DESIGN GUIDELINE 4.3.1
DESIGN-PHASE COMMISSIONING

Scope

This design guideline describes the role and responsibilities the commissioner (a.k.a. Commissioning Authority, or "CxA") is to perform for design-phase commissioning (Cx). Design phase commissioning is performed on projects with complex and challenging mechanical, electrical and plumbing (MEP) systems. Normally design phase commissioning is handled by internal U-M commissioning staff, when staff is available. Occasionally the University hires an outside commissioning firm for this task; when done, this document outlines the minimum required scope of work.

Related Documents

U-M Design Guidelines:
DG 2.1 - Owner's Project Requirements (OPR) and Basis of Design (BOD)
DG 2.3 - Owner's Review
DG 3.1 - Sustainable Design and LEED® Requirements
DG 3.2 - Energy and Water Conservation
DG 4.2 - Building Envelope
DG 4.3 – Building Commissioning
DG 230900 – Mechanical Systems Controls

U-M Master Specification Sections:
MS 017823 – Operation and Maintenance Manuals
MS 019100 – Project Commissioning

Reference Documents:
ASHRAE Guideline 0, "The Commissioning Process"
ASHRAE Guideline 0.2, "Commissioning Process for Existing Systems and Assemblies"
ASHRAE Guideline 1.1, "HVAC&R Technical Requirements for the Commissioning Process"
ASHRAE Guideline 1.5, "Commissioning Process for Smoke Control Systems"
ASHRAE Standard 202, "Commissioning Process for Buildings and Systems"
Building Commissioning Association, "The Building Commissioning Handbook"
NIBS Guideline 3, "Building Enclosure Commissioning Process"
USGBC, "LEED® Reference Guide for Green Building Design and Construction"

General

The CxA will perform the following activities during the design phase:

1. Contact the U-M Design Manager, introduce themselves and describe their role. Find out the general schedule of the project and request to be invited to the appropriate MEP meetings.

- Recommend and establish with the Design Manager the frequency of the MEP meetings at each design stage (SD, DD, and CD). Also schedule a MEP kick-off meeting. Establish who will send out the meeting invitations, normally the Design manager.

2. Become knowledgeable about the project.
   - Attend at least one presentation regarding the project's program by the Architect/Engineer (A/E) to become familiar with the scope, schedule, budget, and design intent. At the first meeting attended, introduce yourself and describe your role briefly.
   - Request and review available program documents to learn about the project scope, including:
     - Number of floors, square footage of each floor, extent of new building or addition work, extent of renovation work, division of space by function (clinical, laboratory, classroom, office, support space), division of space among departments, etc.
     - Connections to and interactions with surrounding buildings, including any related renovations in surrounding buildings.
     - Site requirements including proposed grade, roadway and utility changes.
     - Schedule for the schematic design (SD), design development (DD) and construction documents (CD) design phases, and for project bidding and award.

3. Become knowledgeable about and promote adherence to the U-M Design Guidelines, Master Specifications, Standard Details, Preferred Manufacturers Lists and Design Deliverables list. Require that deviations from these standards be approved by the Design Manager and documented in memos, emails or meeting minutes, and the OPR/BOD.

4. As early in design as possible, promote the incorporation of U-M sustainability goals. See Design Guidelines 3.1 and 3.2.
   - Explain these Design Guidelines in detail to the A/E and promote the early identification of energy conservation measures.
   - Promote optimization of the building's aspect ratios, siting, glass orientation, glass area, glass type, exterior shading, daylighting features, envelope insulation, air and water barriers, etc.

5. Conduct an MEP kick-off meeting. *(Not required when external Commissioning firms are hired for design phase Cx.)*
   - The MEP design management kick-off meeting is typically held as part of the first SD MEP meeting.
   - Use the "MEP Meeting Master Kickoff Notes", found on the CPR drive, to conduct the first part of the meeting.
     - Revise the "Notes" to be project specific and pass them out at the meeting. Review/explain the items in the notes.
     - The level of review needed will depend upon how much work the A/E has done previously at U-M and whether they have been through a managed MEP process. Be cautious not to over-assume the A/E knows something.
     - Require the A/E to make the "Notes" an attachment to the meeting minutes.
   - Require the A/E communicate with Plant Operations, Department of Public Safety and Security (DPS), Occupational Safety and Environmental Health (OSEH), UH Facilities

Planning and Development (FP&D), and other U-M personnel through the CxA and Design Manager.

6. Participate in the MEP design meetings at SD, DD, and CD phases.
   - Assist the Design Manager determine the appropriate U-M personnel to invite.
   - Review the A/E's latest design including concepts, drawings and specifications.
   - Discuss the acceptability of the current concept for each system.
   - Review compliance with codes and U-M design standards.
   - Review for inclusion of Cx requirements in the design documents.
   - Identify incomplete design issues.

     - The A/E shall establish the agenda for the MEP meetings, but should obtain input from the CxA and other team members.
     - The A/E should distribute their design documents in advance when possible.
     - The A/E should publish detailed meeting minutes including an action list.

7. Participate in the A/E's development and maintenance of the Owner's Project Requirements (OPR) document as it pertains to system performance requirements and commissioned systems. See Design Guideline 2.1.
   - Review room data sheets produced by the A/E, Hospital Planner, Laboratory Planner, etc. for key project requirements that should be included in the OPR.
   - Help the A/E document the Users' expectations, goals, benchmarks and acceptance criteria for judging the project. Include issues such as indoor temperature and humidity limits, air change rates, air flow rates, sound and vibration limits, medical and laboratory gas needs, laboratory equipment needs, light levels and controls, telecommunications needs, audio/visual needs, access control and security needs, medical systems and equipment needs, training needs, etc.
   - Assure the acceptable ranges of performance are identified for each parameter, and to what extent Users will be able to adjust setpoints.
   - Ask detailed questions to obtain specific acceptance criteria for systems and equipment.
   - Emphasize to the User groups and the U-M Design Manager the importance of establishing acceptance criteria early. Describe the high costs of expanding or changing acceptance criteria later.
   - Periodically review the OPR and identify missing, incomplete and incorrectly documented project requirements.

8. Participate in the A/E's development and maintenance of the Basis of Design (BOD) document as it pertains to system performance requirements and commissioned systems. See Design Guideline 2.1.
   - Periodically review meeting minutes, the latest design drawings and specifications, and the room data sheets.
   - Periodically review the BOD for clarity, completeness, and documentation of deviations from the U-M design standards. Verify the BOD reflects the OPR. Identify missing, incomplete and incorrectly documented design decisions.
   - Require the BOD to contain detailed acceptance criteria needed to commission the MEP systems and equipment.

9. If the project is pursuing LEED v4 Certification, perform all design-phase Cx activities required for the Energy and Atmosphere Prerequisite "Fundamental Commissioning and Verification".

10. If the project is pursuing LEED v4 Energy and Atmosphere Credit "Enhanced Commissioning", contact the project's LEED Coordinator for guidance and perform the design-phase Cx activities required for the paths and options the project has selected for this credit.

11. Assist the Design Manager to assure adherence to the U-M sustainability initiatives and to the U-M energy and water conservation measures. See Design Guidelines 3.1 and 3.2.
    - Attend meetings held by the Design Manager to discuss energy conservation measures and to assure U-M sustainability initiatives are met.
    - Recommend that major energy conservation measures such as envelope insulation and fenestration be optimized.
    - Review the A/E's Energy and Water Conservation Reports and Energy Impact Statements for errors and omissions.

12. Recommend technical studies including studies on sound, vibration, smoke purge, effluent dispersion, electrical capacity, and energy and water conservation.
    - Emphasize the study reports will dictate many design issues, so they should be completed ASAP to minimize redesign.

13. Provide the A/E with sample U-M controls drawings and require adherence to U-M's symbology and control drawing conventions. See Design Guideline 230900.

14. Require that control drawings include detailed sequences of operation, setpoints, allowable variance range from set point, alarm descriptions, and equipment operating schedules.

15. Help identify major equipment that must be pre-purchased to maintain project schedule or to improve quality.

16. Provide the design team with "lessons learned" from previous U-M projects.

17. Promote the use of construction mock-ups and other quality assurance techniques, and participate in the evaluation of MEP-related mock-ups.

18. Require that equipment maintenance access spaces, such as coil and tube pull spaces and electrical working spaces be accounted for in the MEP design and blocked out on plan drawings.

19. Assure means are provided for performing MEP maintenance.
    - Verify lifting rails are provided above chillers for hoisting end caps and motors.
    - Verify hoisting exists for replacing large pumps, large motors and other heavy equipment.

- Verify building egress paths and floor loading capacities are adequate for the future replacement of large equipment such as boilers, chillers and substations.

20. Assist with the Owner's review of technical study reports related to mechanical and electrical equipment (noise studies, dispersion studies, smoke evac. studies, etc.) . Review the reports, identify obvious erroneous assumptions or conclusions, and return your comments to the U-M Design Manager.

21. Early in CD design, instruct the A/E to make Section 1.4 of operation and maintenance (O&M) manual Master Specification Section 017823 and Section 1.2 of Commissioning Master Specification Section 019100 project specific.
    - Instruct the A/E to incorporate the sections into the project's Division 01 specifications.
    - Instruct the A/E to not include O&M manual or Cx requirements in other specification sections, but rather just reference these Division 1 specification sections.

22. Review and submit written comments to the A/E on the project's SD, DD and CD design documents during the Owner's reviews of the SD, DD and CD documents. See Design Guideline 2.3.
    - Check that the design appears to satisfy the OPR and BOD requirements that will be verified during construction phase Cx.
    - Identify errors or omissions related to design, codes, the U-M design standards, agreements made during MEP design meetings, and good engineering practice.
    - During the DD and CD reviews, generally verify the comments submitted during previous Owner's reviews were addressed.
    - Verify the documents reflect recommendations contained in the technical studies. This includes recommendations on MEP issues and also on architectural issues such as envelope and fenestration improvements which affect MEP issues such as energy efficiency.
    - During the CD review, verify the documents include complete testing and acceptance criteria (sequences of operation, setpoints, performance minimums, etc.) for the systems and equipment being commissioned. Identify missing information.
    - During the CD review, notify the Design Manager if the documents are not sufficiently complete to issue for bids.

23. Participate in the SD, DD and CD phase cost estimate reconciliation efforts.
    - Spot-check for estimate errors and omissions.
    - Check for duplicate line items and line items assigned to the wrong funding sources.

24. Participate in the SD, DD and CD phase value engineering (VE) efforts.
    - Recommend VE measures.
    - Assure VE measures do not effect compliance with the OPR.
    - Discourage VE measures that significantly reduce OPR compliance, energy or water conservation, reliability or maintainability.
    - Verify that approved MEP VE measures appear in the next phase of design documents.