

## 1. GENERAL

### 1.1 Summary

- .1 Section includes:
  - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to FPT of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Requirements
  - .1 Section 01 91 31 – Commissioning Plan;
  - .2 Section 01 91 33 – Commissioning Forms;
  - .3 Section 01 91 41 – Commissioning Training;
  - .4 Section 01 91 51 – Building Management Manual;
  - .5 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.
- .3 Acronyms:
  - .1 BMM - Building Management Manual.
  - .2 Cx - Commissioning.
  - .3 EMCS - Energy Monitoring and Control Systems.
  - .4 O&M - Operation and Maintenance.
  - .5 PI – Product Information
  - .6 FPT - Functional Performance Testing
  - .7 TAB - Testing, Adjusting and Balancing.
  - .8 CxA – Commissioning Authority.

### 1.2 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 assists 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's requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

### 1.3 Commissioning Overview

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
  - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative and CxA.
  - .2 Equipment, components, systems, and interaction between those systems have been commissioned.
  - .3 O&M training has been completed.

### 1.4 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 non-functional system, including related systems as deemed required by Departmental Representative and CxA, to ensure effective performance.
- .2 Cost 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 hold-back assessments.

### 1.5 Pre-Cx Review

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Departmental Representative and CxA.
    - .1 Adequacy of provisions for Cx.
    - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
  - .1 Coordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
  - .1 Have completed Cx Plan up-to-date.
  - .2 Ensure installation of related components, equipment, sub-systems and systems are complete.
  - .3 Fully understand Cx requirements and procedures.

- .4 Have Cx documentation shelf-ready.
- .5 Understand completely design criteria and intent and special features.
- .6 Submit complete start-up documentation to Departmental Representative and CxA for approval.
- .7 Have Cx schedule up-to-date.
- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems; submit TAB reports to Departmental Representative and CxA for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .11 Inform Departmental Representative and CxA in writing of discrepancies and deficiencies on finished works.

#### 1.6 Conflicts

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

#### 1.7 Action and Informational Submittals

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit no later than four (4) weeks after award of Contract:
    - .1 Name of Contractor's Cx agent accompanied with a list a relevant projects realized by that person.
    - .2 Draft Cx documentation.
    - .3 Preliminary Cx schedule.
- .2 Request in writing to Departmental Representative and CxA for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
- .3 Submit proposed Cx procedures to Departmental Representative and CxA were not specified and obtain written approval at least 8 weeks prior to start of Cx.
- .4 Provide additional documentation relating to Cx process required by Departmental Representative and CxA

#### 1.8 Commissioning Documentation

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Functional Performance Testing (FPT) Forms for requirements and instructions for use.
- .2 Departmental Representative and CxA to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative and CxA.

**1.9 Commissioning Schedule**

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
  - .1 Approval of Cx reports.
  - .2 Verification of reported results.
  - .3 Repairs, retesting, re-commissioning, re-verification.
  - .4 Training.

**1.10 Commissioning Meetings**

- .1 Convene Cx meetings following project meetings: Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM) and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM). Departmental Representative to 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 and subcontractors, addressing delays and potential problems.
  - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by the Contractor's Cx Agent, who will record and distribute minutes.
- .7 CxA will call for Cx meetings when deemed necessary or to coordinate specific issues.
- .8 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

**1.11 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.

**1.12 Witnessing of Starting and Testing**

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.

- .3 Departmental Representative will witness some tests and/or will ask that tests be repeated if required.
- .4 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

#### 1.13 Manufacturer's Involvement

- .1 Factory testing: manufacturer to:
  - .1 Coordinate time and location of testing.
  - .2 Provide testing documentation for approval by Departmental Representative and CxA.
  - .3 Arrange for Departmental Representative to witness tests.
  - .4 Obtain written approval of test results and documentation from Departmental Representative and CxA before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative and 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 manufacturers 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.

#### 1.14 Procedures

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
  - .1 Included in delivery and installation:
    - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
    - .2 Visual inspection of quality of installation.
  - .2 Start-up: follow accepted start-up procedures and Manufacturer's recommendation.
  - .3 Operational testing: document equipment performance.
    - .1 System FPT: include repetition of tests after correcting deficiencies.
    - .2 Post-substantial performance verification: to include fine-tuning.
    - .3 Seasonal testing: to include full-load and partial load verification based on seasonal environmental conditions (i.e: summer, winter).

- .3 Correct deficiencies and obtain approval from Departmental Representative and CxA after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved FPT 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 and CxA.
  - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative and CxA.
  - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    - .1 Rejected equipment to be removed from site and replace with new.
    - .2 Subject new equipment/systems to specified start-up procedures.

#### 1.15 Start-up Documentation

- .1 Assemble start-up documentation and submit to Departmental Representative and CxA for approval before commencement of commissioning.
- .2 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 check lists.
  - .4 Start-up reports,
  - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative and CxA to repeat start-up at any time.

#### 1.16 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 and CxA 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.

#### 1.17 Test Results

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

**1.18 Start of Commissioning**

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

**1.19 Instruments/Equipment**

- .1 Submit to Departmental Representative and CxA 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 2-way radios.
  - .2 Ladders.
  - .3 Equipment as required to complete work.

**1.20 Commissioning Performance Verification**

- .1 Carry out Cx:
  - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
  - .2 On independent systems and on integrated systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

**1.21 Witnessing Commissioning**

- .1 Departmental Representative and CxA to witness activities and verify results.

**1.22 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 and CxA within 5 days of test and with Cx report.

**1.23 Commissioning Constraints**

- .1 It is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

- .2 In case it is not possible to complete full load testing because of environmental conditions (i.e. test the full load of boilers in the summer), provisions must be made to perform those tests during the course of the year before final acceptance.

#### 1.24 **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 by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.
- .2 Article 1.24.1 excludes the heating system and all of its components for which no extrapolation will be permitted.

#### 1.25 **Extent of Verification**

- .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative and CxA.
- .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 and CxA.

#### 1.26 **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.

#### 1.27 **Deficiencies, Faults, Defects**

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

#### 1.28 **Completion of Commissioning**

- .1 Upon completion of Cx leave systems in normal operating mode.



.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative and CxA.

#### 1.29 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.

#### 1.30 Training

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

#### 1.31 Maintenance materials, Spare Parts, Special Tools

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

#### 1.32 Occupancy

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

#### 1.33 Installed Instrumentation

.1 Use instruments installed under Contract for TAB and FPT 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.

#### 1.34 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.

**1.35 Owner's Performance Testing**

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

**2. PRODUCTS**

**NOT USED.**

**3. EXECUTION**

**NOT USED.**

**End of Section**

## 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 Related Requirements

- .1 Section 01 91 33 – Commissioning Forms;
- .2 Section 01 91 41 – Commissioning Training;
- .3 Section 01 91 51 – Building Management Manual;
- .4 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.

### 1.3 References

- .1 American Water Works Association (AWWA)
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA-13-02, Installation of Sprinkler Systems Handbook.
  - .2 NFPA-14-02, Automatic Sprinkler Systems Handbook.
  - .3 NFPA-20-03, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .3 Public Works and Government Services Canada (PWGSC)
  - .1 PWGSC - Commissioning Guidelines CP.1 -3rd edition-[06].
- .4 ASHRAE Guideline 0-2005 – The Commissioning Process;
- .5 ASHRAE Guideline 1.1-2007 – HVSC&R Technical Requirements for the Commissioning Process;
- .6 NIBS Guideline 3-2006 – Exterior Enclosure Technical Requirements for the Commissioning Process;
- .7 ASHRAE Guideline 4-2008 – Preparation of Operating and Maintenance Documentation for Building Systems;
- .8 ASHRAE Guideline 5-1994 Commissioning Smoke Management Systems;
- .9 ASHRAE Guideline 11-2009 – Field Testing of HVAC Controls Components;
- .10 ASHRAE 202-2013 – Commissioning process for Building and System
- .11 CSA Z320-2011 – Building Commissioning Standard
- .12 Portland Energy Conservation Inc. – Model Commissioning Plan and Guide Specifications;

- .13 SMACNA HVAC Systems Commissioning Manual;
- .14 NEBB Procedural Standards for Whole Building Systems Commissioning of New Construction;
- .15 LEED® Canada 2009 – Reference Manual;
- .16 PWGSC General Procedures and Standards (GP&S).
- .17 Underwriters' Laboratories of Canada (ULC)

#### 1.4 General

- .1 Provide a fully functional facility:
  - .1 Interaction between Systems, 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 Describe process of verification of how built works meet Owner Project Requirements (OPR) and 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 SV – Static Verification
  - .7 OV – Operational Verification.
  - .8 TAB - Testing, Adjusting and Balancing.
  - .9 WHMIS - Workplace Hazardous Materials Information System.
  - .10 CxA – Commissioning Authority

- .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.

#### 1.5 Development of 100% Cx Plan

- .1 Cx Plan 95% complete.
- .2 Cx Plan to be 100% complete at least 12 weeks before the start of Cx.
  - .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. Project construction team's and Cx team's requirements.
- .3 Submit 100% complete Cx Plan to Departmental Representative and CxA and obtain written approval.

#### 1.6 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 and CxA for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

#### 1.7 Composition, Roles and Responsibilities of Cx Team

- .1 Departmental Representative to maintain overall responsibility for project. The CxA will act as a 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 processes are developed in the Cx Plan by the Prime Consultant to deliver a fully operational project.
  - .3 Departmental Representative and CxA are responsible for:
    - .1 Organizing Cx and developing Cx documentation.
    - .2 Monitoring of Cx activities, training, and development of Cx documentation.
    - .3 Witnessing, verifying accuracy of reported results.
    - .4 Witnessing and verifying TAB and other tests.

- .5 Developing BMM.
- .6 Implementation of Training Plan.
- .7 Ensuring implementation of final Cx Plan.
- .8 Testing and verification procedures and sequences of operation for commissioning the equipments, systems and integrated systems must be reviewed and approved by the design consultant before the test and after the test.
- .9 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
- .10 Performing verification of performance of installed systems and equipment.
- .11 Work closely with members of Cx Team.
- .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 Departmental Representative and PWGSC Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx of Construction Team 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.

## 1.8 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.
- .2 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:
  - .3 Modify ventilation rates to meet changes in off-gassing.

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- .4 Changes to heating or cooling loads beyond scope of EMCS.
  - .5 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
  - .6 Redistribution of electrical services.
  - .7 Modifications of fire alarm systems.
  - .8 Modifications to voice communications systems.
- .3 Provide names of participants to Departmental Representative and CxA and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.
  - .4 Client: responsible for intrusion and access systems.
- 1.9 **Extent of Cx (system list on Appendix A of this section & specific Cx plan on Appendix B on this section)**
- .1 Commission mechanical systems and associated equipment:
    - .1 Plumbing systems:
      - .1 Domestic CWS and HWS (including emergency water system).
      - .2 Regular sanitary waste systems.
      - .3 Sump pumps.
      - .4 Fuel oil with tank for heating system and main tank.
    - .2 HVAC and exhaust systems:
      - .1 HVAC systems.
      - .2 Exhaust systems and related systems.
      - .3 Heat recovery systems.
    - .3 Fire and life safety systems:
      - .1 Special fire suppression systems identified herein:
        - .1 Pre-action system.
      - .2 Fire pumps, including transfer switches and controllers.
      - .3 Wet pipe sprinkler systems.
      - .4 Dry pipe sprinkler systems.
      - .5 Hose systems
      - .6 Fire extinguishers.
    - .4 Noise and vibration control systems for mechanical systems.
      - .1 HVAC acoustical level to be measured
    - .5 Seismic restraint and control measures.
      - .1 On equipments where required as specified.
    - .6 EMCS: All.
  - .2 Commission electrical systems and equipment:
    - .1 Medium voltage:
      - .1 Medium voltage switch gear and transformation equipment.
      - .2 Medium voltage distribution system.
    - .2 Low voltage below 750 V:
      - .1 Low voltage equipment.
      - .2 Low voltage distribution system.
      - .3 Central clock system.
      - .4 Voice communications system.
      - .5 Communications structure cabling information system.

- .3 Lighting systems:
  - .1 Lighting equipment.
  - .2 Distribution system.
  - .3 Emergency lighting system, including battery packs.
  - .4 Fire exit emergency signage.
  - .5 Automatisation and control system.
- .4 Fire alarm systems, equipment:
  - .1 Annunciators.
  - .2 Control panels.
  - .3 Fire alarm battery banks.
  - .4 Fire alarm components.
- .5 Other systems and equipment:
  - .1 Intrusion, access control and video-surveillance systems.
  - .2 Grounding and ground fault system.

#### 1.10 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 prepared on client's form and followed client's specifications.
  - .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.
  - .8 Preventive maintenance program.
  - .9 Contractor's and sub-contractors' as-built drawings.

#### 1.11 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:
  - .1 Cx Specifications.
  - .2 Startup, pre-Cx activities and documentation for systems, and equipment.



- .3 Completed installation checklists and static verification forms (SV).
- .4 Completed product information (PI) report forms. – on client's form for maintenance purpose.
- .5 Completed Functional Performance Testing (FPT) report forms and operational verification forms (OV).
- .6 Results of Performance Verification Tests and Inspections.
- .7 Cx Issues Log.
- .8 Tests procedures
- .9 Recommissioning manual
- .10 Test Data Reports
- .11 Description of Cx activities and documentation.
- .12 Description of Cx of integrated systems and documentation.
- .13 Tests witnessed by Departmental Representative.
- .14 Training Plans.
- .15 Cx Reports.
- .16 Prescribed activities during warranty period.

#### 1.12 Pre-Cx Activities and Related Documentation

- .1 Items listed in this Cx Plan include the following:
  - .1 Pre-Start-Up inspections: 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 some 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.
  - .6 Departmental Representative will monitor some of these inspections and tests.
  - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - 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 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.
  - .3 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 days test period. During this period, provide graphics and registered data every week, with variations curves on parameters chosen to demonstrate stability and performance of each system.
- .6 Additional tests to be completed as "Off-Season Tests" or differed tests for weather sensitive systems.
- .3 Pre-Cx activities - ELECTRICAL:
  - .1 Medium voltage distribution systems
  - .2 Low voltage distribution systems under 750 V:
    - .1 Requires independent testing agency to perform pre-energization and post-energization tests.
  - .3 Lighting systems:
    - .1 Emergency lighting systems:
      - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
  - .4 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements.
  - .5 Low voltage systems: these include:
    - .1 Clock, communications, low voltage lighting control systems and data communications systems.
  - .6 Security, surveillance and intrusion alarm systems: to include verification by Departmental Representative.
  - .7 Grounding and ground fault systems

### 1.13 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: All.
- .3 Departmental Representative to monitor some of these start-up activities.
  - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Functional Performance Testing (FPT):
  - .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 verify reported results using approved static and operational verification forms.
  - .4 Contractor's Cx agent to approve completed FPT (operational verification) 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 operational and performance report or report of system startup and testing.

#### 1.14 Cx Activities and Related Documentation

- .1 Perform Cx using procedures developed by ASHRAE, NEBB, SMACNA, or any known organization related to the application of Cx process and approved by the Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved operational and performance verification forms.
- .4 Contractor Cx agent 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.

#### 1.15 Cx of Integrated Systems and Related Documentation

- .1 Cx to be performed by Cx specialist, using procedures developed by ASHRAE, NEBB, SMACNA, or any known organization related to the application of Cx process and approved by Departmental Representative. Cx specialist will follow also the Cx specific plan for each system prepared by Departmental Representative.
- .2 Required presence and support of Contractor and sub-contractors specialists during testing of integrated systems. These tests will start after all static and operational verifications of individual equipments and systems will be completed.
- .3 Duration of tests for integrated systems: 5 days.
- .4 Tests of integrated systems will follow protocols to be prepared by Departmental Representative in accordance with sequences of operation, see article 3.1.3, section 25 01 11.
- .5 Tests to be witnessed by Contractor Cx agent and documented on approved report forms.
- .6 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Contractor Cx agent and submitted to Departmental Representative for review.
- .7 Departmental Representative reserves right to verify percentage of reported results.
- .8 Integrated systems to include:
  - .1 HVAC and associated systems forming part of integrated HVAC systems.
  - .2 Indoor air quality.
  - .3 Indoor ambient parameters.
  - .4 Environmental space conditions.
  - .5 Fire alarm systems
  - .6 Fire pumps and controllers.

- .7 Voice communications systems.
- .8 Emergency lighting systems.
- .9 Test of integrated systems will follow different status to verify systems' respond on multiple loops:
  - .1 **Normal operation (occupied / unoccupied mode):**
    - .1 Variation of set points on HVAC systems;
    - .2 Measurements of indoor ambient parameters (temperature, relative humidity, noise, vibration) and indoor air quality (CO2);
    - .3 Measurements of pressure differential according to pressurisation drawings;
    - .4 Status for sprinkler system, fire pump and fire alarm system – diagram and graphics;
    - .5 Status for lighting – diagram and graphics;
    - .6 Status for voice communication systems;
    - .7 Status for access control and intrusion doors, diagram and graphics;
    - .8 Measured values, reports, graphics to be obtained from BAS.
  - .2 **Emergency status during fire alarm detection:**
    - .1 Status for generator with ventilation system including dampers;
    - .2 Verification of HVAC systems to be off as per sequences of operation;
    - .3 Verification of fume hoods, operating as per sequences of operation;
    - .4 Verification of control access components interlocked with fire alarm system
    - .5 Verification of status for elevators;
    - .6 Verification of alarms sent to BAS and to security post. All emergency procedures to be prepared by others;
    - .7 Verification of emergency lighting systems, measurements to respect minimum lighting level for security and corridor issues;
    - .8 Verification of voice communication systems.
  - .3 **Electrical power failure mode:**
    - .1 Verification of status for HVAC systems;
    - .2 Verification of status for boilers and components;
    - .3 Verification of status for elevators;
  - .4 **Alarm detection:**
    - .1 Maintenance alarms - report from BAS for all equipments base building during commissioning process;
    - .2 Emergency alarms – alarms sent to security post and / or remote to central, phone, mobile.
- .10 Identification:
  - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Project Manager, Property Manager and CxA 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. Contractor shall prepare all forms on client's data sheet format (to be available) using identification codes provided by PWGSC. Each equipment has to be identified with MMS code, on lamicoid plate, as per client's requirements

## 1.16 Installation Check Lists

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists.

- .2 Refer to Appendix B, section 01 91 31 – Commissioning Specific Plan, static verification (SV) forms.

#### 1.17 Product Information (PI) Report Forms

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Product Information (PI) Forms.
- .2 Refer to client's data sheet to be completed for maintenance purpose

#### 1.18 Functionnal Performance Testing (FPT) Report

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Functionnal Performance Testing (FPT) Forms.
- .2 Refer to Appendix B, section 01 91 31 – Commissioning Specific Plan, operational verification (OV) forms.
- .3 Refer to Section 25 01 11 – Start-up, verification and commissioning, for 30 days test, trends and detailed graphic curves.

#### 1.19 Deliverables Relating to administration of Cx

- .1 General:
  - .1 Complete Cx of occupancy, weather and seasonal-sensitive equipment and systems and provide a full operational test in real weather conditions. Document all these different tests and transmit to Departmental Representative to complete O&M Manual.

#### 1.20 Cx Schedules

- .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval at the 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: 90 days 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: to begin 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 reports: immediately upon successful completion of Cx.

- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Departmental Representative, Contractor and Contractor's Cx agent will monitor progress of Cx against this schedule.

#### 1.21 Cx Reports

- .1 Submit reports of tests, witnessed and certified by Contractor's Cx agent to Departmental Representative who will verify reported results.
- .2 Include completed and certified FPT reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.
- .4 Cx Reports include: static and operational verification forms, tests for integrated systems and all tests provided by Manufacturers on their own forms.

#### 1.22 Preliminary and Final Cx

- .1 Preliminary Cx process is considered completed when all the deliverables related to pre-operational and operational tests will be completed and the documents will be received from the contractors.
- .2 Final Cx process is considered completed when the 30 days EMCS reports will be received and verified by Departmental Representative.

#### 1.23 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.
  - .4 Differed tests with participation of all required sub trades in technical specifications.

#### 1.24 Tests to be Performed by Owner/User

- .1 None.

#### 1.25 Training Plans

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

**1.26 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.

**End of Section**

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## **APPENDIX A – SYSTEMS LIST**



	Client: PWGSC		Revision	
	Project: 648139 - New Daycare, Iqaluit, Nnavut		#	Date
	Document Name: Appendix A, section 01 91 31		0	2018-03-16


#### SYSTEMS COMPONENTS LIST

Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
<b>MECHANICAL</b>					
7MRA-0001	Heating system	Hydronic distribution	x		
		Pipe tests - supply / return	x		
		Forced flow heater FFC-ST2	x	x	
		Forced flow heater FFC-121	x	x	
		Forced flow heater FFC-101	x	x	
		Glycol unit heater UH-CR1	x	x	
		Glycol unit heater UH-CR2	x	x	
		Glycol unit heater UH-112	x	x	
		Glycol unit heater UH-203	x	x	
		Heating pump HP1-1 Primary Loop	x	x	
		Heating pump HP1-2 Primary Loop	x	x	
		Boiler Station Pump BSP-2	x	x	
		Boiler Station Pump BSP-3	x	x	
		Boiler Station Pump BSP-7	x	x	
		Boiler Station Pump BSP-8	x	x	
		Boiler Station Pump BSP-1	x	x	
		Boiler Station Pump BSP-4	x	x	
		Boiler Station Pump BSP-5	x	x	
		Boiler Station Pump BSP-6	x	x	
		Expansion tank	x		
		Glycol pressurisation unit - PGU-01	x		
		Perimeter heating - RAD-104	x	x	
		Perimeter heating - RAD-105	x	x	
		Terminal heating coil HC-114	x	x	
		Terminal heating coil HC-115	x	x	
		Terminal heating coil HC-118	x	x	
		Terminal heating coil HC-120	x	x	
		Terminal heating coil HC-204	x	x	
		Terminal heating coil HC-207	x	x	
		Terminal heating coil HC-209	x	x	
		Radiant floor Manifold 1	x	x	
		Radiant floor Manifold 2	x	x	
		Radiant floor Manifold 3	x	x	
		Radiant floor Manifold 4	x	x	
		Radiant floor Manifold 5	x	x	
		Regulation and control - points list and sequences of operation	x	x	
7MRA-0004	Domestic water system	Distribution piping	x		
		Pipe tests - potable water	x		
		Back flow preventer			
		Hot water recirculation pump - HWP1-1	x	x	
		Hot water tank	x	x	
		Expansion tank	x		

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#### SYSTEMS COMPONENTS LIST

Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
7MRA-0005	Fire protection	Distribution piping	x		
		Pipe tests	x		
		Final report as per NFPA codes and verifications		x	final report to be prepared by contractor
7MRA-0007	Fuel Oil Boiler	Distribution piping	x		
		Distribution piping - vent	x		
		Pipe tests - supply / return	x		
		Pipe tests - vent	x		
		Boiler BOIL-01 + burner pump	x	x	
		Boiler BOIL-01 + burner pump	x	x	
		Exterior oil tank FOP-1	x	x	verification report to be prepared by contractor
		Interior oil tank FOP-2	x	x	verification report to be prepared by contractor
		Duplex fuel Oil pumps - FOP-1 & FOP-2	x	x	
		Regulation and control - points list and sequence of operation	x	x	

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#### SYSTEMS COMPONENTS LIST

Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
7MRA-0008	Energy recovery ventilation HRU-01	HRU-01 - General (TEMPEFF)	x	x	
		Fan supply VRE-1	x	x	
		Fan return VRE-2	x	x	
		Motorized dampers	x		
		Filter	x		
		Regulation and control - points list and sequence of operation	x	x	
7MRA-0009	Air Handling Unit AHU-01	AHU-01 - General	x	x	
		Fan supply	x	x	
		Heating coil HC-AHU1	x	x	
		Heat recovery core		x	
		Humidifier HUM-01	x	x	
		Motorized dampers	x		
		Fire dampers	x		
		Pre-filter	x		
		Filter	x		
		Regulation and control - points list and sequence of operation	x	x	
7MRA-0011	Ventilation (Mechanical room 203)	Fan supply	x	x	
		Motorized dampers	x		
		Filter (supply)	x		
		Filter (exhaust)	x		
		Regulation and control - points list and sequence of operation	x	x	

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#### SYSTEMS COMPONENTS LIST


Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
7MRA-0028	Boiler room ventilation system	Fan supply	x	x	
		Filter	x	x	
		Motorized dampers	x		
		Regulation and control - points list and sequence of operation	x	x	
7MRA-0030	Fume Hood H-1	H-1 - General	x	x	
		Regulation and control - points list and sequence of operation	x	x	
7MRA-0012	Energy Monitoring and Control System (EMCS)	List of calibrated instruments	x		
		Terminal heating control valves	x		To be completed by contractor
		Radiator control valves for perimeter heating	x		To be completed by contractor
		Radiant floor control)	x		To be prepared by contractor
		Variable frequency drive (VFD)	x	x	
		Regulation and control - sequence of operation by system		x	To be completed with EMCS contractor's detailed controlled sequences
		Data and graphics for 30 consecutive days report		x	To be prepared by contractor
		Miscellaneous alarms report		x	To be prepared by contractor

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#### SYSTEMS COMPONENTS LIST

Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
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ELECTRICAL					
7ERA-0001	Normal distribution system - low voltage up to 750V	Distribution equipment (Assembly)	x	x	
		Panelboard breaker type - <b>distribution panel</b>	x	x	
		Power breaker (inside switch board)	x		
		Transformer - up to 600V	x	x	
		Starter	x	x	
		Motor	x	x	
		Grounding	x	x	
		Power Factor Correction Capacitors	x	x	
		Heating cable	x	x	
7ERA-0003	Lighting system and control	Lighting control panel	x		
		Emergency lighting system c/w battery packs	x		
		Emergency exit signage	x		
		Emergency lighting system (mechanical, electrical, corridors issues and emergency issues) - intensity level test - min 10 lx		x	
		Verification of sequences of operation		x	
7ERA-0004	Fire Alarm	Listing of sequences of operation		x	
		Fire alarm panel(s)	x	x	Complete report by manufacturer / contractor as per technical specifications
		Battery packs	x	x	


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#### SYSTEMS COMPONENTS LIST

Cx Plan Number	System description	System components	Static verification & start-up	Operational and performance verification	Comments
7ERA-0005	Communication system	UTP Cables	x		
		UTP Patch panels	x		
		UTP Termination connectors	x		
		FO Cables	x		
		FO Patch panels	x		
		Telecom Cabinets	x		
		Analogue phones	x		
		GPS Antenna	x		
		Clocks	x		
		NTP Server (Master Clock)	x		
		Intercommunication system	x		
		FO Vertical distribution		x	
		UTP Horizontal distribution		x	
		Analogue phones		x	
		Clocks		x	
		Intercommunication system		x	
7ERA-0006	Security system	Intrusion detection system	x	x	
		Surveillance camera	x		
		Video surveillance		x	

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## **APPENDIX B – SPECIFIC Cx PLANS**

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**SPECIFIC COMMISSIONING PLAN  
NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE**

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

**APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

**COMMISSIONING**

Checklists have been completed and any deficiencies identified have been resolved.


The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date



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## **SPECIFIC COMMISSIONING PLAN** **NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE**

### **VERIFICATION CHECKS AND ACTIVITIES**

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### **RELATED SYSTEMS**

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.


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## SPECIFIC COMMISSIONING PLAN NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

<b>1.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
1.1	Distribution Equipment (Assembly) .....	4
1.2	Panelboard Breaker Type - Distribution Panel .....	6
1.3	Power Breaker – Inside Switchboard .....	7
1.4	Transformer- up to 600V .....	8
1.5	Starter .....	9
1.6	Motor .....	10
1.7	Power Factor Correction Capacitors .....	11
1.8	Grounding .....	12
1.9	Heating Cable .....	13
<b>2.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS .....</b>	<b>14</b>
2.1	Distribution Equipment (Assembly) .....	14
2.2	Panelboard Breaker Type - Distribution Panel .....	15
2.3	Transformer – up to 600V .....	16
2.4	Starter .....	18
2.5	Motor .....	19
2.6	Power Factor Correction Capacitors .....	20
2.7	Grounding .....	21
2.8	Heating cable .....	22

### ISSUES LOG LIST

Keep issues log list up to date.

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1. STATIC VERIFICATION (SV) CHECKLISTS

#### 1.1 Distribution Equipment (Assembly)


<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>Voltage</b> (V, phases, connectors)		<b>Capacity (A)</b>	
<b>Breaking capacity</b> (kA, S)		<b>Disconnect capacity</b> (peak value kA)	

DESCRIPTION OF VERIFICATIONS			
STATIC VERIFICATION	✓	N.A.	COMMENTS
• Equipment corresponds to plan and shop drawing			
• No visible trace of damage that occurred during delivery			
• Static verification checklist completed by manufacturer and appended			
• No dust and no traces of water or condensation			
• Appropriate anchoring			
• Appropriate painting and finished area			
• Lamicoid plate installed and visible			
• Capacity of short-circuit current and breakers corresponds to plan			
• Cable size – primary (KCMIL, AWG)			
• Equipment is properly grounded			
• Stress cones are suitable			
• Insulators are in good condition			
• Sequence of distribution cables is correct			
• All cables are properly secured			
• Cable connection torque (lb-in.)			
• Bolt torque for buses is suitable (lb-in.)			
• All protection relays and measurement instruments are properly identified			
• All protection relays are adjusted in accordance with coordination study			

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

DESCRIPTION OF VERIFICATIONS												
STATIC VERIFICATION	√	N.A.	COMMENTS									
<ul style="list-style-type: none"> <li>Mimic bus single line diagram is inside the panel</li> <li>Stickers present as per electrical arc study</li> <li>Fuse type and rating correspond to plans</li> <li>Main meters and instruments are installed correctly and are operational. Supply documentation with calibration test results.</li> <li>Branch circuit power monitoring system is installed correctly and is operational. Supply documentation with calibration test results.</li> <li>All disconnect and deactivation mechanisms for load breakers and circuit breaker interrupters have been activated and operate correctly</li> <li>Lead-in movement and pin alignment have been verified</li> </ul>												
<b>GENERAL COMMENTS:</b> _____ _____ _____ _____ _____												
<table style="width: 100%; border: none;"> <tr> <td style="width: 20%; vertical-align: top;"> <b>PERFORMED BY:</b> _____         </td> <td style="width: 40%; text-align: center; vertical-align: bottom;">           _____  <b>SIGNATURE</b> </td> <td style="width: 40%; text-align: center; vertical-align: bottom;">           _____  <b>DATE</b> </td> </tr> <tr> <td style="vertical-align: top; padding-top: 10px;"> <b>WITNESSED BY:</b> _____         </td> <td style="text-align: center; vertical-align: bottom; padding-top: 10px;">           _____  <b>SIGNATURE</b> </td> <td style="text-align: center; vertical-align: bottom; padding-top: 10px;">           _____  <b>DATE</b> </td> </tr> <tr> <td style="vertical-align: top; padding-top: 10px;"> <b>VERIFIED BY:</b> _____         </td> <td style="text-align: center; vertical-align: bottom; padding-top: 10px;">           _____  <b>SIGNATURE</b> </td> <td style="text-align: center; vertical-align: bottom; padding-top: 10px;">           _____  <b>DATE</b> </td> </tr> </table>				<b>PERFORMED BY:</b> _____	_____ <b>SIGNATURE</b>	_____ <b>DATE</b>	<b>WITNESSED BY:</b> _____	_____ <b>SIGNATURE</b>	_____ <b>DATE</b>	<b>VERIFIED BY:</b> _____	_____ <b>SIGNATURE</b>	_____ <b>DATE</b>
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<b>WITNESSED BY:</b> _____	_____ <b>SIGNATURE</b>	_____ <b>DATE</b>										
<b>VERIFIED BY:</b> _____	_____ <b>SIGNATURE</b>	_____ <b>DATE</b>										

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1.2 Panelboard Breaker Type - Distribution Panel

<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>Voltage (V, phases, connectors)</b>		<b>Capacity (A)</b>	

DESCRIPTION OF VERIFICATIONS	√		Comments
<ul style="list-style-type: none"> <li>Equipment corresponds to plan and shop drawing</li> <li>No visible trace of damage that occurred during delivery</li> <li>Static verification checklist completed by manufacturer and appended</li> <li>No traces of water or condensation</li> <li>No dust</li> <li>Appropriate anchoring</li> <li>Appropriate painting and finished area</li> <li>Lamicoid plate installed and visible</li> <li>Transient voltage surge suppressor is installed correctly and is operational</li> <li>Capacity of short-circuit current and circuit breakers correspond to plan</li> <li>Status of connections</li> <li>Cable size – primary (AWG)</li> <li>Identification of up-to-date circuit breaker card installed inside the panel</li> <li>Locked panel door verified and functional</li> </ul>			


  

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>PERFORMED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>
<b>WITNESSED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>
<b>VERIFIED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>



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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE


### 1.4 Transformer- up to 600V

<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>Capacity (kVA)</b>		<b>Type of winding</b>	
<b>Impedance</b>		<b>Insulation class (°C)</b>	
<b>Tap number and setting (%)</b>		<b>Temperature (°C)</b>	
<b>Primary (V, phases, connectors)</b>		<b>Secondary (V, phases, connectors)</b>	

DESCRIPTION OF VERIFICATIONS			
STATIC VERIFICATION	√	N.A.	COMMENTS
• Equipment corresponds to plan and shop drawing			
• No visible trace of damage that occurred during delivery			
• Static verification checklist completed by manufacturer and appended			
• Status of core			
• All connections are properly installed and tightened			
• Rotation verified at primary and secondary			
• Status of winding and transformer cell			
• Status of isolators			
• Status of supports, spacers, levelling pads			
• Status of connections			
• Cable size – primary (AWG)			
• Cable size – secondary (AWG)			
• Capacity of circuit breaker at primary (A)			
• Fan mounted on transformer – verified and operational			
• Status alarm verified and connected to BAS			
• Magnetic mass grounded in one point			

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>PERFORMED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>
<b>WITNESSED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>
<b>VERIFIED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1.5 Starter


<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>System powered</b>		<b>Capacity (hp)</b>	
<b>Fuse (A)</b>		<b>Type of start-up</b>	
<b>Nominal voltage (V)</b>			

DESCRIPTION OF VERIFICATIONS			
STATIC VERIFICATION	√	N.A	COMMENTS
<ul style="list-style-type: none"> <li>Equipment corresponds to plan and shop drawing</li> <li>No visible trace of damage that occurred during delivery</li> <li>Static verification checklist completed by manufacturer and appended</li> <li>Wiring diagram installed inside the panel and visible</li> <li>All connections are properly installed and tightened</li> <li>Starter accessible for safe operation</li> <li>Number of auxiliary contacts: NO/NC</li> <li>Connection of fire alarm relay module</li> <li>Cable size – primary (AWG)</li> <li>Cable size – secondary (AWG)</li> <li>Capacity of short-circuit current and circuit breakers correspond to plan</li> <li>Lock-out device corresponds to plan</li> <li>Lamp lights functional and provide proper colour</li> </ul>			

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>PERFORMED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	_____  <div style="text-align: center;">DATE</div>
<b>WITNESSED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	_____  <div style="text-align: center;">DATE</div>
<b>VERIFIED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	_____  <div style="text-align: center;">DATE</div>



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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE


### 1.6 Motor

<b>Manufacturer</b>		<b>System / TAG</b>	
<b>Serial no.</b>			
<b>Model</b>			

DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)
• No visible traces of damage that occurred during delivery.			
• Nameplate			
– Power (HP) _____			
– Service factor _____			
– Speed (rpm) _____			
– Frame _____			
– Insulation _____			
– Voltage (V) _____			
– Number of phases _____			
– Current (A) _____			
• Protection devices			
– Fuse (A) _____			
– Breaker (A) _____			
– Overload (A) _____			
– # of elements _____			
• Grounding complete.			
• Insulation (Megohms): _____			
• Motor rotation direction verified.			

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_


<b>PERFORMED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>
<b>WITNESSED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>
<b>VERIFIED BY:</b> _____	<b>SIGNATURE</b>	<b>DATE</b>

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1.7 Power Factor Correction Capacitors


<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>Capacity (kVAR)</b>		<b>Voltage (V, ph, Hz)</b>	
<b>DESCRIPTION OF VERIFICATIONS</b>			
<b>STATIC VERIFICATION</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS</b>
<ul style="list-style-type: none"> <li>Equipment corresponds to plan and shop drawing</li> <li>No visible trace of damage that occurred during delivery</li> <li>Static verification checklist completed by manufacturer and appended</li> <li>Assembly clean inside and out</li> <li>All cables are properly secured</li> <li>Upstream circuit breaker is adjusted as per codes in effect</li> </ul>			
<b>GENERAL COMMENTS:</b> _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1.8 Grounding


<b>Manufacturer</b>		<b>Location of main grounding</b>		
<b>Model</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>				
<b>STATIC VERIFICATION</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS</b>	
<ul style="list-style-type: none"> <li>• Grounding network               <ul style="list-style-type: none"> <li>○ Type of wire used (AWG bare stranded copper)</li> <li>○ Grounding network corresponds to plan</li> <li>○ Bonding has been verified for all main conductors</li> <li>○ Grounding bars are present in each electrical utility room and equipment is correctly connected</li> <li>○ Grounding bars are present in each telecommunication room and equipment is correctly connected</li> <li>○ The raised floor has been connected to the grounding network by ground wires</li> <li>○ Metal portions of the water distribution network are connected to the grounding network by ground wires</li> <li>○ Metal portions of the wastewater drainage network are connected to the grounding network by ground wires</li> <li>○ Metal portions of the gas distribution network are connected to the grounding network by ground wires</li> <li>○ As built diagram completed by contractor</li> </ul> </li> <li>• Grounding               <ul style="list-style-type: none"> <li>○ Number of grounding plates</li> <li>○ Spacing between each plates</li> <li>○ Length and width of each plates</li> <li>○ Grounding is connected to the lightning arrestor system ground</li> </ul> </li> </ul>				
	<b>GENERAL COMMENTS:</b> _____			
_____				
_____				
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%; text-align: center;">SIGNATURE</div> <div style="width: 45%; text-align: center;">DATE</div> </div>				
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%; text-align: center;">SIGNATURE</div> <div style="width: 45%; text-align: center;">DATE</div> </div>				
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%; text-align: center;">SIGNATURE</div> <div style="width: 45%; text-align: center;">DATE</div> </div>				

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 1.9 Heating Cable

<b>System/Tag # :</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<b>Before installation</b>			
• Continuity test on reel before installation and report test attached			
• Insulation resistance test on reel before installation and report test attached			
<b>After installation</b>			
• Installation on pipe, insulation and connections properly done and without physical damage			
• Electrical connections are tight and grounded			
• Insulation is dry and sealed			
• Continuity test and insulation resistance test performed and reports attached			
• No moisture can penetrate the insulation			
• Tagging completed with branch circuit breaker, monitor and alarm devices, power connection, circuit number and set-point for each temperature controller			
• Temperature controls properly installed and set points verified			
• Grounding fault protective device installed as per drawing specs			
Functional checks before start-up tests:			
• Close all branch circuits and verify proper current; a temporary bypass may be required for the temperature control device			
• Verify that monitor or alarm circuits are operable; a bypass may be required at field contacts			
• Provide connection diagrams and as built drawings			
• Provide installation instruction and checklist for maintenance			
• Provide technical description and instruction manuals with list of individual pieces of equipment, checklist for maintenance			
<b>COMMENTS:</b> _____			
<b>PERFORMED BY:</b> _____			
<b>SIGNATURE</b>	<b>DATE</b>		
<b>WITNESSED BY:</b> _____			
<b>SIGNATURE</b>	<b>DATE</b>		
<b>VERIFIED BY:</b> _____			
<b>SIGNATURE</b>	<b>DATE</b>		

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 2.1 Distribution Equipment (Assembly)

Manufacturer		Model	
Serial no.		Location	
Voltage (V, phases, connectors)		Capacity (A)	
Breaking capacity (kA, S)		Disconnect capacity (peak value kA)	

**DESCRIPTION OF VERIFICATIONS**

**OPERATIONAL VERIFICATION**

- Insulation resistance measurements using a 1000-V megohmmeter


Phase A-B	Phase B-C	Phase C-A	Phase A-G	Phase B-G	Phase C-G

Final value at meter
- Main electric entrance meter measurements

Voltage (V)		Current (A)	
Phase A-B		Phase A	
Phase B-C		Phase B	
Phase A-C		Phase C	
Phase A-G		Phase G	
Phase B-G			
Phase C-G			

**GENERAL COMMENTS:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

<b>PERFORMED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	<div style="text-align: center;">DATE</div>
<b>WITNESSED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	<div style="text-align: center;">DATE</div>
<b>VERIFIED BY:</b> _____  <div style="text-align: center;">SIGNATURE</div>	<div style="text-align: center;">DATE</div>


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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.2 Panelboard Breaker Type - Distribution Panel

<b>Manufacturer</b>		<b>Model</b>																			
<b>Serial no.</b>		<b>Location</b>																			
<b>Voltage</b> (V, phases, connectors)		<b>Capacity (A)</b>																			
<b>DESCRIPTION OF VERIFICATIONS</b>																					
<b>OPERATIONAL VERIFICATION</b>																					
<ul style="list-style-type: none"> <li>Load balancing</li> </ul> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <th colspan="3">Voltage (V)</th><th colspan="3">Current (A)</th></tr> <tr> <th>Phase A</th><th>Phase B</th><th>Phase C</th><th>Phase A</th><th>Phase B</th><th>Phase C</th></tr> <tr> <td style="height: 20px;"></td><td></td><td></td><td></td><td></td><td></td></tr> </table>				Voltage (V)			Current (A)			Phase A	Phase B	Phase C	Phase A	Phase B	Phase C						
Voltage (V)			Current (A)																		
Phase A	Phase B	Phase C	Phase A	Phase B	Phase C																
<b>COMMENTS:</b> _____ _____ _____ _____																					
<table style="width: 100%;"> <tr> <td style="width: 60%; vertical-align: top;"> <b>PERFORMED BY:</b> _____  <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div> </td> <td style="width: 40%; vertical-align: top;">           _____  <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div> </td> </tr> <tr> <td style="vertical-align: top;"> <b>WITNESSED BY:</b> _____  <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div> </td> <td style="vertical-align: top;">           _____  <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div> </td> </tr> <tr> <td style="vertical-align: top;"> <b>VERIFIED BY:</b> _____  <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div> </td> <td style="vertical-align: top;">           _____  <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div> </td> </tr> </table>				<b>PERFORMED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>	<b>WITNESSED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>	<b>VERIFIED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>												
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<b>VERIFIED BY:</b> _____ <div style="text-align: center; margin-top: 10px;"><b>SIGNATURE</b></div>	_____ <div style="text-align: center; margin-top: 10px;"><b>DATE</b></div>																				




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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____		
<b>PERFORMED BY:</b> _____  <b>WITNESSED BY:</b> _____  <b>VERIFIED BY:</b> _____	_____ <b>SIGNATURE</b>  _____ <b>SIGNATURE</b>  _____ <b>SIGNATURE</b>	_____ <b>DATE</b>  _____ <b>DATE</b>  _____ <b>DATE</b>



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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.4 Starter

<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>System powered</b>		<b>Capacity (hp)</b>	
<b>Fuse (A)</b>		<b>Type of start-up</b>	
<b>Nominal voltage (V)</b>			

DESCRIPTION OF VERIFICATIONS		
OPERATIONAL VERIFICATION		COMMENTS
<ul style="list-style-type: none"> <li>Activate the switches and contactor to ensure that they are working appropriately.</li> <li>Check start-up and shut-down sequence for each contactor and relay.</li> <li>Ensure that sequential commands are functional and respect the requirements.</li> </ul>		

- Measurements:

Voltage (V)		Current (A)	
Phase A-B		Phase A	
Phase B-C		Phase B	
Phase A-C		Phase C	
Phase A-G		Phase G	
Phase B-G			
Phase C-G			
- Insulation resistance measurements (megohmmeter @ 1000 VDC)

Phase A-B	Phase B-C	Phase A-C

**COMMENTS:** \_\_\_\_\_

**PERFORMED BY:** \_\_\_\_\_

**SIGNATURE**

**DATE**

**WITNESSED BY:** \_\_\_\_\_


**SIGNATURE**

**DATE**

**VERIFIED BY:** \_\_\_\_\_

**SIGNATURE**


**DATE**

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.5 Motor


<b>Manufacturer</b>		<b>System / TAG</b>	
<b>Serial no.</b>			
<b>Model</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	<b>COMMENTS (#)</b>
<b>Operational verification</b>			
Current A: _____ A	Voltage A : _____ V		
Current B : _____ A	Voltage B : _____ V		
Current C : _____ A	Voltage C : _____ V		
<b>Connection</b> <i>Indicate electrical connection point and appropriate checklists.</i>			
<ul style="list-style-type: none"> <li>VFD: _____ <b>Complete appropriate form</b></li> <li>Starter / MCC: _____ <b>Complete appropriate form</b></li> </ul>			
<b>COMMENTS:</b> _____			
<b>PERFORMED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>WITNESSED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>VERIFIED BY:</b> _____		_____	
SIGNATURE		DATE	

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.6 Power Factor Correction Capacitors


<b>Manufacturer</b>		<b>Model</b>							
<b>Serial no.</b>		<b>Location</b>							
<b>Capacity (kVAR)</b>		<b>Voltage (V, ph, Hz)</b>							
<b>DESCRIPTION OF VERIFICATIONS</b>									
<b>OPERATIONAL VERIFICATION</b>			<b>COMMENTS</b>						
<ul style="list-style-type: none"> <li>Discharge constant</li> <li>Resistance between terminals and casing (<math>\geq 1000</math> megaohms)</li> <li>Current and voltage balanced and within nominal values</li> <li>Reactive power (kVAR)</li> </ul>									
<b>GENERAL COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____									
<table style="width: 100%; border: none;"> <tr> <td style="width: 30%; vertical-align: top;"> <b>PERFORMED BY:</b> _____   <div style="text-align: center;"><b>SIGNATURE</b></div> </td> <td style="width: 30%; vertical-align: top;">           _____   <div style="text-align: center;"><b>DATE</b></div> </td> </tr> <tr> <td style="vertical-align: top;"> <b>WITNESSED BY:</b> _____   <div style="text-align: center;"><b>SIGNATURE</b></div> </td> <td style="vertical-align: top;">           _____   <div style="text-align: center;"><b>DATE</b></div> </td> </tr> <tr> <td style="vertical-align: top;"> <b>VERIFIED BY:</b> _____   <div style="text-align: center;"><b>SIGNATURE</b></div> </td> <td style="vertical-align: top;">           _____   <div style="text-align: center;"><b>DATE</b></div> </td> </tr> </table>				<b>PERFORMED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>	<b>WITNESSED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>	<b>VERIFIED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>
<b>PERFORMED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>								
<b>WITNESSED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>								
<b>VERIFIED BY:</b> _____  <div style="text-align: center;"><b>SIGNATURE</b></div>	_____  <div style="text-align: center;"><b>DATE</b></div>								

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.7 Grounding

<b>Manufacturer:</b>		<b>Location of main grounding:</b>	
<b>DESCRIPTION OF VERIFICATIONS</b>			
<b>OPERATIONAL VERIFICATION</b>		<b>COMMENTS</b>	
<ul style="list-style-type: none"> <li>Measurement of building ground. Provide value and describe method used in accordance with technical specifications described in section 26 05 28.</li> </ul>			
<b>GENERAL COMMENTS:</b> _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			

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## NORMAL DISTRIBUTION SYSTEM – LOW VOLTAGE

### 2.8 Heating cable

<b>Manufacturer:</b>	<b>Panel number</b>			
<b>Heater number:</b>	<b>Circuit number</b>			
<b>Model:</b>	<b>Wattage unit length/voltage rating</b>			
<b>Location:</b>	<b>Circuit amp / voltage</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>Total design length</li> <li>Thermal insulation thickness</li> <li>Thermal insulation type</li> <li>Normal pipe temperature</li> <li>Maintain pipe temperature</li> <li>Electrical resistance (continuity) test (<math>\Omega</math>)</li> <li>Electrical insulation resistance test (M<math>\Omega</math>)</li> <li>Ambient temperature</li> </ul> <b>Measurements</b> <ul style="list-style-type: none"> <li>Start-up</li> <li>After 10 min</li> <li>After 4h</li> <li>Ambient temperature at time of test (<math>^{\circ}\text{C}</math>)</li> <li>Pipe temperature at beginning of test (<math>^{\circ}\text{C}</math>)</li> <li>Pipe temperature after 4h (<math>^{\circ}\text{C}</math>)</li> <li>Calculated watts per unit length after 4h (VxA/m)</li> <li>Heating controls calibrated</li> <li>Temperature set-point</li> <li>High limit set-point</li> <li>Heating controls operation verified</li> <li>Local alarms verified point by point</li> <li>Remote alarm to BAS verified</li> </ul> Test completed in accordance with cable suppliers' instructions and specifications indicated at art. 3.6, section 26 60 00 Complete test report by manufacturer, attached	Voltage (V) (panel)	Voltage (V) (field)	Current (A)	
	<b>COMMENTS:</b> _____			
<b>PERFORMED BY:</b> _____				
<b>SIGNATURE</b>	<b>DATE</b>			
<b>WITNESSED BY:</b> _____				
<b>SIGNATURE</b>	<b>DATE</b>			
<b>VERIFIED BY:</b> _____				
<b>SIGNATURE</b>	<b>DATE</b>			




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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM

### **VERIFICATION CHECKS AND ACTIVITIES**

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:

- Checklists – Static Inspection;
- Checklists – Operational Inspection.


All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### **RELATED SYSTEMS**

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.




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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM

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<b>1.1</b>	<b>Lighting Control Panel.....</b>	<b>4</b>
<b>1.2</b>	<b>Emergency Lighting System c/w Battery Pack.....</b>	<b>5</b>
<b>1.3</b>	<b>Emergency Exit Signage .....</b>	<b>6</b>
<b>2.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>7</b>
<b>2.1</b>	<b>Emergency Lighting System (Mechanical, Electrical, Generator Room, Corridors Issues and Emergency Issues) – Luminous Intensity Level Test – min 10 lx .....</b>	<b>7</b>
<b>2.2</b>	<b>Verification of Sequences of Operation.....</b>	<b>8</b>
<b>2.3</b>	<b>Listing of Sequences of Operation .....</b>	<b>9</b>

### ISSUES LOG LIST

Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM


### 1. STATIC VERIFICATION (SV) CHECKLISTS

#### 1.1 Lighting Control Panel

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Connections are completed</li> <li>Electrical supply verified</li> <li>Network connection verified as per design specifications</li> <li>Manufacturer's installation check list completed</li> </ul>			
	<b>COMMENTS:</b> _____		
_____			
_____			
_____			
_____			
<b>COMPILED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED FOR START-UP BY:</b> _____		_____	
SIGNATURE		DATE	





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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM

### 2. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 2.1 Emergency Lighting System (Mechanical, Electrical, Generator Room, Corridors Issues and Emergency Issues) – Luminous Intensity Level Test – min 10 lx

Localisation	Equipment	Luminous Intensity Level Measured (lx)	Comments
Calibration certificate of measurement instrument with serial number :		Equipment	Serial number
Expiry date of certificate:			
<b>COMMENTS :</b> _____			
<b>COMPILED BY :</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED BY :</b> _____		_____	
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN LIGHTING SYSTEM

### 2.2 Verification of Sequences of Operation

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Verify communication between lighting control panel and remote components as per design specification</li> <li>Verify communication with BAS</li> <li>Verify all sequences of operation as per specifications on drawing L602 and complete listing with sequence applicable for each room / space.</li> <li>Verify interlink with media control (shade, screen projection, etc)</li> <li>Verify graphic interface operator</li> <li>Prepare as built drawings to reflect modification during construction, as applicable.</li> </ul>			
<b>COMMENTS:</b> _____			
_____			
_____			
_____			
<b>COMPILED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR START-UP BY:</b> _____			
SIGNATURE		DATE	






## ISSUES LOG LIST – LIGHTING SYSTEM

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## SPECIFIC COMMISSIONING PLAN

### FIRE ALARM SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

#### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

#### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## **SPECIFIC COMMISSIONING PLAN**

### **FIRE ALARM SYSTEM**

#### **VERIFICATION CHECKS AND ACTIVITIES**

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
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#### **RELATED SYSTEMS**

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

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## SPECIFIC COMMISSIONING PLAN

### FIRE ALARM SYSTEM

<b>1.</b>	<b>STATIC VERIFICATION (SV) CHECKLIST .....</b>	<b>4</b>
<b>1.1</b>	<b>Fire Alarm Panel – Verification Report by Contractor.....</b>	<b>4</b>
<b>1.2</b>	<b>Battery Packs – Verification Report by Contractor .....</b>	<b>4</b>
<b>2.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>5</b>
<b>2.1</b>	<b>Fire Alarm Panel – Verification Report by Contractor.....</b>	<b>5</b>
<b>2.2</b>	<b>Battery Packs – Verification Report by / Contractor .....</b>	<b>5</b>

### ISSUES LOG LIST


Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN

### FIRE ALARM SYSTEM

- 1. STATIC VERIFICATION (SV) CHECKLIST**
- 1.1 Fire Alarm Panel – Verification Report by Contractor**
- 1.2 Battery Packs – Verification Report by Contractor**

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## SPECIFIC COMMISSIONING PLAN

### FIRE ALARM SYSTEM

#### 2. OPERATIONAL VERIFICATION (OV) CHECKLISTS

2.1 **Fire Alarm Panel – Verification Report by Contractor**

2.2 **Battery Packs – Verification Report by / Contractor**



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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

#### **APPROVAL**

The Commissioning for the system identified above has been completed.

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Commissioning Coordinator, Construction	Date

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Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### **VERIFICATION CHECKS AND ACTIVITIES**

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#### **RELATED SYSTEMS**

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

<b>1.</b>	<b>STATIC VERIFICATION (SV) CHECKLIST .....</b>	<b>4</b>
<b>1.1</b>	<b>UTP Cables .....</b>	<b>4</b>
<b>1.2</b>	<b>UTP Patch Panels.....</b>	<b>5</b>
<b>1.3</b>	<b>UTP Termination Connectors .....</b>	<b>6</b>
<b>1.4</b>	<b>FO Cables .....</b>	<b>7</b>
<b>1.5</b>	<b>FO Patch Panels .....</b>	<b>8</b>
<b>1.6</b>	<b>Telecom Cabinets .....</b>	<b>9</b>
<b>1.7</b>	<b>Analogue Phones .....</b>	<b>10</b>
<b>1.8</b>	<b>GPS Antenna .....</b>	<b>11</b>
<b>1.9</b>	<b>Clocks.....</b>	<b>12</b>
<b>1.10</b>	<b>NTP Server (Master Clock).....</b>	<b>13</b>
<b>1.11</b>	<b>Intercommunication System .....</b>	<b>14</b>
<b>1.12</b>	<b>Core Switches .....</b>	<b>15</b>
<b>1.13</b>	<b>Server Switches .....</b>	<b>16</b>
<b>1.14</b>	<b>Access Switches .....</b>	<b>17</b>
<b>1.15</b>	<b>Firewall .....</b>	<b>18</b>
<b>1.16</b>	<b>Tape Library.....</b>	<b>19</b>
<b>2.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>20</b>
<b>2.1</b>	<b>FO Vertical Distribution .....</b>	<b>20</b>
<b>2.2</b>	<b>UTP Horizontal Distribution .....</b>	<b>21</b>
<b>2.3</b>	<b>Analogue Phones .....</b>	<b>22</b>
<b>2.4</b>	<b>Clocks.....</b>	<b>23</b>
<b>2.5</b>	<b>Intercommunication System .....</b>	<b>24</b>
<b>2.6</b>	<b>Core Switches .....</b>	<b>25</b>
<b>2.7</b>	<b>Server Switches .....</b>	<b>26</b>
<b>2.8</b>	<b>Access Switches .....</b>	<b>27</b>
<b>2.9</b>	<b>Firewall .....</b>	<b>28</b>

#### ISSUES LOG LIST

Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1. STATIC VERIFICATION (SV) CHECKLIST

##### 1.1 UTP Cables

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>Cable Category :</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>Verification of the cable sheath.</li> <li>Cables installation respects bend radius.</li> <li>Installation in cable trays or conduits is clean and organized. Cables are attached every meter in vertical cable trays.</li> <li>Cables are properly installed in Cabinets and follow cables managers.</li> <li>Cables surplus meet specifications and are properly rolled up.</li> <li>Cables are identified.</li> <li>Every UTP cable is tested according to specifications and respects performance requirements.</li> <li>Verification report for calibration tests equipment.</li> <li>UTP Cables length does not exceed 90 meters.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.2 UTP Patch Panels

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Patch Panels are securely installed in Cabinets.</li> <li>All connectors are installed according to specifications.</li> <li>Cables are properly connected to patch panels and follow cables managers.</li> <li>Patch panels are identified.</li> <li>Patch panels are installed in high density.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.3 UTP Termination Connectors

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Termination connectors (faceplates and termination boxes) are securely fixed.</li> <li>All connectors are installed according to specifications.</li> <li>Cables are properly connected.</li> <li>All ports are identified.</li> <li>Unused ports are covered by a dust cover.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.4 FO Cables

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>Verification of the cable sheath.</li> <li>Cables installation respects bend radius.</li> <li>Installation in conduits or cable trays is clean and organized.</li> <li>Cables are adequately installed in Cabinets and follow cables managers.</li> <li>Cables surplus meet specifications and are properly rolled up.</li> <li>Cables are identified.</li> <li>Every fiber in the cable is tested according to specifications and respects performance requirements.</li> <li>Verification report for calibration tests equipment.</li> <li>Verification of the adequate installation of cables.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.5 FO Patch Panels

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Patch Panels are securely installed in Cabinets.</li> <li>All connectors are installed according to specifications.</li> <li>Cables are adequately connected to patch panels and follow cables managers.</li> <li>Patch panels are identified.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.6 Telecom Cabinets

<b>Identification :</b>	<b>Localisation :</b>			
<b>Manufacturer :</b>	<b>Model :</b>			
<b>Serial No:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Verification of the physical installation of the Cabinet; that is securely anchored to ground (or fixed to wall for wall-mounted cabinet). Cabinets in a row are attached together.</li> <li>Respects seismic standards.</li> <li>Verification of cable managers.</li> <li>Verification of the Cabinets' doors, handles and locks.</li> <li>Verifications of the Cabinet's insulation with respect to the building's grounding.</li> <li>Verification of the Cabinet identification.</li> <li>Verification of grounding.</li> <li>Verification of electrical power supply.</li> <li>Verification of electrical power supply redundancy.</li> <li>Verification of the adequate installation of cables.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>				
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____				
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>				
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>				

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.7 Analogue Phones

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Wall-mounted phones are securely fixed using adequate supports.</li> <li>Phones are identified.</li> <li>Emergency Phones are visible, and no obstacle is blocking the visual identification of the phone's location.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	




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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.8 GPS Antenna

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>GPS antenna is securely fixed at specified location.</li> <li>GPS antenna is securely fixed using adequate supports.</li> <li>All connectors are installed according to specifications.</li> <li>Cable is adequately connected to NTP server.</li> <li>GPS antenna is identified.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.9 Clocks

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>Type :</b> Analogue / Digital		
DESCRIPTION OF VERIFICATIONS	√	N/A	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Clocks are securely installed at specified locations.</li> <li>Wall-mounted clocks are securely fixed using adequate supports.</li> <li>All connectors are installed according to specifications.</li> <li>Cables are adequately connected to PoE clocks.</li> <li>Clocks are identified.</li> <li>Clocks are visible from any angle, and no obstacle is blocking the vision.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.10 NTP Server (Master Clock)

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No :</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Master Clock is securely installed in the Cabinet.</li> <li>All modules are installed according to specifications.</li> <li>GPS antenna is securely fixed and is connected to the Master Clock.</li> <li>Master Clock is connected to two power supplies for redundancy or is UPS protected.</li> <li>Verification of grounding.</li> <li>Master Clock is identified.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____			
_____			
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_____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.11 Intercommunication System

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Intercoms are securely fixed using adequate supports.</li> <li>Intercoms are identified.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.12 Core Switches

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Switches are securely fixed using adequate supports</li> <li>Switches are identified.</li> <li>Switches are securely installed in Cabinet</li> <li>Associated cabling and outlets are identified.</li> <li>The SFP, SFP+ connectors are identified and connected to the fiber optic cables</li> <li>Each power supply unit is connected to an independent source</li> <li>The air conditioning of the room is functional</li> <li>The grounding is well connected</li> <li>Installation complies with Construction Plans</li> <li>Registration of results in the checklist</li> <li>Checklists are dated, signed and permanently available on site</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.13 Server Switches

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Switches are securely fixed using adequate supports</li> <li>Switches are identified.</li> <li>Switches are securely installed in Cabinet</li> <li>Associated cabling and outlets are identified.</li> <li>The SFP, SFP+ and Fiber channel SFP+ connectors are identified and connected to the fiber optic cables according to the plan</li> <li>Each power supply unit is connected to an independent source</li> <li>The air conditioning of the room is functional</li> <li>The grounding is well connected</li> <li>Installation complies with Construction Plans</li> <li>Registration of results in the checklist</li> <li>Checklists are dated, signed and permanently available on site</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.14 Access Switches

<b>1.14.1.1.1 Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
DESCRIPTION OF VERIFICATIONS	√	N/A	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Switches are securely fixed using adequate supports</li> <li>Switches are identified.</li> <li>Switches are securely installed in Cabinet</li> <li>Associated cabling and outlets are identified.</li> <li>The SFP+ connectors are identified and connected to the fiber optic cables according to the plan</li> <li>Each power supply unit is connected to an independent source</li> <li>The air conditioning of the room is functional</li> <li>The grounding is well connected</li> <li>Installation complies with Construction Plans</li> <li>Registration of results in the checklist</li> <li>Checklists are dated, signed and permanently available on site</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.15 Firewall

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Firewalls are securely fixed using adequate supports</li> <li>Firewalls are identified.</li> <li>Firewalls are securely installed in Cabinet</li> <li>Each power supply unit is connected to an independent source</li> <li>The air conditioning of the room is functional</li> <li>The grounding is well connected</li> <li>Installation complies with Construction Plans</li> <li>Registration of results in the checklist</li> <li>Checklists are dated, signed and permanently available on site</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			




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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 1.16 Tape Library

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>The equipment is identified</li> <li>The equipment is securely installed in Cabinet</li> <li>The FO links correspond to the estimate and the network management plan</li> <li>The grounding is well connected</li> <li>Installation complies with Construction Plans</li> <li>Registration of results in the checklist</li> <li>Checklists are dated, signed and permanently available on site</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2. OPERATIONAL VERIFICATION (OV) CHECKLISTS

##### 2.1 FO Vertical Distribution

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	✓	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>No visible traces of damage that occurred during delivery or installation.</li> <li>Verification of operation according to required performance.</li> <li>Warranty Certificate obtained.</li> <li>Training completed.</li> <li>Information contained in operations Manual is complete.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.2 UTP Horizontal Distribution

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>No visible traces of damage that occurred during delivery or installation.</li> <li>Verification of operation according to required performance.</li> <li>Warranty Certificate obtained.</li> <li>Training completed.</li> <li>Information contained in operations Manual is complete.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.3 Analogue Phones

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>No visible traces of damage that occurred during delivery.</li> <li>Verification of Communication Link (tone and calls).</li> <li>Verification of the Phone number.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.4 Clocks

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>No visible traces of damage that occurred during delivery.</li> <li>Verification of Communication Link with NTP server.</li> <li>Verification of Clocks synchronization with NTP server.</li> <li>Verification of Alarms triggering in case of problems.</li> <li>Verification of operation continuity in case of interruption with NTP server.</li> <li>Verification of the clocks pre-sets.</li> <li>Verification of PoE.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>		_____ <div style="text-align: center;">DATE AND TIME</div>	


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.5 Intercommunication System

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>No visible traces of damage that occurred during delivery or installation.</li> <li>Verification of Communication Link (see technical specifications on 27 51 23).</li> <li>Verification of sound quality and level.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.6 Core Switches

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>IP Address :</b>		
<b>MAC Address :</b>	<b>Sub-Mask :</b>		
<b>IP Gateway :</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Power supply redundancy</li> <li>Stacking</li> <li>Redundancy of links to the access and servers switches</li> <li>Redundancy of the links to the firewall</li> <li>Integration in the network management system and licensing</li> <li>IP addressing plan and VLAN configuration</li> <li>Routing</li> <li>Routing protocol</li> <li>Switching and routing performances</li> <li>Security</li> <li>QoS</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.7 Server Switches

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>IP Address :</b>		
<b>MAC Address :</b>	<b>Sub-Mask :</b>		
<b>IP Gateway :</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Power supply redundancy</li> <li>Clustering – Virtual Port channel</li> <li>Redundancy and aggregation of links to the core switches</li> <li>Redundancy and aggregation of the vPC peer links</li> <li>Redundancy of FCoE links</li> <li>Redundancy of links to the servers</li> <li>Connection to the Tape library with Fibre channel</li> <li>Integration in the network management system and licensing</li> <li>IP addressing plan, VSAN and VLAN configuration</li> <li>Storage configuration</li> <li>Routing protocol</li> <li>Switching and routing performances</li> <li>QoS</li> <li>Security</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			




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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.8 Access Switches

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>IP Address :</b>		
<b>MAC Address :</b>	<b>Sub-Mask :</b>		
<b>IP Gateway :</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Power supply redundancy</li> <li>Redundancy of links to the core switches</li> <li>Aggregation of links to the core switches</li> <li>Integration in the network management system and licensing</li> <li>IP addressing plan and VLAN configuration</li> <li>Switching performances</li> <li>PoE ports configuration</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			

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## SPECIFIC COMMISSIONING PLAN

### COMMUNICATION SYSTEM

#### 2.9 Firewall

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>	<b>IP Address :</b>		
<b>MAC Address :</b>	<b>Sub-Mask :</b>		
<b>IP Gateway :</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N/A	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Power supply redundancy</li> <li>Redundancy of links to the core switches</li> <li>Aggregation of links to the core switches</li> <li>Connection to the external network</li> <li>Integration in the network management system and licensing</li> <li>IP addressing plan and VLAN configuration</li> <li>Routing and Switching performances</li> <li>Routing protocol</li> <li>QoS</li> <li>Security (IPS, IDS, Malware detection, packet filtering)</li> <li>Performance verification (packets, simultaneous sessions number, general firewall performance)</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span>NAME AND SIGNATURE</span> <span>DATE AND TIME</span> </div>			



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## SPECIFIC COMMISSIONING PLAN

### SECURITY SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

#### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

#### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## **SPECIFIC COMMISSIONING PLAN**

### **SECURITY SYSTEM**

#### **VERIFICATION CHECKS AND ACTIVITIES**

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

#### **RELATED SYSTEMS**

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

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## SPECIFIC COMMISSIONING PLAN

### SECURITY SYSTEM

<b>1.</b>	<b>STATIC VERIFICATION (SV) CHECKLIST .....</b>	<b>4</b>
<b>1.1</b>	<b>Intrusion Detection System .....</b>	<b>4</b>
<b>1.2</b>	<b>Surveillance Camera.....</b>	<b>5</b>
<b>2.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>6</b>
<b>2.1</b>	<b>Intrusion Detection System .....</b>	<b>6</b>
<b>2.2</b>	<b>Video Surveillance .....</b>	<b>7</b>

### ISSUES LOG LIST

Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN

### SECURITY SYSTEM

#### 1. STATIC VERIFICATION (SV) CHECKLIST

##### 1.1 Intrusion Detection System

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No :</b>			
<b>DESCRIPTION DES VÉRIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment locations comply with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Equipment is securely fixed at specified locations.</li> <li>Equipment and cabling identification is completed properly.</li> <li>Installation complies with Manufacturer's specifications, product literature and instructions.</li> <li>Control panel installation check list is completed and is in accordance with technical specifications.</li> <li>Clearance and access for maintenance of control panel(s).</li> <li>Zone diagram prepared by Security Contractor.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			

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## SPECIFIC COMMISSIONING PLAN

### SECURITY SYSTEM

#### 1.2 Surveillance Camera

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N/A</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment complies with Shop Drawings.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Camera is securely fixed using adequate and compatible supports.</li> <li>Installation according to Manufacturer's instructions and recommendations.</li> <li>UTP cord connected to camera and network plug.</li> <li>Camera is identified.</li> <li>Installation complies with Construction Plans.</li> <li>Registration of results in the checklist.</li> <li>Checklists are dated, signed and permanently available on site.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			



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## SPECIFIC COMMISSIONING PLAN


### SECURITY SYSTEM

#### 2. OPERATIONAL VERIFICATION (OV) CHECKLISTS

##### 2.1 Intrusion Detection System

<b>Identification :</b>	<b>Localisation :</b>		
<b>Manufacturer :</b>	<b>Model :</b>		
<b>Serial No :</b>			
DESCRIPTION DES VÉRIFICATIONS	✓	N/A	COMMENTS (#)
<ul style="list-style-type: none"> <li>System and control panel programmed as per technical specifications of section 28 10 00.</li> <li>Verify operation of each device individually after installation including alarms sent to main security computer.</li> <li>Verify operation of each device in relation with programmable schedule and/or specific functions as per Client's particular specifications.</li> <li>Verify day / night schedule as per Client's specifications and ensure the program is working properly.</li> <li>Verify remote maintenance and/or alarm status.</li> <li>Verify arming / disarming system by critical zone, main entrance, etc.</li> <li>For integrated system c/w video-cameras and access control, verify function of equipment which has to be activated by alarm intrusion detection.</li> <li>Verify components of intrusion system or sub-system that have to be activated in case of an emergency or a general alarm.</li> <li>Verify system supervision.</li> <li>Provide a complete report of the entire system and documented test results including list of components, servers, panels, computers, etc.</li> </ul>			
<b>COMMENTS</b> _____ _____ _____ _____ _____			
<b>PERFORMED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			
<b>VERIFIED BY :</b> _____ <div style="display: flex; justify-content: space-between;"> <span><b>NAME AND SIGNATURE</b></span> <span><b>DATE AND TIME</b></span> </div>			



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## SPECIFIC COMMISSIONING PLAN


### SECURITY SYSTEM

DESCRIPTION OF VERIFICATIONS	√	N/A	COMMENTS (#)
<ul style="list-style-type: none"> <li>• Verification of licence validation for VMS.</li> <li>• Installation complies with Construction Plans.</li> </ul>			
<ul style="list-style-type: none"> <li>• Registration of results in the checklist.</li> <li>• Checklists are dated, signed and permanently available on site.</li> </ul>			

**COMMENTS** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>PERFORMED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>	_____ <div style="text-align: center;">DATE AND TIME</div>
<b>VERIFIED BY :</b> _____ <div style="text-align: center;">NAME AND SIGNATURE</div>	_____ <div style="text-align: center;">DATE AND TIME</div>



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## SPECIFIC COMMISSIONING PLAN HEATING SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN HEATING SYSTEM

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.


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## SPECIFIC COMMISSIONING PLAN HEATING SYSTEM

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### ISSUES LOG LIST

Keep issues log list up to date.

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## HEATING SYSTEM

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 Hydronic Distribution – General

<b>Identification:</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Pipe supports are installed as specified.</li> <li>Seismic controls have been installed. The Specialized Consultant's inspection report is appended.</li> <li>Hydrostatic pressure tests have been completed and checklists have been appended.</li> <li>Network purge and rinse have been completed and checklists have been appended.</li> <li>All strainers have been removed and cleaned. Temporary construction-type strainers have been removed.</li> <li>All network valves have been identified and valve schedule has been appended.</li> <li>Thermal insulation has been completed.</li> <li>Network identification is complete and flow direction indicated.</li> <li>Backflow prevention devices have been tested and manufacturer certificates have been appended.</li> <li>Meters are calibrated and certificates appended.</li> <li>The installation has been inspected by the relevant competent authority. The compliance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			




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## HEATING SYSTEM

### 3.2 Pipe Tests – Supply / Return


<b>Identification:</b>	<b>Location:</b>		
<b>Diagram:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Testing of network or portion of heating/cooling network.</li> <li>Fill in a checklist for each network portion tested. Provide a diagram in the appendix.               <ul style="list-style-type: none"> <li>– Hydrostatic pressure test at maximum service pressure or as per specifications.</li> <li>– If testing is done in freezing conditions, the test may be performed with air at 700 kPa (100 psi).</li> <li>– Test duration [ hours ]</li> <li>– Start pressure [ kPa ; psi ]</li> <li>– End pressure [ kPa ; psi ]</li> </ul> </li> <li>Acceptance criterion: no pressure loss for entire test duration.</li> </ul>			
	Complies?	Yes / No	
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			

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## HEATING SYSTEM

### 3.3 Boilers


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>Control instrumentation is calibrated</li> <li>Interlocks verified</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Start-up for supply oil distribution completed and report received</li> <li>Start-up for supply water distribution completed and report received</li> <li>Start-up for primary pump completed and report received</li> <li>Installation and fitting of chimney completed</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## HEATING SYSTEM

### 3.4 Pumps (Primary)


<b>Identification:</b>		<b>Location:</b>		
<b>Manufacturer:</b>		<b>Model:</b>		
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Pump is adequately supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Pump is lubricated.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Temporary strainer has been removed further to cleaning/rinsing.</li> <li>Volute rotation has been verified; it moves freely without friction.</li> <li>Valves and fittings are in start position.</li> </ul>				
<ul style="list-style-type: none"> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklists are complete and appended;</li> <li>– interlocks are verified and operational.</li> </ul> </li> </ul>				
<b>COMMENTS:</b> _____ _____ _____				
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				

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## HEATING SYSTEM

### 3.5 Pumps (Secondary)


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Pump is adequately supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Pump is lubricated.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Temporary strainer has been removed further to cleaning/rinsing.</li> <li>Volute rotation has been verified; it moves freely without friction.</li> <li>Valves and fittings are in start position.</li> </ul>			
<ul style="list-style-type: none"> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklists are complete and appended;</li> <li>– interlocks are verified and operational.</li> </ul> </li> </ul>			
<b>COMMENTS:</b> _____			
_____			
_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>WITNESSED BY:</b> _____			
SIGNATURE		DATE	
<b>VERIFIED BY:</b> _____			
SIGNATURE		DATE	

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## HEATING SYSTEM

### 3.6 Expansion Tank

<b>Identification:</b>		<b>Location:</b>	
<b>Make:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Tank secured properly.</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Initial fill pressure [ psi ; kPa ]</li> <li>Network load pressure [ psi ; kPa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## HEATING SYSTEM

### 3.7 Glycol Pressurisation Unit

<b>Identification:</b>		<b>Location:</b>	
<b>Make:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Type of glycol used is in compliance with specifications and material safety data sheet has been appended.</li> <li>Check valve has been installed.</li> <li>Accessories (manometers, valves, etc.) have been installed.</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Pump power [ HP ; kW ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Supply pressure adjustment [ psi ; kPa ]</li> <li>Safety valve adjustment [ psi ; kPa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			













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## HEATING SYSTEM

3.12      **Regulation and Control** – Points List to be included by Contractor


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## HEATING SYSTEM

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 Boilers

<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)
<b>Environmental conditions</b>			
• Outdoor temperature			
• Relative humidity			
<b>Design parameters</b>			
• Flow [gpm, l/s]			
• Power [BHP, W]			
• Pressure drop [kPa]			
• Temperature supply [° F; ° C]			
• Temperature return [° F; ° C]			
<b>Electrical verification</b>			
• Courant [A]: T1			
• Courant [A]: T1			
• Courant [A]: T1			
• Tension [V] : T1			
• Tension [V] : T1			
• Tension [V] : T1			
• Power factor			
<b>Combustion efficiency and analysis test done by supplier has to be joint</b>			
<b>COMMENTS:</b> _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>WITNESSED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>VERIFIED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			


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## HEATING SYSTEM

### 4.2 Pumps (Primary)

<b>Identification:</b>		<b>Location:</b>	
<b>Make:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – pump [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> <li>Flow [ gpm ; l/s ]</li> <li>Suction pressure [ psi ; kPa ]</li> <li>Discharge pressure [ psi ; kPa ]</li> <li>Head pressure [ psi ; kPa ]</li> </ul>			
	<b>COMMENTS:</b> _____		
_____			
_____			
_____			
_____			
_____			
_____			
_____			
_____			
_____			
<b>PERFORMED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>WITNESSED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>VERIFIED BY:</b> _____		_____	
SIGNATURE		DATE	




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## HEATING SYSTEM

### 4.4 Heating Coils - HC

<b>HC TAG</b>						
IN - air temperature at maximum air flow [°C ]						
OUT – air temperature at maximum air flow[°C ]						
Specified capacity						
Control points are in compliance and operational						
Control at BAS verified						
Balancing valve adjusted						
<b>HC TAG</b>						
IN - air temperature at maximum air flow [°C ]						
OUT – air temperature at maximum air flow[°C ]						
Specified capacity						
Control points are in compliance and operational						
Control at BAS verified						
Balancing valve adjusted						
<b>COMMENTS :</b> _____ _____ _____						
<b>PERFORMED BY:</b> _____						
SIGNATURE			DATE			
<b>WITNESSED BY:</b> _____						
SIGNATURE			DATE			
<b>VERIFIED BY:</b> _____						
SIGNATURE			DATE			


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## HEATING SYSTEM

### 4.5 Unit Heaters – UH

<b>UH TAG</b>						
Water inlet temperature [°C ]						
Water outlet temperature [°C ]						
Current (A)						
Voltage (V)						
Speed (rpm)						
Control points are in compliance and operationels						
Control valve verified						
<b>UH TAG</b>						
Water inlet temperature [°C ]						
Water outlet temperature [°C ]						
Current (A)						
Voltage (V)						
Speed (rpm)						
Control points are in compliance and operationels						
Control valve verified						
<b>COMMENTS :</b> _____ _____ _____						
<b>PERFORMED BY:</b> _____						
	SIGNATURE			DATE		
<b>WITNESSED BY:</b> _____						
	SIGNATURE			DATE		
<b>VERIFIED BY:</b> _____						
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## HEATING SYSTEM

### 4.6 Perimeter Radiators – R-x


<b>R-x TAG</b>						
Water inlet temperature [°C ]						
Water outlet temperature [°C ]						
Current (A)						
Voltage (V)						
Speed (rpm)						
Control points are in compliance and operationels						
Control valve verified						
Water inlet temperature [°C ]						
Water outlet temperature [°C ]						
Current (A)						
<b>R-x TAG</b>						
Water inlet temperature [°C ]						
Water outlet temperature [°C ]						
Current (A)						
Voltage (V)						
Speed (rpm)						
Control points are in compliance and operational						
Control valve verified						
<b>COMMENTS :</b> _____ _____ _____						
<b>PERFORMED BY:</b> _____						
SIGNATURE			DATE			
<b>WITNESSED BY:</b> _____						
SIGNATURE			DATE			
<b>VERIFIED BY:</b> _____						
SIGNATURE			DATE			

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## HEATING SYSTEM

### 4.7 Radiant Panels - RP


<b>RP TAG</b>						
Flow design						
Flow measured						
Pressure drop						
Specify capacity						
<b>RP TAG</b>						
Flow design						
Flow measured						
Pressure drop						
Specify capacity						
<b>RP TAG</b>						
Flow design						
Flow measured						
Pressure drop						
Specify capacity						
<b>COMMENTS :</b> _____						
_____						
_____						
<b>PERFORMED BY:</b> _____						
	SIGNATURE			DATE		
<b>WITNESSED BY:</b> _____						
	SIGNATURE			DATE		
<b>VERIFIED BY:</b> _____						
	SIGNATURE			DATE		

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## HEATING SYSTEM

4.8      **Regulation and Control** – Sequences of Operation to be included by Contractor



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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.


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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

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<b>2.</b>	<b>RELATED SYSTEMS.....</b>	<b>2</b>
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### ISSUES LOG LIST

Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 Distribution Piping

<b>Identification:</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Pipe supports are installed as specified.</li> <li>Seismic controls have been installed. The Specialized Consultant's inspection report is appended.</li> <li>Hydrostatic pressure tests have been completed and checklists have been appended.</li> <li>Network purge and rinse have been completed and checklists have been appended.</li> <li>All strainers have been removed and cleaned. Temporary construction-type strainers have been removed.</li> <li>All network valves have been identified and valve schedule has been appended.</li> <li>Thermal insulation has been completed.</li> <li>Network identification is complete and flow direction indicated.</li> <li>Backflow prevention devices have been tested and manufacturer certificates have been appended.</li> <li>Meters are calibrated and certificates appended.</li> <li>The installation has been inspected by the relevant competent authority. The compliance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			



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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.2 Pipe Tests – Potable Water

<b>Identification:</b>	<b>Location:</b>		
<b>Diagram:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Testing of entire network or a portion of potable water network in compliance with Section 2.3.7 of the National Plumbing Code of Canada – 2005.</li> <li>Fill in a checklist for each network portion tested. Provide a diagram in the appendix.               <ul style="list-style-type: none"> <li>– Hydrostatic pressure test at maximum service pressure.</li> <li>– If testing is done during freezing conditions, the test may be performed with air at 700 kPa (100 psi).</li> <li>– Test duration [ hours ]</li> <li>– Start pressure [ kPa ; psi ]</li> <li>– End pressure [ kPa ; psi ]</li> </ul> </li> <li>Acceptance criterion: no pressure loss for entire test duration.</li> </ul>			
	2		
	Complies?	Yes / No	

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_


<b>PERFORMED BY:</b> _____ <div style="text-align: center; margin-top: 5px;">SIGNATURE</div>	_____ <div style="text-align: center; margin-top: 5px;">DATE</div>
<b>APPROVED FOR TESTING BY:</b> _____ <div style="text-align: center; margin-top: 5px;">SIGNATURE</div>	_____ <div style="text-align: center; margin-top: 5px;">DATE</div>

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.3 Domestic Water Recirculation Pump


<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Pump is adequately supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Pump is lubricated.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Temporary strainer has been removed further to cleaning/rinsing.</li> <li>Volute rotation has been verified; it moves freely without friction.</li> <li>Valves and fittings are in start position.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____			
<ul style="list-style-type: none"> <li>Electrical connections:             <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls:             <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklists are complete and appended;</li> <li>– interlocks are verified and operational.</li> </ul> </li> </ul>			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-around; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-around; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.4 Domestic Water Tank


<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Complies with shop drawing.</li> <li>Tank and electrical elements intact upon delivery.</li> <li>Piping and check valve installed</li> <li>Safety valve installed</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A]: T1 / T2 / T3</li> <li>Flow [ gpm; l/s ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.5 Expansion Tank


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment complies with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Tank secured properly.</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Initial fill pressure [ psi ; kPa ]</li> <li>Network load pressure [ psi ; kPa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.6 Water Meter


<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment as per shop drawing</li> <li>Installation as per drawing specification</li> <li>Safe access for maintenance</li> <li>Access to remove / replace equipment, if required for calibration</li> <li>Possibility to isolate water meter during maintenance without shut-down the network</li> <li>Factory calibration test attached</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Operating range verified</li> <li>Type of measurements and internal setting verified</li> <li>Compatibility with BAS</li> <li>Remote reading tested and accurate</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-around;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 3.7 Water Fountain

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Complies with shop drawing.</li> <li>Piping, valves and all components installed and easy to access for maintenance</li> <li>Refrigeration system installed, functional and accessible</li> <li>Documentation completed as per environmental requirements.</li> <li>No leaks</li> <li>Filter installed</li> <li>Electrical plug installed and functional</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Verification of water temperature</li> <li>Label installed and visible</li> <li></li> <li></li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			


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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

3.8      **Regulation and Control** – Point by Point List to be included by Contractor





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## SPECIFIC COMMISSIONING PLAN DOMESTIC WATER

### 4.2 **Regulation and Control** – Sequences of Operation to be included by Contractor



## ISSUES LOG LIST – DOMESTIC WATER

[illegible]

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

#### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

#### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

#### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:

Checklists – Static Inspection;


Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

#### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

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### ISSUES LOG LIST

Keep issues log list up to date.

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

#### 3. STATIC VERIFICATION (SV) CHECKLISTS

##### 3.1 Distribution Piping – General

<b>Identification:</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Pipe supports are installed as specified.</li> <li>Seismic controls have been installed. The Specialized Consultant's inspection report is appended.</li> <li>Hydrostatic pressure tests have been completed and checklists have been appended.</li> <li>Network purge and rinse have been completed and checklists have been appended.</li> <li>All strainers have been removed and cleaned. Temporary construction-type strainers have been removed.</li> <li>All network valves have been identified and valve schedule has been appended.</li> <li>Identification of extinguishers is doneé</li> <li>Thermal insulation has been completed.</li> <li>Network identification is complete and flow direction indicated.</li> <li>Backflow prevention devices have been tested and manufacturer certificates have been appended.</li> <li>Meters are calibrated and certificates appended.</li> <li>The installation has been inspected by the relevant competent authority. The compliance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			


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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

#### 3.2 Pipe Tests

<b>Identification:</b>	<b>Location:</b>		
<b>Diagram:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Testing of network or portion of network.</li> <li>Fill in a checklist for each network portion tested. Provide a diagram in the appendix.               <ul style="list-style-type: none"> <li>– Hydrostatic pressure test as per NFPA 13 specifications.</li> <li>– Test duration [ hours ]</li> <li>– Start pressure [ kPa ; psi ]</li> <li>– End pressure [ kPa ; psi ]</li> </ul> </li> <li>Acceptance criterion: no pressure loss for entire test duration.</li> </ul>			
<b>COMMENTS:</b> _____			
_____			
_____			
_____			
_____			
_____			
_____			
_____			
_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

#### 3.3 Fire Protection Pump

<b>Identification:</b>	<b>Location:</b>			
<b>Manufacturer:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Pump is adequately supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Pump is lubricated.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Temporary strainer has been removed further to cleaning/rinsing.</li> <li>Volute rotation has been verified; it moves freely without friction.</li> <li>Valves and fittings are in start position.</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– interlocks are verified and operational.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
_____				
_____				
_____				
<b>COMPILED BY:</b> _____				
SIGNATURE		DATE		
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE		DATE		




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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

#### 3.4 Jockey Pump

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Pump is adequately supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Pump is lubricated.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Temporary strainer has been removed further to cleaning/rinsing.</li> <li>Volute rotation has been verified; it moves freely without friction.</li> <li>Valves and fittings are in start position.</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– interlocks are verified and operational.</li> </ul> </li> </ul>			
	<b>COMMENTS:</b> _____		
_____			
_____			
<b>COMPILED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR START-UP BY:</b> _____			
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

3.5      **Supervised and Alarmed Points** – Report to be prepared by Contractor






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## SPECIFIC COMMISSIONING PLAN

### FIRE PROTECTION

- 4.3      **Final Report as per NFPA Codes and Verifications – Report to be prepared by Contractor**



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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:

- Checklists – Static Inspection;
- Checklists – Operational Inspection.


All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.




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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

<b>1.</b>	<b>VERIFICATION CHECKS AND ACTIVITIES.....</b>	<b>2</b>
<b>2.</b>	<b>RELATED SYSTEMS .....</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
<b>3.1</b>	<b>Distribution Piping .....</b>	<b>4</b>
<b>3.2</b>	<b>Distribution Piping - Vent.....</b>	<b>5</b>
<b>3.3</b>	<b>Pipe Test – Supply / Return .....</b>	<b>6</b>
<b>3.4</b>	<b>Pipe Tests – Vent .....</b>	<b>7</b>
<b>3.5</b>	<b>Fuel Oil Pumps .....</b>	<b>8</b>
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<b>3.7</b>	<b>Primary Oil Tank – Static Verification Report to be prepared by Contractor .....</b>	<b>9</b>
<b>3.8</b>	<b>Regulation and Control – Point by Point List to be included by Contractor .....</b>	<b>9</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>10</b>
<b>4.1</b>	<b>Fuel Oil Package .....</b>	<b>10</b>
<b>4.2</b>	<b>Heating Daily Fuel Tank – Operational Verification Report to be prepared by Contractor ..</b>	<b>11</b>
<b>4.3</b>	<b>Primary Oil Tank – Operational Verification Report to be prepared by Contractor .....</b>	<b>11</b>
<b>4.4</b>	<b>Regulation and Control – Sequences of Operation to be included .....</b>	<b>11</b>

### ISSUES LOG LIST

Keep issues log list up to date.


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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 Distribution Piping


<b>Identification:</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Pipe supports are installed as specified.</li> <li>Seismic controls have been installed. The Specialized Consultant's inspection report is appended.</li> <li>Hydrostatic pressure tests have been completed and checklists have been appended.</li> <li>Network purge and rinse have been completed and checklists have been appended.</li> <li>All strainers have been removed and cleaned. Temporary construction-type strainers have been removed.</li> <li>All network valves have been identified and valve schedule has been appended.</li> <li>Thermal insulation has been completed.</li> <li>Network identification is complete and flow direction indicated.</li> <li>Backflow prevention devices have been tested and manufacturer certificates have been appended.</li> <li>Meters are calibrated and certificates appended.</li> <li>The installation has been inspected by the relevant competent authority. The compliance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			

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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

### 3.2 Distribution Piping - Vent

<b>Identification:</b>	<b>Location:</b>		
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Pipe supports are installed as specified.</li> <li>Seismic controls have been installed. The Specialized Consultant's inspection report is appended.</li> <li>Hydrostatic pressure tests have been completed and checklists have been appended.</li> <li>Network purge and rinse have been completed and checklists have been appended.</li> <li>All strainers have been removed and cleaned. Temporary construction-type strainers have been removed.</li> <li>All network valves have been identified and valve schedule has been appended.</li> <li>Thermal insulation has been completed.</li> <li>Network identification is complete and flow direction indicated.</li> <li>Backflow prevention devices have been tested and manufacturer certificates have been appended.</li> <li>Meters are calibrated and certificates appended.</li> <li>The installation has been inspected by the relevant competent authority. The compliance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			


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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

### 3.3 Pipe Test – Supply / Return

<b>Identification:</b>		<b>Location:</b>	
<b>Diagram:</b>			
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Pipe test in compliance with CSA-B139 and CSA-B140</li> <li>Fill in a checklist for each network portion tested. Provide a diagram in the appendix.               <ul style="list-style-type: none"> <li>– Test duration [ hours ]</li> <li>– Start pressure [ kPa ; psi ]</li> <li>– End pressure [ kPa ; psi ]</li> </ul> </li> <li>Acceptance criterion: no pressure loss for entire test duration.</li> </ul>			
	2		
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="text-align: center; margin-top: 5px;">SIGNATURE</div>		_____ <div style="text-align: center; margin-top: 5px;">DATE</div>	
<b>APPROVED FOR TESTING BY:</b> _____ <div style="text-align: center; margin-top: 5px;">SIGNATURE</div>		_____ <div style="text-align: center; margin-top: 5px;">DATE</div>	




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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER


### 3.5 Fuel Oil Pumps

<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>✓</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Nameplate installed and visible</li> <li>Pumps is adequately anchored / supported and secured in place.</li> <li>Vibration attenuation devices are in place.</li> <li>Pump alignment is correct.</li> <li>Seismic controls are in place.</li> <li>Accessories (thermometers, manometers, etc.) are in place.</li> <li>Valves and fittings are in start position.</li> <li>Pumps and network are primed</li> </ul>			
<ul style="list-style-type: none"> <li>Electrical connections: <ul style="list-style-type: none"> <li>– electrical connections are complete;</li> <li>– overload protection has been installed and correctly sized;</li> <li>– volute rotation direction has been verified.</li> </ul> </li> <li>Controls: <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– float controls are installed and functional;</li> <li>– float switches are functional;</li> <li>– interlocks are verified and functional.</li> </ul> </li> </ul> <p>Contractor's checklist attached</p>			
<b>COMMENTS:</b> _____			
<b>COMPILED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED FOR START-UP BY:</b> _____		_____	
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

- 3.6      **Heating Daily Fuel Tank** – Static Verification Report to be prepared by Contractor
  
- 3.7      **Primary Oil Tank** – Static Verification Report to be prepared by Contractor
  
- 3.8      **Regulation and Control** – Point by Point List to be included by Contractor

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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 Fuel Oil Package

<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)
• Rotation speed – pump [ rpm ]			
• Rotation speed – motor [ rpm ]			
• Electrical supply [ V / ph / Hz ]			
• Current [ A ] : T1			
• Current [ A ] : T2			
• Current [ A ] : T3			
• Motor power [ HP ; kW ]			
• Overload protection adjustment			
• Flow [ gpm ; l/s ]			
• Suction pressure [ psi ; kPa ]			
• Discharge pressure [ psi ; kPa ]			
• Head pressure [ psi ; kPa ]			
Activate float switches and test if the pumps start and stop at desired levels			
Note levels and prepare a filling chart for tank			
Check all float switches and operation of lead-lag pumps			
Note any modification of sequence of operation on site, if required and included in O&M manual.			
<b>COMMENTS:</b> _____			
_____			
_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>VERIFIED BY:</b> _____			
SIGNATURE		DATE	



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## SPECIFIC COMMISSIONING PLAN FUEL OIL SYSTEM FOR BOILER

- 4.2      **Heating Daily Fuel Tank** – Operational Verification Report to be prepared by Contractor
- 4.3      **Primary Oil Tank** – Operational Verification Report to be prepared by Contractor
- 4.4      **Regulation and Control** – Sequences of Operation to be included



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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

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<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
<b>3.1</b>	<b>General .....</b>	<b>4</b>
<b>3.2</b>	<b>Supply Fans .....</b>	<b>6</b>
<b>3.3</b>	<b>Return Fans .....</b>	<b>7</b>
<b>3.4</b>	<b>Heating Coil .....</b>	<b>8</b>
<b>3.5</b>	<b>Motorized Dampers .....</b>	<b>9</b>
<b>3.6</b>	<b>Fire Dampers .....</b>	<b>10</b>
<b>3.7</b>	<b>Air Filters .....</b>	<b>11</b>
<b>3.8</b>	<b>VAV Boxes .....</b>	<b>12</b>
<b>3.9</b>	<b>Regulation and Control – Points List to be included by Contractor; .....</b>	<b>13</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>14</b>
<b>4.1</b>	<b>General .....</b>	<b>14</b>
<b>4.2</b>	<b>Heat Recovery Core .....</b>	<b>15</b>
<b>4.3</b>	<b>Supply Fans .....</b>	<b>16</b>
<b>4.4</b>	<b>Return Fans .....</b>	<b>17</b>
<b>4.5</b>	<b>Heating Coil .....</b>	<b>18</b>
<b>4.6</b>	<b>Regulation and Control – Sequence of Operation to be included by Contractor .....</b>	<b>19</b>

### ISSUES LOG LIST

Keep issues log list up to date.



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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION


### 3.1 General

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Belt guards are in place.</li> <li>Moving parts have been lubricated.</li> <li>All moving parts have been verified manually and no friction has been detected.</li> <li>Static verification checklists for all components have been completed and no elements appearing on the deficiency list prevent start-up of the AHU.</li> <li>The manufacturer's installation acceptance certificate has been appended.</li> </ul>			
<b>COMMENTS:</b> _____			
<b>COMPILED BY:</b> _____			
SIGNATURE	DATE		
<b>APPROVED FOR START-UP BY:</b> _____			
SIGNATURE	DATE		







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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 3.4 Heating Coil

<b>Sub-contractor:</b>	<b>Project No.:</b>	<b>Document No.:</b>
<b>System / Tag # :</b>	<b>Location:</b>	


DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)
• Access/clearance for maintenance.			
• Piping installed, cleaned and tested.			
• Valves and fittings installed and tested for leaks.			
• Installation allows for removal of coils.			
• Piping supports are independent of equipment.			
• Instrumentation and sight glass are accessible.			
• Accessories (manometers, thermometers, purges and drain valves) are installed.			
• Pressure valve installed and tested.			
• Strainer removed and cleaned.			
• Valves and fittings are in start position (as per diagram).			
• Fins are cleaned and combed.			
• Flow direction has been verified.			
• Check valves are present.			

**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
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 \_\_\_\_\_  
 \_\_\_\_\_

**PERFORMED BY:** \_\_\_\_\_  

SIGNATURE
DATE




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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 3.6 Fire Dampers

DESCRIPTION OF VERIFICATIONS					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
<b>COMMENTS:</b> _____					
<b>PERFORMED BY:</b> _____					
SIGNATURE			DATE		
<b>APPROVED FOR TESTING BY:</b> _____					
SIGNATURE			DATE		


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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 3.7 Air Filters


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Complies with shop drawing.</li> <li>Filter intact upon delivery.</li> <li>Manufacturer's certificate included (this certificate is mandatory for HEPA and ULPA filters).</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Air flow [ cfm ; l/s ]</li> <li>Face speed [ ft./min ; m/s ]</li> <li>Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			



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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

3.9      **Regulation and Control** – Points List to be included by Contractor;

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 General

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>AHU has been started and operates normally.</li> <li>AHU does not generate any excessive noise.</li> <li>Air supply network has been balanced and the verification report appended.</li> <li>Control sequences have been verified and the verification report has been appended.</li> <li>Permanent marking for damper and valve positioning has been performed (further to balancing report approval).</li> <li>Deficiency list is up to date. Points remaining may be transferred to the project monitoring list. None of the points awaiting resolution prevent the system from operating normally.</li> <li>O&amp;M training on AHU may begin.</li> <li>Performance testing may begin.</li> </ul>			
<b>COMMENTS:</b> _____			
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<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	




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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 4.2 Heat Recovery Core


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
1) Exterior air			
Inlet air into core:			
– Air flow [ cfm ; l/s ]			
– Dry bulb temperature [ °F ; °C ]	[ 1 ]		
– Wet bulb temperature [ °F ; °C ]	[ 1 ]		
Outlet air into core:			
– Air flow [ cfm ; l/s ]			
– Dry bulb temperature [ °F ; °C ]	[ 1 ]		
– Wet bulb temperature [ °F ; °C ]	[ 1 ]		
2) Exhaust air:			
– Air flow [ cfm ; l/s ]			
– Dry bulb temperature [ °F ; °C ]	[ 1 ]		
– Wet bulb temperature [ °F ; °C ]	[ 1 ]		
Efficiency:	[ 2 ]		
– Supplier's certificate is appended.			
<b>COMMENTS: [ 1 ] TEMPERATURES TAKEN WILL BE USED TO CALCULATE CORE EFFICIENCY USING THE SUPPLIER'S SOFTWARE.</b> <b>[ 2 ] CORE EFFICIENCY AT MEASURED CONDITIONS MUST BE INDICATED. SUPPLIER MUST CERTIFY THAT THIS EFFICIENCY IS IDENTICAL TO THAT IN ARI CONDITIONS.</b>			
<hr/> <hr/> <hr/>			
<b>PERFORMED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____		_____	
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 4.3 Supply Fans


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
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_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 4.4 Return Fans


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
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_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

### 4.5 Heating Coil

<b>Identification:</b>	<b>Location:</b>			
<b>Manufacturer:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)	
<ul style="list-style-type: none"> <li>• Water/glycol side: <ul style="list-style-type: none"> <li>– Flow [ gpm ; l/s ]</li> <li>– Inlet temperature [ °F ; °C ]</li> <li>– Outlet temperature [ °F ; °C ]</li> <li>– Temperature differential [ °F ; °C ]</li> <li>– Pressure loss [ psi ; kPa ]</li> </ul> </li> <li>• Air side: <ul style="list-style-type: none"> <li>– Flow [ cfm ; l/s ]</li> <li>– Air speed [ ft/min ; m/s ]</li> <li>– Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> <li>– Inlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Outlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Coil capacity</li> </ul> </li> </ul>				
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ 				
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				

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## SPECIFIC COMMISSIONING PLAN ENERGY RECOVERY VENTILATION

4.6      **Regulation and Control** – Sequence of Operation to be included by Contractor



## ISSUES LOG LIST – ENERGY RECOVERY VENTILATION

[illegible]

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## SPECIFIC COMMISSIONING PLAN AIR HANDLER UNIT

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN AIR HANDLER UNIT

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:

- Checklists – Static Inspection;
- Checklists – Operational Inspection.


All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.




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## SPECIFIC COMMISSIONING PLAN AIR HANDLER UNIT

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<b>2.</b>	<b>RELATED SYSTEMS .....</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
<b>3.1</b>	<b>AHU – General .....</b>	<b>4</b>
<b>3.2</b>	<b>Supply Fan .....</b>	<b>5</b>
<b>3.3</b>	<b>Exhaust Fan .....</b>	<b>6</b>
<b>3.4</b>	<b>Heating Coil .....</b>	<b>7</b>
<b>3.5</b>	<b>Humidifier .....</b>	<b>8</b>
<b>3.6</b>	<b>Motorized Dampers .....</b>	<b>9</b>
<b>3.7</b>	<b>Fire Dampers .....</b>	<b>10</b>
<b>3.8</b>	<b>VAV Boxes .....</b>	<b>11</b>
<b>3.9</b>	<b>Ceiling Fan .....</b>	<b>12</b>
<b>3.10</b>	<b>Regulation and Control – Points List to be included by Contractor .....</b>	<b>13</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>14</b>
<b>4.1</b>	<b>AHU - General .....</b>	<b>14</b>
<b>4.2</b>	<b>Supply Fan .....</b>	<b>15</b>
<b>4.3</b>	<b>Exhaust Fan .....</b>	<b>16</b>
<b>4.4</b>	<b>Heating Coil .....</b>	<b>17</b>
<b>4.5</b>	<b>Humidifier .....</b>	<b>18</b>
<b>4.6</b>	<b>Ceiling Fans .....</b>	<b>19</b>
<b>4.7</b>	<b>Regulation and Control – Sequences of Operation to be included .....</b>	<b>20</b>

### ISSUES LOG LIST

Keep issues log list up to date.

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## AIR HANDLER UNIT

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 AHU – General

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS</b>
<ul style="list-style-type: none"> <li>Unit assembly is as per shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Identification of unit and components is complete.</li> <li>Access doors are seal tight.</li> <li>Viewing ports are clean.</li> <li>All vibration attenuating devices have been removed from their shipping restraints.</li> <li>Sound attenuating devices are in place.</li> <li>Thermal insulation is complete.</li> <li>All accessories (manometers, thermometers, etc.) have been installed and calibrated.</li> <li>Supply network ducts and unit have been cleaned.</li> <li>Construction-type filters have been removed and the filters as specified in contract have been installed.</li> <li>Condensate drip pans are functional and water guards have been filled.</li> <li>All balancing dampers are in maximum opening position for start-up.</li> <li>Marine inspection lights have been connected and are operational.</li> <li>Belt guards are in place.</li> <li>Moving parts have been lubricated.</li> <li>All moving parts have been verified manually and no friction has been detected.</li> <li>Static verification checklists for all components have been completed and no elements appearing on the deficiency list prevent start-up of the AHU.</li> <li>The manufacturer's installation acceptance certificate has been appended.</li> </ul>			
	<b>COMMENTS:</b> _____		
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			
<b>APPROVED FOR START-UP BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span><b>SIGNATURE</b></span> <span><b>DATE</b></span> </div>			




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## AIR HANDLER UNIT

### 3.3 Exhaust Fan


<b>Identification:</b>	<b>Location:</b>			
<b>Manufacturer:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Registers and control dampers are in start position (as per diagram).</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
_____				
_____				
_____				
_____				
_____				
<b>COMPILED BY:</b> _____				
SIGNATURE	DATE			
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE	DATE			

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## AIR HANDLER UNIT

### 3.4 Heating Coil

<b>Sub-contractor:</b>	<b>Project No.:</b>	<b>Document No.:</b>		
<b>System / Tag # :</b>	<b>Location:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)	
• Access/clearance for maintenance.				
• Piping installed, cleaned and tested.				
• Valves and fittings installed and tested for leaks.				
• Installation allows for removal of coils.				
• Piping supports are independent of equipment.				
• Instrumentation and sight glass are accessible.				
• Accessories (manometers, thermometers, purges and drain valves) are installed.				
• Pressure valve installed and tested.				
• Strainer removed and cleaned.				
• Valves and fittings are in start position (as per diagram).				
• Fins are cleaned and combed.				
• Flow direction has been verified.				
• Check valves are present.				
<b>COMMENTS:</b> _____				
<b>PERFORMED BY:</b> _____		_____		
SIGNATURE		DATE		


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## AIR HANDLER UNIT

### 3.5 Humidifier

<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Piping supported as required by specifications</li> <li>Piping cleaned and free from leaks</li> <li>Steam lines sloped to ensure proper drainage away from humidifier</li> <li>Vapour lines and manifolds sloped to ensure proper drainage away from ventilation duct</li> <li>Even distribution of vapour</li> <li>Freedom from water deposit</li> <li>Clearance around unit for maintenance</li> <li>Unit label installed and visible</li> <li>Valves easy to access</li> <li>Valves tags installed and visible</li> <li>Manufacturer's report completed and attached</li> </ul>			
<b>COMMENTS:</b> _____			
_____			
_____			
_____			
_____			
<b>COMPILED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____		_____	
SIGNATURE		DATE	



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## AIR HANDLER UNIT

### 3.7 Fire Dampers

DESCRIPTION OF VERIFICATIONS					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
Fire Damper No.					
Manufacturer					
Model					
Size					
Location					
Label visible					
Damper track clean, without obstruction					
Access for maintenance					
<b>COMMENTS:</b> _____					
<b>PERFORMED BY:</b> _____			_____		
SIGNATURE			DATE		
<b>APPROVED FOR TESTING BY:</b> _____			_____		
SIGNATURE			DATE		






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## AIR HANDLER UNIT


### 3.9 Ceiling Fan

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>			
	<b>COMMENTS:</b> _____		
_____			
_____			
_____			
<b>COMPILED BY:</b> _____			
SIGNATURE	DATE		
<b>APPROVED FOR START-UP BY:</b> _____			
SIGNATURE	DATE		

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## AIR HANDLER UNIT

3.10      **Regulation and Control – Points List to be included by Contractor**


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## AIR HANDLER UNIT

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 AHU - General


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>AHU has been started and operates normally.</li> <li>AHU does not generate any excessive noise.</li> <li>Air supply network has been balanced and the verification report appended.</li> <li>Control sequences have been verified and the verification report has been appended.</li> <li>Permanent marking for damper and valve positioning has been performed (further to balancing report approval).</li> <li>Deficiency list is up to date. Points remaining may be transferred to the project monitoring list. None of the points awaiting resolution prevent the system from operating normally.</li> <li>O&amp;M training on AHU may begin.</li> <li>Performance testing may begin.</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## AIR HANDLER UNIT

### 4.2 Supply Fan


<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## AIR HANDLER UNIT

### 4.3 Exhaust Fan


<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## AIR HANDLER UNIT

### 4.4 Heating Coil

<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>• Water/glycol side:               <ul style="list-style-type: none"> <li>– Flow [ gpm ; l/s ]</li> <li>– Inlet temperature [ °F ; °C ]</li> <li>– Outlet temperature [ °F ; °C ]</li> <li>– Temperature differential [ °F ; °C ]</li> <li>– Pressure loss [ psi ; kPa ]</li> </ul> </li> <li>• Air side:               <ul style="list-style-type: none"> <li>– Flow [ cfm ; l/s ]</li> <li>– Air speed [ ft/min ; m/s ]</li> <li>– Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> <li>– Inlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Outlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Coil capacity</li> </ul> </li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			


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## AIR HANDLER UNIT

### 4.5 Humidifier

<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Valves operation working properly</li> <li>Air flow and HR sensor operation verified</li> <li>Sequence of control verified</li> <li>Duct high limit operation verified</li> <li>Low / high HR alarms verified on BAS</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span>SIGNATURE</span> <span>DATE</span> </div>			




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## AIR HANDLER UNIT

### 4.6 Ceiling Fans

<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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4.7      **Regulation and Control** – Sequences of Operation to be included



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## SPECIFIC COMMISSIONING PLAN MECHANICAL ROOM VENTILATION SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN MECHANICAL ROOM VENTILATION SYSTEM

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.


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## SPECIFIC COMMISSIONING PLAN MECHANICAL ROOM VENTILATION SYSTEM

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<b>2.</b>	<b>RELATED SYSTEMS .....</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
<b>3.1</b>	<b>Supply Fan .....</b>	<b>4</b>
<b>3.2</b>	<b>Return Fan .....</b>	<b>5</b>
<b>3.3</b>	<b>Motorized Dampers .....</b>	<b>6</b>
<b>3.4</b>	<b>Air Filters .....</b>	<b>7</b>
<b>3.5</b>	<b>Regulation and Control – Points List to be included by Contractor .....</b>	<b>8</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>9</b>
<b>4.1</b>	<b>Supply Fan .....</b>	<b>9</b>
<b>4.2</b>	<b>Return Fan .....</b>	<b>10</b>
<b>4.3</b>	<b>Regulation and Control – Sequences of Operation to be included by Contractor .....</b>	<b>11</b>

### ISSUES LOG LIST

Keep issues log list up to date.


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## MECHANICAL ROOM VENTILATION SYSTEM

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 Supply Fan

<b>Identification:</b>	<b>Location:</b>			
<b>Manufacturer:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>√</b>	<b>N.A.</b>	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Registers and control dampers are in start position (as per diagram).</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
_____				
_____				
_____				
_____				
<b>COMPILED BY:</b> _____				
SIGNATURE		DATE		
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE		DATE		

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## MECHANICAL ROOM VENTILATION SYSTEM

### 3.2 Return Fan

<b>Identification:</b>	<b>Location:</b>			
<b>Manufacturer:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Registers and control dampers are in start position (as per diagram).</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
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<b>COMPILED BY:</b> _____				
SIGNATURE	DATE			
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE	DATE			






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## MECHANICAL ROOM VENTILATION SYSTEM


### 3.4 Air Filters

<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Complies with shop drawing.</li> <li>Filter intact upon delivery.</li> <li>Manufacturer's certificate included (this certificate is mandatory for HEPA and ULPA filters).</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Air flow [ cfm ; l/s ]</li> <li>Face speed [ ft./min ; m/s ]</li> <li>Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <div style="text-align: center;">SIGNATURE</div> <div style="text-align: center;">DATE</div> </div>			

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## MECHANICAL ROOM VENTILATION SYSTEM

3.5      **Regulation and Control – Points List to be included by Contractor**


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## MECHANICAL & ELECTRICAL ROOM VENTILATION SYSTEM

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 Supply Fan


<b>Identification:</b>	<b>Location:</b>		
<b>Manufacturer:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
DESCRIPTION OF VERIFICATIONS	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## MECHANICAL & ELECTRICAL ROOM VENTILATION SYSTEM

### 4.2 Return Fan

<b>Identification:</b>		<b>Location:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
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<b>PERFORMED BY:</b> _____		_____	
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____		_____	
SIGNATURE		DATE	

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## MECHANICAL & ELECTRICAL ROOM VENTILATION SYSTEM

4.3      **Regulation and Control** – Sequences of Operation to be included by Contractor



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## SPECIFIC COMMISSIONING PLAN

### REGULATION AND CONTROL

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

#### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

#### **COMMISSIONING**

Checklists have been completed and any deficiencies identified have been resolved.


The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date



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## **SPECIFIC COMMISSIONING PLAN**

### **REGULATION AND CONTROL**

#### **1. VERIFICATION CHECKS AND ACTIVITIES**

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

#### **2. RELATED SYSTEMS**

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

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## SPECIFIC COMMISSIONING PLAN

### REGULATION AND CONTROL

<b>1.</b>	<b>VERIFICATION CHECKS AND ACTIVITIES.....</b>	<b>2</b>
<b>2.</b>	<b>RELATED SYSTEMS.....</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS .....</b>	<b>4</b>
<b>3.1</b>	<b>List of Calibrated Instruments .....</b>	<b>4</b>
<b>3.2</b>	<b>Variable Frequency Drive (VFD) .....</b>	<b>5</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS.....</b>	<b>6</b>
<b>4.1</b>	<b>Regulation and Control – <i>sequence of operation by system – example only – to be completed with EMCS contractor’s detailed controlled sequences</i>.....</b>	<b>6</b>
<b>4.2</b>	<b>Regulation and Control – <i>sequences of operation for integrated systems – to be completed with EMCS contractor’s detailed controlled sequences</i>.....</b>	<b>7</b>
<b>4.3</b>	<b>Data and Graphics for 5 Consecutive Days – to be prepared by contractor, send weekly....</b>	<b>7</b>
<b>4.4</b>	<b>Miscellaneous Alarms Report – to be prepared by contractor .....</b>	<b>7</b>
<b>4.5</b>	<b>Variable Frequency Drive (VFD) .....</b>	<b>8</b>

### ISSUES LOG LIST

Keep issues log list up to date.




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## SPECIFIC COMMISSIONING PLAN – REGULATION AND CONTROL

### 3. STATIC VERIFICATION (SV) CHECKLISTS

### 3.1 List of Calibrated Instruments

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## SPECIFIC COMMISSIONING PLAN REGULATION AND CONTROL

### 3.2 Variable Frequency Drive (VFD)

<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>System powered</b>		<b>Capacity (hp)</b>	
<b>Fuse (A)</b>		<b>Type of start-up</b>	
<b>Nominal voltage (V)</b>			

DESCRIPTION OF VERIFICATIONS			
STATIC VERIFICATION	√	N.A.	COMMENTS
• Equipment corresponds to plan and shop drawing			
• No visible trace of damage that occurred during delivery			
• Static verification checklist completed by manufacturer and appended			
• Wiring diagram installed inside the panel and visible			
• All connections are properly installed and tightened			
• VFD accessible for safe operation			
• Number of auxiliary contacts: NO/NC			
• Connection of fire alarm relay module			
• Cable size – primary (AWG)			
• Cable size – secondary (AWG)			
• Capacity of short-circuit current and circuit breakers correspond to plan			
• Lock-out device corresponds to plan			
• Lamp lights functional and provide proper colour			


**COMMENTS:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**PERFORMED BY:** \_\_\_\_\_  

**SIGNATURE**
**DATE**

**VERIFIED BY:** \_\_\_\_\_  

**SIGNATURE**
**DATE**


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## SPECIFIC COMMISSIONING PLAN REGULATION AND CONTROL

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

4.1 **Regulation and Control** – *sequence of operation by system – example only – to be completed with EMCS contractor's detailed controlled sequences*

OPERATION SEQUENCES VERIFICATION TABLE					
ACTION	Expected results	Observed results	Accepted? (Yes / No)	Initials/ Date	Remarks
Decrease or increase pressure set point, temperature, humidity of flow or others.	Control signal of damper, valve or EFV must decrease or increase according to control loop operation.				Note the signal value and measured variable value before and after variation.
Simulate a controller breakdown.	Valves, dampers and signals must return to their normal position and value.				Note or generate reports on signal values and on measured variable values before and after variation.
Simulate a defect of a temperature, pressure, humidity or flow probe and others if required.	Valves, dampers and signals must return to their normal position and value.				Note or generate reports on signal values and on those of the measured variable before and after variation.
Simulate a power breakdown, a power return to normal, an emergency mode, an unoccupied mode, a winter mode, a summer mode or any other critical mode or situation.	Systems must start-up in sequence according to pre-programmed time periods. Systems will be activated in order to react and respond to operation requirements, depending on modes.				Note or generate reports on systems start-up actual time periods and sequences execution in emergency mode.
Simulate temperature and pressure low and high limits.	The system must stop and operations on dampers, motors and valves will be executed by the BAS system.				Note or generate reports on systems start-up actual time periods and sequences execution in protection mode.
Initialise a system start-up.	All alarms will be deactivated for an adjustable period of 15 minutes.				Note or generate reports on alarms during deactivation

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## SPECIFIC COMMISSIONING PLAN REGULATION AND CONTROL


OPERATION SEQUENCES VERIFICATION TABLE					
ACTION	Expected results	Observed results	Accepted? (Yes / No)	Initials/ Date	Remarks
					period.

4.2 **Regulation and Control** – sequences of operation for integrated systems – *to be completed with EMCS contractor's detailed controlled sequences*

- HVAC associated system for cooling mode
- HVAC associated system for heating mode
- Emergency generator and main equipments respond on power failure mode
- Fire alarm, fire pump and main equipment respond on emergency mode

4.3 **Data and Graphics for 5 Consecutive Days** – to be prepared by contractor, send weekly

4.4 **Miscellaneous Alarms Report** – to be prepared by contractor

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## SPECIFIC COMMISSIONING PLAN REGULATION AND CONTROL

### 4.5 Variable Frequency Drive (VFD)

<b>Manufacturer</b>		<b>Model</b>	
<b>Serial no.</b>		<b>Location</b>	
<b>System powered</b>		<b>Capacity (hp)</b>	
<b>Fuse (A)</b>		<b>Type of start-up</b>	
<b>Nominal voltage (V)</b>			

DESCRIPTION OF VERIFICATIONS																																						
OPERATIONAL VERIFICATION		COMMENTS																																				
<ul style="list-style-type: none"> <li>Activate the switches and contactor to ensure that they are working appropriately.</li> <li>Communication protocol and port functional</li> <li>Input choke value</li> <li>DV/DT filter</li> <li>Check start-up and shut-down sequence for each contactor and relay.</li> <li>Ensure that sequential commands are functional and respect the requirements.</li> </ul>																																						
<ul style="list-style-type: none"> <li>Measurements: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <th colspan="2">Voltage (V)</th><th colspan="2">Current (A)</th></tr> <tr> <td>Phase A-B</td><td></td><td>Phase A</td><td></td></tr> <tr> <td>Phase B-C</td><td></td><td>Phase B</td><td></td></tr> <tr> <td>Phase A-C</td><td></td><td>Phase C</td><td></td></tr> <tr> <td>Phase A-G</td><td></td><td>Phase G</td><td></td></tr> <tr> <td>Phase B-G</td><td></td><td></td><td></td></tr> <tr> <td>Phase C-G</td><td></td><td></td><td></td></tr> </table> </li> <li>Insulation resistance measurements (megohmmeter @ 1000 VDC) <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <th>Phase A-B</th><th>Phase B-C</th><th>Phase A-C</th></tr> <tr> <td></td><td></td><td></td></tr> </table> </li> <li>Total harmonic distortion: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <th>(% THD)</th></tr> <tr> <td></td></tr> </table> </li> </ul>	Voltage (V)		Current (A)		Phase A-B		Phase A		Phase B-C		Phase B		Phase A-C		Phase C		Phase A-G		Phase G		Phase B-G				Phase C-G				Phase A-B	Phase B-C	Phase A-C				(% THD)			
Voltage (V)		Current (A)																																				
Phase A-B		Phase A																																				
Phase B-C		Phase B																																				
Phase A-C		Phase C																																				
Phase A-G		Phase G																																				
Phase B-G																																						
Phase C-G																																						
Phase A-B	Phase B-C	Phase A-C																																				
(% THD)																																						

**COMMENTS:** \_\_\_\_\_

**PERFORMED BY:** \_\_\_\_\_  

**SIGNATURE**
**DATE**

**VERIFIED BY:** \_\_\_\_\_  


**SIGNATURE**
**DATE**



## ISSUES LOG LIST – REGULATION AND CONTROL

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## SPECIFIC COMMISSIONING PLAN BOILER ROOM VENTILATION SYSTEM

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN BOILER ROOM VENTILATION SYSTEM

### 1. VERIFICATION CHECKS AND ACTIVITIES

The checklists included in the appended table of this protocol must be filled in by the system's Specialized Contractor. Some of the activities described in the checklists may be performed by a sub-contractor. These activities fall under the responsibility of the Specialized Contractor.

Verification checklists are presented according to components and divided according to two different types:


- Checklists – Static Inspection;
- Checklists – Operational Inspection.

All static verification checklists must be completed, signed by the related contractor and countersigned by Design Engineer and the Cx Manager before the system is started and operational verifications have commenced.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

### 2. RELATED SYSTEMS

The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.


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## SPECIFIC COMMISSIONING PLAN BOILER ROOM VENTILATION SYSTEM

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<b>2.</b>	<b>RELATED SYSTEMS</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS</b>	<b>4</b>
<b>3.1</b>	<b>Fan supply – SF-F133.1-1</b>	<b>4</b>
<b>3.2</b>	<b>Fan supply – SF-F133.1-2</b>	<b>5</b>
<b>3.3</b>	<b>Fan exhaust – EF-F133.1</b>	<b>6</b>
<b>3.4</b>	<b>Heating Coil – F-F133.1-HC</b>	<b>7</b>
<b>3.5</b>	<b>Motorized Dampers</b>	<b>8</b>
<b>3.6</b>	<b>Air Filters – MERV-8</b>	<b>9</b>
<b>3.7</b>	<b>Regulation and control – point par point list to be included by contractor</b>	<b>10</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS</b>	<b>11</b>
<b>4.1</b>	<b>Fan supply – SF-F133.1-1</b>	<b>11</b>
<b>4.2</b>	<b>Fan supply – SF-F133.1-2</b>	<b>12</b>
<b>4.3</b>	<b>Fan exhaust – EF-1-F133.1</b>	<b>13</b>
<b>4.4</b>	<b>Heating coil – F-F133.1-HC</b>	<b>14</b>
<b>4.5</b>	<b>Regulation and control – sequences of operation to be included by contractor</b>	<b>15</b>

### ISSUES LOG LIST

Keep issues log list up to date.

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## BOILER ROOM VENTILATION SYSTEM

### 3. STATIC VERIFICATION (SV) CHECKLISTS

#### 3.1 Fan supply – SF-F133.1-1

<b>Identification:</b>	<b>Location:</b>			
<b>Make:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Registers and control dampers are in start position (as per diagram).</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
_____				
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_____				
<b>COMPILED BY:</b> _____				
SIGNATURE		DATE		
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE		DATE		




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## BOILER ROOM VENTILATION SYSTEM

### 3.3 Fan exhaust – EF-F133.1

<b>Identification:</b>	<b>Location:</b>			
<b>Make:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)	
<ul style="list-style-type: none"> <li>Equipment is in compliance with shop drawing.</li> <li>No visible traces of damage that occurred during delivery.</li> <li>Shipping bolts have been removed.</li> <li>Bolting and support base are complete.</li> <li>Vibration isolators move freely.</li> <li>The fan rotates freely with no friction.</li> <li>The belt is tight and pulley is properly aligned.</li> <li>Bearings and housing units have been lubricated.</li> <li>Registers and control dampers are in start position (as per diagram).</li> <li>Electrical connections:               <ul style="list-style-type: none"> <li>– connections are complete and electrical supply verified;</li> <li>– overload protection has been installed and is correctly sized;</li> <li>– fan rotation direction has been verified.</li> </ul> </li> <li>Controls:               <ul style="list-style-type: none"> <li>– control points are in compliance and functional;</li> <li>– VFD checklist has been completed;</li> <li>– interlocks have been verified and are functional.</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____			
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<b>COMPILED BY:</b> _____				
SIGNATURE		DATE		
<b>APPROVED FOR START-UP BY:</b> _____				
SIGNATURE		DATE		

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## BOILER ROOM VENTILATION SYSTEM

### 3.4 Heating Coil – F-F133.1-HC

<b>Sub-contractor:</b>	<b>Project No.:</b>	<b>Document No.:</b>		
<b>System / Tag # :</b>	<b>Location:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	√	N.A.	COMMENTS (#)	
• Access/clearance for maintenance.				
• Piping installed, cleaned and tested.				
• Valves and fittings installed and tested for leaks.				
• Installation allows for removal of coils.				
• Piping supports are independent of equipment.				
• Instrumentation and sight glass are accessible.				
• Accessories (manometers, thermometers, purges and drain valves) are installed.				
• Pressure valve installed and tested.				
• Strainer removed and cleaned.				
• Valves and fittings are in start position (as per diagram).				
• Fins are cleaned and combed.				
• Flow direction has been verified.				
• Check valves are present.				
<b>COMMENTS:</b> _____				
_____				
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_____				
_____				
<b>PERFORMED BY:</b> _____		_____		
SIGNATURE		DATE		






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## BOILER ROOM VENTILATION SYSTEM

### 3.6 Air Filters – MERV-8


<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF STATIC VERIFICATIONS</b>	√	N.A.	COMMENTS (#)
<ul style="list-style-type: none"> <li>Complies with shop drawing.</li> <li>Filter intact upon delivery.</li> <li>Manufacturer's certificate included (this certificate is mandatory for HEPA and ULPA filters).</li> </ul>			
<b>DESCRIPTION OF OPERATIONAL VERIFICATIONS</b>	SPECIFIED	MEASURED	COMMENTS (#)
<ul style="list-style-type: none"> <li>Air flow [ cfm ; l/s ]</li> <li>Face speed [ ft./min ; m/s ]</li> <li>Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> </ul>			
<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____			
<b>COMPILED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>			

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## **BOILER ROOM VENTILATION SYSTEM**

3.7      **Regulation and control** – point par point list to be included by contractor

Use template in reference with table 4, page 13, MD 250005 - 2009


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## BOILER ROOM VENTILATION SYSTEM

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

#### 4.1 Fan supply – SF-F133.1-1


<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
_____			
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_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE	DATE		
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE	DATE		

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## BOILER ROOM VENTILATION SYSTEM

### 4.2 Fan supply – SF-F133.1-2


<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
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<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	

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## BOILER ROOM VENTILATION SYSTEM

### 4.3 Fan exhaust – EF-1-F133.1


<b>Identification:</b>	<b>Location:</b>		
<b>Make:</b>	<b>Model:</b>		
<b>Serial No.:</b>			
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>
<ul style="list-style-type: none"> <li>Rotation speed – fan [ rpm ]</li> <li>Rotation speed – motor [ rpm ]</li> <li>Electrical supply [ V / ph / Hz ]</li> <li>Current [ A ] : T1</li> <li>Current [ A ] : T2</li> <li>Current [ A ] : T3</li> <li>Motor power [ HP ; kW ]</li> <li>Overload protection adjustment</li> </ul>			
<b>COMMENTS:</b> _____			
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_____			
<b>PERFORMED BY:</b> _____			
SIGNATURE		DATE	
<b>APPROVED FOR TESTING BY:</b> _____			
SIGNATURE		DATE	

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## BOILER ROOM VENTILATION SYSTEM

### 4.4 Heating coil – F-F133.1-HC

<b>Identification:</b>	<b>Location:</b>			
<b>Make:</b>	<b>Model:</b>			
<b>Serial No.:</b>				
<b>DESCRIPTION OF VERIFICATIONS</b>	<b>SPECIFIED</b>	<b>MEASURED</b>	<b>COMMENTS (#)</b>	
<ul style="list-style-type: none"> <li>• Water/glycol side: <ul style="list-style-type: none"> <li>– Flow [ gpm ; l/s ]</li> <li>– Inlet temperature [ °F ; °C ]</li> <li>– Outlet temperature [ °F ; °C ]</li> <li>– Temperature differential [ °F ; °C ]</li> <li>– Pressure loss [ psi ; kPa ]</li> </ul> </li> <li>• Air side: <ul style="list-style-type: none"> <li>– Flow [ cfm ; l/s ]</li> <li>– Air speed [ ft/min ; m/s ]</li> <li>– Pressure loss [ in.H<sub>2</sub>O ; Pa ]</li> <li>– Inlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Outlet temperature (dry bulb/wet bulb) [ °F ; °C ]</li> <li>– Coil capacity</li> </ul> </li> </ul>				
	<b>COMMENTS:</b> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ 			
<b>PERFORMED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				
<b>APPROVED FOR TESTING BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 100%;"> <span>SIGNATURE</span> <span>DATE</span> </div>				

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## BOILER ROOM VENTILATION SYSTEM

4.5      **Regulation and control** – sequences of operation to be included by contractor



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## SPECIFIC COMMISSIONING PLAN FUME HOODS

<b>Identification:</b>	
<b>Description:</b>	
<b>Location:</b>	

### **APPROVAL**

The Commissioning for the system identified above has been completed.

The checklists have been completed, reviewed and approved by those responsible. This Commissioning protocol is submitted for approval and unresolved deficiencies have been included in the appendix. Deficiencies do not prevent the system from operating reliably or safely.

Commissioning Coordinator, Construction	Date

### **COMMISSIONING**


Checklists have been completed and any deficiencies identified have been resolved.

The System Manual has been provided, reviewed and approved.

Necessary training has taken place.

Performance testing for the equipment may begin.

Commissioning Authority	Date	Design Engineer	Date

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 1. VERIFICATION CHECKS AND ACTIVITIES - REF. PWGSC GUIDELINE MD 15128-2013

All parts involved in design, installation, testing and approval have to refer to the document: PWGSC Guideline MD 15128–2013 – Laboratory Fume Hoods

Several steps have to be completed before starting integral tests of each Fume Hood. The general contractor, the manufacturer and all the sub-contractors will follow PWGSC guidelines MD 15128-2013 and ASHRAE 110-95. All technical and architectural specifications have to be followed during the process and verified on site before starting tests.

Table 5-1, chapter 5, MD 15128-2013 Guideline indicates the roles and responsibilities of each part during purchase and manufacturer's tests, installation, on site tests and annual tests.

A deficiency list must be appended to the protocol and updated as verification work takes place. Any system deficiency of any components must be included in this list. Once deficiencies have been resolved, pertinent information must be included in this list. The Specialized Contractor may submit the System Commissioning Report even if deficiencies have not been corrected, on the condition that such deficiencies do not present a danger for operators or the system itself, and that performance losses due to a deficiency do not prevent TAB work from taking place.

For all fume hood test see section 23 05 93.13

### 2. RELATED SYSTEMS


The Commissioning for the system and its components must be coordinated with the Commissioning of related networks and systems.

The Fume Hood tests will be done by specialized fume hood tester and coordinated by general contractor on site with plumbing, TAB, BAS, HVAC and electrical sub-contractor.

Once TAB report completed, provide smoke test for:

- ventilated cabinets storage
- elephant trunk
- biosafety cabinet
- ventilated table

For smoke test see section 23 05 93


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## SPECIFIC COMMISSIONING PLAN FUME HOODS

<b>1.</b>	<b>VERIFICATION CHECKS AND ACTIVITIES - REF. PWGSC GUIDELINE MD 15128-2013</b>	<b>2</b>
<b>2.</b>	<b>RELATED SYSTEMS</b>	<b>2</b>
<b>3.</b>	<b>STATIC VERIFICATION (SV) CHECKLISTS</b>	<b>4</b>
<b>3.1</b>	<b>C.1 – Commissioning checklist</b>	<b>4</b>
<b>3.2</b>	<b>Regulation and control – point list verification to be included by contractor</b>	<b>5</b>
<b>3.1</b>	<b>C.1 – Commissioning checklist</b>	<b>6</b>
<b>4.</b>	<b>OPERATIONAL VERIFICATION (OV) CHECKLISTS</b>	<b>8</b>
<b>4.1</b>	<b>C-2 – Performance Verification (PV) Report Forms – Hood and systems</b>	<b>8</b>
<b>4.2</b>	<b>C-4 – Forms for Test Results – VAV</b>	<b>8</b>
<b>4.3</b>	<b>C-5 – Statement of Conformance</b>	<b>8</b>
<b>4.4</b>	<b>Smoke test for ventilated cabinets, ventilated table, biosafety cabinet</b>	<b>8</b>
<b>4.5</b>	<b>Regulation and control – sequences of operation verification to be included by contractor</b>	<b>8</b>
<b>4.1</b>	<b>C-2 – Performance Verification (PV) Report Forms – Hood and systems</b>	<b>9</b>
<b>4.2</b>	<b>C-4 – Forms for Test Results – VAV</b>	<b>11</b>
<b>4.3</b>	<b>C-5 – Statement of Conformance</b>	<b>16</b>

### ISSUES LOG LIST

Keep issues log list up to date.


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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 3. STATIC VERIFICATION (SV) CHECKLISTS

See MD 15128-2013 Laboratory Fume Hoods, Appendix C – On-site test forms:


#### 3.1 C.1 – Commissioning checklist

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 3.2 **Regulation and control – point list verification to be included by contractor**

Use template in reference with table 4, page 13, MD 250005 – 2009


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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 3.1 C.1 – Commissioning checklist

## C.1 Commissioning Checklist


Laboratory Fume Hoods			Page 1
Project:	Project No:	Date:	
Room:	Type:	Overall sizes:	
Fume Hood No. on Contract Dwgs:			
Mfr:	Mfr Serial No.:	MMS Identifier:	
<b>Installation:</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> Minimum disturbance of smooth air flow into fume hood by passing traffic  <input type="checkbox"/> No obstructions to air flow into hood  <input type="checkbox"/> Freedom of movement for fume hood user </div> <div style="width: 48%;"> <input type="checkbox"/> All labels firmly attached  <input type="checkbox"/> User instructions complete and in place  <input type="checkbox"/> Electronic sketch of the room, showing the location of the hood, windows and doors, all major furniture, air supply and return, etc. </div> </div>			
<b>Bypass (if provided):</b> <input type="checkbox"/> Operates as designed		<b>Work Surface:</b> <input type="checkbox"/> Work surface recessed to contain spills	
<b>Baffles:</b> <input type="checkbox"/> Factory settings <input type="checkbox"/> Unalterable by fume hood user <input type="checkbox"/> Position of baffles recorded and dimensioned (mm)		<b>Bottom Airfoil:</b> <input type="checkbox"/> Height fixed (usually 25 mm)	
<b>Sash:</b> <input type="checkbox"/> Freedom of movement <input type="checkbox"/> Locations of stop set to limit maximum operating position (manual override for set-up)		<b>Counterbalance Mechanism:</b> <input type="checkbox"/> Sash moveable from one end <input type="checkbox"/> Sash remains fixed (i.e., no creep)	
<b>Services:</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> Corrosion-resistant finish as required  <input type="checkbox"/> Electrical: <div style="margin-left: 20px;"> <input type="checkbox"/> Receptacle—correct power  <input type="checkbox"/> Connected to emergency power (if required) </div> </div> <div style="width: 48%;"> <input type="checkbox"/> Mechanical: <div style="margin-left: 20px;"> <input type="checkbox"/> Correct gases from each outlet  <input type="checkbox"/> Outlets properly identified  <input type="checkbox"/> Correct pressure at outlet  <input type="checkbox"/> Isolating controls easily accessible  <input type="checkbox"/> Correct identification on each outlet </div> </div> </div>			

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.1 Commissioning Checklist (cont'd)

Laboratory Fume Hoods	Page 2		
<b>Fire Extinguishing System</b> (if installed): <input type="checkbox"/> Tested and operational			
<b>Scrubber System</b> (if installed): <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Correct neutralizing agent and concentration for contaminant  <input type="checkbox"/> Fluid pressure developed by pump sufficient for good atomization  <input type="checkbox"/> Atomizing sprays operating properly  <input type="checkbox"/> Spray system drainage operates correctly and is accessible for cleaning               </td> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Reservoir drainage and recharging facilities easily accessible  <input type="checkbox"/> Control system verified  <input type="checkbox"/> Pump connected to emergency power (if required)  <input type="checkbox"/> Scrubber efficiency tested and verified               </td> </tr> </table>		<input type="checkbox"/> Correct neutralizing agent and concentration for contaminant <input type="checkbox"/> Fluid pressure developed by pump sufficient for good atomization <input type="checkbox"/> Atomizing sprays operating properly <input type="checkbox"/> Spray system drainage operates correctly and is accessible for cleaning	<input type="checkbox"/> Reservoir drainage and recharging facilities easily accessible <input type="checkbox"/> Control system verified <input type="checkbox"/> Pump connected to emergency power (if required) <input type="checkbox"/> Scrubber efficiency tested and verified
<input type="checkbox"/> Correct neutralizing agent and concentration for contaminant <input type="checkbox"/> Fluid pressure developed by pump sufficient for good atomization <input type="checkbox"/> Atomizing sprays operating properly <input type="checkbox"/> Spray system drainage operates correctly and is accessible for cleaning	<input type="checkbox"/> Reservoir drainage and recharging facilities easily accessible <input type="checkbox"/> Control system verified <input type="checkbox"/> Pump connected to emergency power (if required) <input type="checkbox"/> Scrubber efficiency tested and verified		
<b>Light Fixture:</b> <input type="checkbox"/> Lens sealed <span style="float: right;"><input type="checkbox"/> Light level verified</span>			
<b>Controls:</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Control sequences and alarm systems verified  <input type="checkbox"/> Visual, audible annunciator for power to fume hood system, adequate air flow for fume hood operation  <input type="checkbox"/> Visual and audible alarm for low air flow, audible alarms with muting switches               </td> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Vapour warning system (if required)  <input type="checkbox"/> Connected to emergency power  <input type="checkbox"/> Written instructions available               </td> </tr> </table>		<input type="checkbox"/> Control sequences and alarm systems verified <input type="checkbox"/> Visual, audible annunciator for power to fume hood system, adequate air flow for fume hood operation <input type="checkbox"/> Visual and audible alarm for low air flow, audible alarms with muting switches	<input type="checkbox"/> Vapour warning system (if required) <input type="checkbox"/> Connected to emergency power <input type="checkbox"/> Written instructions available
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<b>Fume Hood Exhaust Air Systems:</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Exhaust air flow rate confirmed by TAB  <input type="checkbox"/> Minimum air flow when sash closed verified at 150 to 375 air changes per hour (see <i>ANSI Z9.5</i>)               </td> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Exhaust systems connected to emergency power (if required)               </td> </tr> </table>		<input type="checkbox"/> Exhaust air flow rate confirmed by TAB <input type="checkbox"/> Minimum air flow when sash closed verified at 150 to 375 air changes per hour (see <i>ANSI Z9.5</i> )	<input type="checkbox"/> Exhaust systems connected to emergency power (if required)
<input type="checkbox"/> Exhaust air flow rate confirmed by TAB <input type="checkbox"/> Minimum air flow when sash closed verified at 150 to 375 air changes per hour (see <i>ANSI Z9.5</i> )	<input type="checkbox"/> Exhaust systems connected to emergency power (if required)		
<b>Tests Completed:</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> AM—As-manufactured  <input type="checkbox"/> AI—As-installed (i.e., after installation)               </td> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Integrated systems tests  <input type="checkbox"/> Certificates provided               </td> </tr> </table>		<input type="checkbox"/> AM—As-manufactured <input type="checkbox"/> AI—As-installed (i.e., after installation)	<input type="checkbox"/> Integrated systems tests <input type="checkbox"/> Certificates provided
<input type="checkbox"/> AM—As-manufactured <input type="checkbox"/> AI—As-installed (i.e., after installation)	<input type="checkbox"/> Integrated systems tests <input type="checkbox"/> Certificates provided		
<b>Training</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Familiarization during installation  <input type="checkbox"/> Classroom               </td> <td style="width: 50%; vertical-align: top; border: none;"> <input type="checkbox"/> Hands-on  <input type="checkbox"/> Log books prepared and in place               </td> </tr> </table>		<input type="checkbox"/> Familiarization during installation <input type="checkbox"/> Classroom	<input type="checkbox"/> Hands-on <input type="checkbox"/> Log books prepared and in place
<input type="checkbox"/> Familiarization during installation <input type="checkbox"/> Classroom	<input type="checkbox"/> Hands-on <input type="checkbox"/> Log books prepared and in place		
Installation verified by:	Date:		
Supervisor:	Date:		

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 4. OPERATIONAL VERIFICATION (OV) CHECKLISTS

See MD 15128-2013 Laboratory Fume Hoods, Appendix C – On-site test forms:

- 4.1 **C-2 – Performance Verification (PV) Report Forms – Hood and systems**
- 4.2 **C-4 – Forms for Test Results – VAV**
- 4.3 **C-5 – Statement of Conformance**
- 4.4 **Smoke test for ventilated cabinets, ventilated table, biosafety cabinet**
- 4.5 **Regulation and control – sequences of operation verification to be included by contractor**



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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 4.1 C-2 – Performance Verification (PV) Report Forms – Hood and systems

## C.2 Performance Verification (PV) Report Forms— Hood and Systems


Agency Name
Building Name:
Laboratory:
Date:

### Hood Information

Hood ID:	Hood Type:
Manufacturer:	Hood Model:
Serial:	Size:

### Hood Design Features

Sash: <input type="checkbox"/> Vertical <input type="checkbox"/> Combination <input type="checkbox"/> Horizontal <input type="checkbox"/> None	Number of Sashes/Panels: _____ Panel Widths _____	Baffle: <input type="checkbox"/> Adjustable <input type="checkbox"/> None <input type="checkbox"/> Fixed
Number of Slots:	Interior Depth:	Internal Construction:
Services:		
General Comments:		


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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.2 Performance Verification (PV) Report Forms— Hood and Systems (cont'd)

#### System Information

System ID:	
Exhaust Type: <input type="checkbox"/> VAV <input type="checkbox"/> CAV <input type="checkbox"/> Other	Exhaust Configuration: <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Single Hood—Single Fan  <input type="checkbox"/> Single Hood—Multiple Fan  <input type="checkbox"/> Multiple Hood—Single Fan         </div> <div> <input type="checkbox"/> Multiple Hood—Multiple Fan  <input type="checkbox"/> No Exhaust         </div> </div>
Hood Duct Diameter:	Monitor:
Duct Material:	Monitor Type:
Filtration:	Alarm:
Filtration Type:	Damper:
VAV Control Type:	VAV Manufacturer:

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 4.2 C-4 – Forms for Test Results – VAV

## C.4 Forms for Test Results—VAV

### Identification

Agency Name:
Building Name:
Laboratory:
Date:


### Test Conditions

Sash Opening Description:				
Normal Operating Position Dimensions:	Width: _____ mm	Height: _____ mm	Area: _____ m <sup>2</sup>	Total Area: _____ m <sup>2</sup>
Baffle Opening:				
Apparatus in Hood:	<input type="checkbox"/> Yes <input type="checkbox"/> No			
Monitor:	Type:	Reading:		
Additional Test Comments:				

### C.4.1 Cross Draft Test Results

Horizontal Draft	Left	Centre	Right
Peak m/s			
Average m/s			
Vertical Draft	Left	Centre	Right
Peak m/s			
Average m/s			
Perpendicular Draft	Left	Centre	Right
Peak m/s			
Average m/s			



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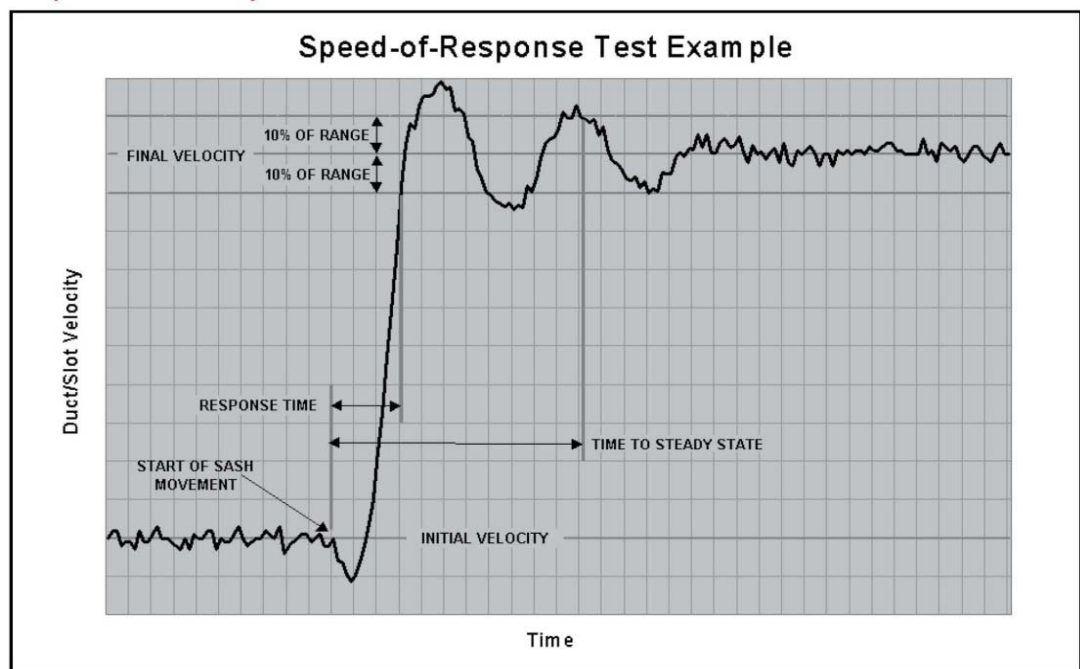
## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.4 Forms for Test Results—VAV (cont'd)

#### C.4.3 Flow Response


	Cycle 1	Cycle 2	Cycle 3
VAV speed of response: time to reach 90% of the average steady state value			
VAV time to steady state: return to $\pm 10\%$ of average face velocity or flow			

#### Response and Stability Plot



#### C.4.4 Minimum Flow Test

	Litres per second	Air changes per hour
Airflow with sash closed		

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.4 Forms for Test Results—VAV (cont'd)

#### C.4.5 Airflow Visualization

	Diffuser Location #1: <input type="text"/>	Diffuser Location #2: <input type="text"/>	Diffuser Location #3: <input type="text"/>
Observations:			
Time to evacuate smoke (sec.):			
Performance Evaluation:	High Pass: <input type="checkbox"/> Yes <input type="checkbox"/> No Low Pass: <input type="checkbox"/> Yes <input type="checkbox"/> No Low Fail: <input type="checkbox"/> Yes <input type="checkbox"/> No High Fail: <input type="checkbox"/> Yes <input type="checkbox"/> No		
Comments:			

#### C.4.6 Tracer Gas Test Results

##### Sash at Normal Operating Position


Ejector and Mannequin Position	Left	Centre	Right
Average ppm			
Peak ppm			

##### Peripheral Scan

Peak Reading, ppm, Design Sash Position:
--

##### Sash Movement Effect (sash moving from closed to normal operating position)

	Cycle 1	Cycle 2	Cycle 3
45 second Rolling average			

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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.4 Forms for Test Results—VAV (cont'd)

#### C.4.7 Fume Hood Monitor, Alarm and Sensors

Calibration: all sensors reporting to BAS calibrated	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monitor display: to at least 2 decimal points	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monitor accuracy: display is within +/- 5% of actual value	<input type="checkbox"/> Yes <input type="checkbox"/> No
Alarm Annunciation: occurs when beyond +/- 20% of design flow set point	<input type="checkbox"/> Yes <input type="checkbox"/> No
Alarm Response: Annunciation delay (maximum 10 seconds)	_____ seconds


#### C.4.8 Fume Hood Test Summary

Hood ID:		
Tester(s):		
Date:		
Hood Inspection: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> <input type="checkbox"/> Hood Integrity  <input type="checkbox"/> Sash Operation </div> <div> <input type="checkbox"/> Light Operation  <input type="checkbox"/> Liner/Baffle Integrity </div> <div> <input type="checkbox"/> Monitor Operation  <input type="checkbox"/> Alarm Operation </div> </div>		
Comments:		

#### Summary Performance Rating

Rating: <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A <input type="checkbox"/> Restricted Use <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Marginal
Reason—Comments:
General Comments/Recommendations:



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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### 4.3 C-5 – Statement of Conformance

## C.5 Statement of Conformance

### Statement of conformance for Laboratory Fume Hood Testing

We \_\_\_\_\_ certify that our company/agency conforms to the qualification requirements stated in *Section 6.2 of MD 15128-2013: Laboratory Fume Hoods*.

In particular, the following criteria have been met:

Qualification Criteria	
Minimum of 3 years of experience in the verification of fume hoods	<input type="checkbox"/> Met <input type="checkbox"/> Not Met
Attended the <i>HVAC Systems and Laboratory Design</i> course (by U.S. Eagleson Institute or equivalent)	<input type="checkbox"/> Met <input type="checkbox"/> Not Met
Attended <i>ASHRAE 110: Testing Workshop</i> training by U.S. Eagleson Institute, or <i>Fume Hood Testing Seminar for Certified Professionals</i> by National Environmental Balancing Bureau (NEBB), or equivalent	<input type="checkbox"/> Met <input type="checkbox"/> Not Met
Fully cognizant of contents in <i>MD 15128: Laboratory Fume Hoods</i>	<input type="checkbox"/> Met <input type="checkbox"/> Not Met

Contact Information
Company/Agency Name:
Contact Name:
Address:
Telephone Number:
E-Mail Address:


Please provide details on the following page.

I certify that all of the above statements are correct:

\_\_\_\_\_  
(Date and Place)

\_\_\_\_\_  
(Signature of the Authorized Party)



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## SPECIFIC COMMISSIONING PLAN FUME HOODS

### C.5 Statement of Conformance (cont'd)

#### Details of How the Qualifications Are Met

Qualification Criteria	Explanation/Examples
Minimum of 3 years of experience in the verification of fume hoods  <i>Examples of 3 projects for which verification of fume hoods was required:</i>	Project name (1):  Project date and place:  Number of hoods tested:  Contact/reference name:  Project name (2):  Project date and place:  Number of hoods tested:  Contact/reference name:  Project name (3):  Project date and place:  Number of hoods tested:  Contact/reference name:
<i>HVAC Systems and Laboratory Design</i> course (by U.S. Eagleson Institute or equivalent)	Name of the Training Institution:  Name of the Training Course:  Date course taken:  Name of the attendee:  Copy of the certificate attached: <input type="checkbox"/> Yes <input type="checkbox"/> No
<i>ASHRAE 110: Testing Workshop</i> training (by U.S. Eagleson Institute or <i>Fume Hood Testing Seminar for Certified Professionals</i> by National Environmental Balancing Bureau (NEBB), or equivalent)	Name of the Training Institution:  Name of the Training Course:  Date course taken:  Name of the attendee:  Copy of the certificate attached: <input type="checkbox"/> Yes <input type="checkbox"/> No



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## **APPENDIX C – OWNER’S PROJECT REQUIREMENTS (OPR)**

## **APPENDIX C – OWNER’S PROJECT REQUIREMENTS (OPR)**

This section has been deliberately left blank.  
Contents of this section will be included in the final report.

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## **APPENDIX D – BASIS OF DESIGN (BOD)**

**APPENDIX D – BASIS OF DESIGN (BOD)**

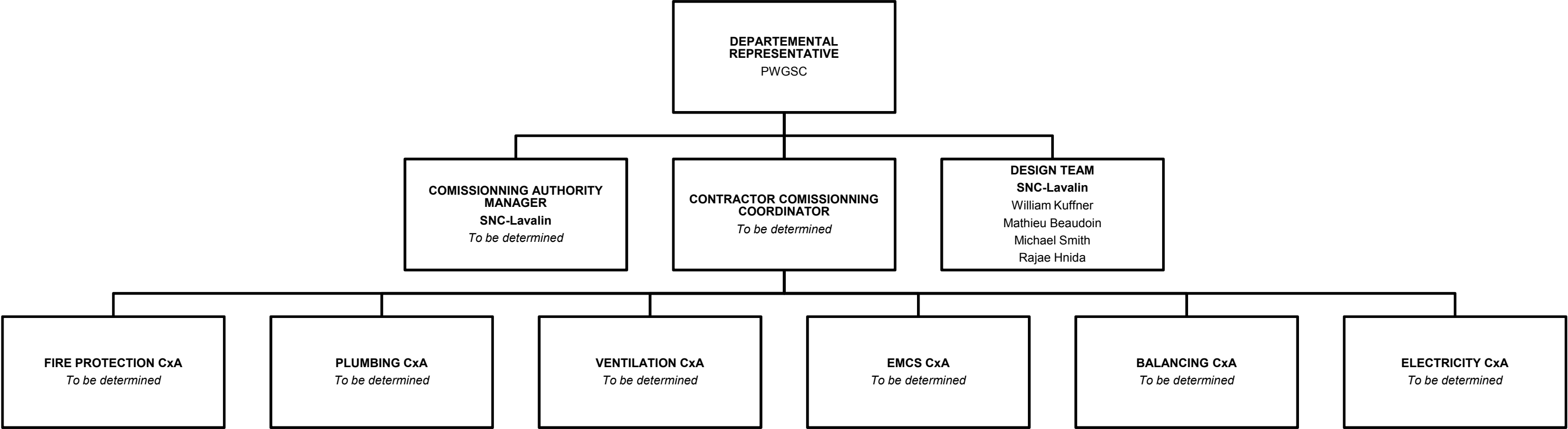
This section has been deliberately left blank.  
Contents of this section will be included in the final report.

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## **APPENDIX E – COMMISSIONING TEAM ORGANIZATIONAL DIAGRAM**

APPENDIX E – COMMISSIONING TEAM ORGANIZATIONAL DIAGRAM

To be completed following contract award.





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## **APPENDIX F – Cx SCHEDULE**

**APPENDIX F – CX SCHEDULE**

This section has been deliberately left blank.  
Contents of this section will be included in the final report.

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## **APPENDIX G– SPECIFIC Cx PLANS AND REPORTS**

## **APPENDIX G – SPECIFIC CX PLANS AND REPORTS**

This section has been deliberately left blank.  
Contents of this section will be included in the final report.

## 1. GENERAL

### 1.1 Summary

- .1 Section Includes:
  - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Requirements
  - .1 Section 01 91 13 – Commissioning Requirements;
  - .2 Section 01 91 31 – Commissioning Plan;
  - .3 Section 01 91 41 – Commissioning Training;
  - .4 Section 01 91 51 – Building Management Manual;
  - .5 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.

### 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 and CxA, 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 and CxA. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Samples of installation and start-up check lists (Static Verification – SV) are included in Specific Cx plan, Appendix B, section 01 91 31.

### 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 Each PI form is to be specific to the project. Each form is to identify precisely the equipment tag used for the project. If generic forms are used (i.e forms applicable to multiple models from a same manufacturer), specific model number, options or requirements of the installed equipment are to be precisely indicated.
- .3 Prior to Functionnal Performance Testing (FPT) of systems complete items on PI forms related to systems and obtain Departmental Representative and CxA approval.
- .4 Information required on these forms could be mentioned on start-up check-list or performance verification forms.
- .5 Specific client's form shall be completed by contractor with product information and specific identification for maintenance and guarantee purpose.

#### 1.4 Performance Verification (FPT) Forms

- .1 FPT 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 FPT report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to FPT of integrated system, complete FPT forms of related systems and obtain Departmental Representative and CxA approval.
- .4 Samples of performance verification forms (Operational Verification – OV) are included in Specific Cx plans, Appendix B, section 01 91 31.

#### 1.5 Samples of Commissioning Forms

- .1 CxA will provide to Contractor required project-specific Commissioning forms in electronic format.
- .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 CxA develop appropriate verification forms and submit to Departmental Representative and CxA for approval prior to use.
  - .1 Additional commissioning forms to be in same format as provided by CxA
  - .2 Contractor, sub-contractors and manufacturers shall complete Specific Cx plans for each system with specific forms for those equipments which are specialized, are delivered on package unit or are controlled by Specific Codes (i.e. Fire protection sprinklers and Fire protection Alarm system, Fuel Oil system, Waste water treatment, Purified water, etc.)

**1.7 Commissioning Forms.**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Contractor will prepare Cx forms with project-specific 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 and CxA.
  - .9 Submit immediately after tests are performed.
  - .10 Reported results in true measured SI unit values.
  - .11 Provide CxA with originals of completed forms.
  - .12 Maintain copy on site during start-up, testing and commissioning period.
  - .13 Completed Commissioning Issues Log lists for each system
  - .14 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

**1.8 Language**

- .1 Documents to be filled in English.

**End of Section**

## 1. GENERAL

### 1.1 Related Requirements

- .1 Section Includes:
  - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Requirements
  - .1 Section 01 91 13 – General Commissioning Requirements;
  - .2 Section 01 91 31 – Commissioning Plan;
  - .3 Section 01 91 33 – Commissioning Forms;
  - .4 Section 01 91 51 – Building Management Manual;
  - .5 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.

### 1.2 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.

### 1.3 Instructors

- .1 Departmental Representative will provide:
  - .1 Description of systems.
  - .2 Instruction on design philosophy, design criteria, and design intent.
  - .3 Single line flow diagram overlaid with P&ID step by step sequences of operation on how the system should operate c/w set points and limits for normal, abnormal and emergency situation.
- .2 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 Control logic narrative for static and dynamic operation specific to normal, abnormal and emergency situation.
  - .4 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
  - .1 Start-up, operation, maintenance and shut-down of individual equipment, systems and integrated systems they have certified installation, started up and carried out PFT tests for normal, abnormal and emergency situation.



#### 1.4 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 on-going inspection, measurements of system performance.
  - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
  - .4 Ability to update documentation.
  - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

#### 1.5 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 Management Manual.
  - .5 TAB and PFT Reports.
  - .6 Training Plan (sample included in Appendix A)
- .3 Project Manager, CxA and Facility Manager 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.

#### 1.6 Scheduling

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, each training session to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.
- .4 No training activities will be allowed before the O&M manuals have been approved by the Departmental Representative and CxA.

#### 1.7 Responsibilities

- .1 Be responsible for:
  - .1 Implementation of training activities.
  - .2 Coordination among instructors.

- .3 Quality of training, training materials.
- .2 Departmental Representative and CxA will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative and CxA. A sample training report is presented in Appendix B.

#### 1.8 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.


#### 1.9 Video-Based Training

- .1 Manufacturer's videotapes to be used as training tool with Departmental Representative's and CxA's review and written approval 3 months prior to commencement of scheduled training.
- .2 On-Site training videos:
  - .1 Videotape 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 quality.

## **APPENDIX A**

### **Training Plan**

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CLIENT:	PWGSC		 <b>SNC • LAVALIN</b>
PROJECT:	New Daycare		
Iqaluit, Nunavut			
SNC-LAVALIN REF.:	648139	DATE:	2018-03-16
DOCUMENT No.:		REV.:	0
SYSTEM IDENTIFICATION:		Page 1	

## TRAINING PLAN

<b>Identification:</b>	<i>(system no.)</i>
<b>Description:</b>	<i>(type of system and sectors served)</i>
<b>Location:</b>	<i>(block, level, etc).</i>


### WHO IS THE TRAINING COURSE AIMED AT?

<input type="checkbox"/>	Users	These are the individuals who operate the systems but do not take part in maintenance activities.
<input type="checkbox"/>	Maintenance Personnel	They are responsible for responding to calls for assistance, doing initial troubleshooting and making adjustments or minor repairs.
<input type="checkbox"/>	Specialized Personnel	These individuals have advanced skills in troubleshooting, optimization, calibrating and managing facilities, systems and components.

### 1. INSTRUCTORS

Write the names of the instructors who will be responsible for giving the training course.


Name	Company	Specialty

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## 2. TRAINING PLAN

The following is a non-exhaustive list of subjects to be covered. Place a check beside the subjects that will be covered and add any other pertinent subjects. Indicate the anticipated duration of each subject.

	Subjects	Duration	Completed ( √ )
<input type="checkbox"/>	General description of system		
<input type="checkbox"/>	Description of design criteria including operating limits		
<input type="checkbox"/>	Review of control diagrams and schematics		
<input type="checkbox"/>	Review of flow diagrams and schematics		
<input type="checkbox"/>	Description of procedures:		
	- Start-up		
	- Normal operating mode		
	- Emergency operating mode		
	- Stop		
	- Unoccupied mode		
	- Seasonal changes		
	- _____		
	- _____		
<input type="checkbox"/>	Integrated controls: programming, investigation and troubleshooting, alarms, manual mode operation		
<input type="checkbox"/>	Building Automation System (BAS): programming, investigation and troubleshooting, alarms, manual mode operation		
<input type="checkbox"/>	Interaction with other systems, operation during electrical failure or fire alarm		
<input type="checkbox"/>	Health and safety: description of components or operating modes that can pose a risk to health or physically harm people		
<input type="checkbox"/>	Description of energy saving strategies		
<input type="checkbox"/>	Description of air quality maintenance strategy		
<input type="checkbox"/>	Identification of warrantee maintenance criteria		
<input type="checkbox"/>	Description of causes of stoppage for this type of equipment: list of main troubleshooting procedures, alarm control and use of BAS for operations monitoring		

<b>CLIENT:</b>	<b>PWGSC</b>		 <b>SNC • LAVALIN</b>
<b>PROJECT:</b>	<b>New Daycare</b>		
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<b>SNC-LAVALIN REF.:</b>	<b>648139</b>	<b>DATE:</b>	<b>2018-03-16</b>
<b>DOCUMENT No.:</b>		<b>REV.:</b>	<b>0</b>
<b>SYSTEM IDENTIFICATION:</b>		<b>Page 3</b>	


Subjects		Duration	Completed ( √ )
<input type="checkbox"/>	Identification of main usage needs with regard to building users linked to network		
<input type="checkbox"/>	Description of maintenance procedures, methods and calendars including presentation of various spare part suppliers		
<input type="checkbox"/>	Question period		
<input type="checkbox"/>	As needed, complete the list of subjects discussed thereafter.		
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			

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### 3. TEACHING MATERIALS

The following materials will be used in the training course. Check the boxes of pertinent materials from the following non-exhaustive list. Include any other document or additional training materials anticipated for the course.

Document and/or Materials	
<input type="checkbox"/>	As-built contractual documents
<input type="checkbox"/>	O&M Manual
<input type="checkbox"/>	Control schematics and as-built control sequences
<input type="checkbox"/>	Balancing reports
<input type="checkbox"/>	Performance verification reports
<input type="checkbox"/>	Video presentation
<input type="checkbox"/>	PowerPoint presentation
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	

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#### 4. APPROVAL

The following people reviewed and approved the training course content. This does not constitute an approval of the training course itself. A copy of this training plan must be appended to the Training Report.

<b>Facilities Manager:</b>		<b>Date:</b>	
	(Signature)		(Year/Month/Day)


<b>Cx Manager:</b>		<b>Date:</b>	
	(Signature)		(Year/Month/Day)



## **APPENDIX B**

### **Training Report**

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CLIENT:	PWGSC		 <b>SNC • LAVALIN</b>
PROJECT:	New Daycare		
Iqaluit, Nunavut			
SNC-LAVALIN FILE:	648139	DATE:	2018-03-16
DOCUMENT No.:		REV.:	0
SYSTEM IDENTIFICATION:		Page 1	

## TRAINING REPORT

<b>Identification:</b>	(system no.)
<b>Description:</b>	(type of system and sectors served)
<b>Location:</b>	(block, level, etc).

### INSTRUCTIONS

Fill in a training report for each training session provided on a system.

Include each participant's signature.

Append the course plan and a copy of all teaching materials used to the present report, or refer to the location where these materials are kept.

**Date of training course:**

**Duration:**

\_\_\_\_\_  
(Year/Month/Day)

	Name	Company
<b>Instructors:</b>		

	Name	Signature
<b>Participants:</b>		

DESCRIPTION OF VERIFICATIONS	√	N.A.	COMMENTS (#)
• A copy of the course plan is appended.			
• Teaching materials have been appended (if not, refer to the location where the materials are kept in 'Comments' section).			



## 1. GENERAL

### 1.1 Summary

- .1 Section Includes:
  - .1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.
- .2 Related Requirements
  - .1 Section 01 91 13 – General Commissioning Requirements;
  - .2 Section 01 91 31 – Commissioning Plan;
  - .3 Section 01 91 33 – Commissioning Forms;
  - .4 Section 01 91 41 – Commissioning Training;
  - .5 Section 01 91 51 – Building Management Manual;
  - .6 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.
  - .7 Section 25 01 12 – EMCS: Training.
  - .8 Section 25 05 03 – EMCS: Project Record Documents
- .3 Acronyms:
  - .1 BMM - Building Management Manual.
  - .2 Cx - Commissioning.
  - .3 CxA – Commissioning Authority.
  - .4 HVAC - Heating, Ventilation and Air Conditioning.
  - .5 PI - Product Information.
  - .6 PFT - Functionnal Performance Testing.
  - .7 TAB - Testing, Adjusting and Balancing.
  - .8 WHMIS - Workplace Hazardous Materials Information System.

### 1.2 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.

### 1.3 Approvals

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

---

## 1.4 General Information

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM. The organization of the BMM (final Table of Content) will be coordinated with the Client:
  - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project.
  - .2 Summary of architectural, fire protection, mechanical and electrical systems installed and commissioned
  - .3 As-built drawings
  - .4 Including sequence of operation as finalized after commissioning is complete.
  - .5 Description of building operation under conditions of heightened security and emergencies.
  - .6 System, equipment and components Maintenance Management System (MMS) identification.
  - .7 Information on operation and maintenance of architectural systems and equipment installed and commissioned.
  - .8 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned.
  - .9 Information on operation and maintenance of mechanical systems and equipment installed and commissioned.
  - .10 Information on operation and maintenance of electrical systems and equipment installed and commissioned.
  - .11 Operating and maintenance manual.
  - .12 Final commissioning plan as actually implemented.
  - .13 Completed commissioning checklists.
  - .14 Commissioning test procedures employed.
  - .15 Completed Product Information (PI) and Performance Verification (FPT) report forms, approved and accepted by Departmental Representative.
  - .16 Commissioning reports.
  - .17 Commissioning issues log and deficiencies list.

## 1.5 Contents of Operating and Maintenance Manual

- .1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.
- .2 Departmental Representative and CxA to review and approve format and organization of the BMM.
- .3 Provide the following information including:
  - .1 original manufactures brochures and written information on products and equipment installed on this project.
  - .2 Record and organize for easy access and retrieval of information contained in BMM.
  - .3 Completed PI report forms, data and information from other sources as required.
  - .4 Inventory directory relating to information on installed systems, equipment and components.

- .5 Approved project shop-drawings, product and maintenance data.
- .6 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, and O&M, shutdown and training materials.
- .7 Inventory and location of spare parts, special tools and maintenance materials.
- .8 Warranty information.
- .9 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .10 Maintenance program supporting information including:
- .11 Recommended maintenance procedures and schedule.
- .12 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

#### 1.6 Life Safety Compliance (LSC) Manual

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Provide the following information including :
  - .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 Emergency control procedures for fire, power and major equipment failure.
  - .7 Emergency contacts and numbers.
  - .8 Manual to be readily available and comprehensible to non- technical readers.

#### 1.7 Supporting Documentation for Insertion Into Supporting – Appendices

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
- .2 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.
  - .6 Architectural and structural:
    - .1 Inspection certificates, construction permits.
    - .2 Roof anchor log books.
    - .3 FPT reports.
  - .7 Fire prevention, suppression and protection:
    - .1 Test reports.

- 
- .2 Smoke test reports.
      - .3 FPT reports.
    - .8 Mechanical:
      - .1 Installation permits, inspection certificates.
      - .2 Piping pressure test certificates.
      - .3 Ducting leakage test reports.
      - .4 TAB and FPT reports.
      - .5 Charts of valves and steam traps.
      - .6 Copies of posted instructions.
    - .9 Electrical:
      - .1 Installation permits, inspection certificates.
      - .2 TAB and FPT reports.
      - .3 Electrical work log book.
      - .4 Charts and schedules.
      - .5 Locations of cables and components.
      - .6 Copies of posted instructions.
  - .3 Assist Departmental Representative with preparation of BMM.
- 1.8 **Language**
- .1 English.
- 1.9 **Identification of Facility**
- .1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:
    - .1 To be coordinated with Client.
- 1.10 **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's approval before starting Work .

**End of Section**