

Facilities Management Council Program Series Construction Institute

Building Commissioning

The Tricks and Tips of an Expert

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FUSS & O'NEILL
Disciplines to Deliver

A topographic map showing contour lines and a river, serving as a background for the title.

Commissioning

- A systematic process of ensuring that new building systems perform interactively according to the documented design intent and the owner's operational needs, and that specified system documentation and training are provided to the facility staff.

How Can Commissioning be a NEW Subject?

IT ISN'T!

- Commissioning has been going on to varying degrees as long as buildings have been constructed.
- Now, we are trying to organize and finalize the process to everyone's benefit.

Acceptance of Commissioning

- Tough to sell in many projects
 - Why should we pay extra for something “you” should provide as part of your service.
 - Engineers have been “commissioning” their projects under such names as “punchlist”, “de-bugging”, etc.
- What has changed?
 - Building systems have multiplied and become more complex.
 - Building automation systems
 - Elevator recall
 - Generators
- Growing number of examples – consequences of NOT commissioning

Designer's Perspective

- Fear of Retro-Commissioning
 - C.A. may be your competitor
 - Decisions made by others may be characterized as “design errors”
- Full Commissioning is Attractive
 - Involvement from beginning
 - C.A. “buys into” design concept
 - Constraints accounted for
 - Design team does not have to “commission”
- Facilitates LEED Certification



Project Perspective

- Adds Value (pro)
 - Owner's project goals are integrated from the beginning
 - Budget and schedule constraints are factored in
 - C.A. is independent – does not work for engineer or contractor (may work for Architect)
- Adds Upfront Cost (con)
- Long Term Economics Are Positive
- Facilitates LEED Certification

Certifications

- **5 Organizations Working on Certification for Commissioning Work**
 - **The Building Commissioning Association's Certified Commissioning Professional (CCP).**
<http://www.bcxa.org/northeast/index.htm>
 - **The Association of Energy Engineers Certified Building Commissioning Professional (CBCP).**
 - **The University of Wisconsin series of certifications for various related commissioning services including the Qualified Commissioning Process Provider (QCP), the Commissioning Manager (CM), the Commissioning Technical Support (CTS), and the Accredited Commissioning Process Provider (CAP).**
 - **The Associated Air Balance Council (AABC) Building Commissioning Provider (BcCp).**
 - **The National Environmental Balancing Bureau (NEBB) Qualified Commissioning Administrator (QCA) and a certification for commissioning firms.**



Guidelines

- Many reputable organizations have published Commissioning Guidelines
- Some for the HVAC industry are:
 - ASHRAE 2007 “Applications Handbook” Chapter: 42
 - ASHRAE Guideline 0-2005, The Commissioning Process
 - SMACNA HVAC Systems - Commissioning Manual
 - US DOE – Building Commissioning Guidelines
 - The Chartered Institution of Building Services Engineers (CIBSE: UK) – Commissioning Code



The Process

- Full Commissioning (Onset of Project)
 - Conceptual and Study Phase
 - Pre-Design
 - Design Phase
 - Construction Phase
 - Post Construction Phase
 - On-Going (as necessary)
- Partial Commissioning (Limited Scope)
 - Review reports and submittals
 - Review controls and how equipment operates
 - Educate staff



Team Members

- Owner's Team
 - Building occupants/end users
 - Building management/procurement
 - Financial and legal
- Design Team
 - Architect
 - MEP and FP Engineers
 - Site/Civil Engineers
 - Structural Engineers
 - Specialty Consultants (LEED, Kitchen Equipment)

Team Members (cont'd)

- Construction Team
 - Contractors and Construction Managers
 - Vendors
 - Suppliers
- Oversight Team
 - Commissioning Agent
 - Special Inspections
 - Code Officials



Key Objectives

- **Owner's Team**
 - Sets the tone and scope for the project
 - Selects all project team members
 - **Prepares Owner's Project Requirements (OPR) Document**
- **Design Team**
 - Prepares design for building and systems to meet OPR
 - **Prepare Basis of Design (BOD) Document**
 - **Prepare Construction Documents and Specifications**
 - **Coordinate Systems Scope of Work**
 - **Provide Budget Information (cost)**

Key Objectives (cont'd)

- **Construction Team**
 - **Constructs Per Contract Documents**
 - **Installation “Know-How”**
 - **Practical Means and Methods**
 - **Training**
 - ❖ **Operation**
 - ❖ **Maintenance**
 - ❖ **Control Limitations and Set Points**

Key Objectives (cont'd)

- **Oversight Team**
 - **Review and Aid in Preparing OPR Document**
 - **Reviews BOD Document and Makes Comment/Suggestions**
 - **Leads dialogue to resolve scope, design and performance issues**
 - **Second Professional Opinion**
 - **Prepares Commissioning Plan (Project Specific)**
 - **Performs Commissioning Functions**
 - **Design Verification**
 - **Verify System Functionality and Performance**
 - **Verify System construction in accordance with OPR, BOD and Contract Documents**
 - **Help Resolve Issues During and After Construction**
 - **Review Submittals and Testing Reports**
 - **Prepare Commissioning Report/Statement**

Estimating Commissioning Costs

- In General Cost of Commissioning, New Construction (taken from DOE web site)

Commissioning Scope	Cost
Entire Building (HVAC, Controls, Electrical, Mechanical)	0.5%-1.5% of total construction cost
HVAC and Automated Control System	1.5%-2.5% of mechanical system cost
Electrical Systems	1.0%-1.5% of electrical system cost
Energy Efficiency Measures	\$0.23-\$0.28 per square foot

- Typically, firms will charge based on project size and scope



Summary

- Team Members and Responsibilities
- Understand Scope and Budget Constraints Early
- Start Commissioning Process Early...End Last
 - Second Professional Opinion
- Keep Project Team on Same Page
 - Changes During Construction
 - Maintain Quality and Follow-Up
- Functional Tests
 - Equipment and Devices Operation
 - Sensor Calibration
 - Sequence of Operations
 - Failure, Poor, Good or Better?

A topographic map showing contour lines and terrain features, serving as a background for the title.

Summary (cont'd)

- ID Issues and Aid in Resolution
 - Execution and Construction or Concept and Application
 - Unacceptable Limitations
- Maintain Good Working Relationship and Attitude With Others

Examples of Issues for Commissioning Agent

- **Framework of Design and Option Evaluation**
 - **Poor, Good or Better Idea?**
- **Overlap Between Disciplines**
 - **Building Envelope Deficiencies Resulting in HVAC Performance Issues**
 - **Special Equipment Requirements**
- **System Renovation/Improvement Project**
 - **Control System Options**
 - **ID Limitations of Existing Systems**
 - **ID HVAC Performance Issues**
 - **Verify Anticipated Energy Performance**
- **Addition/Renovation Project Scope of Work**
 - **Stand alone or Connections to Existing?**
 - **Set Design Scope of Work Early in Process**
 - **Existing System Condition ok? or Start Over**

Chiller or NASA Project?



Control Panel

Typical 150 Ton Centrifugal Chiller

Typical Rooftop HVAC Unit



Typical EMS Control Panel



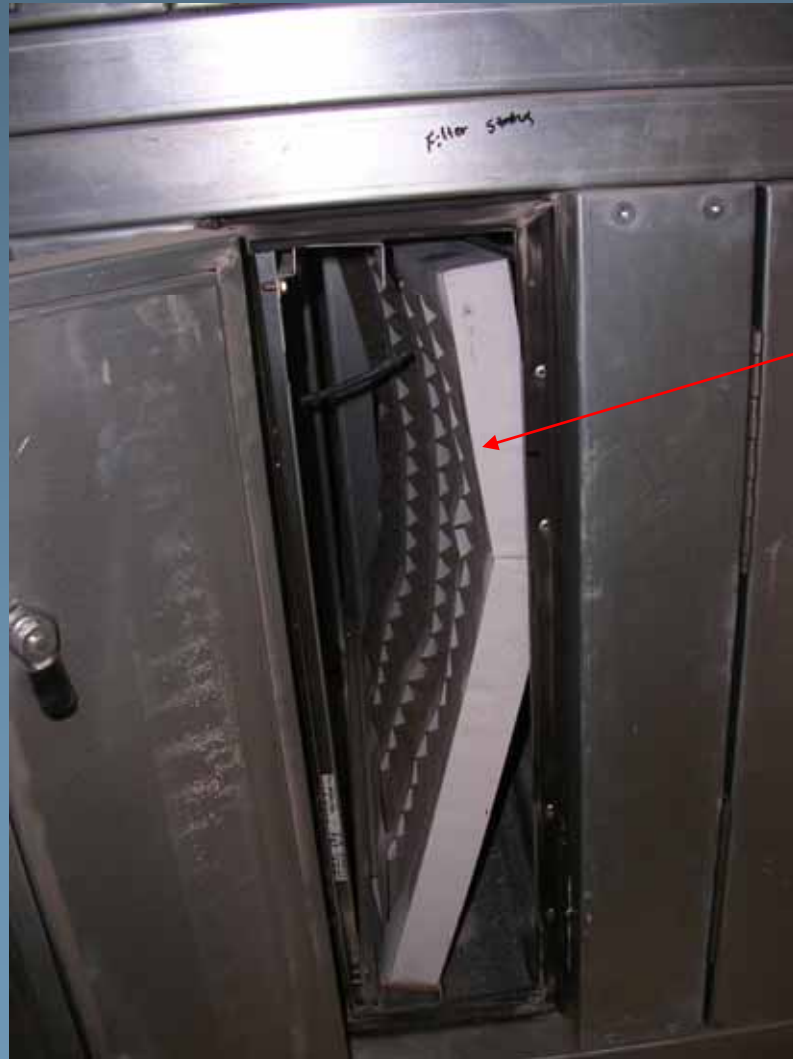
Poor Sensor Installation



Is That Mud in the Condensate Drain Pan?



Useless Filter



Useless
Filter

Poor Floor Drain Placement



Poor Solution to Bad
Condensate Drain
Design/Layout

Treatment Mess....What Water on the Floor?



Useless Sprinkler Head



Poor Sprinkler Head Location

Clogged Drain



Clogged Drain