COMMISSIONING PLAN

FOR

Project Name
Project # 12345

UNIVERSITY OF CINCINNATI
CINCINNATI, OHIO

January 2005

DRAFT

Plan Approval:

Project Manager
Project Manager – University of Cincinnati

Architect
Architect Project Manager –

Mr. Ken Bloomer
Commissioning Authority – University of Cincinnati

Signature                          Date

Signature                          Date

Signature                          Date
Summary

This Commissioning Plan provides the details for the implementation of the commissioning process as related to the University of Cincinnati Teachers College / Dyer Hall Renovation building project.

- This Commissioning Plan outlines and describes the commissioning process that will be used for this project.
- This plan identifies the specific members of the commissioning team.
- This plan describes and assigns the roles and responsibilities of each member of the Commissioning Team.
- This Commissioning Plan includes specific details required to implement the various commissioning activities.

This plan does not include the details of the required testing procedures; rather, it outlines the scope of responsibilities for development and application of the testing. Testing procedures and assignment of responsibilities shall be clearly presented in the project specifications. The entire commissioning process to be used for the University of Cincinnati Teachers College / Dyer Hall Renovation Project is provided in outline form following this summary.
Commissioning Process Outline

Design Phase
1. Commissioning objectives are developed.
2. A Commissioning plan is finalized.
3. The design intent/basis of design is compiled.
4. Commissioning specifications are created & incorporated into bid documents.
5. Design review of design development (DD) submittal.
6. Design review of construction documents (CD) submittal.

Construction Phase
1. Commissioning scope meetings are held.
2. Submitted Operation & Maintenance manual are reviewed.
3. Equipment submittals are reviewed in parallel with A/E
4. Prefunctional / Startup binders prepared by contractors.
5. Equipment needs incorporated into job schedule (e.g. a section of the building is to be conditioned on a specific date, than the commissioning of all the pieces and the system must be listed as a predecessor to that date.)
6. Commissioning activities are reviewed in the job progress meeting. Separate commissioning meetings are scheduled with A/E or contractors as needed.
7. Site observations are scheduled, focusing on prefunctional checklist.
8. Startup request submitted by contractors.
9. Startups scheduled and witnessed.
10. Functional testing and verification procedures are developed and implemented as systems become ready for demonstration.

Acceptance Phase
1. Execution of remaining functional test.
2. Training and orientation of University of Cincinnati personnel is scheduled and conducted.
3. Systems are accepted and warranty period begins.
4. Turnover meeting held to transition responsibility of building operation from Construction Management to Facilities Management.
5. Final summary report is issued.

Occupancy Phase (Post-Acceptance)
1. Off-season functional testing is scheduled and is performed.
2. System performance monitoring takes place.
3. 10-month final walk-through held with Facilities management to coordinate any remaining warranty/construction items.
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Overview of Commissioning Process

Commissioning (Cx) is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner’s operational needs. This is achieved through a complete commissioning process; beginning at the design phase with documented design and operating intent and continuing through construction and acceptance phases, with actual verification of performance.

Commissioning activities during the design phases are intended to achieve the following specific objectives:

- Provide a plan for the implementation of the commissioning process, including the initial scope of systems to be commissioned for the project.
- Ensure that the design and operational intent are clearly documented.
- Provide a design review focusing on system performance, maintainability, and adherence to design intent.
- Ensure that commissioning for the construction phase is adequately reflected in the bid documents.

Commissioning activities during the construction phases are intended to achieve the following specific objectives:

- Ensure the various members of the commissioning team clearly understand their responsibilities in their commissioning roles.
- Ensure the applicable equipment and systems are installed properly and receive adequate pre-operational checkout.
- Verify and document proper performance of equipment and systems.
- Ensure that operation and maintenance documentation is provided for the continued management of the facility after the construction project is complete.
- Ensure proper training of the University of Cincinnati Facilities Management personnel.

Definitions / Acronyms

<table>
<thead>
<tr>
<th>A/E</th>
<th>Architects and design engineers</th>
<th>P.C.</th>
<th>Plumbing Contractor</th>
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<td>CA</td>
<td>Commissioning Agent (UC)</td>
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<td>Automatic Temperature Control Contractor</td>
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<td>Cx</td>
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<td>SSE</td>
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<td>E.C.</td>
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<td>SD</td>
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<td>CD</td>
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<td>FM</td>
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<td>PFC</td>
<td>Prefunctional Checklist</td>
<td>LEED</td>
<td>Leadership in Energy &amp; Environmental Design</td>
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Systems to be Commissioned

The following is a list of systems that the University of Cincinnati considers for commissioning. The project specific list of equipment to be commissioned will be included in the construction specifications (Section 01810). Major equipment associated with each system is identified. Commissioning of each system includes all major equipment, unless noted otherwise.

HVAC Systems

1. Chilled water system
   - Piping, pumps, heat exchangers, meters, and variable speed drives
2. Heating hot water system
   - Piping, pumps, heat exchangers and variable speed drives
3. Air distribution systems
   - Air handling units, duct systems, and air terminal
4. Exhaust systems
   - Fans and duct system
5. Automatic temperature control system
   - Control devices, general building controls, energy management and system integration
6. Steam and condensate return systems
   - Pressure regulation devices, traps, trap test stations, condensate pumps, piping, and meters

Life Safety Systems

7. Fire alarm system
   - Alarm panels, devices, interface with other systems (HVAC, Fire Suppression, Remote Monitoring)
8. Emergency power system
   - ATS, protective device setting

Electrical Systems

9. Lighting controls
   - Limited to sweep, dimming and scheduled controlled lighting systems (general lighting not included)
10. Electrical power distribution system
    - Meters, circuit breaker setting, transformers

Communications & Technology Systems

11. Security systems
    - Card reader, devices, remote monitoring
12. Audio / Visual

Plumbing & Fire Suppression Systems

13. Domestic water supply system (hot & cold)
    - System pressure booster pump, hot water heating generation, and meters
14. Fire suppression system
    - Physical inspection of piping system

Specialty Systems

15. Swimming pool systems
    - Water heating, filtration and controls

General Building Systems

16. Curtain Walls & Skylights
    - Leak test
17. Elevator controls
Project Narrative
[Insert a brief narrative of project/building here]
<table>
<thead>
<tr>
<th>Team Member</th>
<th>Company</th>
<th>Contact</th>
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<tr>
<td>UC Project Manager (PM)</td>
<td>University of Cincinnati</td>
<td></td>
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<tr>
<td>UC Commissioning Agent (CA)</td>
<td>University of Cincinnati</td>
<td>Ken Bloomer</td>
</tr>
<tr>
<td>Architect (Arch)</td>
<td></td>
<td>(513) 556-0605 (W)</td>
</tr>
<tr>
<td>UC Senior Staff Engineer (SSE)</td>
<td></td>
<td>(513) 503-8610 (Cel)</td>
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<td>Electrical Contractor (EC)</td>
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<td>Fire Protection Contractor (FPC)</td>
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</table>
Roles and Responsibilities

General Descriptions of Roles
The following is a listing of commissioning responsibilities. The list is not intended to capture all the task of an associate, owner, or contractor on a construction/renovation project; just the task associated with commissioning.

**UC Project Manager (PM)**
- Works with the CA to determine the level of commissioning required/budgeted for the specific project.
- The PM and GC provide the CA with information regarding substitutions, change orders, RFI’s and any Architect’s Supplemental Instructions (ASI) that may affect commissioning.
- Conveys to the A/E their commissioning requirements. This includes defining the deliverables and negotiating fees.
- The PM is responsible for budget and scheduling; therefore, any suggested change to the budget or schedule brought about from commissioning activities must be approved by the PM.
- If the University Architect Office decides to hire a construction manager for a project then the contracted construction manager will share the PM’s commissioning duties.

**UC Commissioning Agent (CA)**
- The CA develops the commissioning plan.
- The CA develops the project specific functional performance testing procedures and forms.
- The CA issues the final commissioning report.
- Works with A/E & PM to get commissioning requirements into specification.
- The CA distributes DD & CD plans and specifications to key University of Cincinnati personnel for review comments. The CA tracks the review comments so that the “reviewers” are informed as to the status of their comments.
- Presents design intent to FM personnel that will be involved in commissioning on this project.
- Make periodic site visits to assure that installation of wide spread systems (i.e. duct work, conduit, wiring, and piping) are meeting contract requirements.
- Performs functional testing along with the involvement of FM personnel.
- Contracts a third party to perform commissioning duties if necessary. This third party will be independent of the A/E and report directly to the CA.
- Seek proposals from term contractors for TAB services (as described in TAB specification (15991)). Manage TAB contractor. These responsibilities will be shared with the SSE.
- Generates TAB specification.
- Coordinates owner training and spare material turnover Communicates Cx status to construction and commissioning team.
- Communicate all discrepancies found during commissioning activities to PM. Attends progress meetings to discuss commissioning issues as needed.

**Senior Staff Engineer (SSE)**
- Seek proposals from term contractors for TAB services. Manage TAB contractor. These responsibilities will be shared with the CA.
- Provides support to insure adherence to the design intent described in the specification and drawings.

**Architect & Engineer (A/E)**
- Provides design intent documents.
• Provides design intent clarification to CA as needed.
• Provides written responses to design review comments
• Provides support to insure adherence to the design intent described in the specification and drawings. There will likely be overlap here between the commissioning responsibilities of the A/E and the acquired construction administration services.
  o The services intended to be the A/E’s commissioning responsibility are to verify on site that a piece of equipment is installed per specs and manufacturers recommendations prior to startup. This service would be provided once for each different type of equipment. The first piece of equipment of each group to have startup performed on it. That way the frequency of a deficiency will be minimized.
    § Method - The CA will contact the A/E when a startup request is submitted for the first piece of equipment in an equipment type group. The CA and A/E will inspect together with the possible inclusion of FM personnel. Any discrepancies will be reported to the SSE/PM for resolution.
  o Make periodic site visits to assure that installation of wide spread systems (i.e. duct work, conduit, wiring, and piping) are meeting contract requirements.
• Provide consultation for the CA when a situation arises to where the design intent is unclear.
• Provide electronic specifications to the CA for use in PFC and FPT development.
• Witness functional testing if desired.

Contractors (GC, PC, MC, FPC)
• Modifies the prefunctional checklist provided by the CA to make them project specific
• Accumulates all the manufactures startup procedures for the equipment they purchased
• Assembles, in an orderly fashion, a startup binder that would include the PFC and manufactures startup procedure for each piece of equipment provided.
• Provides assistance during FPT of systems provided (as indicated on Commissioned Equipment Listing)
• Provides training of UC FM as specified. Training sessions to be scheduled thru the CA.

Automatic Temperature Control Contractor (ATC)
• Has the majority of the FPT
• Provides trend data to CA to demonstrate functionality of system. The CA will transmit trend requirements to the ATC.
• Provides training of UC FM as specified. Training sessions to be scheduled thru the CA.

Testing and Balancing Contractor (TAB)
• Reports directly to CA & SSE
• Performs task and generates reports as listed in TAB specification
  o Weekly status report including any discrepancies found that degrade the system
• Works with CA during FPT to collect data for reports (i.e. static profile of an AHU)
• Spot check 10% of VAV boxes with CA for deviation from original calibration

UC Facilities Management Personnel (FM)
• Supply review comments of DD & CD documents to the CA (labor charged to project)
• Assist CA in the completion of the PFC (labor charged to project)
• Attends FPT sessions as desired
• Attends contractor training sessions
Commissioning Process
This section sequentially details the commissioning process by task or general activity.

Design Phase

Overview of Commissioning During Design
Commissioning (Cx) is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by documenting design and operation intent at the design phase and continuing through construction and acceptance with actual verification of performance. Commissioning during design is intended to achieve the following specific objectives: * Provide commissioning focused design review. * Ensure that the design and operational intent are clearly documented. * Ensure that commissioning for the construction phase is adequately reflected in the bid documents.

Commissioning Plan
The University of Cincinnati Commissioning Agent develops the project specific commissioning plan based on budget, current staffing, and input from the University of Cincinnati Project Manager.

Design Intent and Basis of Design Documentation
The design documentation differs from traditional specifications in that it provides a more narrative description of the building systems. In general, specifications detail what is to be done on a component level, while design documentation explains why something is done and, in general terms, how design and operating objectives will be accomplished. Design documentation consists of two dynamic components: design intent and the basis of design.

Design Intent
The design intent is a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and schematic design phases. This document will be provided from the A/E at the completion of the schematic design phase.

Basis of Design
The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included. This document will be provided from the A/E at the completion of the design documentation phase.

The design intent narrative and basis of design documentation should cover the following, for each system, major component, facility and area:

1. General Construction
   a. Energy performance
   b. Applicable codes and standards
   c. Glazing fraction, U-value and shading coefficient
   d. Objectives and functional use of the system, equipment or facility
   e. Occupancy, usage, and schedule assumptions, all seasons.
   f. Building envelope assumptions
   g. Floor load assumptions and calculations
   h. Vibration assumptions and calculations
   i. Noise criteria and acoustic assumptions and calculations
j. Fire and life safety considerations
k. Fire zoning rationale
l. Smoke control rationale
m. Life safety operations modes and sequences
n. LEED goals
o. Cost considerations and design compromises
p. Restrictions and limitations of system or facility

2. Mechanical
   a. Indoor and outdoor design conditions, all seasons
   b. Indoor “heat to” temperatures, general and specific
   c. Indoor “cool to” temperatures, general and specific
   d. Indoor humidity, general and specific
   e. Equipment sizing criteria and calculations
   f. Diversity used in sizing
   g. Occupant density and function
   h. Air quality criteria
   i. Air distribution zoning rationale
   j. Ventilation requirements and calculations
   k. Occupied and unoccupied operation modes, all seasons
   l. Steam distribution and condensate recovery rationale
   m. Chilled water distribution rationale
   n. Life safety operation modes
   o. For individual systems, sequences of operation, setpoints, and dead-bands
   p. For interactive systems, sequences of operations
   q. Metering and submetering requirements

3. Electrical
   a. Lighting requirements and calculations
   b. Lighting zone assumptions
   c. Outdoor lighting control
   d. Fire and life safety considerations
   e. Fire alarm zoning rationale
   f. Equipment load assumptions and calculations
   g. Energy conservation intentions and calculations
   h. Life safety operations modes
   i. Occupied and unoccupied operation modes, all seasons
   j. Equipment sizing criteria and calculations
   k. Emergency power and what equipment is connected
   l. Metering and submetering assumptions

Design Development Review
The design development review is documented in writing and submitted to the PM, who forwards the information to the CA. The PM will compile any comments/corrections to the documentation and forward to the A/E. The architect distributes the comments to the design team members. The team members respond to the architect who
provides a written response to the PM & CA. The final draft of the design intent and basis of design documentation will be available at the end of construction documents design phase.

**Commissioning Specification Development**

The commissioning specifications, for inclusion in the construction bid documents, are developed by the CA, PM, and members of the design team as part of the commissioning process during design.

**Purpose**

The specifications provide detail so that those bidding on the project can clearly understand how the commissioning process works and specifically what role they have in the process.

**Specification Content**

The commissioning specifications shall provide the bidders a clear description of the extent of the verification testing required, including what components and systems will be tested and the documentation, reporting and scheduling requirements. Details of the extent of testing and who is responsible for writing tests, executing tests, witnessing and signing-off on tests shall be included. The relationship between and requirements for start-up, prefunctional checklists, manual functional performance tests, control system trend logs and stand-alone data logging shall also be given. Example tests shall also be provided. The specifications shall also detail the operator training and the O&M documentation and any O&M plan requirements. Any specific program of tasks focusing on indoor air quality should be included in the specifications.

**General Review of Drawings and Specifications**

Drawings and specifications are reviewed throughout the design process. As a minimum, the documents are distributed at the end of schematic design, at the end of design development, and at 50% & 95% construction documents. The commissioning agent distributes the documents to the different trades in the facilities management department. FM personnel provide the commissioning agent with review comments. Those are compiled and transmitted to the UC Project Manager. The PM provides the CA with written responses to the review comments as provided by the associates. This commissioning review of the plans and specs is in addition to any traditional review process.

**Purpose**

- Provide MEP with additional information on existing conditions
- Make sure that the University standards are maintained in the construction documents
- Make sure the commissioning requirements are incorporated
- Verify the design intent is maintained
- Maintainability
- O&M requirements
- Devices present for proper balancing
- Training requirements
- Attic Stock requirements

**Leadership in Energy & Environmental Design (LEED)**

There is a prerequisite in the LEED program that requires *Fundamental Building Systems Commissioning* and a point available for *Additional Commissioning*. The University plan is to perform the task of these two requirements regardless of the LEED goals on a project. The following is a listing of the requirements. How the commissioning team will achieve these requirements is listed throughout this document.

**Prerequisite 1 Fundamental Building Systems Commissioning**

- Engage a commissioning authority
• Review design intent and basis of design documentation
• Include commissioning requirements in the construction documentation
• Develop and utilize a commissioning plan
• Verify installation, functional performance, training and documentation
• Complete a commissioning report

**Credit 3 Additional Commissioning**
• Conduct a focused review of the design prior to the construction documents phase
• Conduct a focused review of the Construction Documents when close to completion
• Conduct a selective review of contractor submittals of commissioned equipment (The above three reviews must be performed by a firm other than the designer)
• Develop a recommissioning management manual
• Have a contract in place for a near-warranty end or post occupancy review
**Construction Phase**

This section details the commissioning process and activities during the construction phase.

**Construction Phase Commissioning Activities**

The following is an outline of commissioning activities during the construction phase. The topics are described in detail in this section. **Kickoff Meeting**

1. **Submittal Review**
2. **Prefunctional Checklist and formal startups**
   - Contractor commissioning meeting
   - Startup Request Forms
   - A/E site inspections
   - PM, CA, FM, SSE site inspections
3. **Tracking of deficiencies**
4. **Commissioning Progress Reporting**
5. **TAB**
6. **Functional Performance Testing**

**Submittal Review**

The CA will conduct a selective review of contractor submittals of equipment to be commissioned. The A/E will provide the CA with specific submittals as requested by the CA. This review will not take the place of the A/E submittal review process but will be done in parallel. Any comments by the CA will be forwarded to the A/E. The CA submittal review process is done for two reasons. One is to gather additional information not in the O&Ms to use in prefunctional inspections and functional performance test. The other reason is to assure that the submitted equipment meets the specifications.

**Prefunctional Checklist and formal startups**

Prefunctional checklists (PFC) are important to ensure that the equipment and systems are hooked up and operational and that functional performance testing may proceed without unnecessary delays. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., oil levels OK, fan belt tension, labels affixed, gages in place, sensor calibration, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Prefunctional checklists augment and are combined with the manufacturer’s start-up checklist.

**Contractor commissioning meeting**

A commissioning scoping meeting is planned and conducted by the CA. This will be done with each of the prime contractors commissioning representative. The contractor will be given generic prefunctional checklist templates (electronically). They will take these forms and remove any items that don’t apply and add any items that were not included. The contractor will then create a form for each piece of equipment from the templates, with equipment specific information filled in (e.g. Equipment Tag, location, manufacturer, model #, serial number, horsepower, voltage, gpm, cfm, . . .). These forms will be placed logically into 3 ring binders. The contractor will then compile manufacturer recommended startup procedures and place this documentation into the binders in the appropriate sections. This binder will be submitted to the CA for approval. Once approved, a copy will be generated. One copy will be given to the CA and one will be maintained on the job site by the field commissioning representative, as
appointed by each contractor. The contractor will initial and date the items on the prefunctional checklist and manufacturer startup forms as they are completed.

The completed contractor commissioning binder will be submitted to the CA once all equipment startup has been completed. This binder will include all the “signed off” prefunctional checklist, manufacturer startup forms, and startup request forms.

**Startup Request Forms**

Each contractor will be given an electronic version of the University of Cincinnati Equipment Startup Request Form along with the PFCs. The contractor is required to submit a signed Startup Request Form a week in advance prior to equipment startup. The signature on the Startup Request Form is to indicate that all of the prefunctional requirements for that equipment have been accomplished. The equipment that will require an official scheduled startup will be designated in the “Equipment to be Commissioned” listing (in spec section 01810). All startups and testing must be witnessed by the CA and/or the PM.

Equipment started up for temporary heat will be done in a formal matter. The equipment will be inspected so that all safety and filters are in place. This will not take the place of the official startup for that equipment, but in addition to.

**A/E site inspections**

The applicable party on the A/E team will be notified when a startup request form has been submitted the first time for each different type of equipment. The A/E will schedule a site visit with the CA to verify that all the requirements specific to that type of equipment has been completed.

**CA, FM, SSE site inspections**

The CA will schedule periodic site inspections with FM personnel that are on the commissioning team. The focus of these inspections will be on equipment that is scheduled to be operating, as determined by the construction schedule. The team will meet with the contractors commissioning field rep to discuss job progress and to get a startup schedule look ahead.

The A/E’s construction administration field representative (if applicable), FM personnel, and the SSE will all perform periodic site inspections. The field inspectors will refer to the prefunctional checklist but will not be responsible for “signing off” on them. This is the contractors responsibility. The field inspectors will focus on equipment that is schedule to be started in the near future in order to make the construction team aware of any deficiencies prior to the startup date. The field inspectors will also focus on systems that are installed over a large section of the schedule, like ductwork, piping, terminal units, insulation, and conduits. The goal here is to catch deficient installation issues before they are repeated.

**Tracking of deficiencies**

Any deficiencies (deviations from the plans and specifications) found during commissioning activities will be forwarded to the PM for tracking and resolution. The CA will log these issues and resolutions for inclusion in the final Cx report.

Any other issues found during Cx that are not considered deviations from the bid documents, but none the less affect the performance of a system will be championed by the CA. This will include maintainability issues, differences in design intent interpretations, or systems not performing up to design criteria. These type issues will be resolved through a collaborative effort of the CA, PM, Contractors and A/E. These issues will be tracked on a commissioning log, distributed periodically, and included in the final commissioning report.

**Commissioning Progress Reporting**

The CA regularly communicates with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling issues through memos, progress reports, and commissioning status summary sheets. At the beginning of construction, the CA provides monthly commissioning progress reports. Thirty (30) days prior to the startup of the first piece of major equipment, the frequency of progress reports is increased to twice per month, until startup is completed. The CA & PM may adjust the reporting frequency as needed. The progress reports contain: a two week look ahead for commissioning activities, a list of new and outstanding deficiencies, a description of commissioning progress.
TAB
The testing and balance work will be performed by one of the University of Cincinnati’s term contractors. The CA and PM will seek proposals based on U.C.’s TAB specification (which states specific commissioning requirements of the TAB contractor). The CA and PM will manage the TAB contractor throughout the construction process. The TAB contractor is an integral part of commissioning. Contracting the TAB directly from the PM and CA helps to facilitate the interactions between the TAB contractor and the CA.

Functional Performance Testing

- Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., all hot water pumps and hot water converters will be looked at simultaneously for temperature control, pressure control, staging and lead/lag rotation). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all of the control system’s sequences of operation and components are verified to be responding as the sequences state. The commissioning agent develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor.

- It is imprudent to assume that all the functional performance testing will be completed during the construction phase of a project. Having all the systems in a building complete and demonstrated to the owner prior to occupancy would be ideal, but seldom a reality. Therefore, some of the FPT will carry on post-occupancy. This will be done with as little disruption to the occupants as possible.
Acceptance Phase

The following section describes the commissioning activities that occur during the acceptance phase.

O&M Documentation

The A/E will forward all submitted O&Ms to the CA for review. The CA will review the O&Ms (with the assistance of FM personnel) to assure that the information contained within will provide adequate direction to the FM department over the life of the building and systems within. If the documentation is inadequate, it will be noted as such and returned to the A/E for resubmittal from the contractors.

Turnover Meeting

Purpose: To officially transfer the responsibility of maintaining the facilities from the contractors and UC CM to UC FM. Attendees will be the PM, CA, A/E and appropriate FM personnel.

The CA will schedule and lead meeting. The following is a basic agenda for the turnover meeting.

- As-built drawing status – PM to provide copy of field prints if the final as-builds are not available at this time
- Turnover O & M Manuals
- Turnover remaining Attic Stock
- Keys / Access
- Contractor contact listing and the work they performed (provided by PM – A/E)
- Warranty start/finish dates consolidated listing (provided by PM – A/E)
- Training – what’s been done and what’s left
- Commissioning status - Remaining functional performance testing schedule
- Open Punchlist / Commissioning Issues Review - Creating an action plan and assigning a champion for any open items

System Warranties

System warranties shall not take effect until successful functional testing is complete and the system is accepted by the CA, CM, CxPM and PM. Warranty periods and requirements during such shall be described in the project contract specifications.

During the warranty period, seasonal testing and other deferred testing required will be completed according to the Specifications. The CA coordinates these activities. Systems requiring seasonal testing during the warranty period shall have the warranty start date adjusted if the system does not initially pass functional testing, regardless of the initial acceptance of the system at the end of the Acceptance Phase.

Off-season Functional Testing

Due to the nature of HVAC systems operation, performance of the systems cannot all be evaluated for performance during one season of the year. It is anticipated that the performance of the systems will require evaluation during all four seasons of the project completion year. The system will also require functional testing during the two peak seasons, cooling and heating, to complete the commissioning of these seasons. The CA will work with FM to accomplish the seasonal testing. Any deficiencies will be taken directly to the contractor as a warranty call.

Performance Monitoring

During the warrantee period of the building FM personnel will evaluate the HVAC systems through performance monitoring using the BAS system. The CA will assist FM in this task.

Ten (10) Month Final Walk-Thru and System Review

Ten months into the warrantee period, the CA and FM will meet and discuss any remaining outstanding operational issues and review the performance of each system. Any remaining open contractor issues will be processed at this time.
Recommissioning Management Manual

The CA will provide FM blank functional test forms and information on the equipment provided on the PFC by the contractors. FM will use this information and forms for their preventative maintenance / recommissioning program for the equipment provided under this project.

Commissioning Report

The CA will issue a final summary report. The report will include an executive summary, 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 system commissioned equipment, the report will contain the disposition of the commissioning authority regarding the results of the commissioning work.

The results of commissioning each system should include as summary identifying the;

1. Equipment met the owner’s design intent
2. Equipment met the specification requirements
3. Equipment has been installed properly
4. Functional performance status of each system
5. As-built documentation, and
6. Operator training was completed.

Any non-compliance issues remaining shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.

Appendices will contain logs, meeting minutes, progress reports, deficiency lists, site visit reports, findings, unresolved issues, communications, etc. Pre-functional checklists and functional tests (along with blanks for the operators) and monitoring data and analysis will be provided in a separate labeled binder.

The commissioning plan, the pre-functional checklists, functional tests and monitoring reports will not be part of the final report, but will be kept on file by the CA.