

1.0: INQUIRY RESPONSES:

1. Acoustic Wall Components:

What Sound Wave Series is Specified?

Delete reference to Sound Wave Series noted in Specifications Section 09 84 00:
ACOUSTIC WALL COMPONENTS 2.2.1. Modify as indicated in Architectural
Specifications Clarifications, Article 3.0 this addendum.



2.0: CIVIL/LANDSCAPE

DRAWINGS:

C100: Add the following:

Include in price for supply and install of three (3) site signs as detailed on SKL1.
Exact location to be site verified.

ATTACHMENTS

1. Drawing Sketch SKL1

END OF CIVIL AND LANDSCAPE ADDENDUM

3.0 ARCHITECTURAL

SPECIFICATIONS:

1. Section 00 00 10 Add to Table of Contents:
 - Section 01 91 31 Plan COMMISSIONING (CX) PLAN
 - Section 01 91 33 COMMISSIONING FORMS
2. Add the following Specifications Sections
 - .1 Section 01 91 31 Plan COMMISSIONING (CX) PLAN (Total Pages-12)
 - .2 Section 01 91 33 COMMISSIONING FORMS (Total Pages - 17)
 - .3 Section 09 99 90 ROOM FINISH SCHEDULE (Total Pages - 1)
3. Specifications Section 07 81 00: APPLIED FIRE PROOFING
Modify 3.8 SCHEDULE as follows:
 - 3.8.1 Existing beams and columns in work area are sprayed with fire spray. Underside of Metal Deck is not sprayed. Limit damage to existing fire spray.
Install New fire spray in the following areas:
 - 1.) Lower Level Existing Beams, Joists and Columns: Refer to demolition plan A604 for extent of fire spray removals. Reapply new fire spray to clean and primed beams, joists and columns at demolished firespray locations and at areas of retrofit.
 - 2.) Lower Level New Beams and Joists: Apply new firespray to clean and primed beams and joists.
 - 3.) Main Floor Level Existing Beams, Joists and Columns: Refer to demolition plan A604 for extent of fire spray removals. Reapply

new fire spray to clean and primed beams, joists and columns at demolished firespray locations and at areas of retrofit.

- 4.) Main Floor Level New Beams and Joists: Apply new firespray to clean and primed beams and joists.
- 5.) All areas required to make work complete and as indicated on drawings.

4. Specifications Section 09 84 00: ACOUSTIC WALL COMPONENTS
Modify 2.2.1 as follows:

2.2 ACOUSTIC WALL PANEL TYPES

- .1 AAP-1 Acoustic Absorber Panel Type 1: sound absorber in upper frequency range, 500 Hz and above, and as follows
 - .1 Size: panel sizes 610 x 610 x 125 and as indicated on Drawings.
 - .2 Color and Fabric: Mold and Mildew and fire retardant (felt) panels with pre-formed raised patterned fabric, three colors to be selected from manufacturers entire color range.
 - .3 Install on solid backing on concealed fastening.

DRAWINGS:

5. Reference Drawing: A-601:
Add Note .5 to Wall Assembly Notes:
 - .5 Install acoustic sealant to top and bottom of wall at all walls with acoustic ratings.

W6 and W8 ULC reference should read W446 not 446
W10 ULC reference should read Z500, not Z502. Two layers Type X GWB is specified to match existing wall cladding construction.
6. Reference Drawing: A-603 Window Schedule:
Window A and Window B are 1 hour fire rated frames with 1 hour fire rated glazing. Glazing for frame is by frame supplier. Refer to 2.4.4.
Window D and Window E are Aluminum acoustically rated frames, refer to specifications section 08 56 00. These windows are not fire rated.
7. Reference Drawing: A-604 Demolition plan
 - .1 General Electrical Demolition Notes: ADD: Refer also to electrical drawings.
 - .2 Demolition Note C1: Clarification: There are two ceiling fans to be removed. Both are located on the main floor ceiling.
 - .3 Condition of Existing Space: There is existing hoarding in the space, this is constructed of steel studs with 12mm gypsum wall board installed on one side.

The existing hoarding is constructed from top of main floor to u/s of ceiling (2440MM high) and is braced to the underside of the structure for the full length of the existing mezzanine on Gird F.

There is also hoarding and a single door access at the top of stairs leading to the lower level. This material is to be removed and disposed of by the General Contractor but may be salvaged and reused for hoarding as indicated on A6504 or for drywall repairs.

8. Reference Drawing: A-605 New Main Floor Plan
 - .1 Revise wall studs from 92 to 200 mm on the north-east wall of room B-09, (Wall type W8.)
 - .2 Added Section Detail Reference for finished beam.
 - .3 Refer to revised drawing A605

9. Reference Drawing: A-606 New Lower Floor Dimension, Finish and Equipment Plan
 - .1 Notation CG-1 should Read SG-1.
 - .2 SH-2 shall be 4mm Rubber Backed Flooring not Linoleum Sheet Flooring
SH2 = RF1: refer to Room Finish Schedule attached in this Addendum.
 - .3 RF1- is noted as located on Main Floor. RF1 is located on the Lower Level.
Coordinate with Specifications Section 09 99 90 ROOM FINISH SCHEDULE added this Addendum.
 - .4 Clarification: column located at 2X-2Y is existing to remain, from top of Lower Floor to underside of Roof Deck. Protect from damage.
 - .5 Refer to revised drawing A606.

10. Reference Drawing: A-609 New Information Desk Equipment Plan, Dimension Plan and Finish Plan
 - .1 Add Notation SG-3 beside SG-2, to reflect the second portion of the bi-parting security grill around the information desk.
 - .2 Add one millwork Door to plan at location of SG-3 grill storage box.
 - .3 Clarification: location of expansion joint and existing slab edge is indicated.
 - .4 Refer to revised plan A609

11. Reference Drawing: A-619 Sectional Elevations
 - .1 Add Details 3 and 4, floor expansion joint and encased beam.
12. Reference Drawing: A-622 Sectional Elevations
 - .1 Revise lintels over windows A,B, D and E to metal C-Channels.

13. Reference Drawing: A623 and A624,
 - .1 Revise top of handrail post support. Drop post support 60 mm down under handrail and connect post to rail with 10 mm solid steel pin. Fasten to u/s rail and to cap plate on top of post, weld and grind smooth. Detail to permit handrail to be graspable along full length. This applies to all handrails in Theatre and theatre vestibule. (three locations)

14. Reference Drawing: A625,
 - .1 Include in price for Window Sills as defined indicated on A605/Corridor B13.
 - .2 Include in millwork price for Podium in theatre with plastic laminate finish. This was originally specified as a proprietary product. All substrates shall be moisture resistant. Functional requirements of this movable unit are described in 8.0 of Addendum 02.

ATTACHMENTS:

Specifications Section 01 91 31 Plan COMMISSIONING (CX) PLAN
Specifications Section 01 91 33 COMMISSIONING FORMS
Specifications Section 09 99 90 ROOM FINISH SCHEDULE

DRAWINGS

A605, A606, A609, A619

END OF ARCHITECTURAL ADDENDUM

4.0: STRUCTURAL

DRAWINGS:

1. Reference Drawing S631, Section 1 – Provide steel stud lintels over duct openings in stud walls. Lintels to consist of 2 – 100mm x 0.88mm steel studs; maximum span 1000mm. Refer to mechanical drawings for locations.

END OF STRUCTURAL ADDENDUM

5.0: MECHANICAL

SPECIFICATIONS:

1. Refer to Commissioning forms attached in Specifications Section 01 91 33 required for completion of the mechanical installation. Section 01 91 33 is added this Addendum.

END OF MECHANICAL ADDENDUM

6.0 ELECTRICAL

SPECIFICATIONS

1. Refer to Commissioning forms attached in Specifications Section 01 91 33 required for completion of the mechanical installation. Section 01 91 33 is added this Addendum.

END OF ELECTRICAL ADDENDUM

7.0: AV SYSTEMS

DRAWINGS:

1. Reference Drawings E660 AV INFRASTRUCTURE DETAILS
 - .1 EXPANSION JOINT CONDUIT DETAIL added, refer to A660

ATTACHMENTS:

E660

END OF AV ADDENDUM

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

- .1 American Water Works Association (AWWA)
- .2 National Fire Protection Association (NFPA)
- .3 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
 - .2 PWGSC General Procedures and Standards (GP&S),
 - .3 PWGSC CP -1.
- .4 CSA Z320-11 Building Commissioning,
- .5 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

- .1 Overview of Cx.
- .2 General description of elements that make up Cx Plan.
- .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .5 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.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 95% completed before added into Project Specifications.
- .2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 months during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
 - .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Developing BMM.
 - .6 Ensuring implementation of final Cx Plan.
 - .7 Performing verification of performance of installed systems and equipment.
 - .8 Implementation of Training Plan.
 - .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
 - .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.

- .2 Training.
- .3 Testing.
- .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
 - .5 Client: responsible for intrusion and access security systems.
 - .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
 - .4 Redistribution of electrical services.
 - .5 Modifications of fire alarm systems.
 - .6 Modifications to voice communications systems.
 - .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
 - .1 Architectural and structural:
 - .1 Accessibility and operational safety:
 - .2 Doors, windows, related hardware:
 - .1 Special doors in laboratories as identified herein:
 - .2 new door and window hardware.
 - .2 Commission mechanical systems and associated equipment:
 - .1 HVAC and exhaust systems:
 - .1 HVAC systems
 - .2 General exhaust systems
 - .3 Exhaust systems and related systems
 - .4 Smoke control systems installed is contract.
 - .2 Fire and life safety systems:
 - .1 Heat Detection Fire suppression systems
 - .2 Fire extinguishers.
 - .3 Noise and vibration control systems for mechanical systems.
 - .3 Commission electrical systems and equipment:
 - .1 High voltage:
 - .1 High voltage distribution systems.
 - .2 Low voltage below 750 V:
 - .1 Low voltage equipment.
 - .2 Low voltage distribution systems.
 - .3 Central clock systems.
 - .4 Voice communications systems.
 - .5 Audio/visual systems.
 - .6 Electronic data and communications information systems.
 - .7 Simultaneous translation systems.
 - .8 MP's call systems.
 - .3 Lighting systems:
 - .1 Lighting equipment.
 - .2 Distribution systems.
 - .3 Emergency lighting systems, including battery packs.
 - .4 Fire exit emergency signage.
 - .4 Fire alarm systems, equipment:
 - .1 Control panels.
 - .2 Fire alarm battery banks.

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:

- .1 Compile English documentation.
- .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests of following witnessed by PWGSC Design Quality Review Team:
 - .10 Tests performed by Owner/User
 - .11 Training Plans.
 - .12 Cx Reports.
 - .13 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor all of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor some of these inspections and tests.
 - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:
 - .1 Doors, windows, related hardware:
 - .1 Door and window hardware.
- .3 Pre-Cx activities - MECHANICAL:
 - .1 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, 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.
 - .2 EMCS:
 - .1 EMCS trending to be available as supporting documentation for performance verification.
 - .2 Perform point-by-point testing in parallel with start-up.
 - .3 Carry out point-by-point verification.
 - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.
 - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.
 - .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".
- .4 Pre-Cx activities - LIFE SAFETY SYSTEMS
 - .1 Include equipment and systems identified above.

- .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .5 Pre-Cx activities - ELECTRICAL:
 - .1 Low voltage distribution systems under 750 V:
 - .1 Requires independent testing agency to perform pre- energization and post-energization tests.
 - .2 Lighting systems:
 - .1 Emergency lighting systems:
 - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
 - .3 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.
 - .4 Low voltage systems: these include:
 - .1 Clock, communications, low voltage lighting control systems and data communications systems.
 - .2 Special systems such as Simultaneous Translation systems, MPs Call systems, Messenger Call systems, Division Bell systems.
 - .5 Security, surveillance and intrusion alarm systems: to include verification by RCMP and Departmental Representative.
 - .6 Lightning protection systems.
 - .7 Watchman's tour systems.

1.12 **START-UP**

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
- .3 Departmental Representative to monitor all of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.

- .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
- .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.
- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
 - .1 HVAC and associated systems forming part of integrated HVAC systems
 - .2 Smoke control systems
 - .3 Indoor air quality
 - .4 Environmental space conditions
 - .5 Fire alarm systems
 - .6 Voice communications systems
 - .7 Emergency lighting systems
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Project Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to

PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms

1.17 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.19 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.
 - .4 Cx procedures: 3 months after award of contract.
 - .5 Cx Report format: 3 months after contract award.
 - .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
 - .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
 - .8 Notification of intention to start TAB: 21 days before start of TAB.
 - .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
 - .10 Notification of intention to start Cx: 14 days before start of Cx.

- .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
- .12 Identification of deferred Cx.
- .13 Implementation of training plans.
- .14 Cx of smoke management/control systems: after Cx of related systems is completed and 7 days before proposed date of Cx these systems.
- .15 Cx reports: immediately upon successful completion of Cx.
- .16 Emergency evacuation exercises: after 80% occupancy and at same time as Cx of stair shaft pressurization systems.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Consultant, Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.20 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.21 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.22 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project

1.23 TRAINING PLANS

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

1.24 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.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

- .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 check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.7 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.

- .12 Maintain copy on site during start-up, testing and commissioning period.
- .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual.

1.8 LANGUAGE

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

AIR HANDLING UNIT DATA SHEET (AHU-XX)

	Specification	Shop Drawing	Installed
Manufacturer:			
Model:			
Serial Number:			
Type:			
Location:			
Air Volume:			
Static Pressure:			
Voltage			
Phase			
HP:			

INSTALLATION:

Fan Housing:		Belt Size/Number:		Thrust Absorbers:	
Bearing Type:		Pulley Size / #:			
Alignment/Tension:		Flex Connections:			
Local Disconnect:		Access:			
Magnetic Starter:		Fan Rotation:			
MCC Number		Unit Identification:			
Acoustic Insulation:		Interlocks:			

REMARKS/COMMENTS:

.....

.....

CHECKED BY CONTRACTOR:.....

COMPANY.....DATE:.....

WITNESSED BY AND APPROVED BY CONSULTANT:.....

COMPANY.....DATE:.....

EXHAUST FAN DATA SHEET (EF-XX)

	Specification	Shop Drawing	Installed
Manufacturer:			
Model:			
Serial Number:			
Type:			
Location:			
Air Volume:			
Static Pressure:			
FRPM:			
Voltage			
Phase			
HP:			

INSTALLATION:

Fan Housing:		Belt Size/Number		Access:	
Bearing Type:		Pulley Size / #		Silencer:	
Alignment/Tension:		Back Draft Damper:		Fan Rotation:	
Local Disconnect:		Roof Curb:		Unit Identification:	
Magnetic Starter:		Flex Connections:		Interlocks	
MCC Number		Inlet Cone:		Thrust Absorbers:	
Acoustic Insulation:		Outlet Cone:			

REMARKS/COMMENTS:

.....

.....

CHECKED BY CONTRACTOR:.....

COMPANY.....DATE:.....

WITNESSED BY AND APPROVED BY CONSULTANT:.....

COMPANY.....DATE:.....

FORCE FLOW HEATER DATA SHEET (FF-XX)

	Specification	Shop Drawing	Installed
Manufacturer:			
Model:			
Serial Number:			
Location:			
Heating Capacity:			
Voltage:			
Phase:			

INSTALLATION:

Unit Identification:					

REMARKS/COMMENTS:

.....

.....

CHECKED BY CONTRACTOR:.....

COMPANY.....DATE:.....

WITNESSED BY AND APPROVED BY CONSULTANT:.....

COMPANY.....DATE:.....

TEST 1 General

1.1 SYSTEM TEST PURPOSES

- .1 The intent is to test all system components through a series of check and procedures designed to exercise the system as it would be used in normal and abnormal operating procedures.
- .2 To ensure system operation as per contract documents.
- .3 To make adjustments to the system components as required to the design intent and operational requirements.
- .4 Abbreviations:
 - .1 “C” denotes contractor sign off.
 - .2 “E” denotes Engineer’s verification.

TEST 2 Theatre Ventilation Unit System Test

1.2 TEST PURPOSES

- .1 To test all heating system components and controls that pertains to the Theatre space.

1.3 TEST PRE-REQUISITES

- | | | C | E |
|----|--|----|----|
| .1 | All component verifications are complete and approved. | [] | [] |
| .2 | Air balance is complete. | [] | [] |
| .3 | Vendor start-up and testing has been completed. | [] | [] |

1.4 REQUIRED ITEMS

- | | | C | E |
|-----|--|----|----|
| .1 | Ensure that system controller has been programmed with adequate occupancy schedule. | [] | [] |
| .2 | Ensure that the outdoor air damper closes when the unit is shut down and opens to minimum opening area when starting the unit. | [] | [] |
| .3 | Ensure that the exhaust air damper closes when the unit is shut down and opens to minimum opening area when starting the unit. | [] | [] |
| .4 | Ensure that the return air damper is fully open when the unit is shut down and is closed to the maximum opening area when starting the unit. | [] | [] |
| .5 | Verify that supply fan and associated exhaust fan are energised at the same time when a call for cooling is made. | [] | [] |
| .6 | Verify that outdoor air damper and exhaust air damper maintain identical opening areas. | [] | [] |
| .7 | Verify that outdoor air louver adequately modulates open on call for cooling. | [] | [] |
| .8 | Verify that exhaust air louver adequately modulates open on call for cooling. | [] | [] |
| .9 | Verify that return air louver adequately modulates closed on call for cooling. | [] | [] |
| .10 | Verify that electric heating coil is energised on low supply air temperature. | [] | [] |

- .11 Verify that supply fan, exhaust fan and electric heating coil are energised on call for heating during unoccupied hours. [] []
- .12 Verify that force flow heater energises on call for heating. [] []

Remarks/Comments:

.....

.....

Signature of Contractor:.....Date:.....

Name of Contracting Firm.....

Signature of Consultant:.....Date:.....

Name of Consultant Firm.....

TEST 3 A/V Room Ventilation Unit System Test

1.5 TEST PURPOSES

- .1 To test all heating system components and controls that pertains to the A/V Room.

1.6 TEST PRE-REQUISITES

- | | | C | E |
|----|--|-----|-----|
| .1 | All component verifications are complete and approved. | [] | [] |
| .2 | Air balance is complete. | [] | [] |
| .3 | Vendor start-up and testing has been completed. | [] | [] |

1.7 REQUIRED ITEMS

- | | | C | E |
|----|--|-----|-----|
| .1 | Verify that exhaust fan is energised on call for cooling. | [] | [] |
| .2 | Verify that exhaust fan shuts down when acceptable temperature is achieved in the space. | [] | [] |

Remarks/Comments:

.....

.....

Signature of Contractor:.....Date:.....

Name of Contracting Firm.....

Signature of Consultant:.....Date:.....

Name of Consultant Firm.....

TEST 4 Gallery Ventilation Unit System Test

1.8 TEST PURPOSES

- .1 To test all heating system components and controls that pertains to the Gallery.

1.9 TEST PRE-REQUISITES

- | | | | |
|----|--------------------------|----|----|
| | | C | E |
| .1 | Air balance is complete. | [] | [] |

1.10 REQUIRED ITEMS

- | | | | |
|----|--|----|----|
| | | C | E |
| .1 | Verify that electric baseboards are energised on call for heating. | [] | [] |
| .2 | Ensure that existing ventilation system temperature sensor is operational. | [] | [] |

Remarks/Comments:

.....

.....

Signature of Contractor:.....Date:.....

Name of Contracting Firm.....

Signature of Consultant:.....Date:.....

Name of Consultant Firm.....

Project _____

EMERGENCY LIGHT UNIT TEST REPORT

Room No.: _____

Room Name: _____

Circuit No.: _____

No. Remote Heads: _____

No. Lamp Heads: _____

INDICATE ACCEPTANCE
WITH A (✓) MARK

INSTALLATION REVIEW

COMMENTS

Adjacent Receptacle ()

Location ()

Mounting ()

Wire Guard ()

Properly Aimed Direction ()

OPERATIONAL CHECKS

Test Switch ()

Ammeter ()

Voltmeter ()

Pilot Light ()

Auto Recharge ()

Wired to Exit Lights ()

Lamp Head Operation ()

Remote Head Operation ()

REMARKS

(Signature of Testing Agent)

(Name of Testing Firm)

(Date)

Project _____

PANELBOARD TEST REPORT

Panel ID.: _____ Isolated Ground: _____
Panel Location: _____ Main Breaker Size _____
Manufacturer: _____ No. of Circuits: _____
Model No.: _____ Bus Bracing kA: _____
Volt/Phase/Wire: _____ Mounting (F/S): _____
Bus Amp: _____ Contactor Size: _____

INDICATE ACCEPTANCE
WITH A (✓) MARK

INSTALLATION REVIEW

COMMENTS

Nameplate Complete ()
Identification Lamicoid ()
Cable and Wiring Identifications ()
Spare Conduit Stub-ups ()
Breaker Lock-On Device* ()
Filler Pieces In Place ()
Door and Key Lock ()
Grounding of Equipment ()
Typewritten Panel Directory Confirmed ()
Condition of Assembly & Paint Finish ()
Equipment Cleanliness ()
Clearance around Equipment ()

REMARKS

Note: * (1) List Circuit Breaker with Lock-On Device in Remarks

(Signature of Testing Agent)

(Name of Testing Firm)

(Date)

Project

INTERIOR LIGHTING TEST REPORT

CHECK:(✓)	ROOM #	ROOM #	ROOM #	ROOM #	ROOM #	ROOM #
LUMINAIRE CLEAN						
LUMINAIRE MOUNTING						
BALLAST						
DIFFUSER						
LAMPS						
MEASURED LIGHTING LEVEL (fc) (NOTE 1)						
SWITCH TYPE: (Check Operation)						
LINE VOLTAGE SWITCH						
LOW VOLTAGE SWITCH						
DIMMER						
CONTACTOR						
EMERGENCY LIGHTING						
NIGHT LIGHT						

Notes: (1) Natural daylight should not be included in these values. For a large room, a minimum of three readings should be taken.

REMARKS

(Signature of Testing Agent)

(Name of Testing Firm)

(Date)

TELEPHONE / DATA SYSTEM START-UP REPORT

Telephone: _____	Data: _____
Backboard Size: _____	Backboard Size: _____
Location: _____	Location: _____
Telephone Jack: _____	Data Jack: _____
Tel. Cable: _____	Data Cable: _____
Ground Wire: _____	Ground Wire: _____

INDICATE ACCEPTANCE
WITH A (✓) MARK

<u>INSTALLATION REVIEW</u>	<u>CONTRACTOR</u>	<u>CONSULTANT</u>	<u>COMMENTS</u>
Equipment Conform to Shop Drawings	()	()	
Identification Lamicoid	()	()	
Cable and Wiring Identifications	()	()	
Sufficient Length of Slack Cable	()	()	
Data Patch Panel	()	()	
Cable Terminations Complete	()	()	
Neatness of Cabling	()	()	
Telephone/Data Outlets Identification	()	()	
All System Components Identified	()	()	
Power Supply	()	()	
Equipment Grounding	()	()	
Wiring & Schematic Diagrams	()	()	
System Interconnections:			
_____ Conduit to _____	()	()	
_____ Conduit to _____	()	()	

TEST RESULTS

Attach Contractor's Data Cable Testing Results

REMARKS

(Signature of Contractor)

(Name of Contracting Firm)

(Date)

(Signature of Consultant)

(Name of Consulting Firm)

(Date)

