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SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

Fundamental commissioning of the building energy systems per LEED-NC Prerequisite EA 1 applies to all projects. Consult MSU PDC if enhanced commissioning per LEED-NC EAc3 is considered for the project. Review LEED requirements and revise the Text to meet specific requirements.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Sections:
 - 1. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.
 - 2. Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
 - 3. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.
 - 4. Division 27 Section "Commissioning of Communications" for commissioning process activities for communications systems, assemblies, equipment, and components.
 - 5. Division 28 Section "Commissioning of Electronic Safety and Security" for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

1.3 DEFINITIONS

- A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards,

and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxR: Commissioning Representatives of the contractors, sub-contractors, manufacturers, and suppliers.
- D. CxM: Commissioning Manager. The commissioning representative of the CM, appointed by the CM to manage and lead the commissioning effort on behalf of the CM.
- E. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- F. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ABBREVIATIONS

- A. CM: Construction Manager.
- B. Cx: Commissioning.
- C. CxA: Commissioning Authority.
- D. CxM: Commissioning Manager.
- E. CxR: Commissioning Representatives.
- F. FPT: Functional Performance Testing.
- G. GC: General Contractor.
- H. PIV: Pre-installation Verification.
- I. PSV: Pre-startup Verification.
- J. STV: Startup Testing and Verification.

1.5 COMMISSIONING APPROACH

- A. Commissioning process activities shall be completed, by the commissioning team, in accordance with LEED-NC 3. Systems to be commissioned include:

1. HVAC&R systems and associated control systems.
 2. Lighting and daylighting controls.
 3. Domestic hot water systems.
 4. Renewable energy systems.
- B. Include a series of checks, tests, and operational procedures applied in specific sequences to each system or equipment component to be commissioned.
- C. Commissioning representatives of the sub-contractors, manufacturers, and suppliers shall perform the procedures, under the direction of the GC, utilizing members of the construction staff and representatives of the equipment and system manufacturers who are fully knowledgeable of the equipment and systems installation and operation.
- D. Before the start of system installation, all contractors, sub-contractors, manufacturers, and suppliers providing labor or materials for items specified to be commissioned shall designate specific individuals as commissioning representatives (CxR) to be associated with the commissioning work. The CxM shall provide a complete listing of those designated CxRs. The commissioning representatives shall participate in the commissioning process as team members, providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. All CxRs shall be selected as individuals having sufficient authority to direct their respective staff to provide the services required, accept and provide minor changes to the work on behalf of the sub-contractors or various organizations involved, and to speak on behalf of their organizations in all commissioning related contractual matters.
- E. With exception to the pre-installation verification (PIV) phase all commissioning procedures and completion of Cx documents are to be carried out in collaboration between the CxA and CxRs. The PIV will be carried out and documented exclusively by the CxRs.
- F. Where vibration testing and analysis, acoustic testing and analysis, fume hood testing, biological safety cabinet testing and certification, HVAC systems testing, adjusting and balancing, detailed mechanical alignment by laser systems, or electrical systems testing is required, these services shall be provided by testing agents skilled in the provision of the services specified to perform the work.

1.6 COMMISSIONING TEAM

- A. The Commissioning Team consists of the CxA, CxM, AExA and CxR(s).
- B. Members Appointed by Contractor(s):
1. CxM & CxR: Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- C. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. AExA: Architect and engineering design professionals.

1.7 OWNER'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.8 CONTRACTOR'S RESPONSIBILITIES

- A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 3. Attend commissioning team meetings held on a variable basis.
 4. Integrate and coordinate commissioning process activities with construction schedule.
 5. Review and accept construction checklists provided by the CxA.
 6. Complete paper construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
 7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
 8. Complete commissioning process test procedures.
 9. Provide comprehensive set of equipment submittals for review by CxA.
 10. Provide control device submittals, sequence of operation descriptions and all control drawings for review by CxA.
 11. Aid in the completion of pre-installation verification checklists.
 12. Aid in the completion of pre-startup verification checklist procedures.
 13. Aid in and the support the CxA as required to complete startup testing and verification checklist procedures (includes startup of all equipment).
 14. Carry out functional performance testing procedures as directed by CxA.
 15. Provide final control drawings and comprehensive operation and maintenance documentation for review by CxA.
 16. Provide comprehensive operation and maintenance documentation for review by CxA.
 17. Provide Owner training as required by the CxA.

1.9 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Review and provide comment on submittals from Contractor for compliance with the OPR, BoD, and Contract Documents.
- D. Convene commissioning team meetings.
- E. Provide Project-specific construction checklists and commissioning process test procedures with exception of PIV carried out by respective contractor.
- F. Verify the execution of commissioning process activities using random sampling. The sampling rate is 20%. A 100% verification shall be carried out for the PSV, STV and FPT phases. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- G. Verify 20% of all readings on both air and hydronic systems. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- H. Prepare and maintain the Issues Log for each phase of the commissioning process; address all noted issues through resolution.
- I. Prepare and maintain testing and verification checklists and completed construction checklist log.
- J. Witness systems, assemblies, equipment, and component startup.
- K. Perform systems, assemblies, equipment, and component functional performance testing activities with the control contractor.
- L. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

1.10 COMMISSIONING PLAN

- A. Prior to the start of construction of any system required to be provided with commissioning services, the CxA shall assemble and make available the commissioning plan. This will be developed based on all project documentation and through input provided by the CxM and CxRs. All information, procedures, forms, drawings, and system descriptions will be made available for utilization by the GC and CxRs for carrying out the requirements of the commissioning process.

- B. The commissioning plan shall detail the overall approach to commissioning, team organization, sequence and scheduling of activities, checks, tests, and procedures to be employed, coordination and methods of team communication and record keeping, and construction activities required in other sections of the project specifications.
- C. The completed and approved commissioning plan and all subsequent revisions to the plan shall be made available to the GC and CxRs in hard copy and in electronic media form.
- D. Detailed project scheduling information may be provided in the computer program and format preferred by the GC or may be provided as hard copy only if a computerized scheduling program is not utilized by the GC.
- E. The CxA shall complete all sections of the Plan, providing sufficient detail and expanded information as required to fully complete all required commissioning work.

1.11 COMMISSIONING PROCEDURES

- A. The CxM and CxRs shall fully review all commissioning checks, tests, and procedures, and related sequencing requirements provided by the CxA and become thoroughly knowledgeable of all commissioning procedure requirements. The CxRs shall thoroughly review all procedures with the respective equipment manufacturers to determine that the procedures can be provided in a manner which fully protects the equipment, the construction staff, the commissioning team members, and which maintains full equipment warranties and guarantees.
- B. The CxRs shall review and identify any modifications necessary for the following items:
 - 1. To adequately reflect the requirements for job-site safety and adequate protection of the systems and equipment.
 - 2. To coordinate all scheduling and sequencing requirements.
 - 3. To adequately reflect the actual conditions, equipment, and systems as installed.
 - 4. To fully demonstrate that the equipment or system is adequately installed and fully functional.
 - 5. To provide a fully coordinated construction and commissioning effort and to provide the commissioning sequencing requirements.
- C. The CxA shall provide sufficient procedure forms as necessary to provide sufficient space to record all required information for each component item and system included in the procedure. All procedure forms shall clearly indicate equipment identification numbers and descriptions coordinated with the Owner's identification system. All procedure tasks or elements shall have provision within the forms to include the procedure results directly within the computer program electronic file copy without modification of the forms or data sheets.
- D. Modifications and additions to the commissioning procedures shall be fully annotated to indicate the specific changes and the reasons for each change. Additions and modifications to the commissioning procedures shall be subject to review and approval by the CxA.

- E. All commissioning procedures shall include a specific team listing of all individuals participating in each procedure and their respective organizations or roles. Provide space for each participant to sign as verification of attendance only. Signatures provided by participants, including the CxM, CxA, and AExA shall not constitute acceptance of the procedure, equipment, or system.
- F. The GC or CM shall submit all proposed commissioning procedural changes from CxRs to the CxA for review and approval. Procedures shall not be scheduled for completion prior to obtaining satisfactory review and approval by the CxA.
- G. The CxM or designated assistant shall provide field record keeping of all procedure results. All field data, notes, and comments, shall be neatly hand labeled in the respective procedure forms during each procedure. The CxM shall maintain a master file of all completed procedure originals and submit a copy to the CxA for implementation into the Final Commissioning Report. The CxM shall transfer all field procedure results, comments, and annotations to the computerized file copy of the procedure. Signature spaces shall be annotated as “yes” or “no” as verification of attendance in the computerized file copies.

1.12 COMMISSIONING DOCUMENTATION

- A. MSU Physical Plant/Commissioning Services will provide all required field checklist documentation to CM or GC, and CxA.
- B. CM/GC and CxA shall prepare an index to include storage location of each document.
- C. CxRs shall complete all checklist items during each phase of commissioning process for each system and/or each piece of equipment as indicated by MSU Commissioning Services.
- D. CM/GC and CxA shall verify the completion and accuracy of field checklist documentation on a basis of 20% for each system to be commissioned.
- E. CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document re-test results.
- F. CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems and equipment.
- G. CxA shall gather required information and compile final commissioning report.

1.13 SUBMITTALS

- A. CxA shall submit sample checklists and forms to CxM for review and comment. Submit (2) copies of each checklist and report form.

1.14 COORDINATION

- A. Coordination Meetings: CxA shall conduct two pre-construction coordination meetings and three to five additional meetings as required upon near completion of the mechanical system.

1.15 PROJECT COMMISSIONING REPORT

- A. Prior to final acceptance of the commissioning process, and as a condition of final acceptance of the work, the CxA shall compile the detailed Project Commissioning Report.
- B. The Project Commissioning Report shall detail the overall approach to commissioning, team organization, sequence and scheduling of activities, checks, tests, procedures employed, and methods of team communication and record keeping. The project commissioning report shall include a dedicated section that includes one copy of this commissioning specification section.
- C. The Project Commissioning Report shall include all commissioning procedure results, test data, system or equipment descriptions, adjustments and set-up data, and the procedure descriptions and results of special testing, alignments and calibrations. The record shall contain all special reports, all certified final system adjusting and balancing reports, approved operations and maintenance manuals, certifications, and meeting minutes.
- D. Contractors, sub-contractors, manufacturers, and suppliers shall provide all test data, reports, and information to the CxA in a timely manner for incorporation and inclusion in the Project Commissioning Report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRE-COMMISSIONING WORK SESSION

- A. The CxA shall chair and the CxM shall schedule a pre-commissioning work session to kick-off the project commissioning and to review the development of the commissioning plan. The work session shall be held soon after award of contract, prior to the installation of any of the systems that are to be provided with commissioning services, and prior to the initial submittal of the commissioning plan.
- B. The work session shall be held at the GC's on-site construction office. The CxM, CxA, AExA, the GC's project manager, GC's designated construction superintendent, and the A/E's principle construction administration representative shall be scheduled for attendance, at a minimum. Sub-contractor representatives involved in the commissioning process may be scheduled for attendance at the direction of the CxM.

- C. The CxA shall present an overview of the commissioning process. The CxM shall present and review the status and development of the updated commissioning plan and shall review all requirements of the plan in detail. The review shall include the CxA's approach to management and administration of the commissioning process, reporting lines and communications, record keeping, construction integration and coordination, commissioning procedures, scheduling, sequencing, and plan format.
- D. Provide meeting date notification to the required participants a minimum of four weeks prior to the session. The meeting notification shall include a detailed agenda.
- E. The CxA shall record participant comments and distribute minutes of the session to all parties involved.

3.2 PRE-COMMISSIONING SCHEDULING AND SEQUENCING WORK SESSION

- A. The CxM shall schedule and chair a pre-commissioning scheduling and sequencing work session to review the CxM's initial commissioning schedule and interactively develop it further, integrating it with the construction schedule. The work session shall be held before the start of installation of any systems or equipment for which commissioning services are required and during the same time frame that the construction schedule is being developed.
- B. The CxM, CxRs, CxA, AExA, GC's project manager, GC's field superintendent, GC's scheduler, and A/E's principle construction administration representative shall be scheduled to attend the work session, at a minimum.
- C. The CxM shall present and review the schedule for commissioning work and the sequenced order in which work shall proceed.
- D. Provide meeting date notification to the required participants at the Pre-Commissioning Work Session, a minimum of two weeks prior to the session. The meeting notification shall include a detailed agenda.
- E. The CxM shall record and distribute meeting minutes, including the resulting updated commissioning schedule, to all parties involved.
- F. The CxA shall finalize the commissioning plan immediately following this meeting to reflect the actual construction schedule.

3.3 COMMISSIONING PROGRESS AND COORDINATION MEETINGS

- A. The CxM shall convene and chair three to five scheduled on-site, commissioning review, progress, and coordination meetings. The meetings shall include the CxM, all CxRs, the CxA, and associated special testing agents, outside agents, or manufacturer's representatives as appropriate.

- B. The meetings shall be initiated immediately prior to the initiation of the pre-startup verification process and shall be held at least monthly during the remaining construction duration.
- C. The CxA shall record and distribute meeting minutes to all parties.

3.4 CHANGES TO THE WORK

- A. Changes to the work shall be as directed by Change Order, Construction Change Directive, or Change Authorization as defined in Section 00800, Supplementary General Conditions, Article 7: Changes in the Work.
- B. The CxA shall have authority to issue Orders for Minor Change, on behalf of the Owner and with the approval of the A/E, on-site, in conjunction with the commissioning activities. Such directions to the contractor will be provided in writing and will be signed and dated by the CxA.
- C. The CxM shall have authority to accept Orders for Minor Change as directed by the CxA on behalf of the CM. The CxM, if in agreement with the Order for Minor Change, shall sign and date the Order and provide one copy to the CxA for record purposes.
- D. All changes to the work shall be attached to the related procedures and shall be included as attachments to the submittals and to the final Project Commissioning Record.
- E. If, in the opinion of the CxA, Change Orders or Construction Change Directives are required or if other special provisions are necessary to resolve a commissioning, construction or performance issue, the issue and recommendations will be documented by the CxA and submitted to the A/E's construction administration staff for disposition. If the continuation of a commissioning procedure is affected by the issue, the procedure will be continued to the extent possible or as determined appropriate by the CxA. The CxA shall have full authority to stop or postpone any procedure pending disposition of commissioning, construction, or performance issues.

3.5 FINAL ACCEPTANCE

- A. Final acceptance will be contingent upon satisfactory completion of all commissioning tasks and submittals, with final review and recommendation of acceptance to the Owner by the Commissioning Authority.

END OF SECTION 019113