

COMMON WORK RESULTS FOR MECHANICAL

1. GENERAL

1.1 Intent

- .1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.
- .2 Contract Documents and Drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- .3 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.
- .4 Install equipment generally in locations and routes shown. Run piping and ductwork close to building structure, parallel to building lines to maximize headroom and with minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Contract Administrator at no extra cost.
- .5 Install equipment to provide access and ease of maintenance.
- .6 Connect to equipment specified in other Sections.
- .7 Install control valves, control dampers, thermal wells, and other devices on piping and ducts.

1.2 Coordination of Work

- .1 Make reference to electrical, plumbing, structural and architectural Drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on-site before fabricating or installing any materials or equipment.
- .2 Where dimensional details are required, work with the applicable architectural and structural Drawings.
- .3 Any areas indicated as space for future materials or equipment shall be left clear.

1.3 Quality of Work

- .1 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Contract Administrator.

1.4 Metric Conversion

- .1 All units in this Division are expressed in SI units.
- .2 Submit all Shop Drawings and maintenance manuals in SI units.
- .3 On all submittals (Shop Drawings etc.) use the same SI units as stated in the Specification.
- .4 Equivalent Nominal Diameters of Pipes - Metric and Imperial:

COMMON WORK RESULTS FOR MECHANICAL

- .1 Where pipes are specified with metric dimensions and Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment and piping.
- .2 When CSA approved SI Metric pipes are provided, the Contractor shall provide at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

mm (in. NPS)	mm (in. NPS)	mm (in. NPS)
3 (1/8)	65 (2½)	375 (15)
6 (1/4)	65 (2½)	450 (18)
10 (3/8)	75 (3)	500 (20)
15 (1/2)	100 (4)	600 (24)
20 (3/4)	125 (5)	750 (30)
25 (1)	150 (6)	
30 (1¼)	200 (8)	
40 (1½)	250 (10)	
50 (2)	300 (12)	

- .5 Metric Duct Sizes:

- .1 The Metric duct sizes are expressed as 25 mm = 1 inch.

1.5 Salvage

- .1 Remove from Site all equipment, ducting or piping which is no longer required because of Work under this Contract.
- .2 Turnover to and deliver to the City's storage area all items which have been determined to have salvage value and has been removed due to the Work.

1.6 Cutting, Patching and Coring

- .1 Provide holes and sleeves, cutting and fitting required for mechanical Work.
- .2 Drill for expansion bolts, hanger rods, brackets, and supports.
- .3 Obtain written approval from the Contract Administrator before cutting or burning structural members.
- .4 Provide openings and holes required in precast members for mechanical Work. Cast holes 100 mm or larger in diameter. Field-cut smaller than 100 mm.
- .5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

1.7 Installation of Equipment

- .1 Pipe all equipment drains to building drains.

COMMON WORK RESULTS FOR MECHANICAL

- .2 Unions and flanges shall be provided in piping or ductwork to permit easy removal of equipment.
- .3 Maintain permanent access to equipment for maintenance.

1.8 Fire-Stopping

- .1 Fire-stop all pipe, duct, conduit and wire penetrations through floors and walls, designated as fire and/or smoke separations. The Contractor is required to coordinate with the architectural drawings to contractual rated wall types and installation details.
- .2 Fire-stopping materials to meet CAN S115. Acceptable Materials: "Tremco" or "National Firestopping", or Hilti CP680 Cast-in-Place Firestopping System.
- .3 Preparation of surfaces and installation of fire-stopping materials shall be carried out as per manufacturer's instructions.

1.9 Connections to Existing Services

- .1 Maintain liaison with the City and provide a schedule to interrupt, re-route or connect to water, sewer, heating, or gas systems, with minimum interruption of services.
- .2 Major services shall not be interrupted before all preparatory work is completed and all required materials are on-site. Provide a minimum of 48 hours notice for all service shutdown.
- .3 Interruptions and shutdowns of existing services shall be by the building/plant maintenance staff.

1.10 Equipment and Materials

- .1 Materials and equipment installed shall be new, full weight and of quality specified.
- .2 Each major component of equipment shall bear manufacturer's name, address, catalogue and serial number in a conspicuous place.
- .3 Where two or more products of the same type are required, products shall be of the same manufacturer.

1.11 Equipment Protection and Clean-Up

- .1 Protect equipment and materials in storage on-site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out unsealed bearings and refill with new change of oil, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

COMMON WORK RESULTS FOR MECHANICAL

- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

1.12 Electrical Motors

- .1 Supply mechanical equipment complete with electrical motors.
- .2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be CSA labelled. All motors to be approved for use in the designated area classification by the Provincial Electrical Protection Branch.
- .3 All motors intended for use with a variable speed drive (variance frequency drive) shall be inverter only rated. Variable speed drive shall be matched to motor.
- .4 Two speed motors shall have separate winding for each speed.
- .5 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC Design C or D.
- .6 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection.
- .7 Motors less than 1/2 hp shall be 120 V, 60 Hz, 1 phase. Motors 1/2 hp and larger shall be 3 phase at the indicated voltage.
- .8 All motors shall be 1800 rpm except where indicated.
- .9 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.
- .10 Provide motors designed with Class B insulation; Class F insulation for totally enclosed motors.
- .11 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.
- .12 All motors shall be premium efficiency rated according to NEMA standards unless specified otherwise.
- .13 All motors shall be inverter duty rated when driven by a variable speed drive.

1.13 Access Doors

- .1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:
 - .1 Valves
 - .2 Volume and splitter dampers

COMMON WORK RESULTS FOR MECHANICAL

- .3 Fire dampers
- .4 Cleanouts and traps
- .5 Controls, coils and terminal units
- .6 Expansion joints
- .7 Filters
- .8 Strainers
- .2 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed.
- .3 Mark removable ceiling tiles used for access with colour coded dots.
- .4 Sizes to be 200 mm x 200 mm for cleanout, 300 mm x 300 mm for hand 600 mm x 600 mm for body access minimum.
- .5 Provide ULC-listed fire rated access doors installed in rated wall and ceilings.

1.14 Miscellaneous Metals

- .1 Provide all necessary miscellaneous metals to hang or support materials, equipment and provide access for work under this contract.
- .2 All miscellaneous metals shall be prime painted.
- .3 Miscellaneous metals shall include but are not limited to:
 - .1 Hangers for equipment, piping and ductwork.
 - .2 Support for equipment.

1.15 Escutcheon and Plates

- .1 Provide escutcheon and plates on piping and ductwork passing through finished walls, floors and ceilings.
- .2 Escutcheons shall be split type, stainless or chrome plated steel.

1.16 Painting and Identification

- .1 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour coding schedule below.
- .2 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm high black lettering shall be equal in accordance with B6 to the Brady

COMMON WORK RESULTS FOR MECHANICAL

System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B 946 for insulated surfaces.

- .3 Identify piping with labels, colour bands, and flow arrows. Provide identification at 3 m maximum intervals, before and after pipes pass through walls, at all sides of tees, behind access doors and in equipment rooms as required.
- .4 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.
- .5 Provide 20 mm diameter brass, with metal photo black numbers, or white lamacoid with black engraved numbers, secured to valve stem with key chain.
- .6 Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to the City. Include copies in O&M Manuals.
- .7 Tag automatic controls, instruments and relays and match/key to control shop drawing identification numbers. Tag all equipment and control panels.
- .8 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplied under this division with lamacoid plates having 6 mm (1/4 inch) minimum letter size. Identification to state equipment controlled.
- .9 Identify the usage of duct access panels with self-adhesive Brady stick-on coloured labels. Apply labels conforming to the following schedule.

	<u>Colour</u>	<u>Letters</u>
Cleaning and service access	yellow	C.A.
Controls, including heat sensors	black	C.
Dampers (backdraft, balance & control)	blue	D.
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

Note: Provide black lettering for yellow or white background, white for all other colours.

- .10 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". Place identification dots on the access panel. The colours shall conform to the following schedule:

Concealed equipment and cleaning access	yellow
Control equipment, including control dampers and valves, and heat sensors	black
Fire, smoke, and sprinkler equipment including dampers	red
Pipe mounted equipment with the exception of fire, smoke, sprinkler and control equipment	green

COMMON WORK RESULTS FOR MECHANICAL

Balancing Dampers

blue

When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

1.17 Colour Coding Schedule

.1 Identification Symbols and Colour for Piping

	Pipe Colour	Stripe Colour	Symbol
Condensate	Green	Orange	Cond.
Cooling Water Supp.	Green	Orange	Cool Wat.S.
Cooling Water Ret.	Green	Orange	Cool Wat.R.
Domestic Cold Water	Light Blue	None	Dom. Cold Wat.
Domestic Hot Water	Green	Orange	Dom. Hot Wat.
Drains	Aluminum	Red/Orange	Drain
Glycol Return	Green	Orange	Glycols R.
Glycol Supply	Green	Orange	GlycolS
Heating Hot Water Return	Yellow	Orange	Heat Wat.R.
Heating Hot Water Supp.	Yellow	Red	Heat Wat.
Vent	Aluminum	Red/Orange	Vent
Water Boiler Feed	Green	Orange	Blr.Feed, Under 120°C (250°F)

.2 Mechanical Control Systems

- .1 Conduit pull boxes, terminal boxes and junction boxes - GREY Covers - GREY with black 'C'.
- .2 Main and secondary control panels, factory finish acceptable - control Contractor to install company label to identify.

.3 Ductwork

All ductwork in mechanical rooms to be identified as follows, complete with directional arrows:

Return Air	R.A.
Supply Air	S.A.
Mixed Air	M.A.
Combustion Air	Comb. Air
Exhaust Air	E.A.

1.18 Temporary Heat

- .1 Do not use the permanent system for temporary heating purposes without written permission from the Contract Administrator.
- .2 Thoroughly clean and overhaul permanent equipment used during the construction period, replace worn or damaged parts before final inspection.

COMMON WORK RESULTS FOR MECHANICAL

- .3 Use of permanent systems for temporary heat shall not modify terms of warranty.
- .4 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate with proper safety devices and controls installed and fully operational. Operate systems only with treated water as specified.
- .5 When permanent systems are used for temporary heat, provide alarm indicating system failure.
- .6 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals.

1.19 Temporary or Trial Usage

- .1 Temporary or trial usage by the City or Contract Administrator of mechanical equipment supplied under Contract shall not represent acceptance.
- .2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.
- .3 Avoid thermal shock to heating system by coordination with the City during planning, construction and operation of temporary heating system.

1.20 Substantial and Total Performance

- .1 Prior to requesting an inspection for Substantial Performance, provide a complete list of items which are deficient.
- .2 A certificate of Substantial Performance will not be granted unless the following items are completed:
 - .1 Heating air conditioning, systems have been commissioned and are capable of operation with alarm controls functional and automatic controls in operation. Commissioning checklists must be submitted prior to the request by the Contractor to have a Substantial Completion Inspection.
 - .2 The necessary tests on equipment and systems including those required by authorities have been completed with certificates of approval.
 - .3 Air and water systems have been balanced with draft report submitted to the Contract Administrator.
 - .4 Valve tagging and equipment identification is complete.
 - .5 Systems have been chemically cleaned. Flush and initiate water treatment. Provide report from Manufacturer's Representative to confirm status of treatment.
 - .6 Draft Operating/Maintenance Manuals have been submitted.
 - .7 Operating and Maintenance demonstrations have been provided to the City.

COMMON WORK RESULTS FOR MECHANICAL

- .8 Written inspection report by Manufacturer's Representative has been submitted for noise and vibration control devices and flexible connections.
- .9 Record Drawings have been submitted.
- .10 Fan plenums have been cleaned, and temporary filters have been replaced with permanent filters.
- .11 All previously identified deficiencies have been corrected.
- .3 Prior to Total Performance Inspection provide declaration in writing that deficiencies noted at time of Substantial Performance Inspection have been corrected and the following items completed prior to the Total Performance Inspection:
 - .1 Submit final air and water balance reports.
 - .2 Submit final operating and maintenance manuals.
 - .3 Complete final calibration.
 - .4 Mail warranty forms to the manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.
- .4 The Contract Administrator will provide one (1) visitation for the purpose of Total Performance Inspection. Subsequent visitations if required, shall be at the expense of the Contractor.
- .5 The Contractor shall provide qualified personnel in appropriate numbers to operate the facility until Substantial Performance is declared.

1.21 Scope

- .1 Provide rough-in for and make all connections to equipment supplied by others including, but not limited to, kitchen, laundry and sterilising equipment.

1.22 Installation

- .1 Make all mechanical connections to equipment supplied by others under this Contract. This shall include all water, drain, gas, exhaust, traps, ductwork and similar connections required. Provide isolation valves, unions, flanges and traps as required for a complete installation.
- .2 Change to rough-in of services or final equipment connections due to a change in the make of equipment from that specified shall be made at no extra cost to the City, provided that proper Shop Drawings are available for rough-in. Prior to commencing installation of rough-in for the equipment, coordinate with the final reviewed equipment Shop Drawings and with the Manufacturer.
- .3 Exposed piping shall be painted as per Contract Administrator's instructions.
- .4 Arrange piping connections to allow for equipment removal.

COMMON WORK RESULTS FOR MECHANICAL

2. PRODUCTS

2.1 Acceptable Manufacturers/Suppliers and Agencies

- .1 The following listed manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The list does not endorse the acceptability of all products available from the listed manufacturers/suppliers.
- .2 In accordance with B6, it remains the responsibility of the Contractor to ensure the products supplied are equal to the specified products in every respect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.
- .3 The Contractor shall be fully responsible for any additional Work or materials, to accommodate the use of equipment from the acceptable manufacturers and suppliers list.

.4 List of Acceptable Manufacturers/Suppliers and Agencies:

- | | |
|---|--|
| .1 Access Doors | Maxam, Acudor, Milcor, Can.Aqua, Mifab, The Williams Brothers Corporation |
| .2 Air Separators, Relief Valves | Armstrong, Bell & Gossett, Taco, Wheatley |
| .3 Air Terminals - Grilles Registers, Diffusers | E.H. Price, Titus, Anemostat, Nailor |
| .4 Backflow Preventers | Febco, Watts, Hersey, Singer, Ames |
| .5 Balancing Agents | AMS, AHS, DFC, Airdronics |
| .6 Chimney (Boiler Intake and Venting) | Heat Fab |
| .7 Controls Contractors and/or Suppliers | Johnson Controls |
| .8 Expansion Compensators | Flexonics, Tube Turn, Hyspan, Hydroflex, Metraflex, United Flexible, Mason |
| .9 Expansion Joints | Flexonics, Hyspan, Hydroflex, Metraflex, United Flexible, Mason |
| .10 Flexible Connectors - Ducting | Thermafex, G.I. Industries Type IHP |
| .11 Flexible Connectors - Piping | Flexonics, Tube Turn, Atlantic, Hyspan, Hydroflex, Metraflex, United Flexible, Mason |
| .12 Flexible Duct | Thermafex, Wiremold, GI Industries Type H.P. |
| .13 Gauges - Air | Dwyer, Magnehelic |
| .14 Gauges - OWG Pressure | Treerice, Marsh, Ashcroft, Weiss |

COMMON WORK RESULTS FOR MECHANICAL

.15 Grooved Mechanical Pipe Joints	Victaulic
.16 Insulation - Piping and Duct	Fibreglass Canada, Manson, Knauf Fibreglass, Plasti-Fab, Manville
.17 Meters, Positive Displacement	Neptune, Rockwell
.18 Pipe Restraints	Trelleborg
.19 Piping Hangers and Saddles	Grinnell, Myatt
.20 Plug Cocks	DeZurik, Newman-Milliken
.21 Strainers	B&G, Armstrong, Sarco, Mueller, Toyo, Anderson, Metraflex, Yarway
.22 Thermometers	Trelice, Marsh, Ashcroft, Winters
.23 Valves - Butterfly	Jenkins, Keystone, DeZurik, Centreline, Monotight, Dresser, Lunkenheimer, Crane, Bray, Toyo, Grinnell
.24 Valves - Circuit Balancing	Armstrong, B & G, Wheatley, Tour & Anderson, Taco
.25 Valves - Drain, Radiator	Jenkins, Dahl, Crane, Toyo, Kitz
.26 Valves - Eccentric Plug	DeZurik, Homestead
.27 Valves - Gate, Globe, Swing, Check, Ball	Jenkins, Toyo, Crane, Kitz, Milwaukee
.28 Valves - Pressure Balanced Mixing	Symmons
.29 Valves - Pressure Reducing	Armstrong, Bell & Gossett, Taco
.30 Valves - Relief	Armstrong, Bell & Gossett, Taco, Wheatley
.31 Valves - Silent Check	Val-matic, APCO, StreamFlo
.32 Valves - Suction Diffusers, Combination Check and Balance (Triple Duty Valve)	Armstrong, B&G, Taco
.33 Valves - Water Pressure Reducing	Watts, Clayton, Singer, Zurn. Wilkins, BCA, Cash Acme, Braukman
.34 Vibration Isolation	Mason, Vibro Acoustic

2.2 Counter Flashing Materials

- .1 Counterflashings: galvanized sheet steel of 0.85 mm (22 ga) minimum thickness.
- .2 Counterflashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

COMMON WORK RESULTS FOR MECHANICAL

- .3 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.
- .4 Vertical flange section of roof jacks shall be screwed to face of curb.

3. EXECUTION

- .1 Not Applicable.

END OF SECTION