



**MOVING DAY:  
OCCUPANCY**

# Occupancy

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## OVERVIEW OF THE PLANNING, DESIGN, AND CONSTRUCTION PROCESS

CHAPTER 1: INTRODUCTION

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**OCCUPANCY****Move Into Building**

Time must be allocated in the schedule to deliver and set up loose furnishings and move equipment, supplies, and materials into the building.

**Commissioning Process**

While the Commissioning Agent should be an active team member from the beginning, the work involved with system documentation and performance testing can only start as the systems come on line. ***Commissioning begins as systems are started and deemed functionally operational.***



## School Commissioning

“... is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets the defined objectives and criteria.” - ASHRAE, The Commissioning Process

## The Commissioning Agent

- Is the owners representative.
- Reports directly to the owner.
- Is responsible for the commissioning process.
- Is responsible for commissioning reporting and documentation.
- Works with and through the Construction Manager.

## Why is OSFC Commissioning

- Quality Assurance Process
  - A parallel process to verify design intent and function
- Value
  - Timeline
  - Operational Cost Avoidance and Cost Savings
  - Ownership

## OSFC Commissioning Primary Focus

- Mechanical, Electrical Plumbing Systems.
- HVAC Control Systems
- Original Design Intent

## The OSFC Commissioning Process

- OSFC Project Administrator and the School District Recommend Commissioning
- Initial Project Scope is Outlined
- School District Selects a Commissioning Agent from the OSFC Pre-Qualified List
- Final Project Scope is Defined
- Commissioning Agent Develops Plan and Authors Process
- A Commissioning Report is delivered
- Reduced Project Close-Out Stress

## nStewardship:

*...Understand the total impact of your decision.*

*...a Quality First Environment*

*...for a Quality First Education*

**MEMORANDUM OF AGREEMENT  
OHIO SCHOOL FACILITIES COMMISSION  
COMMISSIONING SERVICES**

This Memorandum of Agreement for Commissioning Services (Agreement), is by and between the Ohio School Facilities Commission (Commission), 10 West Broad Street, Suite 1400, Columbus, Ohio 43215, and «Company» (Commissioning Authority), «Business\_Address\_Street», «City», «State».

WHEREAS, the mission of the Commission is to provide funding, management oversight, and technical assistance to Ohio school districts for construction and renovation of school facilities in order to provide an appropriate learning environment for Ohio's school children; and

WHEREAS, the Commission desires to implement and monitor a systematic process of quality control to ensure that major building systems in newly completed school facilities are installed and functioning as designed; and

WHEREAS, the Commissioning Authority is pre-qualified by the Commission as an individual or firm with experience in developing and/or implementing effective commissioning programs for institutional facilities; and

WHEREAS, the Commissioning Authority is an independent party with no affiliations to a design team or participating contractors in a school facilities program; now

THEREFORE, in consideration of the foregoing premises and mutual promises herein contained, the Commission and the Commissioning Authority agree as follows:

**ARTICLE I — SCOPE OF SERVICES**

- 1.1 The Commissioning Authority shall provide professional services for the purpose of confirming that major building systems in newly completed school facilities are good operational systems that are low on maintenance and operating costs and perform interactively according to the contract documents.
- 1.2 The Commissioning Authority shall perform services with professional standards of skill, care and reasonable diligence in accordance with generally accepted commissioning practices, the terms of this Agreement and the Commission's Commissioning Guidelines as updated from time to time, attached as Appendix I to this Agreement.
- 1.3 Basic Services provided by the Commissioning Authority are defined as services starting in the design phase through the warranty phase and seasonal commissioning. The Commissioning Authority shall review design documents, develop a commissioning specification, develop and coordinate the execution of a testing plan, which includes observing and documenting system's performance to ensure that systems are functioning in accordance with the design intent of the contract documents and School District objectives.

- 1.4 Special services provided by the Commissioning Authority are based upon a scope of work that is appropriate for the phase of the project. The Commissioning Authority will develop a scope of work, schedule and fixed lump sum total cost for special services for approval by the Commission.
- 1.5 Services provided by a pre-qualified Commissioning Authority are an eligible expense of the project budget when approved by the Commission.
- 1.6 The Commissioning Authority may provide commissioning services through one or more Subconsultants employed by the Commissioning Authority. Any Subconsultant shall be an independent party with no affiliations to a design team or participating contractors in a school facilities program. All Subconsultants shall be approved by the Commission before providing services. The Commission retains the discretion to reject the services of a Subconsultant to provide commissioning services. The Commission, in consultation with a School District, retains the discretion to reject a Subconsultant for a specific project.
- 1.7 The Commissioning Authority is not responsible for design or general construction scheduling, cost estimating, construction management, or performing corrective work, but may assist with problem solving or addressing non conformance issues or deficiencies.

## ARTICLE II – COMPENSATION

- 2.1 Selection by a School District. The Commissioning Authority is pre-qualified by the Commission to provide commissioning services and School Districts may randomly request the Commissioning Authority to provide a lump sum fee proposal to provide Basic Services and Special Services.
- 2.2 Fixed Fee for Basic Services. Basic Services will be compensated at the rate not to exceed **35 cents per square foot**, which shall include all the Commissioning Authority's fees and expenses for services. The Commissioning Authority shall be compensated an established percentage of the Fixed Fee on a monthly basis in proportion to services performed in accordance with the percentages listed below . Projects that engage Basic Services commissioning after the design phase can have the payment schedule modified by agreement prior to commencing work.
- **Design Review.....15%**  
*Design Review & Analysis, Document Review, Meetings, Reporting and Check lists*
  - **Pre-Functional Test.....20%**  
*Documents, Meetings, Site Visits and Equipment, Systems & Work Verifications, Reporting and Check lists*
  - **Functional Testing.....40%**  
*Systems & Equipment Start-Up, Testing & Verification, Meetings, Reporting and Check lists*
  - *Completion of Functional Testing Activities, Retests and Verifications, Meetings, Reporting and Check lists, Redline and Shop Drawing Review*
  - **1st Report Delivery.....15%**  
*Resolution and Delivery of the Final Commissioning Report except for Seasonal & Warranty Commissioning, Meetings*
  - **Seasonal Testing.....5%**

*Completion of Functional Testing Activities, Retests and Verifications, Meetings, Reporting and Check lists, Redline and Shop Drawing Review*

- **Final Report.....5%**  
*Resolution and Delivery of the Final Commissioning Report With the Seasonal & Warranty Commissioning, Meetings*

2.3 Fee Proposal for Special Services. The Commissioning Authority will provide a lump sum fee proposal to the School District for the performance of Special Services with a breakdown of the fee amount associated with each separate facility. All lump sum fee proposals for Special Services are subject to Commission approval. The Commissioning Authority shall be compensated an established percentage of the Fixed Fee on a monthly basis in proportion to services performed in accordance with the percentages listed below . Projects that engage special services commissioning after the design phase can have the payment scheduled modified by agreement prior to commencing work.

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*Resolution and Delivery of the Final Commissioning Report With the Seasonal & Warranty Commissioning, Meetings*

2.4 Contract with School District. The School District will engage the services of the Commissioning Authority according to terms specified in this Agreement and any supplemental terms agreed to between the Commissioning Authority and the School District.

2.5 Additional Services. The Commissioning Authority may provide a fee proposal to the School District for the performance of Additional Services that may assist the School District, including without limitation, the commissioning services for non-Design Manual spaces and equipment, design review in such areas as indoor environmental quality, maintainability, structural, envelop and moisture, energy efficiency, and staff evaluation and training. A proposal for Additional Services is not required to be segregated by cost for each facility, but may be to provide services to the School District for overall commissioning program needs. The cost of Additional Services provided by Commissioning Authority is not an eligible expense of the project budget. All lump sum fee proposals for Additional Services are subject to Commission approval.

### **ARTICLE III — CONFLICTS OF INTEREST, INDEMNIFICATION AND LIMITATION OF LIABILITY**

- 3.1 Conflicts of Interest. Unless waived or otherwise modified in writing by the Commission, the Commissioning Authority and any of the Commissioning Authority's Subconsultants, having provided commissioning services for a School District, shall abstain from participating, either directly or indirectly, in any service contract, executed by the applicable School District, for the cyclical upkeep and repair of any applicable building systems or components.
- 3.2 Indemnification. The Commissioning Authority shall defend, indemnify and hold harmless the Commission and a School District from and against any and all claims, demands, suits, damages, costs, expenses and fees which are or may be asserted against the Commission or a School District to the extent caused by the negligent acts or negligent omissions of the Commissioning Authority in performing services under this Agreement.
- 3.3 Limitation of Liability. The Commissioning Authority shall not be responsible for and shall not have control or charge of the means, methods, techniques, procedures or scheduling used by a School District in the operation of a completed facility. By providing services pursuant to this Agreement, the Commissioning Authority in no way assumes or abrogates the responsibilities or obligations of any contractors, or other parties providing services to perform such services for the School District in accordance with their respective contract documents, nor shall Commissioning Authority be responsible for the acts or omissions of such other parties.

### **ARTICLE IV — MISCELLANEOUS**

- 4.1 Ohio Services. Unless otherwise authorized by the Commission, the Commissioning Authority's services shall be performed within the State of Ohio.
- 4.2 Limitation of Authority. The Commissioning Authority shall not have any authority to bind the Commission or School District for the payment of any costs or expenses without the express written approval of the Commission or the School District, as applicable.
- 4.3 Ethics. The Commissioning Authority represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements.
- 4.4 Non-Discrimination. The Commissioning Authority represents that the Commissioning Authority is in compliance with all applicable equal employment opportunity requirements under law as required by Section 153.59 of the Ohio Revised Code and any other applicable state or federal laws.
- 4.5 Law of Ohio. This Agreement shall be governed by the law of the State of Ohio to the exclusion of any other jurisdiction.

4.6 Amendments. This Agreement may be amended only by an amendment prepared by the Commissioning Authority and signed by both the Commissioning Authority and the Commission. No provision of any Amendment shall be applicable to a School District unless the terms and conditions of any Amendment are acknowledged by the School District.

4.7 Termination. This Agreement may be terminated by either party, without cause, upon fifteen (15) days written notice to the other party. In the event of termination by a School District of the Commissioning Authority's services, the Commissioning Authority shall be entitled to compensation, upon submission of a proper invoice, for the work performed prior to receipt of notice of termination.

4.8 Unresolved Finding for Recovery. The Commissioning Authority represents that the Commissioning Authority is not subject to a finding for recovery under Section 9.24, Ohio Revised Code, or that Commissioning Authority has taken the appropriate remedial steps required under Section 9.24, Ohio Revised Code, or otherwise qualifies under this section.

**ARTICLE V - TIME OF PERFORMANCE**

5.1 This Agreement shall remain in effect until December 31, 2006.

5.2 If the Commissioning Authority is continuing to provide services to School Districts at the time of the expiration date, the parties may extend this Agreement by executing an "Intent to Extend" letter.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date and year written below.

«COMPANY»

By: \_\_\_\_\_

Print Name: \_\_\_\_\_

Date: \_\_\_\_\_, \_\_\_\_\_

**OHIO SCHOOL FACILITIES COMMISSION**

By: \_\_\_\_\_

Mary Lynn Readey  
Executive Director

Date: \_\_\_\_\_

## Ohio School Facilities Commission

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### Commissioning Guidelines

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#### INTRODUCTION

Commissioning (**Cx**) is a quality control process that works to ensure that the buildings designed intent is fully realized. A systematic approach is employed to verify and document that the facility systems are installed and functioning in a manner to meet the needs of the students, teachers and staff. Commissioning does not replace or eliminate any requirements for quality control by any other firm, organization, or party. The designers, contractors and project managers maintain their obligations as a function of their roles and responsibilities. The process begins in the design phase and extends through to project completion, closeout and warranty reviews. Functional testing of the systems includes actual seasonal systems tests.

Projects that are in various stages of construction or occupancy can be commissioned. The commissioning process can be modified to engage the project timeline, verify the design intent and integrity of the systems performance.

The Commissioning Authority (**CA**) develops the commissioning plan and is the leader and facilitator of the commissioning process. They are the owner's representative and act in accordance to accepted professional standards and the owner's best interest.

The Construction Manager (**CM**) is the primary scheduler of all project related activity. When a project does not have a CM the CA will be responsible for the planning and scheduling of all commissioning related activities.

The School District (**Owner**) is expected to be fully engaged and active in the commissioning process. The Ohio School Facilities Commission (**OSFC**) is to be considered a Co-Owner in the project.

The CA firm is expected have an expert level proficient understanding of the trade and technology to be commissioned.

The CA firm is expected to have an expert level proficient understanding of the Ohio School Design Manual (OSDM).

The CA firm is responsible for having and maintaining their own inventory of tools, equipment, instruments and software necessary to perform their tasks. All equipment and instrumentation shall be current on all applicable certifications. All CA provided tools, equipment, instruments and software shall remain the property of the CA. The vendor shall supply special tools, equipment, instruments and software, only available from the vendor or unique to a piece of equipment to the Owner for the CA's use. They will remain the property of the Owner. The Contract Documents should be amended to reflect this condition. Specialty or proprietary equipment or systems that are necessary for the commissioning process will be identified by the CA and arrangements made to incorporate these into the commissioning plan.

#### Project Objectives

The following qualities are objectives to be incorporated into each appropriate step of the commissioning process.

1. Quality
2. Value Engineering
3. Designed Intent Equipment Operations
4. Control
5. Comfort
6. Energy Efficiency

## 7. Sustainable Performance

### SCOPE OF WORK (Basic Services)

1. Mechanical, Electrical and Plumbing Systems (**MEP**) and Controls Systems;
2. Indoor Lighting Levels (*Theater and Stadium Lighting are a specialty service*);
3. Classroom Interior Acoustic, Basic Survey (*Detailed analysis would be classified as a special service*);
4. Chiller, Cooling Tower Exterior Noise Review, Basic Survey (*immediate area on premise of the school grounds*);
5. Review Energy Annual Consumption Projections (*Only For Design Phase C<sub>x</sub>*);
6. Inclusion of a Recommended Recommissioning Plan.

### SCOPE OF WORK (Specialty Services)

Systems and services that extend beyond or are not included as Basic Services may be considered specialty services.

### DATA COLLECTION

The CA is expected to collect all data and information necessary to complete their task. As necessary:

1. Review of latest available drawings, specifications and documents;
2. Review records that are appropriate to understand design intent;
3. Review drawings and documents to verify that they are in accordance with the design intent.

### MEETINGS GUIDELINE

It is expected that the CA will meet with members of the commissioning team especially the owner frequently as necessary and as efficiently as possible. Use of technology is encouraged along with Site visits and personnel meetings.

1. The CA will regularly communicate with all members of the C<sub>x</sub> team;
2. As required by project status, activity and need,
  - a. To include: Partnering, Executive Core, C<sub>x</sub> Partnering, Closeout, Monthly C<sub>x</sub> Status meetings;
  - b. Participate in the final review acceptance meeting;
3. Meeting options (not limited to):
  - a. Blend commissioning meetings with other regular project related meetings whenever possible;
  - b. Use of video conferencing or teleconference is encouraged whenever practical;
  - c. Attend quarterly meetings at OSFC Columbus, Ohio offices.

### SERVICES

#### Design Phase:

Document the base information and the document intent to be used to develop the C<sub>x</sub> plan and requirements that will be used in the evaluation of the facilities systems.

1. Perform focused reviews of the design, drawings and specifications at various stages of development;
2. Develop a draft construction phase C<sub>x</sub> plan for each system to be C<sub>x</sub>

3. Develop full C<sub>x</sub> specifications for all commissioned equipment and integrate into the specifications with the architect and construction manager. The C<sub>x</sub> specification will include a detailed description of the responsibilities of all parties, details of the C<sub>x</sub> process; reporting and documentation requirements, including formats; alerts to coordination issues, deficiency resolution; construction checklist and startup requirements; the functional testing process; specific functional test requirements, including testing conditions and acceptance criteria for each piece of equipment being commissioned;
4. Coordinate Control Systems Integration meetings where the electrical and mechanical engineers and the CA discuss integration issues between equipment, systems and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications;
5. Clearly document the sequence of operations for each piece of equipment and each system to be C<sub>x</sub>;
6. Review energy annual consumption projections.

**Goals during design phase:**

1. Ensure that the concepts for building systems developed during pre-design and earlier design phases are included in the subsequent design phases;
2. Ensure that Design Record document is updated;
3. Verify the controls sequence of operation;
4. Ensure that no significant deficiencies exist in the contract documents;
5. Ensure that commissioning is adequately reflected in contract documents.

**Bid Phase:**

Attend pre-bid meeting to answer commissioning related questions.

**Construction Phase:**

1. The C<sub>x</sub> process shall not void or violate any manufactures or contractor warrantees or guarantees;
2. Notify the Owner as to when C<sub>x</sub> personnel are on-site;
3. Perform the tasks and functions in the specifications;
4. Coordinate and direct the C<sub>x</sub> activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and update the construction phase commissioning plan as necessary;
5. Coordinate the C<sub>x</sub> work and, with the contractor and CM, ensure that C<sub>x</sub> activities are being incorporated into the project schedule;
6. Plan and conduct C<sub>x</sub> meetings as needed and distribute meeting minutes and C<sub>x</sub> checklists to the team;
7. Request and review additional information required to perform C<sub>x</sub> tasks, including O & M materials, contractor start-up and checkout procedures;
8. Review and verify normal contractor submittals applicable to systems being commissioned for compliance with C<sub>x</sub> needs, concurrent with A/E reviews;
9. Review requests for information and change orders for impact on C<sub>x</sub> and owner's objectives;
10. Review coordination drawings to ensure that all trades contractors are making a reasonable effort to coordinate work;
11. Write and distribute construction checklists for commissioned equipment;
12. Develop an enhanced start-up and initial systems checkout plan with contractors for selected equipment;

13. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction-meeting minutes for revisions/substitutions relating to the C<sub>x</sub> process. Assist in resolving any discrepancies;
14. Witness/verify HVAC piping pressure test and flushing, sufficient to be confident that proper procedures were followed;
15. Witness/verify any ductwork testing and cleaning in a sufficient manor to be confident that proper procedures were followed;
16. Document construction checklist completion by reviewing completed construction checklists and by selected site observations;
17. Document systems startup by reviewing start-up reports and by selected on-site observations;
18. Verify air and water systems balancing by spot testing and by reviewing completed reports and by selected on-site observations;
19. Write the functional performance test procedures for equipment and systems. Include any necessary assistance and review from installing contractors;
20. Coordinate, witness and document manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved;
21. Analyze functional performance trend logs and monitoring data to verify equipment and systems performance;
22. Tests on respective HVAC equipment shall be executed, during both the heating and cooling season. However, some overwriting of control values to simulate conditions shall be allowed;
23. Maintain a master issues log and separate record of functional testing. Report all issues as they occur directly to the CM. Report all issues to the Owner at regularly scheduled meetings or as necessary or otherwise directed. Provide written progress reports and test results and recommended actions to the CM;
24. Review equipment warranties to ensure that the school district's responsibilities are clearly defined;
25. Oversee and verify the training of the school district's operating personnel;
26. Review and verify the preparation of the O&M manuals for commissioned equipment;
27. Report on construction site housekeeping (broom swept) as observed as a function of any site

### **Warranty Period**

1. Coordinate and supervise required opposite season or deferred testing and deficiency corrections and provide the final testing documentations for the C<sub>x</sub> Record and O&M manuals.
2. Return to site at ten and twelve month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal C<sub>x</sub>. Interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports and documents and requests for services to remedy outstanding problems.

### **REPORTING GUIDELINES**

The CA is expected to report all progress and events in an efficient and timely manner. Reporting frequency may vary according to the project status and commissioning work performed.

1. Design Phase Commissioning Report

2. Monthly Commissioning Progress Reports
3. Functional Testing Phase Reports by System
4. Construction Phase Final Report
5. Seasonal Testing and Warrantee Review Period Final Report (Closeout)
6. OSFC Report

**Compile a Commission Record, which shall include:**

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the C<sub>x</sub> regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
  - a. Equipment meeting the equipment specifications;
  - b. Equipment installation
  - c. Functional performance and efficiency;
  - d. Equipment documentation;
  - e. Operator training.
2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, C<sub>x</sub> process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
3. Issues log, C<sub>x</sub> plan, progress reports, submittal and O & M manual reviews, training record, test schedules, construction checklists, start up reports, functional tests and trend log analysis.
4. Schedule Changes and Additions
5. Calculation of estimated savings or cost avoided by early detection of deficiency.

### **OSFC Report**

Provide to OSFC commentary on any issues related to the OSFC construction process and the Ohio School Design Manual (OSDM) in an issue/ recommendation/ resolution format. This report is delivered separately from the Project C<sub>x</sub> log/ report. Report of construction and operational savings/cost avoidance items as a result of the project commissioning. Identify any primary commissioning issues identified as a result of commissioning.

### **Functional Test Sampling**

The CA will identify the testing process and what is to be tested (i.e., critical, primary, noncritical).

1. All critical and primary systems shall be tested.
2. Multiple identical pieces of equipment of non-life safety or non-critical equipment may be functionally tested using a sampling strategy.
3. Randomly test ten percent of each group of identical equipment
4. The sample set must not be smaller than three.
5. If ten percent of the sample group fail a second group of ten percent is selected and tested. If the second test fails then the whole group fails
6. If at any point, frequent failures are occurring and testing is becoming more troublesome then verification, the commissioning agent will stop and the responsible subcontractor will be required to

perform and document a checkout of all the remaining units, prior to continuing with the functional testing.

## **EXECUTIVE SUMMARY**

A brief executive summary is to be included with each report and be based upon the information and current status of the C<sub>x</sub> project. Compile a Systems Concepts and Operations Manual that consists of the following: Design Narrative and Basis of Design (A/E); Performance metrics, if completed during design; space and use descriptions, single line drawings and schematics for major systems (A/E) control drawings, sequences of control (by contractor) and a table of all set points and implications when changing them, schedules, instructions for operation of each piece of equipment for emergencies, seasonal adjustment, startup and shutdown procedures, instructions for energy savings operations and descriptions of the energy savings strategies in the facility, recommendations for Recommissioning frequency by equipment type, energy tracking recommendations, and recommended standard trend logs with a brief description of what to look for in them.

## Ohio School Facilities Commission

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### Commissioning Guidelines

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4. Coordinate Control Systems Integration meetings where the electrical and mechanical engineers and the CA discuss integration issues between equipment, systems and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications;
5. Clearly document the sequence of operations for each piece of equipment and each system to be C<sub>x</sub>;
6. Review energy annual consumption projections.

**Goals during design phase:**

1. Ensure that the concepts for building systems developed during pre-design and earlier design phases are included in the subsequent design phases;
2. Ensure that Design Record document is updated;
3. Verify the controls sequence of operation;
4. Ensure that no significant deficiencies exist in the contract documents;
5. Ensure that commissioning is adequately reflected in contract documents.

**Bid Phase:**

Attend pre-bid meeting to answer commissioning related questions.

**Construction Phase:**

1. The C<sub>x</sub> process shall not void or violate any manufactures or contractor warrantees or guarantees;
2. Notify the Owner as to when C<sub>x</sub> personnel are on-site;
3. Perform the tasks and functions in the specifications;
4. Coordinate and direct the C<sub>x</sub> activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and update the construction phase commissioning plan as necessary;
5. Coordinate the C<sub>x</sub> work and, with the contractor and CM, ensure that C<sub>x</sub> activities are being incorporated into the project schedule;
6. Plan and conduct C<sub>x</sub> meetings as needed and distribute meeting minutes and C<sub>x</sub> checklists to the team;
7. Request and review additional information required to perform C<sub>x</sub> tasks, including O & M materials, contractor start-up and checkout procedures;
8. Review and verify normal contractor submittals applicable to systems being commissioned for compliance with C<sub>x</sub> needs, concurrent with A/E reviews;
9. Review requests for information and change orders for impact on C<sub>x</sub> and owner's objectives;
10. Review coordination drawings to ensure that all trades contractors are making a reasonable effort to coordinate work;
11. Write and distribute construction checklists for commissioned equipment;
12. Develop an enhanced start-up and initial systems checkout plan with contractors for selected equipment;

13. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction-meeting minutes for revisions/substitutions relating to the C<sub>x</sub> process. Assist in resolving any discrepancies;
14. Witness/verify HVAC piping pressure test and flushing, sufficient to be confident that proper procedures were followed;
15. Witness/verify any ductwork testing and cleaning in a sufficient manor to be confident that proper procedures were followed;
16. Document construction checklist completion by reviewing completed construction checklists and by selected site observations;
17. Document systems startup by reviewing start-up reports and by selected on-site observations;
18. Verify air and water systems balancing by spot testing and by reviewing completed reports and by selected on-site observations;
19. Write the functional performance test procedures for equipment and systems. Include any necessary assistance and review from installing contractors;
20. Coordinate, witness and document manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved;
21. Analyze functional performance trend logs and monitoring data to verify equipment and systems performance;
22. Tests on respective HVAC equipment shall be executed, during both the heating and cooling season. However, some overwriting of control values to simulate conditions shall be allowed;
23. Maintain a master issues log and separate record of functional testing. Report all issues as they occur directly to the CM. Report all issues to the Owner at regularly scheduled meetings or as necessary or otherwise directed. Provide written progress reports and test results and recommended actions to the CM;
24. Review equipment warranties to ensure that the school district's responsibilities are clearly defined;
25. Oversee and verify the training of the school district's operating personnel;
26. Review and verify the preparation of the O&M manuals for commissioned equipment;
27. Report on construction site housekeeping (broom swept) as observed as a function of any site

### **Warranty Period**

1. Coordinate and supervise required opposite season or deferred testing and deficiency corrections and provide the final testing documentations for the C<sub>x</sub> Record and O&M manuals.
2. Return to site at ten and twelve month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal C<sub>x</sub>. Interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports and documents and requests for services to remedy outstanding problems.

### **REPORTING GUIDELINES**

The CA is expected to report all progress and events in an efficient and timely manner. Reporting frequency may vary according to the project status and commissioning work performed.

1. Design Phase Commissioning Report

2. Monthly Commissioning Progress Reports
3. Functional Testing Phase Reports by System
4. Construction Phase Final Report
5. Seasonal Testing and Warrantee Review Period Final Report (Closeout)
6. OSFC Report

**Compile a Commission Record, which shall include:**

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the C $\chi$  regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
  - a. Equipment meeting the equipment specifications;
  - b. Equipment installation
  - c. Functional performance and efficiency;
  - d. Equipment documentation;
  - e. Operator training.
2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, C $\chi$  process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
3. Issues log, C $\chi$  plan, progress reports, submittal and O & M manual reviews, training record, test schedules, construction checklists, start up reports, functional tests and trend log analysis.
4. Schedule Changes and Additions
5. Calculation of estimated savings or cost avoided by early detection of deficiency.

### **OSFC Report**

Provide to OSFC commentary on any issues related to the OSFC construction process and the Ohio School Design Manual (OSDM) in an issue/ recommendation/ resolution format. This report is delivered separately from the Project C $\chi$  log/ report. Report of construction and operational savings/cost avoidance items as a result of the project commissioning. Identify any primary commissioning issues identified as a result of commissioning.

### **Functional Test Sampling**

The CA will identify the testing process and what is to be tested (i.e., critical, primary, noncritical).

1. All critical and primary systems shall be tested.
2. Multiple identical pieces of equipment of non-life safety or non-critical equipment may be functionally tested using a sampling strategy.
3. Randomly test ten percent of each group of identical equipment
4. The sample set must not be smaller than three.
5. If ten percent of the sample group fail a second group of ten percent is selected and tested. If the second test fails then the whole group fails
6. If at any point, frequent failures are occurring and testing is becoming more troublesome then verification, the commissioning agent will stop and the responsible subcontractor will be required to

perform and document a checkout of all the remaining units, prior to continuing with the functional testing.

## **EXECUTIVE SUMMARY**

A brief executive summary is to be included with each report and be based upon the information and current status of the C<sub>x</sub> project. Compile a Systems Concepts and Operations Manual that consists of the following: Design Narrative and Basis of Design (A/E); Performance metrics, if completed during design; space and use descriptions, single line drawings and schematics for major systems (A/E) control drawings, sequences of control (by contractor) and a table of all set points and implications when changing them, schedules, instructions for operation of each piece of equipment for emergencies, seasonal adjustment, startup and shutdown procedures, instructions for energy savings operations and descriptions of the energy savings strategies in the facility, recommendations for Recommissioning frequency by equipment type, energy tracking recommendations, and recommended standard trend logs with a brief description of what to look for in them.

