Chilled Water Storage	CWT	A storage tank for chilled water
78	Tank	Condensate Tank	CONDT	A tank used to collect condensed steam in order to send it back to the boiler as a liquid
78	Tank	Deaerator	DEA	A device that is widely used for the removal of oxygen and other dissolved gases from the feedwater before it is fed to a steam boiler in order to prevent corrosion
78	Tank	Domestic Hot Water Tank	DHWT	A tank used to store and supply heated water for domestic purposes
78	Tank	Expansion Tank	EXP	A tank used to protect closed water heating systems from excessive pressure
78	Tank	Expansions Tank (chilled water)	CWET	Required in a chilled water HVAC system to absorb the expanding fluid and limit the pressure within a cooling system.
78	Tank	Feed Water Tank	FWT	The tank in which demarcated and chemically treated water is stored in preparation for pumping to the boiler drum
78	Tank	Flash Tank	FT	A vessel used for separating the liquid phase from the gaseous phase formed from a rise in temperature and/or a reduction of pressure on the flowing stream
78	Tank	HTHW Expansion Tank	HTET	A tank used in a closed water heating system to allow for fluctuation in system water volume with change in temperature. This tank is normally provided with a means of applying pressure from an external source such as compressed air or nitrogen to keep the system pressure above the flash point of the heating liquid
78	Tank	Make up Water Tank	MUT	A tank used to store treated water that can be pumped into the heating system if there is a leak or if the volume of water in the system is reduced due to a reduction in the temperature of the water in the system.
78	Tank	Vacuum Tank	VT	A container that holds condensate drawn into the boiler by a vacuum pump
78	Tank	Waste Pit	PIT	A disposal area for animal waste
78	Tank	Water Demineralizer	DEM	A device used to remove dissolved minerals from source water. The output from a demineralizer is water that is extremely low in impurities
78	Tank	Water Softener	WS	A tank containing an ion-exchange resin that water is passed through to remove certain hardness producing minerals before the water is introduced into the feedwater circuit
78	Tank	Well Water Tank	WWT	A tank that holds well water
79	Transformer	High Voltage Transformer	HVTR	A high voltage device that transfers an alternating current from one circuit to one or more other circuits, above 600HV

No.	Type	Equipment	Prefix	Definition
79	Transformer	Low Voltage Transformer	LVTR	A device that transfers an alternating current from one circuit to one or more other circuits, 600HV and below
79	Transformer	Transformer	TRAN	A device that transfers an alternating current from one circuit to one or more other circuits, usually with an increase or decrease of voltage
80	Trap	Air Trap	AT	An air trap is a filtering device intended to remove contaminants from a compressed air supply
80	Trap	Grease Trap	GT	A receptor in a drain or waste pipe to prevent grease from passing into a sewer system
80	Trap	Steam Trap	TRAP	A device used to discharge condensate and non condensable gases with a negligible consumption or loss of live steam
81	UPS	Uninterrupted Power Supply	UPS	An electrical apparatus that provides emergency power to a load when the input power source, typically mains power, fails
82	Valve	Atomizing Steam Fuel Differential Pressure Regulating Valve	ASDPV	A valve that automatically maintains the atomizing steam pressure at a pre-determined differential above the fuel pressure to ensure proper and complete combustion
82	Valve	Atomizing Steam Pressure Reducing Valve	ASPRV	A valve that automatically reduces the pressure of steam from the main supply pressure to lower pressure suitable for atomizing fuel oil for combustion
82	Valve	Back Flow Preventer	BFP	A device to prevent contaminated water from traveling from one system back into any part of the main distribution system, usually to prevent contamination of a potable water supply
82	Valve	Control Valve	CV	Valves used to control conditions such as flow, pressure, temperature, and liquid level by fully or partially opening or closing in response to signals received from controllers that compare a "setpoint" to a "process variable" whose value is provided by sensors that monitor changes in such conditions
82	Valve	Economizer Bypass	ECBP	A valve that can be opened to bypass the flow of water around the economizer instead of flowing through the economizer
82	Valve	Fuel Solenoid Valve	FSV	An electromechanical device used for controlling liquid or gas flow. The solenoid valve is controlled by electrical current, which is run through a coil
82	Valve	HTHW Valve I/P and Positioner	HTHWP	A positioner is a device connected to a valve to ensure that it is at a correct position of opening as per the control signal. An I/P converter changes a current input signal from a controller to a pneumatic outlet signal for operating the positioner
82	Valve	Motorized Valve	MV	A valve that is operated by the use of a motor instead of using a handle or hand wheel. The motor can be driven by electricity, compressed air or other source of energy

No.		Type	Equipment	Prefix	Definition
82	Valve	Pressure Reducing Valve	PRV	Reduces the pressure of the water that goes through it, and is used to obtain a regulated and constant value at its outlet	
82	Valve	Relief Valve	RV	A type of safety valve used to control or limit the pressure which can build up by a process upset, instrument or equipment failure, or fire	
82	Valve	Sprinkler Valve	SV	A valve that opens the water flow to the zone that is controlled electronically by the control panel	
82	Valve	Temperature Mixing Valve	TMV	A valve that blends hot water with cold water to ensure constant, safe shower and bath outlet temperatures	
82	Valve	Water Main Valve	WMV	A mechanical device that controls the flow of water by opening and closing. It is located outside of a building	
83	Washer, Cage and Rack	Cage and Rack Washer	CW	A heavy duty, large capacity, hydro-spray washer designed for thorough, efficient cleaning of cages, racks, debris pans, and miscellaneous items	
84	Water Column	Water Column	WC	A column or vessel that is connected to both the water and steam space of a boiler. It normally contains probes or other devices to sense water level in the boiler	
85	Water Fountain	Drinking Water Cooler	DWC	A public drinking fountain to provide drinking water	
86	Water Main	Water Main	WM	A main line in a water supply system, located inside a building	

**PART 1**      **GENERAL**

**1.1**            **SUMMARY**

- .1      TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2      TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this Section.
- .3      This Section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results. In addition carry out acoustical testing as identified below.
- .4      Test, adjust, and balance the following mechanical systems:
  - .1      Fan coil units.
  - .2      Reheat coils.
  - .3      VAV boxes.
  - .4      Venturi valves.
  - .5      Radiant ceiling panels.
- .5      Duct silencers. Measure air pressure drop and insertion loss across each silencer.
- .6      Perform acoustical testing requirements outlined in specification Section 23 32 48 – Acoustical Air Plenums.

**1.2**            **DEFINITIONS**

- .1      Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
  - .1      The balance of air and water distribution.
  - .2      Adjustment of total system to provide design quantities.
  - .3      Electrical measurement.
  - .4      Verification of performance of all equipment and automatic controls.
  - .5      Acoustical testing of finished systems.
- .2      Test: To determine quantitative performance of equipment
- .3      Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

- .4 Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- .5 Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- .6 Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data sheets should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- .7 Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- .8 Main: Duct or pipe containing the system's major or entire fluid flow.
- .9 Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- .10 Branch main: Duct or pipe serving two or more terminals.
- .11 Branch: Duct or pipe serving a single terminal.

### 1.3 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel certified to perform TAB to Owner's Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 Test and Balance Technician's Qualifications: minimum 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.
- .4 Agency Qualifications:
  - .1 Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
  - .2 The independent testing, adjusting, and balancing agency shall be certified by National Environmental Balancing Bureau (NEBB) or by the Associated Air Balance Council (AABC) in those testing and balancing disciplines required for

this project and shall have at least one Technician certified by NEBB or AABC as a Test and Balance Technician.

- .5 Codes and Standards:
  - .1 NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
  - .2 AABC: "National Standards For Total System Balance".
  - .3 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE):
    - .1 ASHRAE Handbook, HVAC Applications Volume, Chapter 36, Testing, Adjusting, and Balancing.
- .6 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .7 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .8 Use TAB standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .9 Where instrument manufacturer calibration recommendations are more stringent than those listed in the TAB standard, use manufacturer's recommendations.
- .10 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures and requirements are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

#### **1.4 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

**1.5 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

**1.6 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

**1.7 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Owner's Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Owner's Representative in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
- .4 Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Owner's Representative and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

**1.8 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in other Divisions.

**1.9 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Owner's Representative for verification of TAB reports.
- .2 Systems operation: systems shall be fully operational prior to beginning procedures.

**1.10 START OF TAB**

- .1 Notify Owner's Representative 7 days prior to start of TAB.

- .2 Start TAB when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weatherstripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere in other Divisions.
  - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 Air systems:
    - .1 Filters in place, clean.
    - .2 Duct systems clean.
    - .3 Ducts are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Access doors, installed, closed.
    - .8 Outlets installed, volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled and vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, baskets clean.
    - .4 Isolating and balancing valves installed, open.
    - .5 Calibrated balancing valves installed at factory settings.
    - .6 Chemical treatment system complete, operational.

#### **1.11 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 5%, minus 5%.

#### **1.12 ACCURACY TOLERANCES**

- .1 Measured values to be accurate to within plus or minus 2 % of actual values.

#### **1.13 INSTRUMENTS**

- .1 Prior to TAB, submit to Owner's Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Owner's Representative.

**1.14 SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
  - .1 Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
  - .2 Sample Forms: Submit sample forms, if other than those standard forms prepared by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) are proposed.

**1.15 PRELIMINARY TAB REPORT**

- .1 Draft report: Upon completion of testing, adjusting, and balancing procedures, prepare draft report on the approved forms. Draft report may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft report in the same manner specified for the final report. Submit 2 complete sets of draft report. Only 1 complete set of draft report will be returned with comments.

**1.16 TAB REPORT**

- .1 Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Technician. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems.
- .2 Final Report: Upon verification and approval of draft report, prepare final report, type written, and organized and formatted as specified below. Submit 2 complete sets of final report.
- .3 Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
  - .1 General Information and Summary
  - .2 Air Systems
  - .3 Water Systems
- .4 Report Contents: Provide the following minimum information, forms and data:

- .1 General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, the Company, Technician, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Technician. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
- .2 The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC or NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
- .3 Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

#### **1.17 VERIFICATION**

- .1 Reported results subject to verification by Owner's Representative.
- .2 Provide manpower and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results to be at discretion of Owner's Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Owner's Representative.

#### **1.18 SETTINGS**

- .1 After TAB is completed to satisfaction of Owner's Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

#### **1.19 COMPLETION OF TAB**

- .1 TAB to be considered complete when final TAB Report received and approved by Owner's Representative.

#### **1.20 AIR SYSTEMS**

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC or NEBB.
- .2 Do TAB of systems, equipment, components, controls specified in other Divisions.
- .3 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.

- .4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage and noise.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

#### **1.21 OTHER TAB REQUIREMENTS**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
  - .1 Adjust HVAC systems, airflow rates to specified values to achieve proper building pressurization.
- .3 Acoustical measurements:
  - .1 As per requirements of specification Section 23 32 48 – Acoustical Air Plenums.
- .4 Domestic hot water recirculation:
  - .1 Balance domestic hot water recirculation flow rates to values indicated on drawings.

#### **PART 2 PRODUCTS (NOT APPLICABLE)**

#### **PART 3 EXECUTION**

##### **3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING**

- .1 Before operating the system, perform these steps:
  - .1 Obtain design drawings and specifications and become thoroughly acquainted with the design intent.