

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises Edmonton Maximum Security Institution, Main Building, Air Handlers Heating and Piping Replacement.
- .2 For all intents and purposes of the contract between Public Works Government Services Canada (otherwise known as Public Services and Procurement Canada) and the Contractor, all contractual obligations for the coordination and performance of the Work remain with the Contractor, regardless if a specialty trade or major subcontractor is listed in the specifications. Major subcontractor and trade references are made to provide an organizationally practical means for coordination and scope division, to aid the Contractor with managing the project with major subcontractors and various trades, but is not intended to otherwise alleviate the Contractor from contractual obligations for the performance and coordination of the Work. All references to Sub-contractors, Mechanical Contractor, Electrical Contractor, TAB contractor, etc. shall ultimately be interpreted as being the contractual responsibility of the Contractor.
- .3 Demolition: Removal of existing mechanical equipment, ductwork, pipes, controls, wiring, conduit, breakers, motor control centres, drywall for access to items.
- .4 Hazardous material: Work will require abatement of hazardous material which include: Asbestos, lead, silica, and mercury.
- .5 Hours of work shall be 8 a.m. – 4 p.m. Monday to Friday.
 - .1 No work shall take place on site during federal statutory holidays, unless approved in writing by the Departmental Representative
- .6 Architectural:
 - .1 Work is to related to areas impacted by HVAC upgrades.
 - .2 Selective demolition of walls, floors, roof to facilitate work by other trades.
 - .3 Replacement of an existing suspended ceiling, removal and replacement of ceiling (gypsum and suspended) to facilitate other work
 - .4 Fire stopping of penetrations.
 - .5 Addition of new exterior doors.
 - .6 New exterior wall penetrations and modifications of existing roof curbs.
 - .7 Patching of fire proofing material on ceilings of mechanical room.
 - .8 Patch and repair penetrations required for controls work.
- .7 Structural:
 - .1 Work is to related to areas impacted by HVAC upgrades.
 - .2 Reinforcing of existing roof,
 - .3 New stands for mechanical equipment,
 - .4 New house keeping pads and changes to existing pads.
 - .5 Miscellaneous metal work.
- .8 Mechanical:
 - .1 Replacement of existing air handlers throughout the facility.

- .1 Modifications to the existing heating system in relation to the air handler replacement.
 - .2 Replacement of boiler system and domestics hot water heaters serving Segregation Unit
 - .3 Replacement of pneumatic control components with electronic.
 - .4 Replacement of existing domestic water distribution system.
 - .5 Replacement of a computer cooling unit.
 - .6 Upgrade of ventilation system serving the executive area (new VAV system)
 - .7 Addition of exhaust and make up air to work shop
 - .8 Replacement and addition of exhaust fans serving cell blocks
 - .9 Replacement of domestic hot water boilers serving the Kitchen.
 - .10 Hydronic and air balancing in coordination with Commissioning Plan.
- .9 Controls:
- .1 Coordinate work done by base building controls contractor, Johnson Controls.
 - .2 Arrange and pay for access and security system modifications by Delco Security.
 - .1 Coordinate Delco Security work to modify existing security controls systems. Contact to obtain quote:
Delco Automation Inc.
Adam Grabka, P. Eng.
P: (306) 244-6449 x 361
Email: agrabka@delcoautomation.com
- .10 Electrical:
- .1 Electrical scope is to provide support for HVAC upgrades. Existing MCCs and panelboards will remain in place with new breakers/buckets installed as required. Refer to electrical SLD and equipment schedule.
 - .2 All existing air handling units have a minimum of 2 smoke detectors associated with it, one for supply and one for return. During HVAC work, electrical contractor shall temporarily remove, support and re-install fire alarm equipment as required.
 - .3 Provide power to new smoke dampers as required.
 - .4 Provide wiring between new and existing unit heaters, as indicated, to new thermostats and control valves.
 - .5 Provide power to new BMS control panels.
 - .6 Coordinate with mechanical contractor for locations of dampers, thermostats, control valves, and new BMS control panels.
 - .7 In areas where ceiling tiles or HVAC ceiling diffuser are being modified/replaced, electrical contractor is responsible to provide temporary support for fire alarm devices, security system devices, and lighting fixtures. After other contractors complete their work, the electrical contractor shall re-install all electrical equipment in previous locations.
 - .8 To mitigate the need for a generator during busduct key interlock breaker replacement, a recommended shutdown procedure has been provided (see Section 26 05 00). It is expected that individual MCCs will be shutdown for a short period, less than 1 hour, during busduct breaker replacement.

- .9 Existing MCC buckets that are removed shall be sent back to the manufacture for testing. buckets that pass testing are to be given to the Departmental Representative for spare buckets. Provide test results to Department Representative.
- .10 Coordination with Department Representative is required during shutdown of any powered equipment.
- .11 Refer to electrical drawings for complete scope of work.
- .12 Any cables being demolished are to be demolished back to the source or last accessible location and marked as unused.
- .13 During commissioning, contractor to confirm loading of MCCs or panels by completing a thermal scan as well as measuring current in main incoming feeders to MCCs or panels. Provide data to Department Representative.
- .11 The work also requires
 - .1 Provisions for temporary heating and ventilation.
 - .2 Full time supervision during any work at the project site.
 - .3 Weekly Construction Progress Reports.
 - .4 Provisions for Commissioning process.

1.2 CONTRACT METHOD

- .1 Construct Work under stipulated price contract.

1.3 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of Project executed during Work of this Contract, and which is specifically excluded from this Contract:
 - .1 R.077214.001 EMSI Program Building A/C
 - .2 R.077217.001 EMSI Unit Offices A/C
 - .3 R.077218.001 EMSI Heating Controls Upgrade (Gate House and DNS)
- .4 Work of this Project must include provisions for co-ordinating work, identified in Contract Documents, for following principal items.
 - .1 Building Automation System - Johnson Controls

1.4 WORK SEQUENCE

- .1 Definitions
 - .1 Shoulder season: Mar 15 – May 15 & Sept. 15 – Nov. 15
 - .2 Warm weather conditions: May 16 – Sept. 14
 - .3 Winter season: Nov. 16 – Mar. 14
 - .4 Long lead term: More than 2 weeks' delivery

- .2 Shut downs shall not occur unless new equipment for work is on site.
- .3 Construct Work in stages to accommodate Departmental Representative continued use of premises during construction.
- .4 Co-ordinate Progress Schedule and co-ordinate with Departmental Representative Occupancy during construction.
- .5 Below is a non-exhaustive list of distinct work areas for this project. The following areas have unique phasing constraints.
 - .1 Segregation Wing (SEG)
 - .2 Segregation Boiler Room
 - .3 West Mechanical Room
 - .4 Executive Area
 - .5 Tunnel System
 - .6 Cell Blocks (A/ B, C/ D, E/ F, G/ H)
 - .7 Roof Top Area
 - .8 East Mechanical Room
 - .9 Main Boiler Room (SIS)
 - .10 Engineering & Maintenance
 - .11 Education
 - .12 Corcan
 - .13 Gym
 - .14 Laundry Area
 - .15 Plumbing General
 - .16 Valves and Controls General
- .6 Work in these areas will be guided by the following high level restrictions
 - .1 Segregation Wing
 - .1 AS-1 serves the Segregation Wing inmates, and shall not be decommissioned and replaced while any of the other cell blocks are shut down. Work on only one of the following five units (SEG, A/B, C/D, E/F, G/H) may proceed at any given time:
 - .1 AS-1 – Segregation wing,
 - .2 AH-13 – Cell Block A/B,
 - .3 AH-10 – Cell Block C/D,
 - .4 AH-4 – Cell Block E/F,
 - .5 AH-7 – Cell Block G/H.
 - .2 Work on AS-1 must be successfully commissioned and interim acceptance attained prior to shutdown of any other cell block system.
 - .3 This work must be scheduled well in advance.
 - .4 AS-1 must be replaced in warm weather conditions
 - .5 AS-2 serving program rooms, must be replaced in the shoulder season or in warm weather conditions
 - .2 Segregation Boiler Room

- .1 Phasing of the hot water tank replacement shall not interrupt the supply of hot water to the area.
- .3 West Mechanical Room
 - .1 A new double door accessible from the roof is included in the scope of work for this area to provide options for the removal and installation of the Air Handling Units.
 - .2 There are multiple air handlers serving multiple areas in this wing. Only one AH can be decommissioned at any given time unless stated otherwise below.
 - .3 Each unit is to be fully commissioned and each area is to be cleaned; and accepted prior to shutdown of the next air handler.
 - .1 AH-18 & AH-19 will be replaced by one single AH. Both units serve the Admin & Discharge area and shall be decommissioned together.
 - .2 AH-101 will be replaced. This unit serves the Chapel and Staff Lounge. This unit will have an A/C rooftop condenser added. AH-101 must be replaced in the shoulder season or in warm weather conditions
 - .3 AH-26 will be replaced. This unit serves the Psychology offices. This unit will have an A/C rooftop condenser added. AH-26 must be replaced in the shoulder season or in warm weather conditions
 - .4 AH-27 will be replaced. This unit serves corridor between L & K block. The ductwork capping and associated demolition/new-installation scope in this area must be scheduled well in advance. AH-27 must be replaced in warm weather conditions.
 - .5 AH-20, 21, 22 will undergo a 3-way valve replacement and controls upgrade. Work on these three units must take place at the same time. These units serve the healthcare area. This work must be performed in warm weather conditions.
 - .6 AH-28 will be replaced. This unit serves the west catwalk. The A/C rooftop condenser is also being replaced. AH-28 must be replaced in warm weather conditions.
 - .7 AH-25 is an abandoned unit that will undergo a 3-way valve replacement and controls upgrade. This work may take place while other AH driven work is being performed on other units. This unit does not have any constraints on when the work can take place.
 - .8 AH-102 is not included in the scope of work.
 - .9 AH-103 will be replaced. This unit serves the aboriginal offices. This unit shall be replaced in warm weather conditions.
 - .10 AH-23 will be replaced. This unit serves the gym. There is some associated demolition of abandoned piping in the Gym that must be scheduled well in advance. This unit should be replaced in warm weather conditions.
 - .11 AH-33 will undergo 3-way valve replacement and controls upgrade. It is not located in a separate room adjacent the weight pit. This work can take place while other AH driven work is

being performed on other units. This unit does not have any constraints on when the work can take place.

.4 Executive Area

- .1 This is a sub area of the West Mechanical Room but is treated as standalone work area. During work on the HVAC system in the Executive Services area, no other AH work may proceed in the West Mechanical Room.
- .2 AH-16 and AH-17 both serve the Executive Services area and will both be replaced at the same time
- .3 When work is scheduled to take place in the Executive Services area, the detailed work plan must be approved at least 6 weeks in advance.
- .4 If adequate temporary heat is provided, this work can take place in winter conditions. Refer to section 01 51 00 for temporary heating requirements.
- .5 Under separate contract, not included in the contractor's scope of work, is the complete move of all of the existing furniture (including desks, filing cabinets, etc.) and office supplies out of the Executive Services area and setup into the temporary office area.
 - .1 All furniture and equipment in the Conference Room and the Server room will not be removed, and must be diligently protected from dust/damage by the contractor; these two rooms will remain locked when work is not scheduled to take place in these two rooms specifically.
- .6 AH-16 & AH-17 must be fully commissioned, and the associated demolition, drywall, final painting, etc. must be complete in the Executive Services area to obtain interim acceptance of this area.
- .7 As a condition of interim acceptance for this area, it should be completely cleaned, to the same or better condition in which it was before work began. The cleanliness must be to the satisfaction of the Departmental Representative.
- .8 Upon acceptance, under separate contract, not included in the contractor's scope of work, is the complete return of all of the existing furniture (including desks, filing cabinets, etc.) and office supplies out of the Executive Services area and setup into the temporary office area.

.5 Tunnel System & Cell Unit A/B, C/D, E/F, G/H & SEG Unit

- .1 The AH serving the units are in the tunnel system, though there is work that must take place in the cell areas themselves.
- .2 There are restricted/confined spaces in the tunnel system that must be accessed to perform some of the AH driven work in the cell units.
- .3 The cell blocks shall remain occupied during construction. Work is to be staged to interrupt only 1 cell block at a time. A cell block AH shall not be decommissioned and replaced while any of the other cell blocks are shut down. Work on only one of the following five units (SEG, A/B, C/D, E/F, G/H) may proceed at any given time. Each cell block is to be fully commissioned and accepted work prior to commencement of next air handler replacement.
- .4 The tunnel system air handling units will all be replaced. Constraints for this area for staging are as follows:

- .1 First phase: AH-6, AH-9, AH-12, AH-15 are to be replaced first. These units provide outside air to the tunnel system.
- .2 Second phase: AH-5, AH-8, AH-11, AH-14 are to be replaced in the second phase. These units serve the unit offices. These AH may be replaced in the shoulder season or in warm weather conditions.
- .3 Interim phase: AH-13A, AH-10C, AH-7G, AH-4E form part of the new HVAC system serving the cells (in conjunction with AH-13B, AH-10D, AH-7H, AH-4F) though can be roughed-in as long as the rough-in does not disrupt the HVAC systems serving the cell blocks.
- .4 Third phase: AH-13B, AH-10D, AH-7H, AH-4F must be replaced one at a time as they serve the cell blocks (note AS-1 forms part of the constraint of replacing/commissioned one cell unit at a time). These four units must be commissioned alongside their counterpart (AH-13A and AH-13B for example must be commissioned together) in order to have a fully commissioned unit. This work must take place in warm weather conditions. This work must be scheduled well in advance.
- .5 Since this work will disrupt HVAC to inmate occupied area, authorization to be proceed with this work must be received from the Departmental Representative. In order to take AS-1, AH-13, AH-10, AH-7 or AH-4 offline, the following criteria must be met:
 - .1 Three-week lookahead schedule for each cell unit must be approved by the Departmental Representative
 - .2 All long lead time material and equipment must be already received on site and verified by the Departmental Representative
 - .3 All required rough-in for the cell unit must be complete and verified by the Departmental Representative, including but not limited to:
 - .1 Re-heat coils, associated ductwork and sensors/control wiring installed
 - .2 Ductwork modifications and wall grills installed
 - .3 New exhaust fans installed & old ones replaced
 - .4 Interim phase / companion AH in place and roughed in
- .6 Roof Top Area
 - .1 RTU-1 serves the west lobby entrance and must be replaced in shoulder season or warm weather conditions.
 - .2 If contractors intend to use the roof top exhaust fans for the cells to provide temporary ventilation for the inmates, then the replacement of the exhaust fans must be performed ahead of the planned replacement of the cell unit AH.
 - .1 Roof top exhaust fans serving cell units must be included in the final commissioning of the cell unit AH as they form part of the system

- .2 If contractor uses newly installed exhaust fans for temporary ventilation, this shall not trigger warranty period. Warranty period for the exhaust fans and entire AH system will start after commissioning and interim acceptance.
- .7 East Mechanical Room
 - .1 There are two domestic water heaters that are being replaced in the East Mechanical Room. This replacement must be done without disrupting service. There is a water bypass available to facilitate the installation without disrupting service. The transition from old to new shall be done after final dishwasher use at the end of the work day for DHW-4 only.
 - .2 There are three AH that will be replaced in the East Mechanical Room (AH-29, AH-30, AH-32). These units must be replaced in the shoulder season or in warm weather conditions.
 - .3 AH-29 and AH-30 must be decommissioned and their replacement units roughed in, as well as replacement unit AH-32 roughed into its new location, prior to decommissioning the existing AH-32 unit.
- .8 Main Boiler Room (SIS)
 - .1 There are three AH that will be replaced in this area (AH-1, AH-2, AH-3B). These units must be replaced in the shoulder season or in warm weather conditions. Any associated demolition/finishing work must be scheduled well in advance.
 - .2 Staging of work in this area must allow continuous partial occupancy. Attain Partial Interim Acceptance of each stage of the work prior to commencement of next space in this area
- .9 Engineering & Maintenance
 - .1 As long as there is not total interruption to heat supply to this area, work can take place any time.
- .10 Education
 - .1 There are no additional restrictions for when the work in this area must take place
- .11 Corcan
 - .1 There are no additional restrictions for when the work in this area must take place
- .12 Laundry Area
 - .1 If scaffolding is used in the laundry area, it may only remain erected for 2 days at a time, after such a time, the scaffolding must be dismantled to allow for inmates to perform their laundry duties w/o having outside tools or equipment residing in the area. The allowable work schedule in the laundry area are 2 days in, 2 days out.
 - .2 This work must be scheduled well in advance.
- .13 Plumbing General
 - .1 Much of the piping replacement takes place within a suspended drywall ceiling. Work within the ceiling space will require measures to protect the ceilings and to support personnel in the ceiling. (i.e. plywood).
 - .2 The drywall ceilings are accessed from secure access hatches that will remain unlocked while there are employees working in the ceiling space
 - .3 The ceiling space is a return air plenum.

- .4 Any disruption of water service shall be done during night shift and water shall be operational for the beginning of the next regular work day.
- .14 Heating Terminal Valves and Controls General
 - .1 This work is sporadic throughout the institution and will involve the disruption of numerous spaces. The overall restriction for this work is that only one area may be disrupted at any given time, and that this work must be scheduled well in advance. Interim acceptance must be received prior to moving to the next area of work.
- .7 There are six principal areas that have AH driven work. Further to the phasing constraints described above, there are further restrictions on AH driven mechanical work. Only two areas may be active at any given time. Any AH that are being replaced in a given area must be commissioned, interim acceptance received and associated area occupied prior to moving on to a new principal area of work. The work areas shown on the drawing are:
 - .1 Segregation Wing
 - .2 West Mechanical Room
 - .3 Executive Area
 - .4 Tunnels / Cell Blocks
 - .5 East Mechanical Room – Food Service
 - .6 Main Boiler Room – SIS
- .8 Work outside of each phase Work area is to be coordinated with the Department Representative.
- .9 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for storage, for Work, for access to allow:
 - .1 Maintain 24-hour operational access through all areas of work to meet operational requirements
- .2 Refer to Section 01 35 13 - Security Requirements.
- .3 Co-ordinate use of premises under direction of Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations, restore condition of existing work to equal to or better than that which existed before new work started.

1.6 PARTIAL OWNER OCCUPANCY

- .1 Premises will be occupied during entire construction period for execution of normal operations.
- .2 Cooperate with Department Representative in scheduling operations to minimize conflict and to facilitate usage.

- .3 Execute Partial Interim Certificate of Completion for each designated portion of Work prior to Owner occupancy.
- .4 The facility will be fully occupied during construction.

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants, building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.8 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission a minimum of 48 hr in advance.
- .2 Provide alternative routes for personnel only with written permission from the Departmental Representative.
- .3 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .4 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide temporary services when directed by Departmental Representative to maintain critical building systems.
- .6 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services. Record locations of maintained, re-routed and abandoned service lines.
- .8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Three (3) week look ahead.
 - .11 Health and Safety Plan and Other Safety Related Documents.
 - .12 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work arrange with Departmental Representative to provide temporary means to maintain security. Refer to Section 01 35 13 - Security Requirements.
- .4 Contractor must provide sanitary facilities that will remain outdoors, located inside the security fence, in near proximity to the work area.
 - .1 Coordinate bathroom access and schedule with Commissionaires.
 - .2 If Departmental Representative confirms in writing that CSC operational requirements make it unfeasible for contractor to supply a sanitary facility in near proximity to work area, the contractor will be authorized to use one or more sanitary facilities currently existing within the institution
 - .3 Contractor must be respectful and keep clean any sanitary facilities existing within the institution that are provided temporarily for use. Miss use of facilities will result in removal withdrawal permission.
- .5 Contractor laydown and parking shall be located outside of the security fence, north of the GO building. Security provisions for all tools, assets, equipment & material located in the contractor laydown shall be the responsibility of the contractor.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants, building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum.
- .3 Provide for pedestrian personnel and vehicular traffic.

- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

- .1 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations. Refer to 01 35 13 - Security Requirements.
- .2 Noise generating activities shall be coordinated with department representative and require authorized from the institution.
- .3 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.
- .4 Site access requests:
 - .1 Canadian Police Information Center (CPIC) submission procedure, save file name & pdf format "CPIC_FirstName_LastName_Company.pdf", submissions must be sent once weekly (before Monday 12 pm noon on any given week, or before 12pm noon Tuesday if the Monday falls on a federal statutory holiday) Contractor shall designate a dedicated CPIC responsible manager. Each CPIC must be sent from the same responsible manager from the general contractor to Departmental Representative. Each submission must be accompanied by an updated log that contains a list of First Name, Last Name, Company Name, Date of CPIC submission. Each submission must list the names of the personnel requesting CPIC clearance in the body of the email; following each emailed submission, the email (without including detailed CPIC request, though including detailed CPIC submission log) is to then be sent to additional Departmental Representatives for monitoring. The definition of which Departmental Representative will receive the detailed request and which Departmental Representatives will receive the monitoring email, shall be defined in the kick-off meeting and may be subject to change periodically over the course of the project.
- .5 All deliveries must be received and offloaded outside the security fence by the contractor, in the contractor's laydown. No deliveries will be allowed to be received inside the security fence.
- .6 Half-an-hour (0.5) allowance to be made for screening each instance of personnel at the beginning of the work shift, and for any re-entries throughout the work shift.
 - .1 Any personnel to arrive at site at an unscheduled time or otherwise arrive on site for an unscheduled reason (i.e. late for shift, drop-in or unexpected site visit, etc.) shall allow for one (1) hour for security screening and escort to area of work
- .7 One (1) hour allowance to be made for screening each vehicle.

1.6 SECURITY

- .1 CPIC:
 - .1 Personnel employed on this project will be subject to security check. Obtain CPIC clearance, as instructed, for each individual who will require to enter premises.

- .2 Obtain requisite CPIC clearance, as instructed, for each individual required to enter premises.
- .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .4 CPIC Request Form attached.
- .2 Security escort:
 - .1 Escort required at all times.
 - .2 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.
 - .3 Submit an escort request to Departmental Representative at least 14 days before service is needed. For requests submitted within time noted above, costs of security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.
 - .4 Any escort request may be cancelled free of charge if notification of cancellation is given at least 4 hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.
 - .5 Calculation of costs will be based on average hourly rate of security officer for minimum of 8 hours per day for late service request and of 4 hours for late cancellations.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

- .1 Project Supplementary Conditions

1.2 CASH ALLOWANCES

- .1 Include in Contract Price specified cash allowances.
- .2 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing Work.
- .3 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .4 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.
- .5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.
- .6 Include progress payments on accounts of work authorized under cash allowances in Departmental Representative's monthly certificate for payment.
- .7 Prepare schedule jointly with Departmental Representative and Contractor to show when items called for under cash allowances must be authorized by Departmental Representative for ordering purposes so that progress of Work will not be delayed.
- .8 Amount of each allowance, for Work specified in respective specification Sections is as follows:
 - .1 Section 25 01 11 to 25 90 01 Work assigned to Johnson Controls

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 APPLICATIONS FOR PROGRESS PAYMENT

- .1 Submit to Department Representative, at least 30 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.
- .2 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Department Representative may reasonably require to establish value and delivery of products.

1.2 SCHEDULE OF VALUES

- .1 Provide schedule of values supported by evidence as Department Representative may reasonably direct and when accepted by Department Representative, be used as basis for applications for payment.
- .2 Include statement based on schedule of values with each application for payment.
- .3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Department Representative may reasonably require to establish value and delivery of products.
- .4 Work Area/ Phases requiring separate breakdowns are shown on drawing G3. Schedule of values shall include a breakdown by Specification Divisions for each Work Area/ Phase.
 - .1 Division 01 - GENERAL REQUIREMENTS
 - .1 Mobilization
 - .2 General Conditions
 - .3 Close out and Documentation
 - .2 Division 02 - EXISTING CONDITIONS
 - .1 Demolition
 - .2 Hazardous material/Asbestos Abatement
 - .3 Division 03 - CONCRETE
 - .4 Division 04 - MASONRY
 - .5 Division 05 - METALS
 - .6 Division 06 – WOOD, PLASTICS AND COMPOSITES
 - .7 Division 07 - THERMAL AND MOISTURE PROTECTION
 - .8 Division 08 - OPENINGS
 - .9 Division 09- painting and FINISHES
 - .10 Division 10 - SPECIALTIES
 - .11 Division 22- PLUMBING
 - .12 Division 23- HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
 - .13 Division 25 - INTEGRATED AUTOMATION
 - .14 Division 26 - ELECTRICAL
 - .15 Division 28- ELECTRONIC SAFETY AND SECURITY

- .5 Further detailed breakdown of for Divisions 22, 23, 25, and 26 is required for each sub trade with a minimum of the following sub-categories:

- .1 Mobilization
- .2 Demolition
- .3 Equipment
- .4 Material
- .5 Labour
- .6 Testing Adjusting and Balancing. (Div 23)
- .7 Commissioning
- .8 Training and Close Out Submittals (BMM &, as-builts)
- .9 Documentation

1.3 SUBSTANTIAL PERFORMANCE OF WORK

Prepare and submit to Department Representative, comprehensive list of items to be completed or corrected and apply for a review by Department Representative to establish Substantial Performance of Work or substantial performance of designated portion of Work when Cx Functional Performance Testing is completed and approved by the Department Representative. Failure to include items on list does not alter responsibility to complete Contract.

- .1 Upon receipt of list and application, Department Representative will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- .2 Department Representative will establish a date of Substantial Performance of Work or designated portion of Work.
- .3 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Department Representative, establish reasonable date for finishing Work.

1.4 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

- .1 After issuance of certificate of Substantial Performance of Work:
 - .1 Submit application for payment of holdback amount.
 - .2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
- .2 After receipt of application for payment and sworn statement, Department Representative will issue certificate for payment of holdback amount.

1.5 PROGRESSIVE RELEASE OF HOLDBACK

- .1 Where legislation permits, if Department Representative has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner shall pay holdback amount retained for such subcontract Work, or products

supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

- .2 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.6 FINAL PAYMENT

- .1 Submit application for final payment when Work is completed.
- .2 Upon receipt of application for final payment, Department Representative will review Work to verify validity of application. Department Representative will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.
- .3 Department Representative will issue final certificate for payment when application for final payment is found valid.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Provide physical space and make arrangements for meetings.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants affected parties not in attendance, and Departmental Representative.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors must be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 7 days before meeting.
- .4 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedule – Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site security in accordance with Section 01 35 13 Security Requirements.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 Products provided by Department Representative.
 - .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

- .11 Monthly progress claims, administrative procedures, photographs, holdbacks.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PHASING AND PLANNING MEETINGS

- .1 Schedule and administer bi-weekly (every two weeks alternating with progress meetings) phasing and planning meetings for 12 weeks (six instances) following the pre-construction meeting
- .2 Schedule and administer bi-weekly (every two weeks alternating with progress meetings) phasing and planning meetings at the beginning each subsequent new year that the project is underway
- .3 Pre-schedule and distribute written notice of each phasing and planning meeting five (5) days in advance of the first phasing and planning meeting, submit this to Department Representative.
- .4 Contractor to provide meeting space and make arrangements for meetings.
- .5 Contractor, major Subcontractors involved in Work and Departmental Representative must be in attendance.
- .6 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 2 days. Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting
 - .2 Critical review of 3-week look-ahead
 - .3 Critical review of Master Schedule
 - .4 Review phasing constraints and opportunities
 - .5 Review prioritizing activities driven by operational requirements and contractor presented items
 - .6 Review logistical challenges and opportunities
 - .7 Review of changes and/or discrepancies that may affect quality or schedule
 - .8 Summarize and organize all items recorded at the phasing and planning meetings into categories that are designated as actions and information for the appropriate parties

1.4 PROGRESS MEETINGS

- .1 Schedule and administer bi-weekly (every two weeks) project meetings throughout progress of Work.
- .2 Contractor to provide meeting space and make arrangements for meetings.
- .3 Contractor, major Subcontractors involved in Work and Departmental Representative must be in attendance.
- .4 Notify parties minimum 5 days in advance of meeting

- .5 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 4 days. Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Shop drawing, RFI and CCN logs.
 - .13 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five-day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Department Representative within seven (15) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule. Indicate the following:
 - .1 Indicate the number of working days to complete each work area/phase and the start and end date. The work areas shown on the drawing are:
 - .1 Segregation Wing
 - .2 West Mechanical Room
 - .3 Executive Area
 - .4 Tunnels / Cell Blocks
 - .5 East Mechanical Room – Food Service
 - .6 Main Bolier Room – SIS
 - .2 Within each work area/phase indicate the number of working days to complete each Air Handler System and the start and end date.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 7 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Permits.
 - .3 Mobilization.
 - .4 Pre-shut down confirmation review.
 - .5 Specific Work Area Phase
 - .1 Shop Drawings, Samples.

- .2 Supplied equipment long delivery items.
- .3 Area Preparation and Demolition
- .4 Interior Architecture (Walls, Floors and Ceiling).
- .5 Plumbing.
- .6 Lighting.
- .7 Electrical.
- .8 Piping.
- .9 Controls.
- .10 Heating, Ventilating, and Air Conditioning.
- .11 Fire Systems.
- .12 Testing and Commissioning.
 - .1 Pre-function Checks
 - .2 Start-up
 - .3 Controls Functional Start up
 - .4 Functional Performance Verifications.
- .13 Documentation
- .14 Training
- .15 Other supplied equipment required dates.

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
- .3 Weekly Reports should include
 - .1 Summary of weekly man hours spent the previous week, forecast of weekly man hours for the next week.
 - .2 Schedule forecast on areas of work for the week coming up and any major activities. Identify escort requirements to department representative for scheduling.
 - .3 Material section: report on deliveries, forecasted deliveries in the weeks coming up.
 - .4 Progress of work that has been completed that last week.
 - .5 Commissioning milestones
 - .6 Deficient items.
 - .7 Forecasted inspections.
 - .8 Weather issues.
 - .9 RFI, SI, CCN, CO (forecasted or outstanding).
 - .10 Any as-builts or pictures as required.

- .11 Any upcoming CPICs that will be submitted and when they are requested to be processed by.
 - .4 Communicate daily any deviations from the weekly report.
- 1.8 PROJECT MEETINGS**
 - .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current accepted dates shown on baseline schedule.
- Part 2 Products**
- 2.1 NOT USED**
 - .1 Not used.
- Part 3 Execution**
- 3.1 NOT USED**
 - .1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.
- .11 Submittals shall be posted to Project Buzzsaw Directory and shall be organized and named by specification section.
 - .1 Naming convention shall be "Specification Number_Shop Drawing Description_Date of Submission".
 - .2 Once uploaded, a separate email notification indicating that the submission has been posted shall be sent from the contractor to the Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .3 Allow 5 days for review of each submission by Departmental Representatives.
- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

- .10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Provide a mock-up of the wall penetration detail for cell block exhaust grille and fan installation. Refer to architectural drawings.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic colour digital photography in jpg format, fine resolution monthly with progress statement as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PURPOSE

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the institution is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics;
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization;
 - .3 an explosive or a bomb or a component thereof;
 - .4 currency over \$25, when possessed by an inmate without prior authorization; and
 - .5 any item not described in paragraphs (1) to (4) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 "Unauthorized Smoking Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing or snuffing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Construction employees" means persons working for the general Contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .6 "Departmental Representative" means the Public Works and Government Services Canada (PWGSC) or the Correctional Service Canada (CSC) project manager depending on project.
- .7 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .8 "Construction zone" means the area as shown on the contract drawings where the contractor will be allowed to work. This area may or may not be isolated from the security area of the institution.

1.3 PRELIMINARY PROCEEDINGS

- .1 Prior to the commencement of work, the Contractor will meet with the Departmental Representative to:
 - .1 Discuss the nature and extent of all activities involved in the Project.

- .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 The Contractor will:
 - .1 Ensure that all construction employees are aware of the rules of the institution.
 - .2 Ensure that a copy of the institutional rules is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that the rules of the institution are observed by all construction employees.

1.4 CONSTRUCTION EMPLOYEES

- .1 Submit to the Departmental Representative a list of the names with date of birth of all construction employees to be employed on the construction site and a CPIC clearance form for each employee. (Institutional Access CPIC Clearance Request form CSC/SCC 1279).
- .2 Allow two (2) weeks for processing of security clearances. Construction employees will not be admitted to the institution without a valid CPIC clearance in place and a recent picture identification such as a provincial driver's license. CPIC clearances obtained from other CSC institutions are not valid at the institution where the project is taking place.
- .3 The Departmental Representative may require that facial photographs be taken of construction employees and that these photographs be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Departmental Representative requires that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics.
 - .2 behave in an unusual or disorderly manner.
 - .3 are in possession of contraband.

1.5 VEHICLES

- .1 All unattended vehicles on CSC property shall have windows closed; doors and trunks shall be locked and keys removed. The keys shall be securely in the possession of the vehicle owner or an employee of the company that owns the vehicle.
- .2 The Departmental Representative may limit at any time the number and type of vehicles allowed within the institution.
- .3 Drivers of delivery vehicles for material required by the project shall require security clearances and must remain with their vehicle the entire time that the vehicle is in the institution. The director may require that these vehicles be escorted by institutional staff or Commissionaires while in the institution.

- .4 If the Departmental Representative permits trailers to be left inside the secure perimeter of the institution, these trailer doors will be locked at all times. All windows will be securely locked when left unoccupied. All trailer windows shall be covered with expanded metal mesh. All storage trailers inside and outside the perimeter must be locked when not in use.

1.6 PARKING

- .1 The parking area(s) to be used by construction employees will be designated by the Departmental Representative. Parking in other locations will be prohibited and vehicles may be subject to removal.
- .2 Contractor parking shall be north of the GO building

1.7 SHIPMENTS

- .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the institution's own shipments. The Contractor must have his own construction employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools.
- .2 Contractor shall receive and offload all deliveries outside of the security gate to the contractor laydown north of the GO building. Only after a delivery has been offloaded and received outside of the security gate, may it be brought inside the security fence, for use on the job site.
- .3 Security provisions for all tools, assets, equipment & material located in the contractor laydown shall be the responsibility of the contractor.

1.8 TELEPHONES

- .1 There will be no installation of telephones, Facsimile machines and computers with Internet connections permitted within the perimeter of the institution unless prior approval of the Departmental Representative is received.
- .2 The Departmental Representative will ensure that approved telephones, Facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, BlackBerries, telephone used as two-way radios, are not permitted within the perimeter of the institution unless approved by the Departmental Representative. If wireless cellular telephones are permitted, the user will not permit their use by any inmate. Cellular telephones approved by the Departmental Representative must be signed in and out of the institution.
- .4 The Departmental Representative may approve and limit the use of two-way radios.

1.9 WORK HOURS

- .1 Work hours within the institution are: 8:00 a.m. to 4:00 p.m., Monday to Friday.

1.10 OVERTIME WORK

- .1 Workers can work during the weekend outside of the building for longer hours subject to approval from the Departmental Representative.
- .2 Give a minimum twenty-four (24) hours advance notice when overtime work on the construction project is necessary and approved.
- .3 When overtime work, weekend statutory holiday work is required and approved by the Departmental Representative, extra staff members may be posted by the Departmental Representative or his designate, to maintain the security surveillance. The actual cost of this extra staff may be attributed to the contractor.

1.11 TOOLS AND EQUIPMENT

- .1 Tools brought in need to be counted every day and workers need to have a security briefing upon their initial arrival.
- .2 Maintain on site a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required.
- .3 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.
- .4 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .5 Store all tools and equipment in approved secure locations.
- .6 Lock all toolboxes when not in use. Keys to remain in the possession of the construction employees of the Contractor.
- .7 Scaffolding shall be secured and locked when not erected and when erected, shall be secured in a manner agreed upon with the Departmental Representative.
- .8 All missing or lost tools or equipment shall be reported immediately to the Departmental Representative.
- .9 The Departmental Representative will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every construction project.
 - .2 Weekly, when the construction project extends longer than a one-week period.
- .10 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Departmental Representative at the end of each day. The use of explosive-actuated tools is prohibited on site unless otherwise approved by the Departmental Representative. All broken blades and tools must be accounted for and broken tools are not to be thrown away. Particular attention must be given to power driven tools, files, saw blades, rod saws, wire, rope and ladders. Tool kits must be locked when the area is unattended.

- .11 If propane or natural gas is used for heating the construction, the institution will require that an employee of the contractor supervise the construction site during non-working hours.
- .12 Prior to the mobilization of the job box to the project, the following procedure is to be followed:
 - .1 Name of responsible foreman/field supervisor for the job box
 - .2 Provide a list of tools that will be inside the job box
 - .1 This list must be signed off by the warden
 - .3 No tools can be added to the job box without a formal revision to the tools list
 - .4 For job box, each tool is to have a number affixed to it (unless unsafe to do so and risks damaging the tool thus rendering it unsafe to use), to facilitate the tool inventory.
- .13 A laminated tool list or paper copy should be kept with the job box at all times

1.12 PRESCRIPTION DRUGS

- .1 Employees of the Contractor who are required to take prescription drugs during the workday shall obtain approval of the Departmental Representative to bring a one-day supply only into the institution.

1.13 SMOKING RESTRICTIONS

- .1 Contractors and construction employees are not permitted to smoke inside correctional facilities or outdoors within the perimeter of a correctional facility and must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Contractors and construction employees who are in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist, will be directed to leave the institution.
- .3 Smoking is only permitted outside the perimeter of a correctional facility in an area to be designated by the Departmental Representative.

1.14 CONTRABAND

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Departmental Representative.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the CPIC clearance of the affected employee. Serious infractions may result in the removal of the company from the institution for the duration of the construction.
- .4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of CPIC clearances for the driver of the vehicle.

1.15 SEARCHES

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Departmental Representative suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband or unauthorized items, he may order that person to be searched.
- .3 All employees entering the institution may be subject to screening of personal effects for traces of contraband drug residue.

1.16 ACCESS TO AND REMOVAL FROM INSTITUTIONAL PROPERTY

- .1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Departmental Representative.

1.17 MOVEMENT OF VEHICLES

- .1 Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 8:00 a.m. to 4:00 p.m., Monday to Friday with the following exception:
 - .1 Vehicles cannot access the north sally port from 12:00 p.m. to 1:00 p.m. and 4:30 p.m. to 5:30 p.m.
- .2 The contractor shall advise the Departmental Representative twenty-four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or Commissionaires working under the authority of the Departmental Representative.
- .4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.
- .5 Vehicles shall be refused access to institutional property if, in the opinion of the Departmental Representative, they contain any article which may jeopardize the security of the institution.
- .6 Private vehicles of construction employees will not be allowed within the security perimeter of medium or maximum security institutions without the authorization of the Departmental Representative. Contractor's employees will park their vehicles in a designated area outside the perimeter of the institution.
- .7 With the approval of the Departmental Representative, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Departmental Representative may require that the equipment be secured with a chain and padlock to another fixed object.

1.18 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

- .1 Subject to the requirements of good security, the Departmental Representative will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Departmental Representative may prohibit or restrict access to any part of the institution.
- .3 The Departmental Representative will also require the following:
 - .1 Workers need to be escorted by Correctional Officers while working inside of the building.
 - .2 Workers need to be escorted by commissionaires while working outside of the building.
- .4 During the lunch and coffee/health breaks, all construction employees will remain within the construction site. Construction employees are not permitted to eat in the officer's lounge or the dining room of the institution.

1.19 SURVEILLANCE AND INSPECTION

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

1.20 STOPPAGE OF WORK

- .1 The Departmental Representative may order at any time that the contractor, his employees, sub-contractors and their employees to not enter or to leave the work site immediately due to a security situation occurring within the institution. The contractor's site supervisor shall note the name of the CSC staff member giving this instruction, the time of the request and obey the order as quickly as possible.
- .2 The contractor shall advise the Departmental Representative of this interruption of the work within 24 hours.

1.21 CONTACT WITH INMATES

- .1 Unless specifically authorized, the contractor is not encouraged to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any construction employee doing any of the above without permission will be removed from the site and his security clearance revoked.
- .2 It is to be noted that cameras are not allowed on CSC property except if required for photographic history of the project. In this case, the contractor will be asked to use a designated memory card for the project.

- .3 Notwithstanding the above paragraph, if the Departmental Representative approves of the usage of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the institution other than those required as part of this contract.

1.22 TEMPORARY FENCES

- .1 Temporary fencing should be assumed as necessary around work area unless otherwise told by the Departmental Representative.
- .2 Refer to Section 01 56 00 - Temporary Barriers and Enclosures for other temporary fence requirements.

1.23 COMPLETION OF CONSTRUCTION PROJECT

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the institution as part of the construction contract.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION



INSTITUTIONAL ACCESS
CPIC CLEARANCE REQUEST

ACCÈS À UN ÉTABLISSEMENT
DEMANDE DE VÉRIFICATION
DU DOSSIER AU CIPC

PUT AWAY ON FILE – CLASSER AU DOSSIER
ADMINISTRATIVE OR OPERATIONAL FILE
DOSSIER ADMINISTRATIF OU OPÉRATIONNEL

Original = 3170-12

PLEASE PRINT INFORMATION CLEARLY - VEUILLEZ ÉCRIRE EN LETTRES MOULÉES

Institution – Établissement	Request received Demande reçue le	Date (YYAA-MM-DJ)	PUT AWAY ON FILE CLASSER AU DOSSIER	3170-12
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A. PERSONAL INFORMATION – RENSEIGNEMENTS PERSONNELS

Surname Nom de famille	Full name (no nicknames or initials) Nom au complet (pas de surnoms ou d'initiales)	Maiden name (if applicable) Nom de jeune fille (s'il y a lieu)
Date of birth Date de naissance (YYAA-MM-DJ)	Place of birth – Lieu de naissance City/Town – Ville ou municipalité	Province/State – Province ou état
		Country – Pays

B. PHYSICAL DESCRIPTION – DESCRIPTION PHYSIQUE

<input type="checkbox"/> Male Homme	<input type="checkbox"/> Female Femme	Height – Grandeur	Weight – Poids	Eye color – Couleur des yeux	Hair color Couleur des cheveux
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C. ADDRESS – ADRESSE

Street – Rue	City/Town – Ville ou municipalité	Province	Postal Code - Code postal	Telephone number – Numéro de téléphone Home – Domicile	Work – Bureau
Representing (name of company/organization) – Représente (nom de la compagnie ou de l'organisation)					

D. GENERAL INFORMATION – RENSEIGNEMENTS GÉNÉRAUX

1.	Have you ever been convicted of a criminal offence for which you have not been granted a pardon, or an offence for which you have been granted a pardon and such a pardon has been revoked? Avez-vous déjà été reconnu coupable d'une infraction criminelle pour laquelle on ne vous a pas octroyé un pardon ou d'une infraction pour laquelle on vous a octroyé un pardon qui a été révoqué?	<input type="checkbox"/> Yes Oui	<input type="checkbox"/> No Non
2.	Do you personally know of any person incarcerated in a correctional facility? Connaissez-vous personnellement une personne qui est incarcérée dans un établissement correctionnel?	<input type="checkbox"/> Yes Oui	<input type="checkbox"/> No Non
3.	Do you have any reason to believe coming into contact with this person could pose a risk to your or their personal safety? Avez-vous des raisons de croire que le fait d'entrer en contact avec cette personne pourrait présenter un risque pour votre sécurité personnelle ou la sienne ?	<input type="checkbox"/> Yes Oui	<input type="checkbox"/> No Non
4.	Are you related/associated to an inmate or on an inmate's visiting list? Êtes-vous apparenté ou associé à un détenu ou inscrit sur la liste des visiteurs d'un détenu?	<input type="checkbox"/> Yes Oui	<input type="checkbox"/> No Non

If you have answered YES to any of the above, please explain below. – Si vous avez répondu OUI à une des questions ci-dessus, veuillez fournir une explication ci-après.



E. SIGNATURE (When sections A to E are filled out completely, please return the completed form to the institution for approval.)

(Une fois que les sections A à E ont été remplies, veuillez retourner le formulaire dûment rempli à l'établissement aux fins d'approbation.)

In making this application, I hereby give the Correctional Service of Canada my consent to use the information provided on this form to conduct such inquiries with police authorities as may be necessary to ascertain my suitability. Finally, I acknowledge that the Correctional Service of Canada has no responsibility for any harm that may come to me in the course of my activities, except where such harm is a direct result of negligence on the part of an employee(s) of the Service.

NOTE: Access may be denied for submitting false information. Passes may be issued for those receiving clearance and approval.

En soumettant la présente demande, j'autorise le Service correctionnel du Canada à se servir des renseignements fournis dans le formulaire afin de mener, auprès des services de police, toute enquête jugée nécessaire pour vérifier mon admissibilité. Par ailleurs, je conviens que le Service correctionnel du Canada ne peut être tenu responsable d'un préjudice subi dans le cadre de mes activités sauf si ce préjudice est directement attribuable à la négligence d'un ou de plusieurs employés du Service. NOTA : Tout demandeur qui fournit de faux renseignements peut se voir refuser l'accès à l'établissement. Un laissez-passez peut être émis aux demandeurs dont la demande d'accès est approuvée.

Applicant's signature – Signature du demandeur

Date (YYAA-MM-DJ)

F. FOR OFFICE USE ONLY – RÉSERVÉ AU SCC

Reason for clearance – Motif justifiant la demande d'accès

Department making the request (please print) Unité qui soumet la demande (en lettres moulées s.v.p.)	Signature of Division Head Signature du chef de la division	Date (YYAA-MM-DJ)
<input type="checkbox"/> No criminal record Aucun casier	<input type="checkbox"/> A possible criminal record #: Numéro du casier judiciaire	Last entry: Dernière entrée :
<input type="checkbox"/> An outstanding warrant/charge held by: Auteur du mandat non exécuté/accusation en instance :		
SIGNATURES		
<input type="checkbox"/> Approved Approuvée	<input type="checkbox"/> Not approved Non approuvée	The individual has been advised. – Le demandeur a été informé de la décision.
Security Intelligence Officer Agent de renseignements de sécurité	Institutional Head Directeur de l'établissement	Visit Review Board Comité des visites
Date (YYAA-MM-DJ)	Date (YYAA-MM-DJ)	Date (YYAA-MM-DJ)

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Alberta.
- .3 Occupational Health and Safety Act, R.S.A. - Updated 2013.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .5 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
 - .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
 - .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
 - .5 Submit copies of incident and accident reports.
 - .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
 - .7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
 - .8 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
 - .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta Reg.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.12 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.13 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.14 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.15 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities, Chapter 3.
 - .2 EPA General Construction Permit (GCP).
- .2 Canada Federal Halocarbon Regulations, 2003
- .3 Canadian Correctional Service Canada
 - .1 Internal Service Directive 318-4 – Environmental Management of Halocarbons
- .4 Environment Canada (EC)
 - .1 Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems. (2015)

1.2 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction task[s].
- .6 Include in Environmental Protection Plan:
 - .1 Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from site.
 - .3 Name[s] and qualifications of person[s] responsible for training site personnel.

- .4 Descriptions of environmental protection personnel training program.
- .5 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .6 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .7 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .8 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

1.4 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.5 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day to the Satisfaction of the Departmental Representative.
- .2 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Waste Management: separate waste materials for recycling/reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES TO REGULATORY REQUIREMENTS

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2015.
- .2 Specific design and performance requirements listed in the specifications or indicated on the Drawings may exceed the minimum requirements established by the referenced Building Code; these requirements will govern over the minimum requirements listed in the Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay all fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 - .1 Regulatory requirements and fees in force on date of Bid submission; and
 - .2 Any change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

2.2 EASEMENTS AND NOTICES

- .1 Constructor shall give notices required by regulatory requirements.

2.3 PERMITS

- .1 Building Permit:
 - .1 Constructor shall apply for, obtain and pay for building permit on behalf of Department Representative, and other permits required for Work and its various parts.
 - .2 Constructor will require that specific Subcontractor's obtain and pay for permits required by authorities having jurisdiction, where their Work is affected by Work requiring permits.
 - .3 Constructor will display building permit and other permits in a conspicuous location at Place of Work.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by the Contractor purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Contractor.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for re-testing and re-inspection.

1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

- .1 Submit quality control procedures, forms and reports to Department Representatives.
- .2 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .3 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

- .4 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Department Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.6 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.
- .3 Post copies of inspection and test reports to Buzzsaw using the following naming convention "General Area Description_Specific Inspection Area or Equipment_Date of Inspection or Test". Notify Departmental Representative by email when new inspection and/or test report has been posted.

1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations as specified in specific Section and acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.

- .6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

1.9 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.3 WATER SUPPLY

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.
- .3 Water service throughout the building must be maintained operational throughout the day. All interruptions to water service must be coordinated with the Departmental Representative and should be limited to evenings as required by the facilities.
- .4 If the contractor seeks to use the existing water infrastructure on site for their own use, and this does not interrupt or jeopardize institutional operations, contractor may use their own means to tie-into existing water infrastructure and the contractor will not be charged for the use. Contractor to return modified infrastructure to its original condition before project completion.
- .5 There are hose Bibbs on the exterior of the building. Any temporary use of institutional infrastructure must be approved by the Departmental Representative before use and can be disallowed at any time for any reason, even after approval is given. All temporary infrastructure connections must be removed at the end of the project; brought back to its original condition.

1.4 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Allow continued occupancy without loss of heat. Provisions for temporary heat shall be installed such that use of temporary heat is available within 4 hours.
 - .2 Facilitate progress of Work.
 - .3 Protect Work and products against dampness and cold.
 - .4 Prevent moisture condensation on surfaces.
 - .5 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .6 Provide adequate ventilation to meet health regulations for safe working environment.

- .4 Maintain temperatures of minimum 20 degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Allow continued occupancy without loss of ventilation. Provisions for temporary ventilation shall be installed such that use of temporary ventilation is available whenever the building ventilation system is not operational for more than 24 hours.
 - .2 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .3 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .4 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .5 Ventilate storage spaces containing hazardous or volatile materials.
 - .6 Ventilate temporary sanitary facilities.
 - .7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Pay costs for maintaining temporary heat, when using permanent heating system
Departmental Representative will pay utility charges when temporary heat source is existing building equipment.
- .7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.
- .9 Use of final equipment as temporary shall not start warrantee.

1.5 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction as needed.
- .2 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162lx.
- .3 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract.
- .4 Temp power and light is the responsibility of the contractor. If the contractor seeks to use the departmental representative's existing electrical infrastructure on site for their own use, and this does not interrupt or jeopardize institutional operations, contractor may use

their own means to tie-into departmental representatives existing electrical infrastructure and the contractor will not be charged extra for this power use.

- .5 No power outlets are available on the exterior of the building. Any temporary use of institutional electrical infrastructure must be approved by the Departmental Representative before use and can be disallowed at any time for any reason, even after approval is given. All temporary electrical infrastructure additions must be removed at the end of the project; brought back to its original condition.

1.6 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary data hook up, necessary for own use.

1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction, governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 Temporary Cell Heaters

- .1 Provide 55 individual electric heaters to be used for temporary cell heating.
- .2 Submit shop draw for heater for review by Department Representative.
- .3 Portable ceramic fan heater
 - .1 Heat output: 1500-watt max (12.5 Amp Max) 120V/60HZ/1 PH
 - .2 High and low settings.
 - .3 Built in adjustable thermostat, tip over off switching and overheat protection.
 - .4 Standard receptacle plug in with 1.8m cord.

Part 3 Execution

3.1 Temporary Cell Heaters

- .1 Store and maintain heaters so that they are available for use for temporary heat in cells.
- .2 Place heaters as required for temporary heating conditions and remove for storage after use.
- .3 Upon completion of project move all heaters to storage location as noted by Department Representative.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121, Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2, Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321, Signs and Symbols for the Occupational Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.
- .6 Coordinate locations of site trailer and laydown areas with Departmental Representatives.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, platforms, ladders, and temporary stairs.

1.5 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists and cranes to be operated by qualified operator.

1.6 ELEVATORS

- .1 Elevators are NOT available on this project.

1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- .3 Contractor laydown will be located north of the G.O. building outside of the main gate

1.8 CONSTRUCTION PARKING

- .1 Refer to Section 01 35 13 – Security Requirements.

1.9 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Refer to Section 01 35 13 – Security Requirements

1.12 CONSTRUCTION SIGNAGE

- .1 No signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed Departmental Representative.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with traffic.
- .5 Verify adequacy of existing roads and allowable load limit on these roads.
Contractor: responsible for repair of damage to roads caused by construction operations.
- .6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .7 Dust control: adequate to ensure safe operation at all times.
- .8 Provide snow removal during period of Work.

1.14 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PSPC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.
- .4 Correctional Services Canada (CSC) technical Criteria.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.3 HOARDING

- .1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically flush and butt jointed.

1.4 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Conform to reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.

- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed Departmental Representative.

1.9 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.11 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- .7 Fasteners in inmate accessible areas must have tamper resistant fastenings

1.12 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.14 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Department Representative's identification of existing survey control points and property limits.

1.2 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

1.3 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.4 RECORDS

- .1 Maintain a complete, accurate log of work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Department Representative or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Department Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.
- .6 Contractor must protect existing equipment in operation from dust/debris/or-other-incidental-damage resulting from construction activities, including newly commissioned units in operation and equipment/material on site but not yet installed

1.3 EXECUTION

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.

- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
 - .1 Provide temporary secure closures to openings in secure walls.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ manufacturer authorized installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Department Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from laydown area, site trailer, from access to building and work areas as required to perform the work. Bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris. Containers to be secured and locked at all times when not in use.
- .6 Work areas must be cleaned to the satisfaction of the Departmental Representative at the end of each work day. Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .8 Dispose of waste materials and debris off site.
- .9 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .12 Use only cleaning materials recommended by manufacturer or surface to be cleaned, and as recommended by cleaning material manufacturer.
- .13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

- .4 Remove waste products and debris to the Satisfaction of the Departmental Representative.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fittings, walls, and floors.
- .7 Vacuum, clean, and dust building interiors, behind grilles, louvres, and screens.
- .8 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- .9 Broom clean and wash exterior walks, steps and surface; rake clean other surfaces in work areas.
- .10 Remove dirt and other disfiguration from exterior surfaces.
- .11 Sweep and wash clean paved areas.
- .12 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .13 Clean roof near work areas.
- .14 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .15 Remove snow and ice from access to building.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Construction Association (CCA)
 - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
- .2 Public Works and Government Services Canada (PSPC)
 - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

1.2 DEFINITIONS

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .6 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .8 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .9 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .10 Separate Condition: refers to waste sorted into individual types.
- .11 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

1.3 USE OF SITE AND FACILITIES

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.4 WASTE PROCESSING SITES

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.
- .2 Province of: Alberta
 - .1 Name: Alberta Environment
Construction, Renovation and Demolition Waste Reduction Recycling Branch
Phone: (780) 427-6982 or 1-800-463-6326

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .4 Protect structural components not removed and salvaged materials from movement or damage.
- .5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials. Containers to be secured and locked at all times when not in use.
- .8 Separate and store materials produced during project in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off site processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
 - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.6 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of oil, mineral spirits, volatile materials, waste, or paint thinner into waterways or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.

- .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials on-site as Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.
- 1.7 SCHEDULING**
 - .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.
- Part 2 Products**
- 2.1 NOT USED**
 - .1 Not Used.
- Part 3 Execution**
- 3.1 APPLICATION**
 - .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- 3.2 CLEANING**
 - .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Leave Work area clean at end of each day to the satisfaction of the Departmental Representative.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.
 - .3 Waste Management: separate waste materials for reuse and/or recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Source separate materials to be reused/recycled into specified sort areas.
- 3.3 DIVERSION OF MATERIALS**
 - .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
 - .2 On-site sale of recovered material is not permitted.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative and Commissioning Agent in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, balanced adjusted and fully operational.
 - .4 Certificates required by Fire Commissioner: submitted.
 - .5 Commissioning of mechanical systems: completed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Departmental Representative.
 - .1 Work will not be accepted until Commissioning Requirements are met.
 - .6 Operation of systems: Training to Department Representative's personnel.
 - .7 Work: complete and ready for final inspection.
 - .1 Completion must be signed off by two Authorized Department Representatives.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
 - .2 When Work incomplete according Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in pdf format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, at site one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.

- .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on a full-sized copy of the contract drawings.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.7 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

- .1 Include regulation, control, stopping, shut-down, and emergency instructions.
- .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control 01 91 13 - General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

- .1 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .2 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Additional requirements: as specified in individual specifications sections.

1.9 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.

- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review Departmental Representative.

1.11 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
 - .1 Contractor shall respond to maintenance issues within 3 hours of notification.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Department Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include transformers, HVAC balancing, pumps, motors, commissioned systems,
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.

- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
- .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.12 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate operation and maintenance of equipment and systems to Department Representative two weeks prior to date of substantial completion.
- .2 Department Representative: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel including but not limited to mechanical trade, controls trade, all other applicable trades and manufacturer representatives are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with Section 01 91 13 - General Commissioning Requirements. Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, at the agreed upon, scheduled location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

- .1 Instruct Department Representative.
- .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor shall provide the necessary trades, equipment and instruments to assist in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 CxA - Commissioning Agent
 - .5 EMCS - Energy Monitoring and Control Systems.
 - .6 MSDS - Material Safety Data Sheets.
 - .7 O&M - Operation and Maintenance.
 - .8 PFC - Pre-Functional Check.
 - .9 PI - Product Information.
 - .10 PV - Performance Verification.
 - .11 FPT - Functional Performance Test
 - .12 GIT - Global Integration Test
 - .13 TAB - Testing, Adjusting and Balancing.
 - .14 WHMIS - Workplace Hazardous Materials Information System.
- .4 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

- .5 Commissioning documentation shall be posted to Project Buzzsaw Directory and shall be organized and named by specification section. Refer to section 01 33 00 – Submittals.
 - .1 Naming convention shall be “Specification Number_Shop Drawing Description_Date of Submission”.
 - .2 Once uploaded, a separate email notification indicating that the submission has been posted shall be sent from the contractor to the Departmental Representative.

1.2 COMMISSIONING OVERVIEW

- .1 As per Appendix A - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Appendix A - Commissioning (Cx) Plan.
- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .5 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability, and approved by Departmental Representative.
 - .2 Equipment, components, systems and integrated systems have been fully commissioned and functional as per design intent within the context of the Department Representative Project requirement.
 - .3 Final O & M and Training and Manual received, reviewed and approved by Departmental Representative for suitability.
 - .4 Completion of Training sessions to all Operational and Maintenance staff.
- .6 Equipment commissioning must be completed individually to minimize interruption of operation.

1.3 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or holdback assessments.

1.4 PRE-CX REVIEW

- .1 Before Construction:

- .1 Review Contract Documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Review of up-to-date Cx Plan.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx forms and documentation ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Update construction schedule with Cx activities.
 - .7 Submit complete PFC documentation to CxA.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.5 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.6 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Pre-Functional Check Sheets (PFC) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 Provide completed forms and reports to CxA.

1.7 COMMISSIONING SCHEDULE

- .1 Include Cx activities within the construction schedule.
 - .1 Include for separate individual commissioning of each equipment and system to minimize interruption to operation.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Static Checks / Product information noted on PFC-Part A

- .2 Pre-Functional Start-up
- .3 Functional Testing of Controls
- .4 Functional Performance Testing by CxA
- .5 Repairs, retesting, re-commissioning, re-verification.
- .6 Training.

1.8 COMMISSIONING MEETINGS

- .1 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .2 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .3 Before 80% construction completion stage for each phase. Call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor. Contractor specialty and major subcontractors must be in attendance, to facilitate a thorough understanding of specialty and major subcontractors duties and responsibilities to the Contractor, to ensure correctly and fully commissioned systems, while also addressing any delays or potential problems.
 - .2 Re-iterate the degree of involvement of subcontractor and manufacturer's representatives in the commissioning process.
- .4 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .5 Meeting will be chaired by Cx Agent, who will record and distribute minutes.
- .6 Ensure subcontractors and relevant manufacturer representatives are present at 80% and subsequent Cx meetings and as required.

1.9 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.10 WITNESSING OF STARTING AND TESTING

- .1 Provide 10 days' notice to prior to commencement.
- .2 Confirm with Departmental Representative and Cx Agent of their attendance to witness of start-up and testing.
- .3 Failure to accommodate the Departmental Representative and Cx Agent in tests and start-ups shall not result in extra cost or delay to the project.
- .4 Contractor to be present at tests performed and documented by sub-trades, suppliers, and equipment manufacturers.

1.11 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Notify Departmental Representative and CxA at least 1 week in advance of tests.
 - .3 Provide testing documentation for approval by CxA.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with CxA.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.12 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and FPT.
- .2 Conduct start-up and testing in following distinct phases for each equipment and system:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI on the PFC sheets Part -1.
 - .2 Complete any manufactures Installation sheets and submit to CxA.
 - .2 Upon completion of installation perform follow accepted start-up procedures:
 - .1 Complete manufacturers start-up sheets
 - .2 Complete PFC sheets Part 2.
 - .3 Verification of conformity to specification and submit documentation to CxA.
 - .3 Operational testing:
 - .1 Confirm the controls work is complete and verified by the controls contractor(s) and document equipment performance.
 - .2 Verify the sequence of operation is met and submit test reports to CxA .
 - .4 Functional Performance Test (FPT). (System PV):

- .1 Once the CxA has received all the PFC sheets (Part A and B) and there are no deficiencies impacting the operation a FPT can be scheduled.
- .2 Coordinate the necessary trades and suppliers to facilitate the FPT.
- .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.13 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.14 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.15 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 15 working days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.16 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 Two-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.17 FUNCTIONAL PERFORMANCE VERIFICATION

- .1 Provide subtrades, tools and equipment necessary for the FPV as out lined in the Cx Plan.
- .2 Schedule sufficient time in coordination with the CxA to perform the FPV:
 - .1 Under accepted simulated or actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .3 Results of the verification must be repeatable and reported results are to be verifiable.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.18 WITNESSING COMMISSIONING

- .1 Departmental Representative may witness activities and verify results.

1.19 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.20 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.21 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved Departmental Representative in accordance with

equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.22 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 100% of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.23 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.24 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.25 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative. in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.26 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.27 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.28 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.29 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.30 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.31 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.32 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.33 DEPARTMENT REPRESENTATIVE'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for The Commissioning Process
- .2 ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems
- .3 CSA Z320-11, Building Commissioning Standard and Check sheets
- .4 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
- .5 CAN/ULC-S1001-11, Integrated Systems Testing of Fire protection and Life Safety Systems

1.2 GENERAL

- .1 The attached Cx Plan is 95% completed at time of tender. Refer to Appendix A - Commissioning (Cx) Plan.
- .2 Cx Plan is a dynamic document which will be revised throughout the Cx process in coordination with the contractor, CxA and Department Representative.
- .3 Live document for inclusion during Construction:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Contractor's, sub-contractor's, suppliers' requirements.
 - .5 Project construction team's and Cx team's requirements.
- .4 Term "Cx" in this section means "Commissioning".
- .5 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 CxA - Commissioning Agent
 - .5 EMCS - Energy Monitoring and Control Systems.
 - .6 MSDS - Material Safety Data Sheets.
 - .7 O&M - Operation and Maintenance.
 - .8 PFC - Pre-Functional Check.
 - .9 PI - Product Information.
 - .10 PV - Performance Verification.
 - .11 FPT - Functional Performance Test
 - .12 GIT - Global Integration Test

- .13 TAB - Testing, Adjusting and Balancing.
- .14 WHMIS - Workplace Hazardous Materials Information System.
- .6 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.3 REFINEMENT OF CX PLAN

- .1 During construction phase the contractor shall meet and coordinate with CxA to revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
 - .3 Finalized Functional Performance Testing Process to include finalized control sequences as part of the controls submittal process.

1.4 COMPOSITION, ROLES, AND RESPONSIBILITIES OF CX TEAM

- .1 The CxA has been selected and has developed the Cx Plan.
- .2 For Cx responsibilities refer to Appendix A - Commissioning (Cx) Plan.
- .3 Contractor is responsible for:
 - .1 Review the Cx Plan and updates to the plan.
 - .2 Coordinate/schedule CX activities for PFC and FPV.
 - .3 Ensure subtrades perform their responsibilities relating to the Cx Plan.
 - .4 Ensure all required subtrades are in attendance of FPV to facilitate the required testing.
 - .5 Monitoring Cx activities.
 - .6 Attend Cx Meetings and FPV
 - .7 Witnessing, certifying accuracy of reported results.
 - .8 Witnessing and verify TAB and other tests.
 - .9 Performing verification of performance of installed systems and equipment.
 - .10 Developing BMM.
 - .11 Ensure all documentation for the CX plan is submitted and complete.
 - .12 Implementation of Contractors Training Plan.
 - .13 Notify CxA of any Cx related issues raised during construction.
 - .14 Notify Department Representative of Cx Milestones.
- .4 Building Operator: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving the installation.
 - .2 Day-To-Day operation and maintenance of facility.

1.5 OTHER CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor including but not limited to controls and mechanical contractor
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Ensure that Cx participant:
 - .1 Could complete work within scheduled timeframe.
 - .5 Provide names of participants to CxA and details of instruments and procedures to be followed for Cx 1 months prior to starting date of Cx for review and approval.

1.6 RISK ASSESSMENT

- .1 Contractor shall ensure that the appropriate risks are identified to the Departmental Representative and implement adequate mitigation methods in conjunction with the Departmental Representative to prevent an emergency situation.

1.7 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment listed in the Commissioning (Cx) Plan. (See Appendix A)
- .2 Commission electrical systems and equipment:
 - .1 New and modified Fire alarm systems, equipment:
 - .1 equipment devices, i.e. smoke detection cut off.

1.8 PROCEDURES

- .1 Construction
 - .1 Review the latest Cx Plan.
 - .2 Provide list of contacts for the individuals to be included in the Cx Team. Including:
 - .1 Manufacturers Representatives who will be performing equipment start-ups
 - .2 TAB Agency
 - .3 Mechanical and Electrical subtrades.
 - .4 Controls Contractor.
 - .5 Fire Alarm contractor
 - .6 Specialty systems contractors.
 - .3 Meet with the CxA to coordinate requirements of Cx Plan and develop a process to implement the FPT.

- .2 Shop drawings
 - .1 Provide a shop drawing log
 - .2 Submit shop drawings for review by Department Representative and CxA.
 - .3 Include manufactures installation and start-up procedures and checklists.
 - .4 Address and respond to comments made by the Department Representative and CxA prior to ordering equipment.
- .3 Pre-functional Checks – Installation (Static) Checks – Part A
 - .1 Verification of conformity to specification and shop drawing data for all the components of the system.
 - .2 In addition to manufacturers installation check sheets complete Installation PFC form and submit to CxA after contractor has verified that the installation is as per the contract documents.
 - .3 Address deviations and deficiencies between received equipment and shop drawing.
 - .4 Notify any the Department Representative and CxA of issues which may impact the Cx process.
- .4 Pre-functional Checks – Start-Up Checks – Part B
 - .1 Upon completion of installation checks coordinate/schedule start-up testing including manufactures start-up services.
 - .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction.
 - .3 Notify the Department Representative and CxA of scheduled start-up activities.
 - .4 Upon pre-functional start-up resolve issues preventing a complete start-up prior to calling for CxA witness of start-up.
 - .5 Complete manufactures start-up forms or obtain manufacturers start-up report.
 - .6 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections.
 - .7 Mechanical:
 - .1 Plumbing systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .2 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

- .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
- .8 Electrical:
 - .1 Low voltage distribution systems under 750 V:
 - .1 Requires independent testing agency to perform pre-energization and post-energization tests.
 - .2 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representatives has witnessed and certified report, demonstrate devices to Departmental Representative.
 - .3 Low voltage systems: these include:
 - .1 Communications, low voltage lighting control systems and data communications systems.
 - .9 Address deficiencies noted by manufactures start up process.
 - .10 Complete PFC Start-up form and submit to CxA after contractor has verified that the installation is as per the contract documents.
 - .11 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment;
 - .2 Pre-start-up inspection reports;
 - .3 Signed installation/start-up checklists;
 - .4 Start-up reports; and
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.
 - .12 Address deviations and deficiencies noted by the Department Representative and CxA.
- .5 Functional Verifications:
 - .1 Upon completion of equipment start-up coordinate/schedule controls Functional Verification. The completion of the TAB should be coordinated with the controls verification to meet the functional requirements as note in the contract documents.
 - .2 Notify the Department Representative and CxA of scheduled TAB and controls verification activities.
 - .3 The contractor shall confirm that the TAB and controls work for the equipment is complete and verified by the controls contractor(s).
 - .4 Address any deficiencies discovered during TAB and controls verification prior to scheduling FPT.
 - .5 Verify the sequence of operation is met and submit the controls verification form/report to the Department Representative and CxA.

- .6 Functional Performance Test (FPT). (System PV):
 - .1 FPT can be scheduled when the following is complete and submitted to CxA:
 - .1 PFC sheets (Part A and B);
 - .2 TAB Report;
 - .3 Controls Verification Report/Form;
 - .4 FPT forms for prerequisite; and
 - .5 Confirmation that there are no deficiencies impacting the operation.
 - .2 Coordinate and provide the necessary trades, suppliers, tools and instrumentation, to facilitate the FPT.
 - .3 The FPT forms and process will be updated during construction to reflect changes, submittals and finalized control sequences approved through the controls submittal process.
 - .4 During the FPT the CxA will review the items noted on the FPV Forms. The contractor shall facilitate the operation and measurement of the performance parameters of the system which includes:
 - .1 TAB verification;
 - .2 Interlocks;
 - .3 Equipment interface and controls;
 - .4 EMCS interface;
 - .5 Controls sequence;
 - .6 Fire Alarm interlocks;
 - .7 Security Interlocks; and
 - .8 User Requirements.
 - .5 Address any deficiencies noted during the FPT.
- .7 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .8 The system will not be accepted as complete until the deficiencies from the FPT have been addressed.
- .9 Failure to follow accepted procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

- .1 Provide the following for completed documentation for Cx manual:
 - .1 Construction/Commissioning Schedule;
 - .2 Shop Drawing Log;
 - .3 Pre-Functional Check Sheets/Static Check Sheets. (Part A);
 - .4 Pre-Functional Check Start-Up check sheet (Part B); and
 - .1 Manufacturers Start-up sheets/report, where applicable.
 - .5 TAB reports.
 - .1 Completed performance verification (PV) report forms (Controls).

1.10 ACCEPTANCE

- .1 Cx activities must be completed before issuance of Substantial Performance, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.

1.11 TRAINING PLANS

- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.12 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Departmental Representative, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

1.13 COSTS FOR CX

- .1 Contractor shall include costs associated with Cx activities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION



COMMISSIONING PLAN

Edmonton Maximum Security Institution

September 5th 2017

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Rev.	Date	Issue
0	2017-05-15	DRAFT Issued for review
1	2017-06-06	Revised DRAFT Issued for review
2	2017-08-28	Revised Draft Issue with reference to Departmental representative wording
4	2017-09-05	Issued for Tender

Executive Summary

The purpose of this document is to describe how commissioning will be undertaken during the construction, acceptance, and warranty phases. The Commissioning Plan outlines the process, procedures, and standards for all parties involved in the process.

CDML has been employed by the Associated Engineering to act on their behalf to oversee the start-up, testing, adjusting and balancing operation, and to verify that the equipment and systems are working as specified and conform the owners' project requirements and the contract documentation.

The goals of this Commissioning Plan is to identify and define the following

- ☐ Commissioning Team Members
- ☐ Commissioning Team Members responsibilities for each Commissioning Phase activity
- ☐ Commissioning activities to be conducting during the construction, acceptance, and warranty phases of the project
- ☐ Systems to be commissioned
- ☐ Acceptance criteria for the completion of commissioning.

CDML milestones:

1. Review the design and submittal documents
2. Develop the project specific Commissioning Plan
3. Provide contractors construction checklists to support their QA/QC program
4. Provide system contractor functional performance test sheets for the contractors use
5. Conduct regular commissioning meetings
6. Conduct periodic construction installation inspections
7. Develop and continually maintain the project commissioning issues log
8. Verify construction is complete prior to equipment start-up
9. Verify major system start-up
10. Verify contractor functional performance testing via sample witnessing of systems and equipment
11. Monitor O&M personnel training
12. Conduct seasonal or deferred functional performance testing in conjunction with the operations team
13. Provide a Commissioning Report

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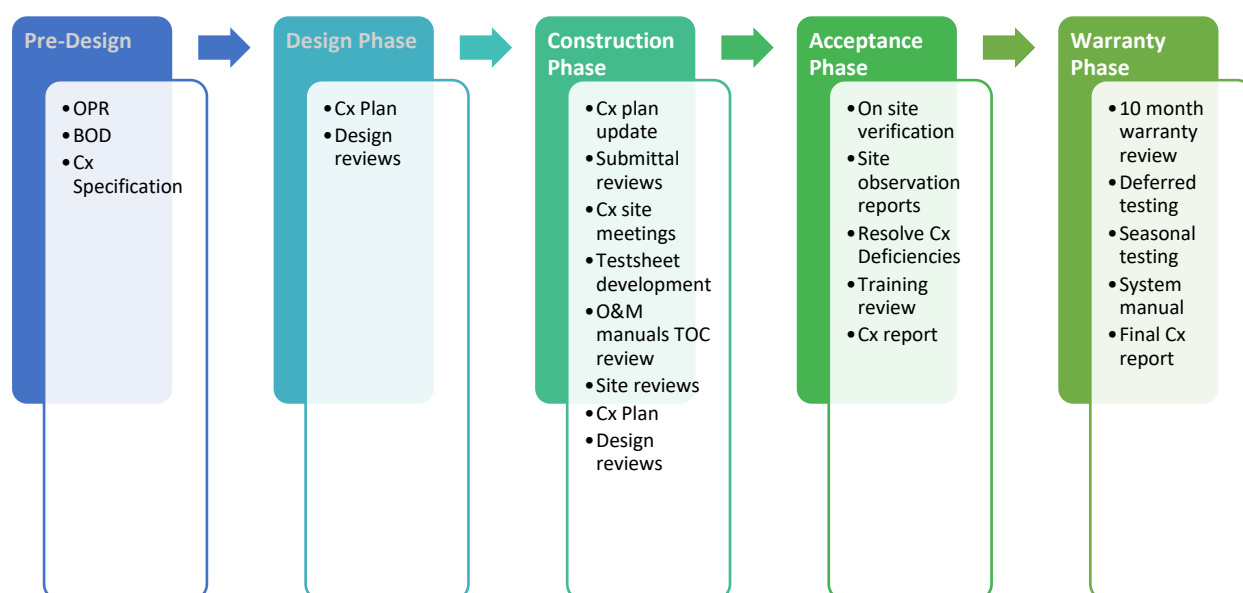
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1 Introduction

The Commissioning Process Flowchart and Matrix graphically depicts the commissioning process and its flow from the Pre-Design Phase through to the Warranty Phase. These are intended to be a quick reference for identifying the fundamental components of commissioning and their relationship to each other. The main narrative provides more detail regarding the activities, responsibilities, and deliverables associated with each activity in the Commissioning Process Flowchart and Matrix. For each Matrix row and Flowchart box, there is a corresponding narrative description.

2 Commissioning Process Flowchart

The commissioning process will be conducted from the Construction Phase to the Warranty Phase and will include a Mechanical & Electrical design review.



3 Responsibility Matrix

The following matrix tabulates the major commissioning activities when they occur during the project and the commissioning team member roles and responsibilities for each activity. Additional information on each activity is detailed further in this document.

The responsibility chart below is intended to provide an organizationally practical means for commissioning responsibility coordination, to aid the Contractor with managing the commissioning process with major subcontractors and various trades, but is not intended to otherwise alleviate the Contractor from contractual obligations for the performance and coordination of The Work. Ultimately the Contractor is responsible to ensure the successful performance of The Work, and in turn the Contractor is responsible for commissioning. All references to Sub-contractors, Mechanical Contractor, Electrical Contractor, TAB contractor, etc. shall ultimately be interpreted as being the contractual responsibility of the Contractor in contract with Public Works Government Services Canada (otherwise known as Public Services and Procurement Canada).

R = Responsible team member

✓ = Team member participation

ACTIVITIES	PROJECT PHASES				COMMISSIONING TEAM MEMBERS								
	Pre-Design	Design	Construction	Acceptance	Departmental Rep	Architect	Mechanical Consultant	Electrical Consultant	General Contractor	Mechanical Contractor	Electrical Contractor	Controls Contractor	CxA
Owners Project Requirements (OPR)	✓		✓		R	✓	✓	✓					✓
Basis Of Design (BOD)	✓					✓	R	R					✓
Commissioning Specification	✓				✓	✓							R
Design Phase Commissioning Meeting	✓				✓	✓	✓	✓					R
Commissioning Plan		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	R
Commissioning Design Reviews		✓				✓	✓	✓					R
On Site Commissioning Meeting			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	R
Shop Drawing Commissioning Reviews			✓			✓	✓	✓					R
Project Tracking Sheet *			✓	✓					✓	✓	✓	✓	R
Pre-Functional Check Sheets *		✓	✓	✓					✓	✓	✓		R
Equipment Start-Ups			✓							R	R		✓
Functional Performance Test Development *			✓				✓	✓					R
Commissioning Issues Log		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	R
TAB Report Acceptance				✓			R			✓			✓
Functional Performance Testing (On Site Verification) **				✓	✓		✓	✓	✓	✓	✓	✓	R
Commissioning Report					✓								R
*Supplied by CxA, filled out and signed by the Contractor/Sub-Contractors, monitored and managed by the Contractors Commissioning Coordinator. **Scheduled and Organized by the Contractors Commissioning Coordinator													

4 Commissioned Systems

The commissioning process described in this Commissioning Plan is applicable (but not limited) to the following systems.

4.1 Mechanical Systems

Air Handling Units (AHU)
Direct Expansion Cooling Systems (Dx)
Roof Top Air Conditioning Units (RTU)
Make Up Air Units (MUA)
Variable Air Volume Boxes (VAV)
Computer Room Air Conditioning Units (CRAC)
Transfer Fans
Exhaust Air Fans
Supply Air Fans

4.2 Plumbing Systems

Heating Boilers
Pumps
Domestic Hot Water Heaters
Radiant Panels
Re-heat Coils
Unit Heaters

4.3 Building Automation System (BAS)

Individual System Control Sequences
Graphics

5 Construction Phase Activities

5.1 Site Commissioning Meetings

Commissioning (Cx) team meetings will be used to plan, coordinate, schedule, track deliverables, review future activities, and discuss/resolve issues.

A Cx kick-off meeting will be conducted early in the project construction phase, this will be followed by monthly meetings facilitated by CDML where the commissioning process is reviewed with the commissioning team members, electrical, mechanical and controls subcontractors.

CDML will participate in some contractor meetings to review Building Automation Sequence of Operation and/or Integrated Systems Testing (IST) as deemed necessary by the Departmental Representative.

5.2 Design/Commissionability Reviews

CDML will conduct a commissionability review on the project documentation. It is CDML's belief that the commissionability review will aid in the following:

- To ensure that the design information is reliable, accurate and complete
- To improve the commissionability of the systems, and reduce life-cycle costs by making appropriate changes at a pre-installation stage
- To assist in the reduction of the cost of systems, for example by removing commissioning valves and dampers where they are not needed, and ensuring that they are present where they are needed

To minimise the potential for subsequent design and installation defects. CDML is not responsible for the design concept, design criteria or compliance with codes. CDML uses industry experience and knowledge to ensure that the design information is reliable, accurate and complete.

Design review comments will be issued in a spreadsheet format, detailing the drawing/specification reviewed and the issue noted. Issues resolution will be tracked until a satisfactory response is received.

5.3 Project Tracking Sheet

The project tracking sheet consists of a list of all equipment to be commissioned as part of the project and the status of each piece of equipment with regards to the major commissioning steps. These steps include the status of shop drawing reviews, installation check sheets, air and water balancing, functional performance testing, training, and O&M manuals issue. Once all steps are completed the system/equipment is then considered commissioned.

5.4 Construction Checklists

Construction checklists are important to ensure that the equipment and systems are energized and operational and that the contractor's functional performance testing may proceed. Each piece of equipment receives full QA/QC checkout by the contractor. No sampling strategies are used. In general, the contractor will complete construction checklists for all equipment and systems prior to formal functional performance testing of equipment or subsystems of the given system. The checklists will be monitored/verified by the Contractors Cx Coordinator and CDML during the construction phase.

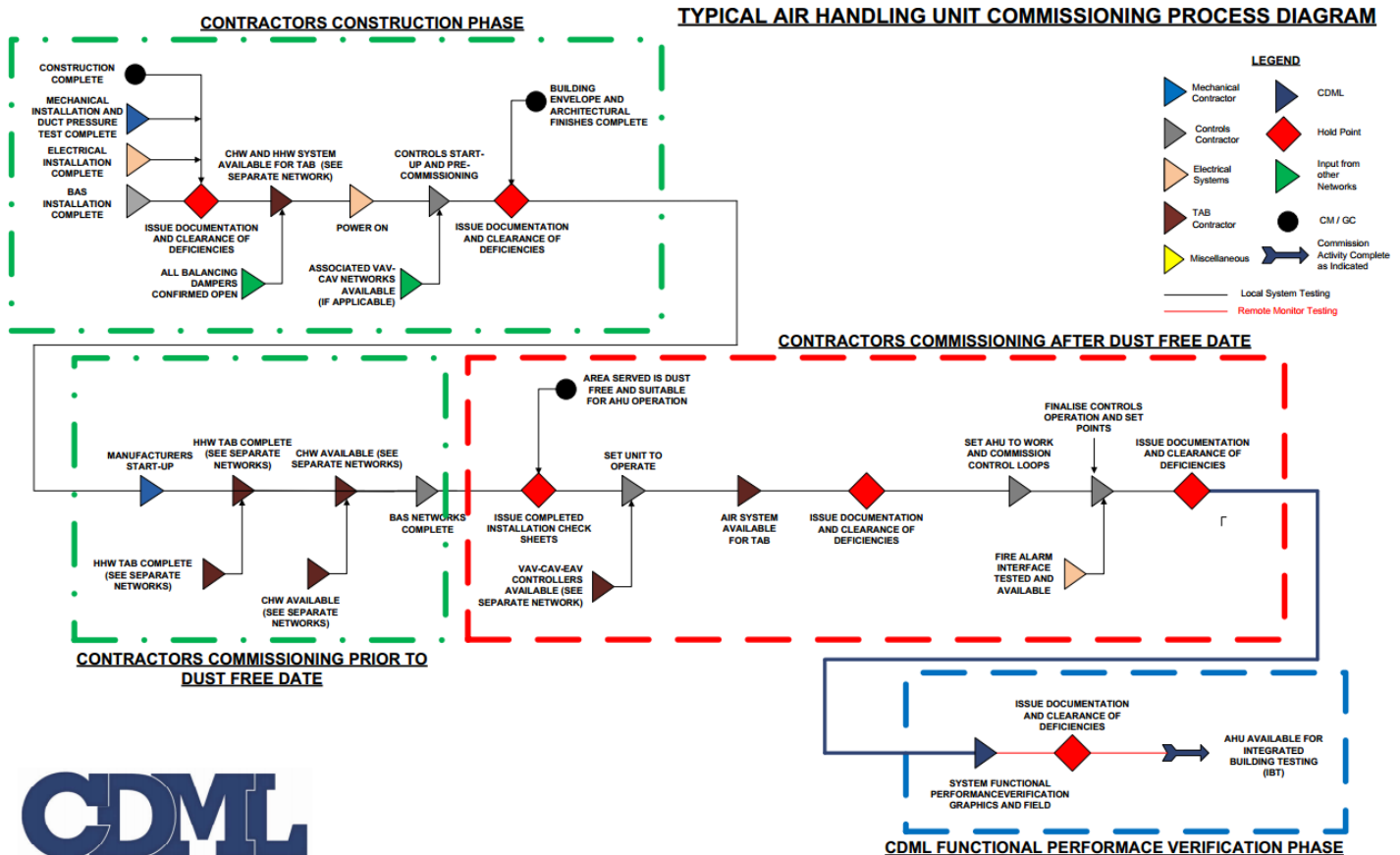
CDML will provide the Construction checklists in electronic format for the project. They detail the general construction installation checklists must be done on each piece of equipment associated with systems to be commissioned once installation is deemed complete. These sheets also detail the pre-requisites for

functional performance testing. These will be included in the appendix of this plan. Additional checklists will be added as necessary. However, if the construction team have their own construction checklists, these may be used once reviewed and accepted by the commissioning team.

5.5 Submittal Reviews

As part of the standard submittal review process, CDML will identify submittals associated with systems to be commissioned that need to be reviewed. CDML will issue our comments to the relevant design team member following the agreed communications protocol. The Design team will incorporate the commissioning comments, at their discretion. Commissioning submittal review comments will focus on the same areas as the commissioning design reviews e.g. compliance with the Owners' Project Requirements (OPR), clarity of the design, integration coordination, accessibility and maintainability, O&M training and documentation requirements, and the ability to test and validate system operation. CDML will be given access to all reviewed submittals after processing by the Design Team.

5.6 Commissioning Process Management Tools and Scheduling



CDML utilizes network diagrams to visualise how the project will be implemented. A network diagram is a sequence of tasks/activities, which are represented by blocks that are linked together in the logical sequence. Network diagrams are produced for each individual system and for the entire commissioning process. Once the logic diagrams have been completed, the commissioning team have a clearer visual picture of the required sequence of events and commissioning critical path related activities that will be required to complete the project.

5.7 Site Reviews

CDML will conduct periodic site visits to witness equipment and system installations. Items of concern noted during the review/visit will be documented in the Commissioning Issues Log, distributed to the Departmental Representative and copied to the relevant design and construction team members.

5.8 Commissioning Issues Log

During construction phase CDML will document commissioning issues in the Commissioning Issues Log. These issues will be distributed by CDML to the Commissioning Team. The Commissioning Team is expected to implement the necessary secondary circulation as necessary for resolution.

The Contractors Cx Coordinator and CDML will track all issues raised to ensure that they are dealt with in a timely manner and will circulate regular status reports to all members of the Commissioning Team.

During the Acceptance Phase, deficiencies identified during the verification and testing will be documented on the Commissioning Issues Log and reported to the Departmental Representative and commissioning team. The issues log includes all details of the components or systems found to be non-compliant with the parameters of the test plans. The issues log details the responsible party('s) required to comment/address the item raised.

5.9 Equipment Start-up

The Contractor shall coordinate equipment and systems start-ups with their mechanical and electrical sub-contractors and their sub-trades such as controls, sheetmetal, fire alarm and the air/ water balancers. Sufficient notice for contractor, sub-contractors, equipment manufactures, and contractors 3rd party testing agencies to plan and coordinate work must be provided. CDML may attend equipment start up at our own discretion or as per contract scope.

The Contractor shall submit start up procedures, data sheets and recording forms for review, a minimum of four weeks prior to execution of the start-up verification process. The start-up data sheets shall be in the form supplied by the manufacturer or, if not available, they must record all necessary setting and checks conducted at start up to satisfy the manufactures warranty.

Issues noted during start up must be tracked on the commissioning issues log and addressed by the relative contractor for the start up to be deemed complete.

The Sub-Contractors and their manufacturers or suppliers shall provide all instrumentation and equipment necessary to conduct the tests as specified in the Mechanical Sections. The Contractor shall advise the Departmental Representatives or CDML of instrumentation to be used and the dates the instruments were calibrated.

When the Contractor has tested confirmed that the systems are operating and controlling per the design intent, and all prerequisites have been completed then functional performance verification/testing can be scheduled and coordinated with the parties referenced above, CDML, the Departmental Representatives and Consultants.

5.10 Contractor Functional Performance Tests (CFPT)

Based on the reviewed submittal for the BAS controls sequence of operation, functional test documentation will be prepared. These tests will be used to functionally test components, systems and their integration with other systems and equipment. These CFPT checklists will be issued to the

commissioning team for review and comment prior to onsite testing and verification. Note that each CFPT sheet has a list of prerequisites that need to be addressed by the contractors prior to functional performance verification in the Acceptance Phase.

5.11 Operation and Maintenance Manual Reviews

As part of the commissioning process, CDML will review the O&M manuals, documentation and redline as-built for systems that were commissioned to verify compliance with the OPR and Specifications. Review comments will be issued to the relevant design team member following the agreed communications protocol. The Design team will incorporate the commissioning comments, at their discretion, into their formal submittal review responses to the Contractor.

5.12 Demonstrations and Instruction Plan

Operations & Maintenance (O&M) training delivery per specifications is contractor lead. A training plan that defines the roles and responsibilities of the project's Construction team, Subcontractors, Suppliers, Design Consultants, and end user as they relate to the operation and maintenance of M&E systems and equipment. At a minimum, the plans will include a schedule of training dates, agenda, times, locations, training provider and durations.

Common Training Topics

- General purpose of system (design intent)
- Use of O&M manuals
- Review of control drawings and schematics
- Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, control setup and programming troubleshooting and alarms.
- Interactions with other systems
- Adjustments and optimising methods for energy consumption
- Health and safety issues
- Special maintenance and replacement sources
- Occupant interaction issues
- System response to different operating conditions

6 Acceptance Phase Activities

6.1 TAB Report Review and Acceptance

The TAB Contractor will prepare a balancing report documenting that all air and hydronic systems have been adjusted and are within acceptable design values. Prior to CDML's accuracy check of the flowrates, the Mechanical Consultant will be required to review and accept the report. CDML will verify that all required data has been collected, that the measured results follow the design documents, and that any non-compliance items have been resolved and rebalanced prior to the start of functional performance Testing. This check of accuracy will be conducted in conjunction with the TAB contractors using their instruments.

6.2 Functional Performance Test Verification

Functional performance Test Verification is performed by CDML and The Contractor. Coordination and scheduling of the functional performance test verification is the responsibility of The Contractor Cx Coordinator. CDML will direct, and document the functional performance test verification for M&E systems. It is the responsibility of the Contractor to manipulate the systems and controls as per CDML's request.

Prior to functional performance test verification all Construction test sheets, manufacturers start up reports and static tests such as duct pressure tests, pipe pressures tests, BAS point-to-point tests must be submitted to the Consultants for their review and acceptance.

CDML will confirm formal functional performance test verification readiness through field observation, review of start-up reports and construction checklists, contractor pre-requisites, observation of the control system and equipment operation, including trending, and when required will review of contractor's pre-tests and testing regimes as per *Contractor Functional Performance Testing*.

Prior to or at the beginning of functional performance test verification, CDML will confirm with the controls contractor, that critical sensor and actuator calibrations and building automation system graphics accurate, calibrated, and operational.

CDML will direct, execute, and document the verification testing on project specific test forms. Any issues that are found during the testing will be added to the commissioning Issues Log and forwarded to the Contractor and Departmental Representative in a timely manner.

Using the functional performance tests developed, each event in the sequence of operation and other significant modes along with sequences and control strategies not mentioned in the written sequences such as start-up, shutdown, unoccupied and manual modes, modulation, alarms, component staging, backup upon failure and interlocks with other equipment will be verified. CDML will provide step-by-step procedures for testing systems with descriptions for methods of verifying.

Where necessary, main equipment will be individually tested. Similar units that are numerous (e.g., many smaller rooftop packaged units, air terminal units, and exhaust fans) may have an appropriate sampling strategy applied. Heating equipment must be tested during the winter and cooling equipment must be tested during the summer, as appropriate to demonstrate performance under near-design conditions.

The Client and their Facilities Management representatives may witness and participate in the functional performance test verification, as they deem necessary, to understand how the systems operate and how optimal performance can be maintained.

The Contractor and sub contractors shall aid CDML (as required) and they shall provide the necessary personnel and equipment during the testing and verification process.

6.2.1 Acceptance Criteria

For each step of the functional performance verification procedures, IST and power fail tests, there will be a pass/fail definition of acceptable response. This typically is a description of how each device in a system is designed to react to the scripted action imposed on the system. In the interest of field testing efficiency, the acceptance criteria will be clearly defined in terms that everyone can understand and agree on. Valves and dampers should “open” or “close”, fans and pumps shall “start” or “stop”, modulating devices shall “modulate higher” or “modulate lower.” If any test fails to meet the pass/fail criteria the issues will be noted in the commissioning issues log and the system will be retested once the issue/deficiency is resolved.

Tolerance is defined as the permissible deviation from the specified design requirements. For example, air and water systems will be considered as balanced in accordance with the specification or AABC or NEBB good practice, any deficiencies beyond this tolerance should be noted on the TAB report by the TAB contractor and may result in a retest.

6.2.2 Re-testing

The contractor corrects the deficiency and notifies the commissioning team that the equipment is ready to be retested. CDML will direct, and document functional performance re-testing for each system that failed to pass its initial FPT. For systems tested with a sampling strategy, such as VAV’s, additional samples will need to be tested during re-testing if the failures of the initial sample exceed the failure rate threshold. The extent and level of rigor of retesting will be as CDML deems necessary to confirm successful resolution of the initial deficiencies without sacrificing performance elements which had originally passed the system FPT.

6.3 Departmental Representatives Demonstrations and Instruction Review

The Contractor will formally document each training session. Documentation of Facilities Management acceptance will require that someone representing the trainees formally and in writing accept each training session as complying with that session’s Training Agenda. CDML will collect this documentation in the form of fully executed Training Agendas and include them as part of the Final Commissioning Report.

6.4 M&E Close-Out List

The following list is provided as reference to the Contractors and Cx Team. The summary list is generic and some item may not be specific to this project.

Perform and/or provide the following items prior to substantial performance review. Provide confirmation that the applicable items listed are completed:

- Heating and air conditioning systems capable of operation with alarm controls functional performance and automatic controls are in operation
- Equipment testing is complete and includes tests required by authorities and certificates of approval have been obtained and submitted
- Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed

- Equipment lubricated as per manufacturer's data. Provide servicing and lubrication schedule, and list of lubricants required
- Warranty forms have been mailed to manufacturer. Submit a copy of the original warranty for equipment which has warranty period longer than one year
- Review and ensure that access doors are suitably located and equipment easily accessible included plumbing cleanouts
- Noise and vibration control devices and flexible connections inspected by the manufacturer's representative and written report submitted
- Equipment alignment carried out by qualified millwright and certified report submitted
- Check operation of plumbing systems and fixtures and ensure that fixtures are solidly supported. Adjust flush rates. Domestic hot water chlorination, flushed and activated for use. Potable/Domestic water service chlorination report submitted.
- Fire Stopping has been reviewed and deemed to be complete
- Fire Damper Drop Testing complete and documentation submitted to the Commissioning Authority and also included in the maintenance manual
- Departmental representative demonstration and instruction of mechanical systems is complete
- Fire sprinkler letter of assurance forwarded and contractor's materials and testing certificate included in the maintenance manuals
- Provide all M&E spare parts. Provide a transmittal of spare parts turned over to the Departmental representative
- Record drawings (Red-Line/As-Built/Revit) provided to the consultant and Departmental representative
- Controls system final electrical approval certificate
- Registration certificates for all pressure vessels
- Pressure test reports for heating, chilled and refrigeration lines have been added to O&M's
- Final plumbing acceptance inspection report from authority with authority accepted report to be in O&M's
- Final natural gas acceptance inspection report/certificate included in O&M's
- M&E equipment cleaned inside and out.
- System startup check lists completed and submitted to Cx Authority
- Fan plenums cleaned and temporary filters removed and permanent filters installed
- Back flow prevention test reports included in O&M's
- Final balancing is complete and final data of air and water reports submitted
- Final calibration of controls completed
- Maintenance manual and instructions given to the Departmental representative

7 Warranty Phase Activities

7.1 Post Occupancy Commissioning

Seasonal testing, deferred testing, and the 10-month on-site review form ‘post occupancy commissioning’. CDML will verify that all commissioning related issues have been cleared, and the project is free from deficiencies would also be conducted during this period. CDML believe that seasonal testing of the systems and equipment is paramount in ensuring a stable, optimized system operation in all ambient conditions.

Fine-tuning of the integrated systems as well as any specific operator or graphical user interface display requirements or amendments will be undertaken under the direction of the CDML commissioning manager during this phase.

7.2 Deferred / Seasonal Testing

Functional Performance Tests (FPTs) may need to be deferred until after Substantial Completion for a variety of reasons. The most common reasons include HVAC systems may need to have different weather conditions than those at the end of construction or commissioned systems may need to have a load put on them before testing can be considered meaningful. FPTs that occur after Substantial Completion will be conducted, documented, and tracked during the warranty phase.

7.2.1 Unforeseen Deferred Tests

If any test cannot be completed due to the building structure, required occupancy condition, or other deficiency, the functional performance testing may be delayed upon approval of the Departmental representative. These tests are conducted in the same manner as the seasonal tests, as soon as possible.

7.2.2 Seasonal Testing

Seasonal variation in operations or control strategies may require additional testing during the opposite season to verify performance of the HVAC system and controls in heating or cooling mode. Trends set up during the acceptance phase testing will be reviewed. Tests are executed and documented, with deficiencies corrected by the Contractor. Any final adjustments to the O&M manuals and as-built drawings due to the testing are also completed.

7.3 Final Commissioning Report

After completion of all commissioning activities, CDML will write a final report documenting the overall results of the commissioning process and recommending acceptance of the commissioning process and related documentation to the Departmental representative.

The final commissioning report provide a summary of the commissioning process and include the project applicable information outlined as follows:

- Commissionability Review Reports
- Commissioning Networks
- Cx Submittal Reviews
- Commissioning Meeting Minutes
- Site Review/Observation Reports
- Construction Checklists (Completed and Signed)
- Manufacturers Start-up Sheets
- Functional Performance Test Sheets (Completed and Signed)
- Integrated Building Test Plan & Matrix
- TAB Reports
- Commissioning Issues Log
- Commissioning Plan

8 Commissioning Team Member Contact List

ROLE	NAME	COMPANY	EMAIL
Client			
Client			
Project Manager			
Architect			
Mechanical consultant			
Electrical consultant			
General contractor			
Mechanical contractor			
Electrical contractor			
Controls contractor			
TAB Contractor			

9 List of Appendices

- Appendix A - Commissioning Meeting Minutes**
- Appendix A - Commissioning Networks**
- Appendix B - Contractor Equipment Cx Tracking Sheet**
- Appendix C - Commissioning Issues Log**
- Appendix D - Construction Installation Check Sheets**
- Appendix E - Functional Performance Test Sheets**

APPENDIX A

COMMISSIONING MEETING MINUTES (SAMPLE)

Cx Meeting Minutes



Project:
Date & Time:
Venue:
Recorder: Dan Popa
Meeting No: 1
Next Meeting:

Name	Company	Email	Ref.	Attendees	Distribution
Dan Popa	CDML	dpopa@cdml.ca	CDML	✓	✓
Dean Willows	CDML	DWillows@cdml.ca	CDML		✓

Ref	Item	Action
1.1	<u>Introductions</u>	Info
1.2	<u>Commissioning Overview</u> When a building is initially commissioned it undergoes an intensive quality assurance process that begins during design and continues through construction, occupancy, and operations. LEED Commissioning ensures that the new building energy related systems are installed, calibrated and perform as the owner intended and that building staff are prepared to operate and maintain its systems and equipment.	Info
1.3	<u>Commissioning Plan</u> A draft of Cx Plan was included in the tender package This document outlines the roles and responsibilities of the Cx team and an overview of the Cx process. The plan shall be updated with contact information and will be reissued. A draft document will be issued for review by CDML and any comments will be discussed in the next Commissioning Meeting. Construction Manager (CM): Mechanical Contractor: Electrical Contractor: Controls Contractor: TAB Contractor: <i>TBC by the Mechanical Contractor</i>	
1.4	<u>Construction Schedule & Commissioning Networks</u> Sample 'Networks' are attached as an illustration of tasks and predecessors related to mechanical and electrical system construction. Networks identify the typical interconnecting systems and services required/recommended for the successful flow of start-up and verification activities. These networks can be used effectively to assist in the construction scheduling process. The Construction Manager and Contractors are encouraged to use System Networks in conjunction with their construction scheduling. The projected date that CDML will be required for functional verification is MM/YYYY, and the following items outline some of the process steps to be considered: <ul style="list-style-type: none"> • Equipment is not started for heating or cooling, until installation checklist items and all manufacturers' pre-start procedures are completed. Please ensure that building integrity issues like moisture, dust and other environmental items are suitable for start-ups. • Pre-requisites for system verification and/or functional performance testing (FPT) are: <ul style="list-style-type: none"> - complete equipment Contractor QA/QC Installation Check sheets are deficiency free and have been submitted - manufactures installation and start-up sheets are deficiency free and have been submitted - all points on the controls system have been calibrated and the sequence of operation has been contractor tested - TAB reports have been submitted and accepted by the Mechanical engineer. 	
1.5	<u>M&E Contractors Project tracking sheet</u> CDML will provide the Construction Manager (CM) with a spreadsheet to track relevant Cx construction tasks/milestones and required documentation submissions. CDML will populate	

Ref	Item	Action
	<p>the spreadsheet with the equipment information. It will then be turned over to Construction Manager for their use as a Commissioning management tool.</p> <p>On a regular basis CDML and the Construction Manager will review the tracking sheet.</p>	
1.6	<p><u>Contractors Construction Check sheets – QA/QC</u></p> <p>These sheets provide an item by item check list of completed works associated with each piece of mechanical and electrical equipment. They also give a clear picture of when the equipment is ready to be started and commissioned and ultimately provide the client with a complete inventory of the systems installed.</p> <p>If either the Mechanical or Electrical contractors have forms that they typically use this is acceptable by CDML if the contractors' forms are compared to CDML and/or forms in the specification to ensure that all items are covered.</p> <p>These sheets need to be filled out as equipment is delivered to site and not towards the end of construction period. Some of the forms are generic, therefore if the forms contain a non-applicable item then fill them as applicable.</p> <p>A copy of the Contractors Construction Check sheets shall be provided to the respective design consultants and Commissioning Authority for review.</p>	
1.7	<p><u>Functional Performance Test (FPT) Sheets</u></p> <p>Functional Performance Test Sheets will be submitted to the Project Manager, Mechanical and Electrical Contractors' for comment and use. Mechanically, the controls contractor will focus on mechanical FPT's. These test sheets provide a detailed analysis of the equipment's operational requirements and performance. When complete the FPT sheets provide documented proof that the system is ready for the Integrated Building Testing. The sheets must be filled out prior to Cx verification.</p> <p>Sample FPT sheets will be provided by CDML for review.</p>	
1.8	<p><u>Commissioning Issues Log</u></p> <p>Items raised throughout Design reviews and shop drawing reviews have been added to the Cx Issues Log for tracking purposes. Items raised through site observation reports will be added to the Cx Issues Log as well. The Cx Issues Log should be discussed at each Cx meeting and an updated copy will be forwarded following a review with M&E Consultants.</p> <p>Throughout the project all site observation items are noted. CDML will address the items with Construction Manager on site at the time of our visit, and will track these on the Cx Issues Log. Any action items that are allocated to CDML will be reviewed during the process of commissioning and through Site visits. These items will remain open until verification.</p>	ALL
1.9		
1.10	<p><u>O&M's, Documentation and Training Schedule</u></p> <p>Completed Contractor Cx documentation such as: contractor's construction check sheets, start-up forms, manufactures pre-start and startup documentation be distributed for review as it becomes available. The Mechanical and Electrical representative shall provide these documents to the Construction Manager for distribution to CDML and the Consultants.</p>	

Ref	Item	Action
	<p>The following documentation is typical of what is required for review by CDML:</p> <ul style="list-style-type: none"> • M&E Construction Check Sheets • BAS technicians signed off points list • M&E Manufacturers Startup documentation • Chemical Treatment Reports for the hydronic system(s) <i>(if applicable)</i> • Duct Cleaning Report <i>(if applicable)</i> • TAB Mechanical Air and Water balancing reports reviewed by the Engineer of Record • Electrical Panel test reports reviewed by the Engineer of Record • Lighting control system test reports reviewed by the Engineer of Record • Fire Alarm VI documentation reviewed by the Engineer of Record <p>O&M's have been submitted and reviewed by the respective Consultants.</p>	
1.11	<p><u>Seasonal Testing</u></p> <p>Due to time of year & outdoor air temperature, there may be an issue with starting certain systems. Consideration must be given to scheduling a visit for the supplier to verify the operation of the system under a genuine load. The Cx team will identify systems impacted by seasonal constraints.</p>	Info
1.12	<p><u>Cx Documentation Representatives</u></p> <p>Prime Contractor: CELL: EMAIL:</p> <p>Mechanical Contractor: CELL: EMAIL:</p> <p>Electrical Contractor: CELL: EMAIL:</p>	Info

If the above minutes are found to be incorrect, please contact me within 5 business days of the date of issue. If notification is not received then these minutes are deemed acceptable by all.

Best Regards,



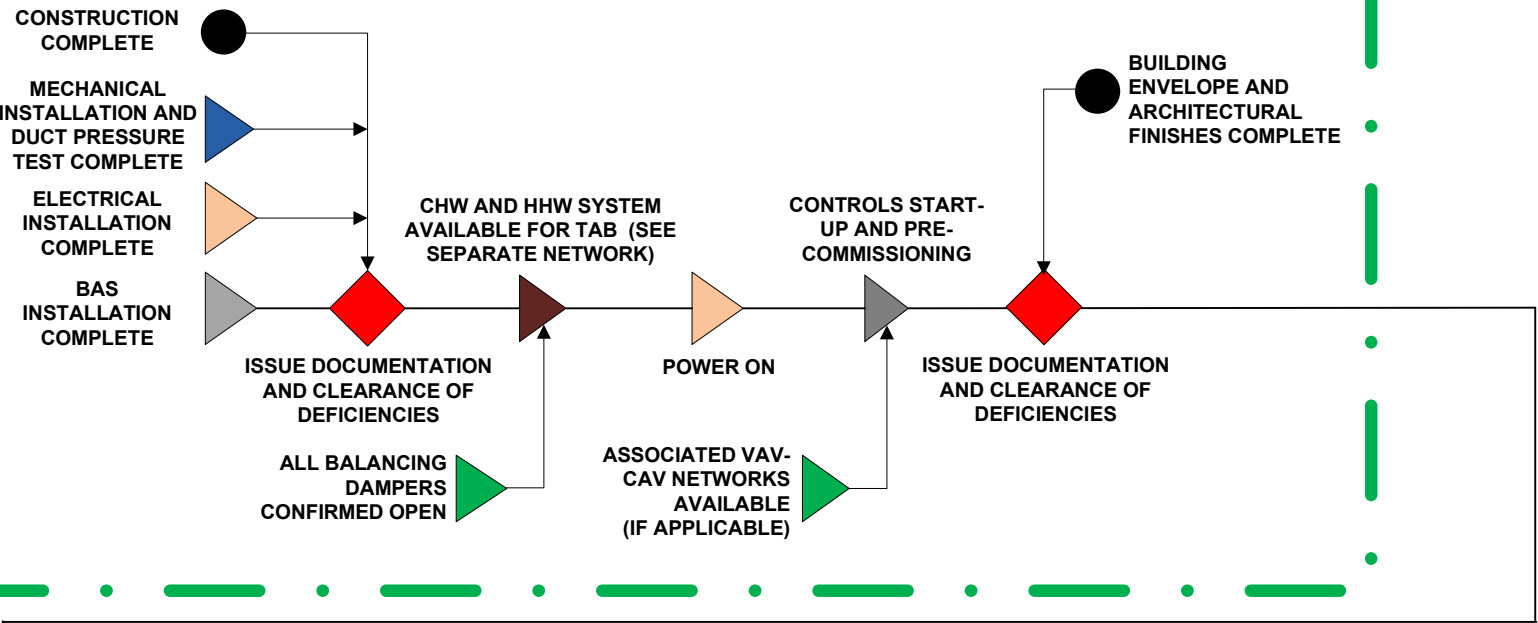
Dan Popa | B.Eng E.i.T. | Senior Commissioning Consultant
CDML | Advancing the Built Environment
www.cdml.ca | dpopa@cdml.ca
Mobile: 1.587.338.9368 | Office: 1.587.523.7474

APPENDIX B

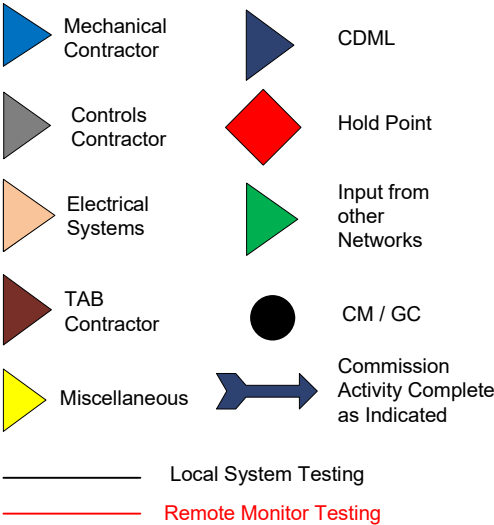
COMMISSIONING NETWORKS (SAMPLES)

TYPICAL AIR HANDLING UNIT COMMISSIONING PROCESS DIAGRAM

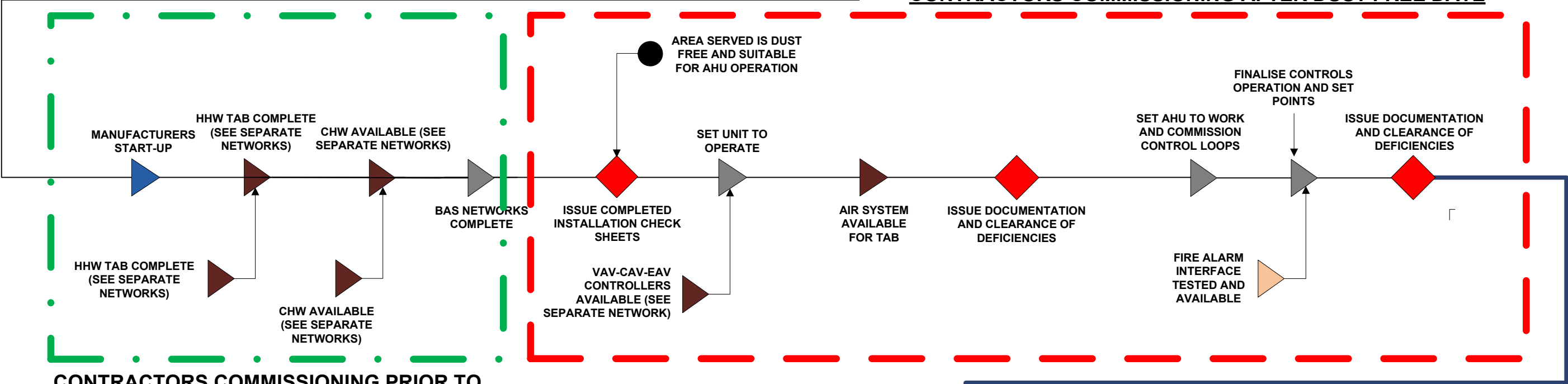
CONTRACTORS CONSTRUCTION PHASE



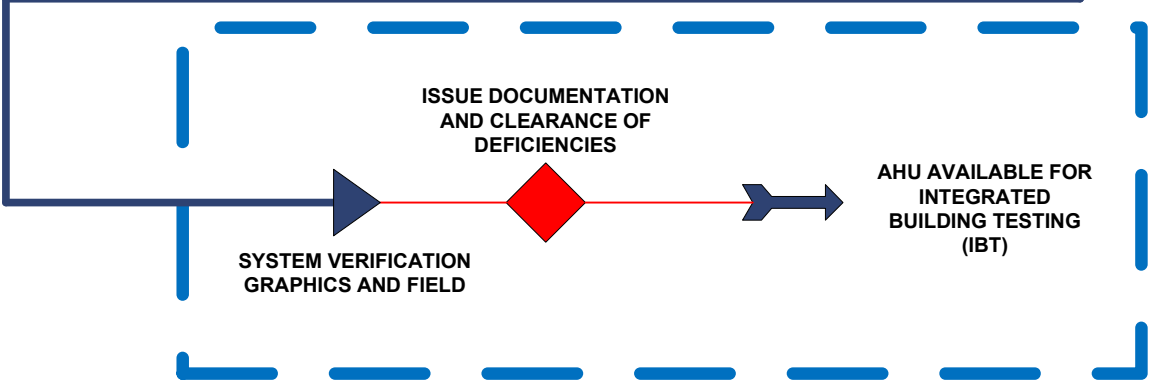
LEGEND



CONTRACTORS COMMISSIONING AFTER DUST FREE DATE



CONTRACTORS COMMISSIONING PRIOR TO DUST FREE DATE

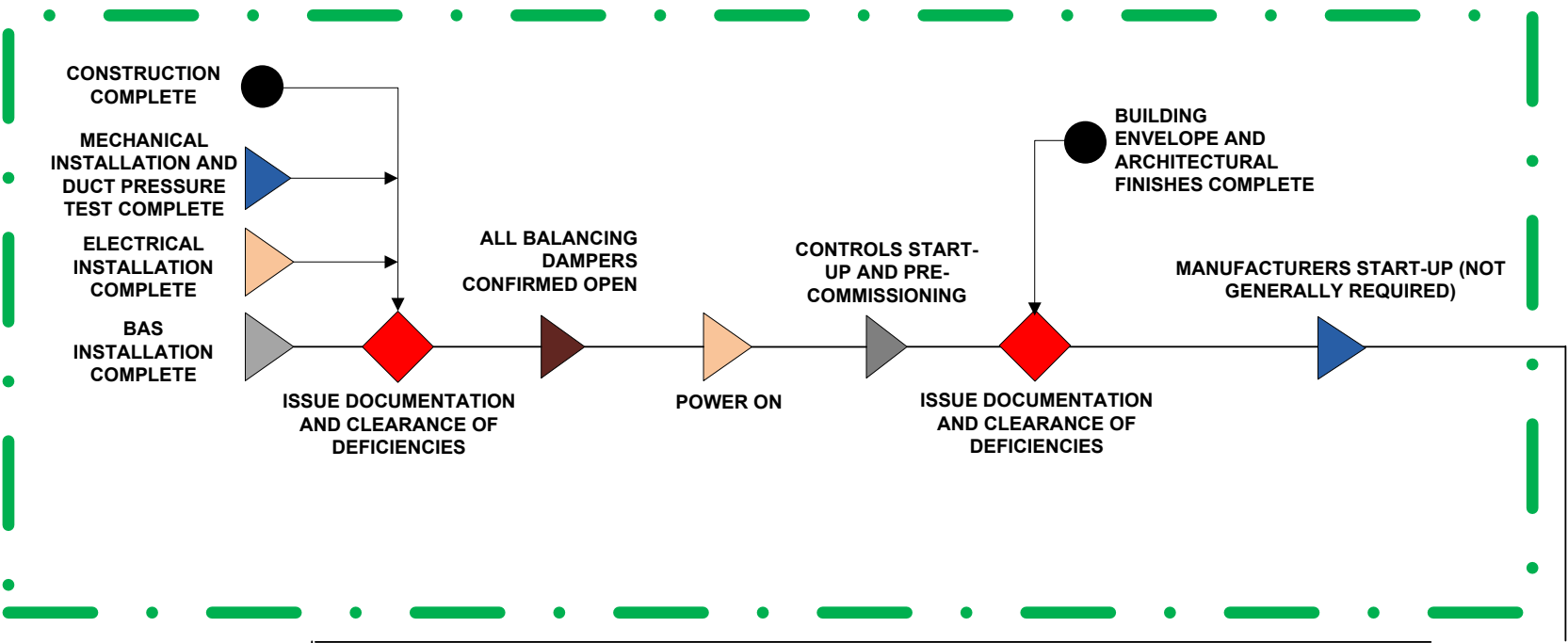


CDML VERIFICATION & TESTING PHASE

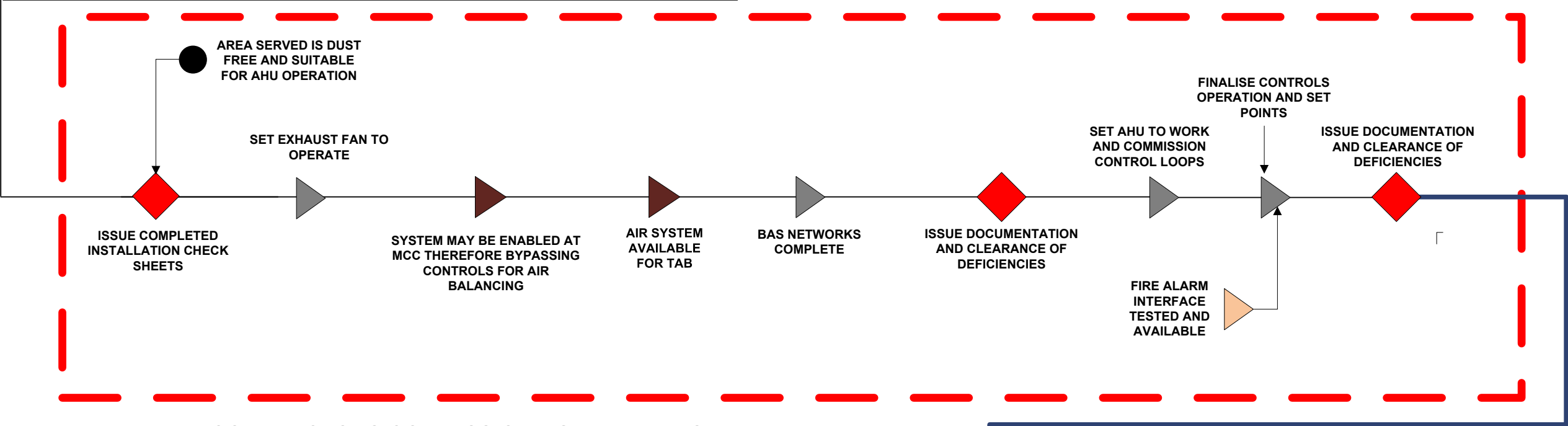
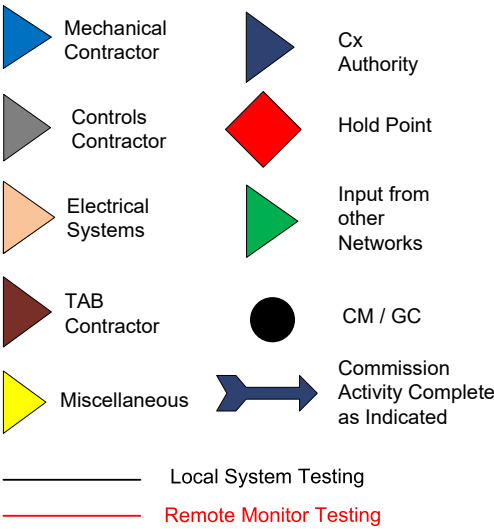


TYPICAL EXHAUST FAN COMMISSIONING PROCESS DIAGRAM

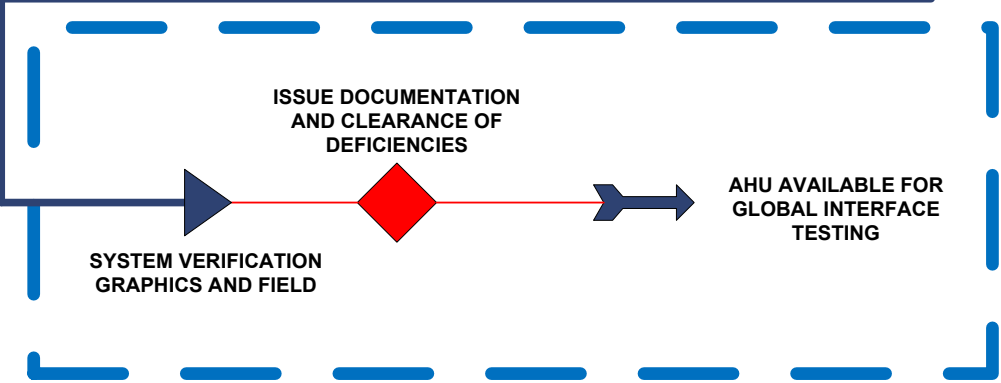
CONTRACTORS CONSTRUCTION PHASE



LEGEND



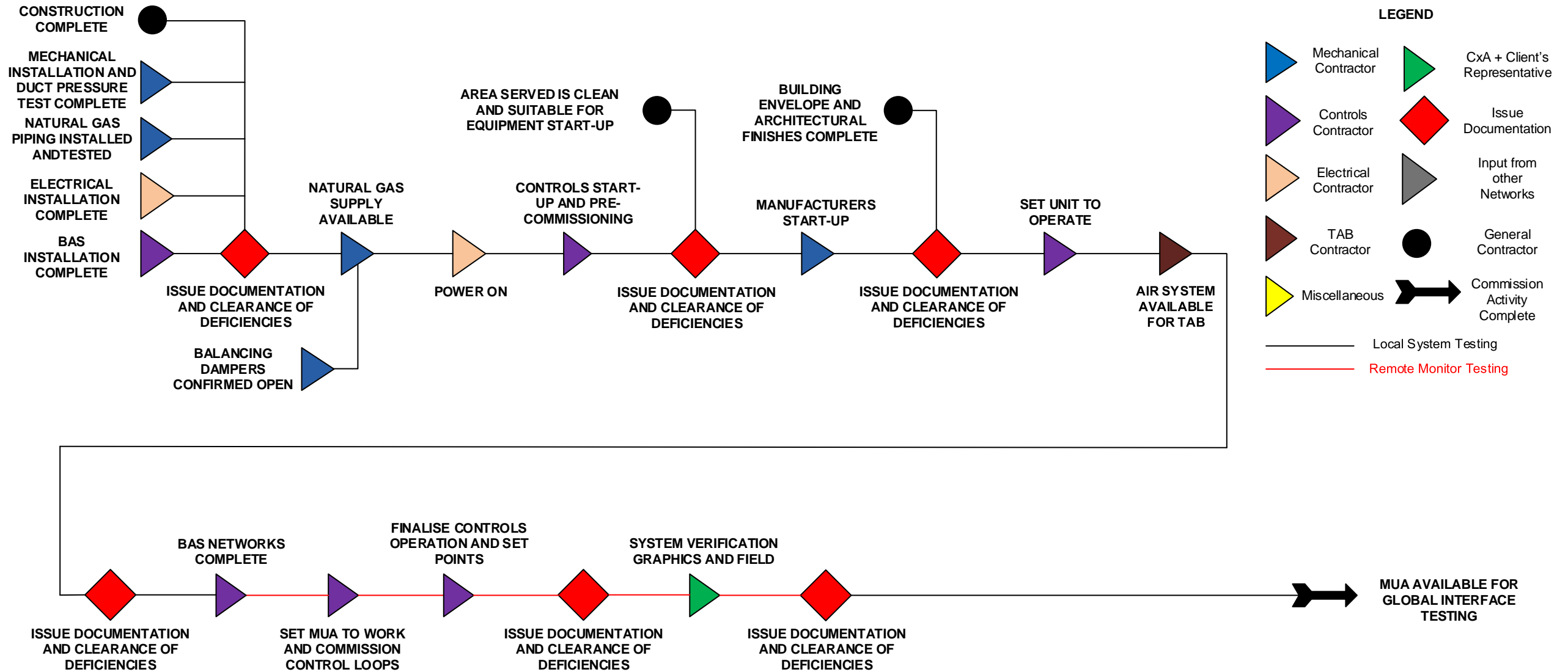
CONTRACTORS COMMISSIONING AFTER DUST FREE DATE



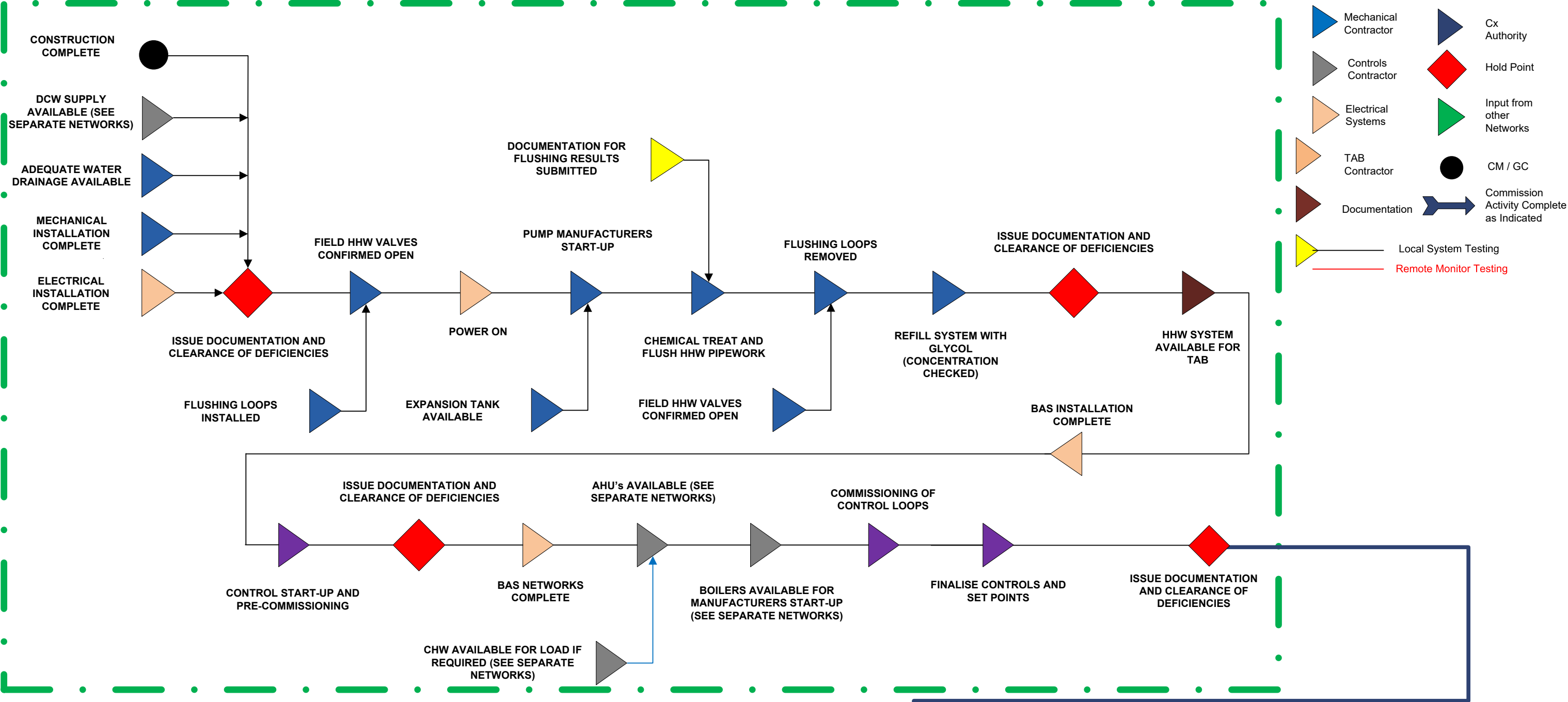
CDML VERIFICATION & TESTING PHASE



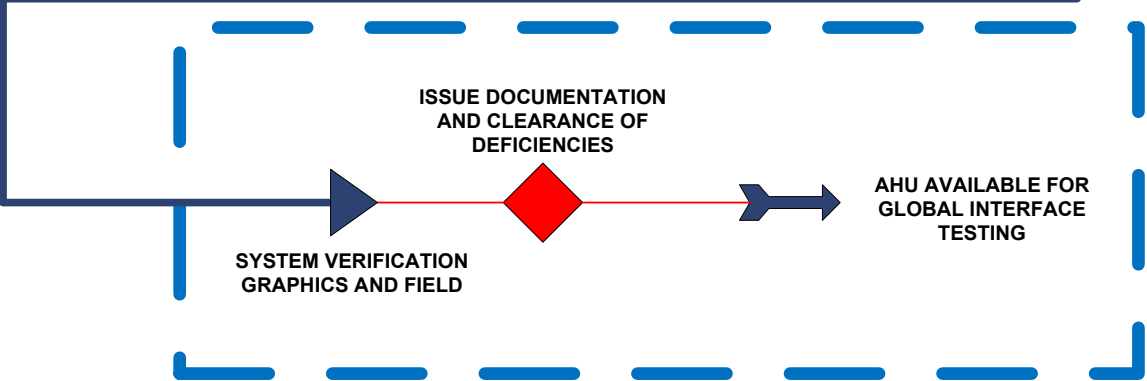
Make Up Air Unit (MUA) Cx Network



CONTRACTOR'S COMMISSIONING PHASE



TYPICAL HEATING WATER SYSTEM COMMISSIONING PROCESS DIAGRAM



CDML VERIFICATION & TESTING PHASE

APPENDIX C

CONTRACTOR EQUIPMENT

CX TRACKING SHEET

Project Tracking Sheet									
Mechanical System - Progress Schedule									

[illegible]

APPENDIX D

COMMISSIONING ISSUES LOG

Commissioning Issues Log



REVISION: 1

PROJECT:

DATE: 2016-10-07

BUILDING OWNER:

REPORT BY: Dean Willows

The aim of this commissioning issues log is to track commissioning related issues and their resolution noted during the course of the project.

OPEN ITEMS: 5

CLOSED ITEMS: 0

TOTAL ITEMS: 5

ACTION CODE:

MC - HVAC/Mech Contractor
FS - Fire/Sprinkler Contractor
DT - Design Team
ES - Equipment Supplier

CC - Controls Contractor
PC - Plumbing Contractor
SC - Security Contractor
CL - Client

GC - General Contractor
EC - Electrical Contractor
DC - Data Contractor

Item Priority: A - High, B - Medium, C - Low

Item	Document Reference	Action	Date Noted	Deficiency / Issue Description	Priority	Recommended Action or Action Taken	Date Resolved	Status	Comment
1									
2									
3									
4									
5									

Limits of Liability

The review of these documents was of a visual nature only. No load or design calculations were verified. The material in this report reflects our best judgment in light of the information available to us at the time of preparation. All responsibility for the design lies with the engineer or engineers of record, not with CDML.

This report has been prepared for the sole benefit of Client. The contents of this report may not be quoted in whole or in part distributed to any person or entity other than by the Client of those parties possessing a reliance letter. CDML accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or

APPENDIX E

CONSTRUCTION INSTALLATION

CHECK SHEETS

PUMP

PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description:
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <div><input type="checkbox"/> Yes</div>
Model*		
Flow Rates L/S or GPM*		
Head Kpa or Ft*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Pump: matches shop drawing, all packing & shipping material removed, free of shipping damage.	<input type="checkbox"/>	<input type="checkbox"/>	
Pump installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Vibration Isolators checked	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate/Safe trays fitted and drains connected to waste	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate/Safe trays drains tested	<input type="checkbox"/>	<input type="checkbox"/>	
System Pipework installation complete	<input type="checkbox"/>	<input type="checkbox"/>	
System Pipework pressure test requirements met.	<input type="checkbox"/>	<input type="checkbox"/>	
Pipework Thermal insulation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Pipework flushing and treatment complete	<input type="checkbox"/>	<input type="checkbox"/>	
Strainers and side stream filters clean	<input type="checkbox"/>	<input type="checkbox"/>	

PUMP

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
System drained and filled with Glycol	<input type="checkbox"/>	<input type="checkbox"/>	
Glycol concentration confirmed as per the specification	<input type="checkbox"/>	<input type="checkbox"/>	
System static pressure set point confirmed	<input type="checkbox"/>	<input type="checkbox"/>	
Expansion Tank pressure set to system pressure and open to the system	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

PUMP

PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
Pump system installation check sheet signed off		
Power available to the Pump		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
TAB hydronic balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

ROOF TOP UNIT (RTU) PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: ROOF TOP UNIT
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Cooling Capacity *		
Heating Capacity *		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Supply fan drive assembly checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Return fan drive assembly checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Interior/Exterior as new condition, clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Evaporator/Condenser Coils as new condition	<input type="checkbox"/>	<input type="checkbox"/>	
Condenser Coil Protection/Louvre installed	<input type="checkbox"/>	<input type="checkbox"/>	
Supply/Return air filters installed and clean	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary air filter media installed and clean	<input type="checkbox"/>	<input type="checkbox"/>	

ROOF TOP UNIT (RTU) PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Gas pipework installed and pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
Gas Supply Available	<input type="checkbox"/>	<input type="checkbox"/>	
Gas Heating assembly complete	<input type="checkbox"/>	<input type="checkbox"/>	
Combustion air available	<input type="checkbox"/>	<input type="checkbox"/>	
Flue installation meets manufacturers requirements	<input type="checkbox"/>	<input type="checkbox"/>	
All duct connections complete and sealed to unit	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork and thermal insulation complete	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate pipework and trap installation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate drain tested	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Duct smoke detectors installed	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe and duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

ROOF TOP UNIT (RTU) PART A: INSTALLATION CHECKSHEET



General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

ROOF TOP UNIT (RTU) PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
RTU system installation check sheet signed off		
Uninterrupted gas supply available		
Power available to the RTU		
BAS controls power available		
BAS point to point complete including high level interface		
Manufacturer start-up complete and documentation available		
TAB air balancing complete		
BAS controls commissioning complete		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

MAKE UP AIR UNIT (MUA)

PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: MAKE UP AIR UNIT
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Heating Capacity *		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan drive assemblies checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Interior/Exterior as new condition, clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Air filters installed Summer/Winter position and clean	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary air filter media installed and clean	<input type="checkbox"/>	<input type="checkbox"/>	
Heating Coils as new condition	<input type="checkbox"/>	<input type="checkbox"/>	
Drainage pipework, trap installation complete and tested	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Valves installed and wired HTG / CHG	<input type="checkbox"/>	<input type="checkbox"/>	
Gas pipework installed and pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	

MAKE UP AIR UNIT (MUA)

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Gas Supply Available	<input type="checkbox"/>	<input type="checkbox"/>	
Gas Heating assembly complete	<input type="checkbox"/>	<input type="checkbox"/>	
Combustion air available	<input type="checkbox"/>	<input type="checkbox"/>	
Flue installation meets manufacturers requirements	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork and thermal insulation complete	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired.	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
All safety interlocks are wired. High Pressure switches, Freeze protection, Smoke sensors, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe and duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

MAKE UP AIR UNIT (MUA)

PART A: INSTALLATION CHECKSHEET



General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

MAKE UP AIR UNIT UNIT (MUA)

PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

CHECKS	INITIALS	COMMENTS
MUA system installation check sheet signed off		
Uninterrupted gas supply available		
Heating Glycol/Water supply available and correct temperature		
Power available to the MUA		
BAS controls power available		
BAS point to point complete including high level interface		
Manufacturer start-up complete and documentation available		
TAB air and hydronic balancing complete		
BAS controls commissioning complete		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

AIR HANDLING UNIT (AHU) Dx COOLING PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: AHU-Direct Expansion Cooling
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Cooling Capacity *		
Heating Capacity *		
Fan Volume*		
Fan Static Pressure*		
Condensing Unit Low Ambient Kit*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Outdoor Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor/Outdoor Unit Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor/Outdoor Units clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor Unit Heating/Outdoor Unit Condensing coils combed	<input type="checkbox"/>	<input type="checkbox"/>	
Outdoor Unit Condenser Coil hail protection fitted	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor Unit Clean Filters installed	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Valves installed and wired	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired.	<input type="checkbox"/>	<input type="checkbox"/>	

AIR HANDLING UNIT (AHU) Dx COOLING

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
All duct connections complete.	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork installation complete	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved.	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Ductwork Thermal insulation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
Work will be completed per Environmental Management of Halocarbons - INTERNAL SERVICES DIRECTIVE 318-4 found in the specification.	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration pipework installed and leak tested (document pressure and duration)	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration system Evacuation test (document micron level achieved and duration)	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration system pre-charged after evacuation	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework connected	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework Pressure test requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate pipework and trap installation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate drain tested	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	

AIR HANDLING UNIT (AHU) Dx COOLING

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
All safety interlocks are wired. High Pressure switches, Freeze protection, smoke sensors, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe and duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

AIR HANDLING UNIT (AHU) Dx COOLING

PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
System installation check sheet signed off		
Power available to the Indoor and Outdoor Units		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete		
TAB air and hydronic balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

AIR HANDLING UNIT (AHU) PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: AIR HANDLING UNIT
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Cooling Capacity *		
Heating Capacity *		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan drive assemblies checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Interior clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Heating/Cooling coils combed	<input type="checkbox"/>	<input type="checkbox"/>	
Air filters installed Summer/Winter position and clean	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary air filter media installed and clean	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Valves installed and wired Heating/Cooling	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired.	<input type="checkbox"/>	<input type="checkbox"/>	

AIR HANDLING UNIT (AHU)

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
System ductwork installation and connections complete	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved.	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Ductwork Thermal insulation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
Heating and Cooling pipework connected	<input type="checkbox"/>	<input type="checkbox"/>	
Heating and Cooling Pipework Pressure test requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Condensate pipework, trap installation complete and tested	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
All safety interlocks are wired. High Pressure switches, Freeze protection, Smoke sensors, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe and duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

AIR HANDLING UNIT (AHU) PART A: INSTALLATION CHECKSHEET



General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

AIR HANDLING UNIT (AHU) PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

CHECKS	INITIALS	COMMENTS
AHU system installation check sheet signed off		
Cooling Glycol/Water supply available and correct temperature		
Heating Glycol/Water supply available and correct temperature		
Power available to the AHU		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
TAB air and hydronic balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

HEATING SYSTEM BOILER

PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description:
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Heating Capacity *		
Flow*		
Head*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Boiler installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
Factory Test documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met.	<input type="checkbox"/>	<input type="checkbox"/>	
Approved electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Boiler clean and free of damage	<input type="checkbox"/>	<input type="checkbox"/>	
Gas pipework installed and pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework installed and pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
Expansion Tank pressure set to system pressure	<input type="checkbox"/>	<input type="checkbox"/>	
Temperature sensors installed	<input type="checkbox"/>	<input type="checkbox"/>	
Thermometers and gauges installed as per design	<input type="checkbox"/>	<input type="checkbox"/>	
Combustion air available	<input type="checkbox"/>	<input type="checkbox"/>	
Flue installation meets manufacturers requirements	<input type="checkbox"/>	<input type="checkbox"/>	

HEATING SYSTEM BOILER

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Electrical wiring complete and tested	<input type="checkbox"/>	<input type="checkbox"/>	
All safety interlocks are wired. Low water, high temperature, flow switch, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
BAS Control wiring complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Glycol concentration level confirmed	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

HEATING SYSTEM BOILER

PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

CHECKS	INITIALS	COMMENTS
Boiler system installation check sheet signed off		
Power available to the boiler		
Gas available and metering operational		
Hydronic system flushed and pumps running		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete		
TAB air and hydronic balancing complete		
BAS high level interface points verified		
BAS controls commissioning complete		
Approved sequence of operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

BUILDING AUTOMATION SYSTEM PART A: INSTALLATION CHECKSHEET



Project:

Equipment Description: BUILDING AUTOMATION SYSTEM

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Maintenance access requirements met to panels and doors	<input type="checkbox"/>	<input type="checkbox"/>	
Layout and location of control panels as per drawings	<input type="checkbox"/>	<input type="checkbox"/>	
Duct static pressure sensor located 2/3 down index run	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic system differential pressure sensors located 2/3 down index run	<input type="checkbox"/>	<input type="checkbox"/>	
Wiring labels attached inside panels	<input type="checkbox"/>	<input type="checkbox"/>	
Location of outdoor sensor on north side out of direct sunlight	<input type="checkbox"/>	<input type="checkbox"/>	
Shielded wiring used on electronic sensors	<input type="checkbox"/>	<input type="checkbox"/>	
Battery/UPS back up available	<input type="checkbox"/>	<input type="checkbox"/>	
Surge suppression available	<input type="checkbox"/>	<input type="checkbox"/>	
Panels properly grounded	<input type="checkbox"/>	<input type="checkbox"/>	
Power available	<input type="checkbox"/>	<input type="checkbox"/>	
Front end graphics available	<input type="checkbox"/>	<input type="checkbox"/>	
BAS control computer location agreed	<input type="checkbox"/>	<input type="checkbox"/>	
Work Station location environment as per manufacturers guidelines	<input type="checkbox"/>	<input type="checkbox"/>	
Control panel identification labels and wire numbers fitted	<input type="checkbox"/>	<input type="checkbox"/>	
Field equipment identification labels and wire numbers fitted	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

BUILDING AUTOMATION SYSTEM

PART B: START-UP CHECKSHEET



INTENT: To verify the start up of systems prior to functional performance tests

CHECKS	INITIALS	COMMENTS
Approved sequence of operations available		
Equipment controls complete (third party)		
BAS point to point complete and documentation attached		
BAS controls Network complete and all controllers online		
Time schedules have been set to owners requirements		
Correct trends have been set up on all relative points		
Alarm Priorities applied to all relative points		
All sensors/transmitters have been calibrated (pressure/temperature/kw/etc.)		
Flow meters calibration has been coordinated with the balancer		
Remote access to the BMS available		
Remote alarm monitoring operational		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

DOMESTIC WATER HEATER

PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: DOMESTIC WATER HEATER
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <div><input type="checkbox"/> Yes</div>
Model*		
Heating Capacity *		
Recovery Rate*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
DWH installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met.	<input type="checkbox"/>	<input type="checkbox"/>	
Approved electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
DWH clean and free of damage	<input type="checkbox"/>	<input type="checkbox"/>	
Gas pipework installed and pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
DHW pipework installation complete and pressure test requirements achieved.	<input type="checkbox"/>	<input type="checkbox"/>	
Recirculation Pumps installed and wired	<input type="checkbox"/>	<input type="checkbox"/>	
System Pressure Relief Valves installed	<input type="checkbox"/>	<input type="checkbox"/>	
Domestic water supply Pressure Regulation Valves installed and set	<input type="checkbox"/>	<input type="checkbox"/>	
Expansion Tank pressure set to system pressure	<input type="checkbox"/>	<input type="checkbox"/>	
Temperature sensors installed	<input type="checkbox"/>	<input type="checkbox"/>	
Thermometers and gauges installed as per design	<input type="checkbox"/>	<input type="checkbox"/>	

DOMESTIC WATER HEATER PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Combustion air available	<input type="checkbox"/>	<input type="checkbox"/>	
Flue installation meets manufacturers requirements	<input type="checkbox"/>	<input type="checkbox"/>	
DHW Disinfection/Chlorination report available	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested	<input type="checkbox"/>	<input type="checkbox"/>	
All safety interlocks are wired. Low water, high temperature, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
BAS Control wiring complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

DOMESTIC WATER HEATER PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
DWH system installation check sheet signed off		
Power available to the DWH		
Gas available and metering operational		
Domestic Water Supply Available		
Recirculation Pumps operational		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete		
BAS controls commissioning complete		
Approved sequence of operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

TRANSFER FAN PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: TRANSFER FAN
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Fan installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan drive assemblies checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Interior clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired. (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>	
All duct installation and connections complete	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Ductwork Thermal insulation complete	<input type="checkbox"/>	<input type="checkbox"/>	

TRANSFER FAN PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels installed	<input type="checkbox"/>	<input type="checkbox"/>	
Duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

TRANSFER FAN PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
Transfer Fan installation check sheet signed off		
Power available to the Transfer Fan		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
TAB air balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

EXHAUST VENTILATION FAN PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: EXHAUST VENTILATION FAN
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Fan installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan drive assemblies checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Interior clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired. (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>	
All duct installation and connections complete	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved.	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Ductwork Thermal insulation complete.	<input type="checkbox"/>	<input type="checkbox"/>	

EXHAUST VENTILATION FAN PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels installed	<input type="checkbox"/>	<input type="checkbox"/>	
Duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

EXHAUST VENTILATION FAN PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
Exhaust Fan installation check sheet signed off		
Power available to the Exhaust Fan		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
TAB air balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

SUPPLY VENTILATION FAN

PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: SUPPLY VENTILATION FAN
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Heating Capacity *		
Fan Volume*		
Fan Static Pressure*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Fan installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Transit bolts removed	<input type="checkbox"/>	<input type="checkbox"/>	
Fan drive assemblies checked i.e. belt tension, lubrication, guards etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Fan Interior clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Valves installed and wired Heating Coil	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Dampers installed and wired. (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>	
All duct installation and connections complete	<input type="checkbox"/>	<input type="checkbox"/>	
Smoke/Fire damper drop test performed, documentation available	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork Pressure test requirements achieved.	<input type="checkbox"/>	<input type="checkbox"/>	
System ductwork cleaning Complete	<input type="checkbox"/>	<input type="checkbox"/>	

SUPPLY VENTILATION FAN

PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Ductwork Thermal insulation complete.	<input type="checkbox"/>	<input type="checkbox"/>	
Pressure gauges and thermometers installed	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework connected	<input type="checkbox"/>	<input type="checkbox"/>	
Heating Pipework Pressure test requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
All safety interlocks are wired. High Pressure switches, Freeze protection, Smoke sensors, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels installed	<input type="checkbox"/>	<input type="checkbox"/>	
Duct identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

SUPPLY VENTILATION FAN PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
Supply Fan installation check sheet signed off		
Heating Glycol/Water supply available and correct temperature		
Power available to the Supply Fan		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
TAB air balancing complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

UNIT HEATER PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: UNIT HEATER
Location:	

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Model*		
Heating Capacity*		
Fan Volume*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Unit Interior clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Heating coil combed	<input type="checkbox"/>	<input type="checkbox"/>	
Motorized Valves installed and wired	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework connected	<input type="checkbox"/>	<input type="checkbox"/>	
Heating pipework Pressure test requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

UNIT HEATER PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
--------	-------------------------	-------------------	---------

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

UNIT HEATER PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
UH installation check sheet signed off		
Power available to the UH		
BAS controls power available		
BAS point to point complete		
TAB hydronic balancing complete		
BAS controls commissioning complete		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

COMPUTER ROOM AC SYSTEM (CRAC) PART A: INSTALLATION CHECKSHEET



Project:	
Equipment Tag:	Equipment Description: COMPUTER ROOM AC SYSTEM
Location:	System/Area Served:

Item	Cx Comment	Contractor Site Review
Manufacturer*	Contractor submitted shop drawing is consistent with design documentation and/or the Owner Project Requirements (OPR).	Delivered equipment matches the reviewed shop drawing submission. <input type="checkbox"/> Yes
Evaporator & Condenser Model*		
Cooling Capacity *		
Heating Capacity *		
Humidifier Capacity kg/hr*		
Fan Volume*		
Low Ambient Kit*		
*Specific detailed data is available in Design Documents, Shop Drawing Submissions, TAB Reports, O&M's and on Automation System		

CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Outdoor unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor unit installed to Manufacturers recommendations	<input type="checkbox"/>	<input type="checkbox"/>	
All maintenance access requirements met	<input type="checkbox"/>	<input type="checkbox"/>	
Approved Electrical isolation installed	<input type="checkbox"/>	<input type="checkbox"/>	
Work will be completed per Environmental Management of Halocarbons - INTERNAL SERVICES DIRECTIVE 318-4 found in the specification.	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration pipework installed and leak tested (document pressure and duration)	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration system Evacuation test (document micron level achieved and duration)	<input type="checkbox"/>	<input type="checkbox"/>	
Refrigeration system pre-charged after evacuation	<input type="checkbox"/>	<input type="checkbox"/>	

COMPUTER ROOM AC SYSTEM (CRAC) PART A: INSTALLATION CHECKSHEET



CHECKS	APPLICABLE/ COMPLETE	NOT APPLICABLE	COMMENT
Indoor/Outdoor units clean and free of debris	<input type="checkbox"/>	<input type="checkbox"/>	
Softened Domestic Cold Water supply required	<input type="checkbox"/>	<input type="checkbox"/>	
Domestic Cold Water pipework installed and connected	<input type="checkbox"/>	<input type="checkbox"/>	
Back Flow Prevention valve installed	<input type="checkbox"/>	<input type="checkbox"/>	
Clean Filters installed on indoor unit	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor unit condensate pipework installation complete and tested	<input type="checkbox"/>	<input type="checkbox"/>	
Coils combed where necessary	<input type="checkbox"/>	<input type="checkbox"/>	
BAS wiring complete	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment labels and valve tags installed	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe identification labels installed	<input type="checkbox"/>	<input type="checkbox"/>	

General Contractor: _____ Date: _____

Mechanical Contractor: _____ Date: _____

Electrical Contractor: _____ Date: _____

BAS Contractor: _____ Date: _____

Cx Authority: _____ Date: _____

Comments:

DIRECT EXPANSON SYSTEMS

PART B: START-UP CHECKSHEET



INTENT: To verify the start-up of systems prior to functional performance tests

<i>CHECKS</i>	<i>INITIALS</i>	<i>COMMENTS</i>
Dx System installation check sheet signed off		
Power available to the Indoor and Outdoor units		
Domestic Water Supply Available		
BAS controls power available		
BAS point to point complete		
Manufacturer start-up complete.		
BAS controls commissioning complete.		
Approved Sequence of Operation available		

General Contractor: _____ **Date:** _____

Mechanical Contractor: _____ **Date:** _____

Electrical Contractor: _____ **Date:** _____

BAS Contractor: _____ **Date:** _____

Cx Authority: _____ **Date:** _____

Comment:

VAV/CAV TERMINAL AIR BOX

PART A: INSTALLATION CHECKSHEET



Project:

TERMINAL UNIT TAG										
Manufacturer, Model & Type										
Box Size matches shop drawing										
Box Air Flows match shop drawing										
Straight Duct to box inlet met										
Silencer/Acoustic Duct Installed										
Unit Undamaged										
Unit Supported Correctly										
Identification Tags Visible										
Controls Accessible										
REHEAT COILS										
Coil matches shop drawing										
Piping Correct										
Piping Identified										
Piping Insulated										
Drain Installed										
Air Vent Installed										
Valves Installed										
Access Doors Installed										
OPERATIONAL CHECKS										
Control Valve Operation										
Controls Verified										

CM/GC Representative

Signature

Date

Mechanical Contractors Representative

Signature

Date



VAV/CAV TERMINAL AIR BOX

PART A: START-UP CHECKSHEET

Installation Check sheet signed-off & documentation submitted.	
BAS point to point complete & documentation submitted.	
Ductwork cleaning complete & documentation submitted.	
TAB complete & report submitted.	
BAS commissioning complete & documentation submitted.	
Approved Sequence of Operation	
Equipment, controls and valve labelling and identification complete	

CM/GC Representative	Signature	Date
Mechanical Contractors Representative	Signature	Date

APPENDIX F

FUNCTIONAL TEST SHEETS

Make-up Air Unit Functional Performance Sheet



Project: _____ System Type: _____
Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Uninterrupted gas supply available	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report attached	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list attached	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete

"N" = No work not done or not installed

"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Unit Installed correctly <input type="checkbox"/>	Unit labeled correctly <input type="checkbox"/> Insulation complete <input type="checkbox"/>
	Filter condition	→	Temporary Filter Media Fitted <input type="checkbox"/>		
	Remote items operational	→	Isolation Dampers <input type="checkbox"/>	Associated Exh Fans <input type="checkbox"/>	
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/>	VSD settings based on motor name plate rating <input type="checkbox"/>	
			Check fan volume & SP @ design conditions <input type="checkbox"/>		
			Area served by MUA operating at a Positive Pressure <input type="checkbox"/>		
			Area served by MUA operating at a Negative Pressure <input type="checkbox"/>		
			Check volume of terminals against TAB Report <input type="checkbox"/>		
	Hard wire interlocks	→	Freeze Stat <input type="checkbox"/>	Supply Fan shutdown <input type="checkbox"/>	Dampers Close <input type="checkbox"/> BAS Annunciation <input type="checkbox"/>
			Fire Alarm <input type="checkbox"/>	Supply Fan shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Supply Fan damper interlocks operational <input type="checkbox"/>		
			Burner shutdown on Gas failure <input type="checkbox"/>		BAS Annunciation <input type="checkbox"/>
Soft wire interlocks	→	Check default settings on sensors and alarms through BAS <input type="checkbox"/>			
		Supply Fan Fail <input type="checkbox"/>	Assoc Exhaust shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>	
		Exhaust Fan Fail <input type="checkbox"/>	Supply Fan shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>	
		Confirm BAS annunciation when fans are operated in hand <input type="checkbox"/>			

Make-up Air Unit

Functional Performance Sheet



Dynamic Verification

(Continued)

BAS Commands

→

Check output to VFD's

☐

Check stroke of dampers

☐

↓

BAS Control Verification

→

Note:

System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation

Verify and document differential between supply and Exhaust air flow

☐

Verify SA temperature control stable at varied set points

☐

Verify Calibration of all temperature and pressure sensors

☐

Verify system enabled by field demand

☐

Verify system unoccupied temperature initiated operation of plant

☐

Check positions of motorized dampers on unit shutdown.

☐

Comments:

Further work required:

Contractor

Sign:

Print:

Date:

Cx Authority

Sign:

Print:

Date:

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Air Handling Unit (AHU) with Dx Cooling

Functional Performance Sheet



Project: _____ System Type: AHU with Direct Expansion Cooling

Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list attached	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Static Verification
(Some items may not be applicable)

Visual Check

Physical Integrity → Clear of dirt/debris ☐ Units Installed correctly ☐ Drainage Check ☐ Units labeled correctly ☐ Insulation complete ☐

Filter condition → AHU Permanent Filters Fitted ☐ Temporary Filter Media Fitted ☐

Remote items operational → Heating Gly/Water ☐ Dx Cooling ☐ Assoc VAV Terminals ☐ Humidifier ☐

Dynamic Verification
(Some items may not be applicable)

Operational Check

TAB Verification → O.L Set to motor name plate rating ☐ VSD settings based on motor name plate rating ☐

Check fan volume & SP @ design conditions ☐
Area served by AHU operating at a Positive Pressure ☐
Area served by AHU operating at a Negative Pressure ☐
Check volume of terminals against TAB Report ☐

Hard wire interlocks → Freeze Stat ☐ Fans shutdown ☐ Dampers Close ☐
Dx shutdown ☐ Heating valve fully open ☐ BAS Annunciation ☐

Fire Alarm ☐ Supply/Return shutdown ☐ BAS Annunciation ☐
Dx Cooling Alarm ☐ BAS Annunciation ☐

Supply Fan damper interlocks operational ☐
Return/Exhaust Fan damper interlocks operational ☐

Soft wire interlocks → Check default settings on sensors and alarms through BAS ☐

Supply Fan Fail ☐ Ret/Exh shutdown ☐ BAS Annunciation ☐
Ret/Exh Fan Fail ☐ Supply shutdown ☐ BAS Annunciation ☐
Confirm BAS annunciation when fans are operated in hand ☐

Air Handling Unit (AHU) with Dx Cooling

Functional Performance Sheet



Dynamic Verification (Continued)	BAS Commands	Check stroke of valves Check output to VFD's	<input type="checkbox"/> <input type="checkbox"/>	Check stroke of dampers Check staging of Dx Cooling	<input type="checkbox"/> <input type="checkbox"/>
		Verify system enabled by field demand Verify system unoccupied temperature initiated operation of plant Check control valve positions on unit shutdown. Check positions of motorized dampers on unit shutdown. Check Dx Cooling is disabled on unit shutdown. Verify Minimum Outside Air Requirements			<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	BAS Control Verification	Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation			
		Verify SA pressure control stable at varied set points Verify location of the SA static pressure sensors Verify SA static pressure sensor is not Network based Verify and document differential between supply and exhaust air flow Verify SA temperature control stable at varied set points Verify Humidity control stable at varied set points Verify Economy Cycle operation of dampers Verify Calibration of all temperature and pressure sensors		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Air Handling Unit (AHU)

Functional Performance Sheet



Project: _____ System Type: Variable Volume with VAV Terminals

Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list attached	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Static Verification
(Some items may not be applicable)

Visual Check

Physical Integrity → Clear of dirt/debris ☐ Unit Installed correctly ☐ Unit labeled correctly ☐
 Drainage Check ☐ Insulation complete ☐

Filter condition → AHU Permanent Filters Fitted ☐
 Temporary Filter Media Fitted ☐

Remote items operational → Heating Glycol ☐ Chilled Glycol ☐ Fan Coil Units ☐
 Assoc VAV Terminals ☐ Humidifier ☐

Dynamic Verification
(Some items may not be applicable)

Operational Check

TAB Verification → O.L Set to motor name plate rating ☐
 VSD settings based on motor name plate rating ☐

Check fan volume & SP @ design conditions ☐
 Area served by AHU operating at a Positive Pressure ☐
 Area served by AHU operating at a Negative Pressure ☐
 Check volume of terminals against TAB Report ☐

Hard wire interlocks → Freeze Stat ☐ Fans shutdown ☐ Dampers Close ☐
 Heating coil fully open ☐ BAS Annunciation ☐

Fire Alarm ☐ Supply/Return shutdown ☐ BAS Annunciation ☐

Supply Fan damper interlocks operational ☐
 Return/Exhaust Fan damper interlocks operational ☐

Soft wire interlocks → Check default settings on sensors and alarms through BAS ☐

Supply Fan Fail ☐ Ret/Exh shutdown ☐ BAS Annunciation ☐
 Ret/Exh Fan Fail ☐ Supply shutdown ☐ BAS Annunciation ☐
 Confirm BAS annunciation when fans are operated in hand ☐

Air Handling Unit (AHU)

Functional Performance Sheet



Dynamic Verification (Continued)	BAS Commands	Check stroke of valves Check output to VFD's	<input type="checkbox"/> Check stroke of dampers <input type="checkbox"/> Heat Wheel Control	<input type="checkbox"/> <input type="checkbox"/>
		Verify system enabled by field demand Verify system unoccupied temperature initiated operation of plant Check control valve positions on unit shutdown. Check positions of motorized dampers on unit shutdown. Verify Minimum Outside Air Requirements		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	BAS Control Verification	Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation		
		Verify SA pressure control stable at varied set points Verify location of the SA static pressure sensors Verify SA static pressure sensor is not Network based Verify and document differential between supply and exhaust air flow Verify SA temperature control stable at varied set points Verify Humidity control stable at varied set points Verify Economy Cycle operation of dampers Verify Heat Wheel is the first stage of heating/cooling based on RA temp Verify Calibration of all temperature and pressure sensors	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Heating Water/Glycol Boiler Functional Performance Sheet



Project: _____ System Type: Heating Water/Glycol Boiler
Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Mechanical room clean and dust free	<input type="checkbox"/>	<input type="checkbox"/>	
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Uninterrupted gas supply available	<input type="checkbox"/>	<input type="checkbox"/>	
Current pipe work inhibitor adjustment report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Glycol concentration level report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Documented list of Boiler controller interface points with the BAS	<input type="checkbox"/>	<input type="checkbox"/>	
HHG system and Expansion Tank pressure settings confirmed	<input type="checkbox"/>	<input type="checkbox"/>	
Adequate load available to operate Boiler at full capacity	<input type="checkbox"/>	<input type="checkbox"/>	

**Deficiencies - Mark "Y" = Yes its operational, installed or complete
"N" = No work not done or not installed
"N/A" = Not Applicable**

Static Verification (Some items may not be applicable)	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Unit Installed correctly <input type="checkbox"/>	Unit labeled correctly <input type="checkbox"/> Insulation complete <input type="checkbox"/>
	Strainers and Gauges	→	Strainers clean <input type="checkbox"/>	Gauges correct range <input type="checkbox"/>	
	Remote items operational	→	Boiler primary pump operational <input type="checkbox"/> Secondary pumping system operational <input type="checkbox"/> Neutralization tank installed <input type="checkbox"/>		
Dynamic Verification (Some items may not be applicable)	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/> VSD settings based on motor name plate rating <input type="checkbox"/> Document boiler safety valve setting <input type="checkbox"/>		
			Check pump volume & SP @ design condition <input type="checkbox"/> Check ΔT across Boiler at full load against manufacturers requirements <input type="checkbox"/>		
	Integral Controller	→	Verify the boiler enables the dedicated pump <input type="checkbox"/> Verify boiler temperature control stable at varied Set Points <input type="checkbox"/> Verify Integral controller temperature set point reset through the BAS <input type="checkbox"/> Verify primary pump run on timer after boiler is shut down <input type="checkbox"/>		

Heating Water/Glycol Boiler

Functional Performance Sheet



Dynamic Verification (Continued)	Hard wire interlocks	→	Fire Alarm	<input type="checkbox"/>	System shutdown	<input type="checkbox"/>	BAS Annunciation	<input type="checkbox"/>	
	↓								
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS						<input type="checkbox"/>
			Boiler common fault/shut down	<input type="checkbox"/>	BAS Annunciation			<input type="checkbox"/>	
			Primary pump shuts down on boiler failure	<input type="checkbox"/>	BAS Annunciation			<input type="checkbox"/>	
			Boiler enabled, no increase in supply temperature	<input type="checkbox"/>	BAS Annunciation			<input type="checkbox"/>	
			Pump failure based on flow	<input type="checkbox"/>	Status Mismatch			<input type="checkbox"/>	
			Run timers on boiler and pump are represented on graphics					<input type="checkbox"/>	
			Verify Calibration of all temperature and pressure sensors					<input type="checkbox"/>	

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Domestic Water Heating Functional Performance Sheet



System Type: Domestic Water Heating System

Date:

System #:

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Uninterrupted water supply available	<input type="checkbox"/>	<input type="checkbox"/>	
Uninterrupted gas supply available	<input type="checkbox"/>	<input type="checkbox"/>	
Pipe work flushing and treatment report attached	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report attached	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
BMS point to point check list attached	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	
DCW system pressure set through PRV (note set point)	<input type="checkbox"/>	<input type="checkbox"/>	
Expansion Vessel pressure set (note set point)	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete
"N" = No work not done or not installed
"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Sys Installed correctly <input type="checkbox"/>	Sys labeled correctly <input type="checkbox"/>
			Drainage check <input type="checkbox"/>	Insulation complete <input type="checkbox"/>	
	Strainers and Gauges	→	Strainers clean <input type="checkbox"/>	Gauges correct range <input type="checkbox"/>	
	Connections complete	→	Electrical <input type="checkbox"/>	BAS installation <input type="checkbox"/>	
	Remote items operational	→	Pump P-9 <input type="checkbox"/>	Pump P-10 <input type="checkbox"/>	DHW Tank <input type="checkbox"/>
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	Pump O.L Set to motor nameplate rating <input type="checkbox"/>		
			Check pumps volume & SP @ design condition <input type="checkbox"/>		
			Document DHW safety valve setting <input type="checkbox"/>		
	Soft wire interlocks	→	Pump failure based on flow <input type="checkbox"/>	Status Mismatch <input type="checkbox"/>	
		Run timers on pumps are represented on graphics <input type="checkbox"/>			
		Confirm BAS annunciation when pumps are operated in hand <input type="checkbox"/>			
		Check default settings on sensors and alarms through BAS <input type="checkbox"/>			

CDML

Comments:

Further work required:

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Transfer Fan Functional Performance Sheet



Project: _____ System Type: Transfer Fan
 Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies (Mark "Y" = Yes its operational, installed or complete or "N" = No work not done or not installed)

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Fan Installed correctly <input type="checkbox"/>	Fan labeled correctly <input type="checkbox"/>
	Filter condition	→	Temporary Filter Media Fitted <input type="checkbox"/>	Insulation complete <input type="checkbox"/>	
	Remote items operational	→	Isolation Dampers <input type="checkbox"/>		
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set <input type="checkbox"/>	VSD settings <input type="checkbox"/>	
			Check fan volumes & SP @ design conditions		<input type="checkbox"/>
			Check volume of terminals against TAB report		<input type="checkbox"/>
	Hard wire interlocks	→	Fire Alarm <input type="checkbox"/>	Fan shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Transfer Fan damper interlocks operational		<input type="checkbox"/>
	Soft wire interlocks	→	Check operation of filter alarms on BAS		<input type="checkbox"/>
			Check default settings on sensors and alarms through BAS		<input type="checkbox"/>
	BAS Commands	→	Confirm BAS annunciation when fans are operated in hand		<input type="checkbox"/>
			Check stroke of dampers <input type="checkbox"/>	Check output to VFD's	<input type="checkbox"/>
		Verify and document Time Schedule operation		<input type="checkbox"/>	
		Verify if fan is operated in conjunction with main air handling plant		<input type="checkbox"/>	
		Verify and document unoccupied temperature initiated operation of fan		<input type="checkbox"/>	
		Check System Shutdown		<input type="checkbox"/>	
		Check positions of motorized dampers on fan shutdown.		<input type="checkbox"/>	
	BAS Control Verification	→	Verify fan is enabled by adjustment of Temp Set Point		<input type="checkbox"/>
			Verify and document temperature differential between fan on/off		<input type="checkbox"/>
			Verify transfer fan minimum run time		<input type="checkbox"/>
			Verify calibration of Temp sensors		<input type="checkbox"/>

Transfer Fan Functional Performance Sheet



Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Exhaust Fan Functional Performance Sheet



Project: _____ System Type: General Exhaust Fan
 Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete
 "N" = No work not done or not installed
 "N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Fan Installed correctly <input type="checkbox"/>	Fan labeled correctly <input type="checkbox"/>
	Filter condition	→	Temporary Filter Media Fitted <input type="checkbox"/>	Insulation complete <input type="checkbox"/>	
	Remote items operational	→	Isolation/Mixing Dampers <input type="checkbox"/>		
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/>	VSD settings based on motor name plate rating <input type="checkbox"/>	
			Check fan volumes & SP @ design conditions <input type="checkbox"/>	Check volume of terminals against TAB Report <input type="checkbox"/>	
	Hard wire interlocks	→	Fire Alarm <input type="checkbox"/>	Exhaust shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Exhaust Fan damper interlocks operational <input type="checkbox"/>		
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS <input type="checkbox"/>	Confirm BAS annunciation when fans are operated in hand <input type="checkbox"/>	
	BAS Commands	→	Check stroke of dampers <input type="checkbox"/>	Check output to VFD's <input type="checkbox"/>	
			Verify and document Time Schedule operation <input type="checkbox"/>	Verify if fan is operated in conjunction with main air handling plant <input type="checkbox"/>	Verify and document unoccupied temperature initiated operation of plant <input type="checkbox"/>
		Check positions of motorized dampers on fan shutdown. <input type="checkbox"/>			

Exhaust Fan Functional Performance Sheet



Dynamic
Verification

BAS Control Verification

Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation

- Verify fan is enabled by adjustment of Temp Set Point
- Verify and document temperature differential between fan on/off
- Verify temperature control stable at varied set points through mixing dampers
- Verify exhaust fan minimum run time
- Verify Calibration of all temperature sensors

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Supply Fan

Functional Performance Sheet



Project: _____ System Type: Supply Fan with Reheat
 Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete

"N" = No work not done or not installed

"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Fan Installed correctly <input type="checkbox"/>	Fan labeled correctly <input type="checkbox"/> Insulation complete <input type="checkbox"/>
	Filter condition	→	Temporary Filter Media Fitted <input type="checkbox"/>		
	Remote items operational	→	Heating Glycol <input type="checkbox"/>	Associated Exhaust <input type="checkbox"/>	
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/> VSD settings based on motor name plate rating <input type="checkbox"/>		
			Check fan volumes & SP @ design conditions <input type="checkbox"/> Check volume of terminals against TAB Report <input type="checkbox"/>		
	Hard wire interlocks	→	Fire Alarm <input type="checkbox"/>	Fan shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Supply Fan damper interlocks operational <input type="checkbox"/>		
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS <input type="checkbox"/> Confirm BAS annunciation when fans are operated in hand <input type="checkbox"/>		
			Fan failure status mismatch <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>	
	BAS Commands	→	Check stroke of valves <input type="checkbox"/>	Check stroke of dampers <input type="checkbox"/> Check output to VFD's <input type="checkbox"/>	
			Verify and document Time Schedule operation <input type="checkbox"/> Verify and document unoccupied temperature initiated operation <input type="checkbox"/> Check control valve positions on fan shutdown. <input type="checkbox"/> Check positions of motorized dampers on fan shutdown. <input type="checkbox"/>		

Supply Fan

Functional Performance Sheet



Dynamic
Verification

BAS Control Verification

Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation

- Verify space temp control stable at varied Set Points through re-heater
- Verify space temp control stable at varied Set Points through damper control
- Verify Calibration of all temperature sensors

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Forced Flow/Unit Heaters

Functional Performance Sheet



Project: _____ System Type: Forced Flow/Unit Heater

Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete

"N" = No work not done or not installed

"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Unit Installed correctly <input type="checkbox"/>	Unit labeled correctly <input type="checkbox"/> Insulation complete <input type="checkbox"/>
	Filter condition	→	Temporary Filter Media Fitted <input type="checkbox"/>		
	Remote items operational	→	Heating Glycol <input type="checkbox"/>	Control Valve Fitted <input type="checkbox"/>	
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/>		
	Hard wire interlocks	→	Fire Alarm <input type="checkbox"/>	Fan shutdown <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS Confirm BAS annunciation when fans are operated in hand Unit Fan Failure based on flow <input type="checkbox"/> Status mismatch <input type="checkbox"/>		
	BAS Commands	→	Check stroke of valves <input type="checkbox"/> Verify and document Time Schedule operation <input type="checkbox"/> Verify and document unoccupied temperature initiated operation <input type="checkbox"/> Check control valve positions on unit shutdown. <input type="checkbox"/>		
	BAS Control Verification	→	Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation		
				Verify space temperature control stable at varied Set Points <input type="checkbox"/> Verify fan is cycled off when the heating valve closes <input type="checkbox"/> Verify fan minimum run time <input type="checkbox"/> Verify Calibration of all temperature sensors <input type="checkbox"/>	

Forced Flow/Unit Heaters

Functional Performance Sheet



Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Computer Room Air Conditioning (CRAC) System Functional Performance Sheet



Project: _____ System Type: CRAC DX Split System
Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Installers pressure test and evacuation report available	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's Operation manual available	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete
"N" = No work not done or not installed
"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check			
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Units Installed correctly <input type="checkbox"/> Units labeled correctly <input type="checkbox"/> Insulation complete <input type="checkbox"/>
	Filter condition	→	Unit Permanent Filters fitted <input type="checkbox"/> Temporary filter media fitted <input type="checkbox"/>	
	Remote items operational	→	Condensate Pump <input type="checkbox"/> Condensing Unit <input type="checkbox"/>	
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check			
	Integral Controls	→	Check system operation through factory controller Verify temperature control stable at varied Set Points Verify Humidity control stable at varied Set Points Check operation on backup cooling mode Check operation of Condensate Pump Check operation of Condensing Unit	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS DX system general alarm monitored by BAS Verify BAS monitors room temperature and record alarm parameters Verify calibration of Temp sensors	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Computer Room Air Conditioning (CRAC) System Functional Performance Sheet



Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Supply Air VAV Terminal Unit Functional Performance Sheet



Project:

System Type:

Variable Supply Air Volume Box with
Reheat and Radiant Panels

Date:

VAV Served by:

VAV #:

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Spreadsheet of BAS parameters and set points available	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete

"N" = No work not done or not installed

"N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Insulation complete <input type="checkbox"/>	VAV Installed correctly <input type="checkbox"/>	Clear of dirt/debris <input type="checkbox"/>
			Valve tags <input type="checkbox"/>	VAV labeled correctly <input type="checkbox"/>	Maintenance Access <input type="checkbox"/>
	Coil condition	→	Access Provided <input type="checkbox"/>	Combing required <input type="checkbox"/>	
	Connections complete	→	BAS installation <input type="checkbox"/>	Network available <input type="checkbox"/>	
	Remote items operational	→	Hot Water Service <input type="checkbox"/>	Radiant Panels <input type="checkbox"/>	No. of Radiant Panels <input type="checkbox"/>
			AHU serving all associated supply and return/exhaust VAV's <input type="checkbox"/>		
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	BAS Commands	→	Check stroke of valves <input type="checkbox"/>	Check stroke of dampers <input type="checkbox"/>	
			Verify Time Schedule operation <input type="checkbox"/>		
	Soft wire interlocks	→	Check default settings on sensors and alarms through BAS <input type="checkbox"/>		
			Verify lighting control interface <input type="checkbox"/>		
	Hard wire interlocks	→	Fire Alarm Interface <input type="checkbox"/>		
	TAB Verification	→	Verify calibration of air volume at maximum flow with TAB Contractor <input type="checkbox"/>		
			Verify calibration of air volume at minimum flow with TAB Contractor <input type="checkbox"/>		
			Check air volume with primary air shut down <input type="checkbox"/>		

Functional Performance Sheet



Dynamic Verification

BAS Control Verification

- Verify SA volume responds to temperature set point changes
- Verify SA volume control stable at varied set points
- Adjust temperature set point until full cooling is achieved
- Verify SA volume at maximum through BAS

- Adjust temperature set point to the current room temperature
- Verify SA volume at minimum through BAS
- Adjust temperature set point to initiate heating
- Verify radiant heating is the first stage
- Verify VAV reheat is the second stage
- Verify SA volume at minimum at full heating through BAS
- Verify unoccupied operation of VAV

Comments:

Further work required:

Contractor

Sign:

Print:

Date:

Cx Authority

Sign:

Print:

Date:

Pump(s) Functional Performance Sheet



Project: _____ System Type: _____
 Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Hydronic balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Deficiencies - Mark "Y" = Yes its operational, installed or complete
 "N" = No work not done or not installed
 "N/A" = Not Applicable

Static Verification <small>(Some items may not be applicable)</small>	Visual Check				
	Physical Integrity	→	Clear of dirt/debris <input type="checkbox"/>	Pumps Installed correctly <input type="checkbox"/>	Labeled correctly <input type="checkbox"/>
			Valve Tags installed <input type="checkbox"/>	Insulation complete <input type="checkbox"/>	
	Strainers and Gauges	→	Strainers clean <input type="checkbox"/>	Gauges correct range <input type="checkbox"/>	
	Drives and Couplings	→	Pump rotation <input type="checkbox"/>		
	Remote items operational	→	Heating Glycol <input type="checkbox"/>	Chilled Glycol <input type="checkbox"/>	Field Control Valves <input type="checkbox"/>
			Heating Water <input type="checkbox"/>	Chilled Water <input type="checkbox"/>	Bypass Valve <input type="checkbox"/>
				Pipework complete <input type="checkbox"/>	
Dynamic Verification <small>(Some items may not be applicable)</small>	Operational Check				
	TAB Verification	→	O.L Set to motor name plate rating <input type="checkbox"/>		
			VSD settings based on motor name plate rating <input type="checkbox"/>		
			Check pump volume & SP @ design conditions		<input type="checkbox"/>
			Check Min flow VSD setting		<input type="checkbox"/>
			Check glycol flow at selected field components		<input type="checkbox"/>
			Confirm if Triple Duty valves have been altered for TAB and document setting		<input type="checkbox"/>
	Soft wire interlocks	→	Lead pump fails <input type="checkbox"/>	Lag pump starts <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Pump fail reset <input type="checkbox"/>	Lead pump resumes <input type="checkbox"/>	BAS Annunciation <input type="checkbox"/>
			Above tests repeated after change of lead pump <input type="checkbox"/>		
		Pump failure based on flow <input type="checkbox"/>	Status Mismatch <input type="checkbox"/>	<input type="checkbox"/>	
		Run timers on pumps are represented on graphics <input type="checkbox"/>		<input type="checkbox"/>	
		Auto changeover of pumps verified based on run time <input type="checkbox"/>		<input type="checkbox"/>	
		Confirm BAS annunciation when pumps are operated in hand <input type="checkbox"/>		<input type="checkbox"/>	
		Check default settings on sensors and alarms through BAS <input type="checkbox"/>		<input type="checkbox"/>	

Pump(s) Functional Performance Sheet



Dynamic Verification
(Continued)

BAS Commands

- Check stroke of bypass valve ☐ Check output to VSD's ☐
- Verify system enable based on field demand/time schedule ☐
- Check bypass valve position on system shutdown ☐

BAS Control Verification

- Note:** System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation
- Verify system pressure/temperature control stable at varied Set Points ☐
 - Verify location of the system pressure sensor ☐
 - Verify system pressure sensor is not Network based ☐
 - Verify system pressure SP against TAB report ☐
 - Verify bypass valve is fully closed with system at full flow ☐
 - Verify Calibration of all temperature and pressure sensors ☐

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Roof Top Unit (RTU) Functional Performance Sheet



Project: _____ System Type: Gas Heat with DX Cooling
Date: _____ System #: _____

Functional Performance Test Sheet Intent:

To verify the operation of the system against the sequence of operation. Including start-up, shutdown, unoccupied, power failure, and interlocks with other equipment, and sensor/actuator calibration.

Functional Performance Test Sheet Pre-requisites:

Item	Yes	No	Comments
Installation check sheet attached	<input type="checkbox"/>	<input type="checkbox"/>	
Uninterrupted gas supply available	<input type="checkbox"/>	<input type="checkbox"/>	
Air Balancing report reviewed	<input type="checkbox"/>	<input type="checkbox"/>	
Manufacturer's start up report attached with deficiencies cleared	<input type="checkbox"/>	<input type="checkbox"/>	
Technicians BAS point to point check list attached	<input type="checkbox"/>	<input type="checkbox"/>	
Approved sequence of operation attached	<input type="checkbox"/>	<input type="checkbox"/>	

Static Verification
(Some items may not be applicable)

Visual Check

Physical Integrity → Clear of dirt/debris ☐ Unit Installed correctly ☐ Unit labeled correctly ☐
 Drainage Check ☐ Insulation complete ☐

Filter condition → Permanent Filters Fitted ☐
 Temporary Filter Media Fitted ☐

Remote items operational → Heat Recovery Ventilator ☐

Dynamic Verification
(Some items may not be applicable)

Operational Check

TAB Verification → O.L Set to motor name plate rating ☐
 VSD settings based on motor name plate rating ☐

Check fan volume & SP @ design conditions ☐
 Area served by RTU operating at a Positive Pressure ☐
 Area served by RTU operating at a Negative Pressure ☐
 Check volume of terminals against TAB Report ☐

Hard wire interlocks → Freeze Stat ☐ RTU shutdown ☐ Dampers Close ☐
 BAS Annunciation ☐

Fire Alarm ☐ RTU shutdown ☐ BAS Annunciation ☐

Supply Fan damper interlocks operational ☐
 Burner shutdown on Gas failure ☐ BAS Annunciation ☐

Soft wire interlocks → Check default settings on sensors and alarms through BAS ☐
 RTU system common alarm ☐ BAS Annunciation ☐

Roof Top Unit (RTU) Functional Performance Sheet



Dynamic Verification <small>(Continued)</small>	BAS Commands	Check system enable <input type="checkbox"/> Check stroke of dampers <input type="checkbox"/>
		Verify time schedule operation <input type="checkbox"/> Verify system unoccupied temperature initiated operation of plant <input type="checkbox"/> Check system shutdown including cooling/heating <input type="checkbox"/> Check positions of motorized dampers on unit shutdown. <input type="checkbox"/> Verify Minimum Outside Air Requirements <input type="checkbox"/>
	BAS Control Verification	Note: System to be tested against the BAS Sequence of operation, a signed copy of the verified sequence will be provided with this documentation
		Verify and document differential between supply and exhaust air flow <input type="checkbox"/> Verify SA temperature control stable at varied set points <input type="checkbox"/> Verify Economy Cycle operation of dampers <input type="checkbox"/> Verify Calibration of all temperature and pressure sensors <input type="checkbox"/>

Comments:

Further work required:

Contractor	Sign:	Print:	Date:
Cx Authority	Sign:	Print:	Date:

Part 1 General

1.1 INSTALLATION/START-UP CHECKLISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up checklists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use checklists for equipment installation. Document checklist verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign checklists upon completion, certifying stated checks and inspections have been performed. Return completed checklists to Departmental Representative. Checklists will be required during commissioning.
- .5 Use of checklists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.2 COMMISSIONING FORMS

- .1 Refer to the forms attached in Appendix A - Commissioning (Cx) Plan.
- .2 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .3 Strategy for Use:
 - .1 Cx Plan has provided Cx forms to supplement the documentation that is require by the contractor.
 - .2 Contractor will meet with the CxA to coordinate documentation requirements and development of the ongoing Cx Plan and Functional Performance Verification Process.
 - .3 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .4 Confirm operation as per design criteria and intent.
 - .5 Identify variances between design and operation and reasons for variances.
 - .6 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .7 Record analytical and substantiating data.
 - .8 Verify reported results.
 - .9 Form to bear signatures of recording technician and reviewed and signed off by Contractor.
 - .10 Submit immediately after tests are performed.

- .11 Reported results in true measured SI unit values.
- .12 Provide Departmental Representative with originals of completed forms.
- .13 Maintain copy on site during start-up, testing and commissioning period.

1.3 LANGUAGE

- .1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.2 INSTRUCTORS

- .1 Contractor, mechanical contractor, controls contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .2 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out FP tests.

1.3 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective ongoing inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and troubleshooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.4 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 TAB and PV Reports.
- .3 Departmental Representative will review training manuals.

- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.5 SCHEDULING

- .1 Include in Construction Schedule time for training.
- .2 Deliver training during regular working hours.
- .3 Time Allocated for Final Training: ensure amount of time required for training on each item of equipment or system as follows:
 - .1 Segregation Wing
 - .1 Boiler system (2 hrs)
 - .2 DHW System (1 hrs)
 - .3 Air Handling System (1.5 hrs per individual unit)
 - .4 Controls (1hrs each air handler, boiler and system)
 - .5 Electrical & Fire Alarm (1 hrs)
 - .6 Miscellaneous (1 hrs)
 - .2 West - Mechanical Room
 - .1 Air Handling System (1.5 hrs per individual unit)
 - .2 Hydronic Pumps (1 hr each)
 - .3 Controls (1hrs each air handler and system)
 - .4 Electrical & Fire Alarm (1 hrs)
 - .5 Miscellaneous (1 hrs)
 - .3 Executive Area
 - .1 Air Handling System (1.5 hrs per individual unit)
 - .2 VAV System (1 hrs)
 - .3 Heating System (1 hrs)
 - .4 Controls (1hrs each air handler and system)
 - .5 Electrical & Fire Alarm (1 hrs)
 - .6 Miscellaneous (1 hrs)
 - .4 Tunnels / Cell Blocks
 - .1 Air Handling System (1.5 hrs per individual unit)
 - .2 Hydronic Pumps (1 hr each)
 - .3 Controls (2 hrs each air handler plus 3 hrs)
 - .4 Electrical & Fire Alarm (1 hrs)
 - .5 Miscellaneous (1 hrs)

- .5 East Mechanical Room – Food Service
 - .1 Air Handling System (1.5 hrs per individual unit)
 - .2 DHW System (2 hrs)
 - .3 Hydronic Pumps (1 hr each)
 - .4 Controls (1hrs each air handler, and system)
 - .5 Electrical & Fire Alarm (1 hrs)
 - .6 Miscellaneous (1 hrs)
- .6 Main Boiler Room – SIS
 - .1 Air Handling System (1.5 hrs per individual unit)
 - .2 Make Up Air system (2 Hrs)
 - .3 Hydronic Pumps (1 hr each)
 - .4 Controls (1hrs each air handler, and system)
 - .5 Electrical & Fire Alarm (1 hrs)
 - .6 Miscellaneous (1 hrs)
- .4 Training to occur after completion of Functional Performance Testing and Submission of Draft O&M manual.
- .5 Training to be completed prior to acceptance of unit or system or work area. Training is a requirement of acceptance by the facility. Each item being turned over must have training completed to be considered substantially complete.

1.6 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative and Contractor.

1.7 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

- .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.8 CONTRACTOR DEMONSTRATION AND TRAINING

- .1 Mechanical:
 - .1 Thoroughly instruct Facilities Manager in safe operation of systems and equipment after installation of Work. Coordinate with Commissioning Authority and arrange commissioning program and schedule for instruction times. Submit commissioning schedule to Commissioning Authority one week prior to commissioning of each system.
 - .2 Hire qualified service engineers and manufacturers' representatives to instruct Facilities Manager on specialized portions of installation, such as the following:
 - .1 Air Handling Units/Ventilation Systems.
 - .2 Direct Expansion Refrigeration Systems.
 - .3 Exhaust Air Systems.
 - .4 Heating Boiler Systems.
 - .5 Domestic Water Heaters.
 - .6 Pumps.
 - .7 Building Automation System.
 - .8 BAS Sequences of Operation.
 - .3 Submit to Commissioning Authority complete record of instructions as part of maintenance instructions and data book given. For each instructional period, include:
 - .1 Date.
 - .2 System and equipment involved.
 - .3 Names of persons giving instructions.
 - .4 Names of persons being instructed.
 - .5 Other persons present.
 - .4 Carry out training of staff and instruction of Facilities Manager within a period of 30 days unless otherwise agreed with Commissioning Authority.
 - .5 Permit Commissioning Authority and Facilities Manager usage of systems prior to Substantial Performance for testing and learning operational procedures.
 - .6 At end of training, obtain and submit to Commissioning Authority, signed statement of Facilities Manager stating they understand system and equipment installation, operation and maintenance requirements.

- .7 Arrange necessary inspections and obtain written approval and acceptance of equipment and systems requiring approval by authorities having jurisdiction, and subsequent correction of those unacceptable items to satisfaction of such authorities.
- .2 Electrical;
 - .1 Thoroughly instruct Facilities Manager in safe operation of systems and equipment after installation of Work. Coordinate with Commissioning Authority and arrange commissioning programme and schedule for instruction times. Submit commissioning schedule to Commissioning Authority one week prior to commissioning of each system.
 - .2 Hire qualified service engineers and manufacturers' representatives to instruct Facilities Manager on specialized portions of installation, such as the following:
 - .1 Life Safety Systems.
 - .2 Security Systems.
 - .3 Fire Alarm Systems.
 - .3 Submit to Commissioning Authority complete record of instructions as part of maintenance instructions and data book given. For each instructional period, include:
 - .1 Date.
 - .2 System and equipment involved.
 - .3 Names of persons giving instructions.
 - .4 Names of persons being instructed.
 - .5 Other persons present.
 - .4 Carry out training of staff and instruction of Facilities Manager within a period of 30 days unless otherwise agreed with Commissioning Authority.
 - .5 Permit Commissioning Authority and Facilities Manager usage of systems prior to Substantial Performance for testing and learning operational procedures.
 - .6 At end of training, obtain and submit to Commissioning Authority, signed statement of Facilities Manager stating they understand system and equipment installation, operation and maintenance requirements.
 - .7 Arrange necessary inspections and obtain written approval and acceptance of equipment and systems requiring approval by authorities having jurisdiction, and subsequent correction of those unacceptable items to satisfaction of such authorities.

1.9 VIDEO-BASED TRAINING

- .1 Manufacturer's videos to be used as training tool with Departmental Representative's review and written approval 2 months prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Provide Video recording of training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.

- .3 Production methods to be professional and high quality.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.2 APPROVALS

- .1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.3 GENERAL INFORMATION

- .1 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 HVAC - Heating, Ventilation and Air Conditioning.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 WHMIS - Workplace Hazardous Materials Information System.
- .2 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
 - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
 - .2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
 - .1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
 - .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
 - .4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.
 - .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.
 - .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
 - .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

- .8 Operating and maintenance manual - Section 3.2 of BMM.
- .9 Final commissioning plan as actually implemented.
- .10 Completed commissioning checklists.
- .11 Commissioning test procedures employed.
- .12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.
- .13 Commissioning reports.

1.4 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- .1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of mobilization.
- .3 Include original manufactures brochures and written information on products and equipment installed on this project.
- .4 Record and organize for easy access and retrieval of information contained in BMM.
- .5 Include completed PI report forms, data and information from other sources as required.
- .6 Inventory directory relating to information on installed systems, equipment and components.
- .7 Approved project shop-drawings, product and maintenance data.
- .8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.
- .9 Inventory and location of spare parts, special tools and maintenance materials.
- .10 Warranty information.
- .11 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .12 Maintenance program supporting information including:
 - .1 Recommended maintenance procedures and schedule.
 - .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.5 LIFE SAFETY COMPLIANCE (LSC) MANUAL

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:
 - .1 All possible Emergency situations modes including: presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.
 - .2 Failure of elevators and escalators.
 - .3 HVAC emergencies and fuel supply failures.
 - .4 Intrusion and security breach.
 - .5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

- .6 Dedicated emergency generators for high security projects, medical facilities and computer systems.
- .7 Emergency control procedures for fire, power and major equipment failure.
- .8 Emergency contacts and numbers.
- .9 Manual to be readily available and comprehensible to non- technical readers.

1.6 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
 - .1 General:
 - .1 Finalized commissioning plan.
 - .2 WHMIS information manual.
 - .3 Approved "as-built" drawings and specifications.
 - .4 Procedures used during commissioning.
 - .5 Cross-Reference to specification sections.
 - .2 Architectural and structural:
 - .1 Inspection certificates, construction permits.
 - .2 Roof anchor log books.
 - .3 PV reports.
 - .3 Fire prevention, suppression and protection:
 - .1 Test reports.
 - .2 Smoke test reports.
 - .3 PV reports.
 - .4 Mechanical:
 - .1 Installation permits, inspection certificates.
 - .2 Piping pressure test certificates.
 - .3 Ducting leakage test reports.
 - .4 TAB and PV reports.
 - .5 Charts of valves and steam traps.
 - .6 Copies of posted instructions.
 - .5 Electrical:
 - .1 Installation permits, inspection certificates.
 - .2 Electrical work log book.
 - .3 Charts and schedules.
 - .4 Locations of cables and components.
 - .5 Copies of posted instructions.
- .2 Assist Departmental Representative with preparation of BMM.

1.7 LANGUAGE

- .1 English and French Language to be in separate binders.

1.8 USE OF CURRENT TECHNOLOGY

- .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
- .2 Obtain Departmental Representative approval before starting Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION