

IMPORTANT NOTICE: This sample document is provided for instructional purposes only. CCC is not rendering advice concerning any commission project or practices. This document is neither approved nor intended to serve as a standard form. The user of these documents should confer with qualified advisors with respect to its commissioning and other documentation.

Model Plan Template
Edit as Appropriate

Existing-Building Commissioning

My Building

My Town, My State

Version: Draft for Review

Final Approved: _____

Owner

Date

Site Address: _____

Primary Site Contact and Telephone: _____

Some instructions for adapting this generic plan are provided in boxes. Alternate wording and choices that must be made are enclosed in brackets in the text. All areas of this plan must be carefully reviewed and adapted as needed for the particular project at hand.

Building Description

Sample Description.

My Building is a 2 story, 120,000 sf retail building, originally built in 1973 by another retailer. My Company bought and renovated the building in 1987. The space contains typical department store sections, a hair styling salon and office areas. The current HVAC distribution system is a 2-supply and return fan multizone constant volume system, divided into seven zones. There are two gas boilers and two water-cooled chillers. Additionally, there are separate split system units that condition the salon and office areas. The pneumatic controls were converted to SuperEMS in 1990. The 284 ton chiller was replaced with 2-150 ton chillers in 1994.

Objectives

The following have been identified by the owner as the primary objectives of this project, in order of importance:

Edit this list as appropriate.

- Bring equipment to its proper operational state
- Reduce comfort calls
- Reduce energy and demand costs
- Increase equipment life
- Improve indoor air quality
- Reduce staff time spent on emergencies
- Retain tenants

- Determine if additional staff training is required
- Identify and gather any missing critical system documentation

This project will primarily focus on the operation side of O&M, with attention being paid only to maintenance issues that will significantly impact indoor environmental quality, operability of the building or energy consumption.

Scope

This project will observe the building's present operation and maintenance strategies and practices in an attempt to find cost effective improvements that can be implemented primarily by the owner's building staff and service contractors. It does not include extensively investigating or implementing capital improvements. However, in the course of the assessment, any energy efficient capital improvements that are thought to be effective, will be offered as recommendations to the owner.

This retrocommissioning is intended to focus on operations rather than maintenance issues and [primarily, not just] operations that affect energy use. It [is, is not] the intent to verify all sequences of operation for the selected equipment, [including, not including] [alarms] [and the verification of rated equipment efficiencies].

The following marked systems will be commissioned in this project.

<i>List as appropriate.</i>

HVAC System (and all integral equipment controls)

- ___ Chiller system (including controls, chillers, cooling towers, piping, pumps and variable speed drives)
- ___ Boiler and heating water system (including controls, boilers, piping, pumps and variable speed drives)
- ___ Pumps
- ___ Variable speed drives
- ___ Heat exchangers
- ___ Piping: ___valves, ___cleaning and flushing
- ___ Chemical treatment
- ___ Ductwork
- ___ Air handling units
- ___ Unitary heating and cooling units
- ___ Exhaust systems (other than smoke control)
- ___ Roof top packaged DX units (heatpumps or AC)
- ___ Computer room A/C units
- ___ Split systems
- ___ Evaporative coolers
- ___ Evaporative condensers
- ___ Terminal units: ___all, ___limited to a sampling

- ___ Testing, Adjusting and Balancing work
- ___ Unit heaters
- ___ Building automation system (controlled devices, control loops and system integration)
- ___ Air distribution to spaces (limited to known problem areas)
- ___ _____

Electrical Systems

- ___ Sweep and scheduled lighting controls
- ___ Daylighting/dimming controls
- ___ Electrical system power quality
- ___ Communications system
- ___ Security system
- ___ Emergency power systems
- ___ Uninterruptible power supply system

Life Safety Systems

- ___ Fire alarm system
- ___ Egress pressurization systems
- ___ Fire suppression/protection systems

Plumbing

- ___ Domestic booster pump
- ___ Domestic hot water heaters

Laboratories/ Clinics

- ___ Fume hoods
- ___ Room isolation
- ___ Process gas _____

Misc.

- ___ Elevator
- ___ Kitchen exhaust equipment
- ___ Refrigeration equipment and systems
 - ___ Walk-in coolers
 - ___ Cases
 - ___ Compressors and condensers
 - ___ Control system

Other (list)

Roles and Responsibilities

The following table lists the members of the commissioning team:

Commissioning Team

Name and Firm	Title or Role	Voice / Pager	Fax/ Email	Address
	Property Manager / Owner			
	Facility Manager			
	Building Operator / Engineer			
	HVAC Service Contractor/Vendor			
	Controls Vendor			
	Commissioning Provider (Lead)			
	Commissioning Provider Assistant			

Edit the following table and responsibility sections as appropriate, particularly in the area of who oversees and manages the implementation of improvements (commissioning provider or facility manager), who conducts the prefunctional checklists and who conducts the manual tests.

Identify who will execute and document prefunctional checklists, depending on facility staff expertise, time availability and interest. The current wording has the facility staff doing it all. However, the facility staff could perform the static checks (nameplate data and installation checks) and the Commissioning Provider perform the Operational Checks.

Make sure this description is consistent with the Commissioning Provider's Contract.

The individual responsibilities of each team member are:

Commissioning Provider Lead

1. Is the technical lead for this project
2. Develops the assessment plan
3. Develops and conducts the scoping meeting
4. Holds other meetings as necessary
5. Provides prefunctional checklist forms and reviews completed forms
6. Gathers and reviews documentation
7. Administers the operations initial site assessment (interviews, inspections and analysis)
8. Oversees the monitoring diagnostic plan and execution
9. Oversees the manual functional testing plan and execution

10. Keeps a master deficiency/improvement list
11. Oversees the energy calculations
12. Works with the facility manager to see that the improvements are implemented and verified
13. Writes the final report.

Commissioning Provider Assistant

1. Assists the commissioning Provider Lead, as necessary, including:
2. Assists in developing the assessment plan
3. Assists in administering the operations initial site assessment
4. Provides input into the diagnostic process
5. Assists with developing the deficiency/improvements list
6. Reviews the final report

Property Manager / Owner

1. Provides overall supervision of this project
2. Is the party referred to as the “owner”
3. Ensures the participation of building personnel
4. Approves the choice of improvements to implement
5. Attends meetings as necessary

Facility Manager

1. Ensures the participation of building personnel and service contractors as needed
2. Provides input into the assessment (via interviews)
3. Directs and oversees the implementation of improvements and the gathering of documentation
4. Attends meetings as necessary
5. Works with the building operator in management of assignments so that operator can assist in the assessment and commissioning process

Building Operator / Engineer

1. Assists in gathering the building documentation
2. Provides input into the site assessment (via interviews)
3. Executes and documents the prefunctional checklists
4. Assists with the installation and removal of diagnostic equipment
5. Executes requesting BAS trend logs
6. Executes manual functional tests
7. Implements the identified O&M improvements
8. Attends meetings, as necessary

Controls Vendor

By direction of the Facility Manager:

1. Assists the Commissioning Provider in identifying and understanding the control sequences (via an interview)
2. Assists the Provider and the facility staff in executing manual functional tests (on-site)
3. Assists building staff in obtaining trend logs

HVAC Service Contractor or Vendor

By direction of the Facility Manager:

1. Assists the Commissioning Provider in identifying and understanding how the systems have been operated and maintained (via an interview)
2. May be needed to assist in manual functional testing.

Management Protocols

The Commissioning Provider is under contract with the [Property Manager, Owner, _____]. On site, the Provider will report to the Facility Manager. All reports from the Provider will go to the Facility Manager, who will forward a copy to the Property Manager. All significant communications by the commissioning Provider with the Controls Vendor or HVAC Service Contractor shall be documented and provided to the Facility Manager.

The commissioning provider will set and adjust schedules with the affected parties directly and inform all other team members of the schedules.

Authorization for making changes to controls sequences, schedules and escort requirements are identified on Form B-6, *Authorization Protocols for Building Assessment*, in Appendix B.

Commissioning / Tune-Up Process

The commissioning provider has obtained a general overview of the building and systems by a cursory walk-through and general review of selected building and system documentation. The following documentation was gathered and reviewed:

List as appropriate.

- *General Building Description, Form B-1*, in Appendix B.
- Drawings relevant to the systems scheduled for commissioning, especially control drawings
- Sequences of operation for [all, some] equipment
- Energy efficient operating strategies for [all, some] equipment
- Equipment list with nameplate information for [all, some] equipment

- O&M manuals for [all, some] equipment
- TAB report
- PM logs for [all, some] equipment
- Energy bill (electric and gas) information for at least 12 months along with a rate schedule

Form B-2, *Request for Documentation and Record of Submissions* contains additional documentation which has not yet been provided. This information will need to be made available to the Commissioning Provider at the operations initial site assessment.

From the reviewed documentation and initial walk-through, the commissioning provider developed this overall commissioning plan. The plan for this project has been divided into nine steps:

1. Perform an operations initial site assessment
2. Execute prefunctional checklists on selected equipment
3. Develop a List of O&M Deficiencies / Opportunities
4. Develop a Diagnostic Monitoring and Functional Testing Plan
5. Implement Monitoring and Testing
6. Analyze the Monitoring and Testing Data and Determine Which O&M Opportunities are Most Cost Effective to Implement
7. Implement O&M Improvements
8. Consider Energy-Efficient Capital Improvements
9. Commissioning Final Report

The following is an outline of the commissioning process for this project. The process may be modified once the initial assessment is completed.

1. Perform an Operations initial site Assessment

The site assessment starts with a kick-off meeting where all parties meet to go over the overall commissioning plan, the *Building Operations Initial Assessment Procedures*, the *Authorization Protocols* document and the schedule.

The assessment entails gaining an in-depth understanding of how and why the building systems and equipment are currently operated and maintained and how that might be improved. This is accomplished by interviewing the facility operating and managing staff and by making site inspections of all primary energy using equipment. Control sequences, setpoints, control parameters and schedules are also closely examined. Actual equipment testing is not done during the assessment. Problems and improvements are identified solely by gaining information from facility staff, equipment vendors, the control system and written documentation.

A significant list of improvements will be generated from the assessment alone, prior to any monitoring or functional testing. The information coming from the assessment will

also identify areas where formal monitoring and testing will be most beneficial to identify further operational improvements.

The assessment will typically consist of the following tasks:

1. Obtain an understanding of the building equipment and systems
2. Identify the largest energy using equipment and analyze utility bills for larger buildings
3. Identify the known most problematic control, operational and comfort problems
4. Identify the design and operational intent and control sequences
5. Identify procedures to reduce unnecessary runtime and unnecessary capacity levels
6. Identify changes to control parameters, strategies, set points, sequences or needed maintenance that will optimize efficiency, comfort, operation and control
7. Document noticed problems of equipment condition (broken dampers, dirty coils, sensor calibration, etc.)
8. Identify missing documentation of control sequences
9. Identify any needed facility staff training
10. Gather necessary nameplate data and scope the monitoring
11. Identify any obvious upgrades to equipment that may be cost-effective
12. Document the assessment process and results

Additional procedural details of the assessment are found in *Building Operations Assessment Procedures*, in Appendix A. During the assessment, there will need to be staff available to work the control system to view schedules and setpoints.

2. Execute Prefunctional Checklists

The Commissioning Provider will provide prefunctional checklists for equipment to be commissioned to the facility staff who will execute and document the results. The prefunctional checklists document the nameplate data and the static condition of the equipment. As well, there is an *Operational Check* section and a *Sensor Calibration* section that deal with checking phase imbalances, smooth operation and stroking of valves and dampers and calibration of actuators and sensors, etc. These are completed and provided to the Commissioning Provider. Successful completion of the calibrations is required prior to starting any monitoring, trending or manual functional testing.

The Commissioning Provider reviews the completed checklists and provides comments to facility staff.

3. Develop a Master List of O&M Deficiencies / Opportunities

During the site assessment and completion of the prefunctional checklists, the commissioning provider begins to develop a master list of O&M deficiencies or

improvements for possible implementation. The list includes the name of the system or piece of equipment involved, a description of the deficiency or problem, and a suggested solution. The list of opportunities and recommendations generated during the initial site assessment and prefunctional checklist completion is submitted to the Facility Manager and owner for review, prior to developing a monitoring and testing plan. Equipment upgrades that may be cost-effective will be kept on another list and submitted later.

4. Develop a Diagnostic Monitoring and Functional Testing Plan

Monitoring and Testing Scope

Form B-3 in Appendix B, *Monitoring and Functional Testing Scope Outline*, provides a list of the equipment and components that are initially intended to be tested, the general modes and functions that will be tested, any expected sampling strategies and who executes the test. The Commissioning Provider revises this table to represent the current focus of the project, after consulting with the Facility Manager and Owner in light of the results of the initial site assessment. The table also contains fields for specifying the testing method (trending, datalogging or manual testing) for each component. However, this field is filled out during the completion of the *Diagnostic Monitoring and Functional Testing Plan*. It is the initial intent to perform most of the hands-on diagnostic work using [dataloggers, EMCS trending, manual functional testing]. The entire table, including equipment to be tested, is in draft form until after the *Diagnostic Monitoring and Functional Testing Plan* is complete. The final version of this table becomes part of that plan.

Monitoring Plan

The commissioning provider develops a diagnostic plan focused on equipment and systems as identified in the site assessment. Where possible, and only after calibration, the building's energy management control system (EMCS) will be used to monitor data. Portable dataloggers will be used for points that cannot be monitored by the EMCS. Monitoring will extend for a minimum of seven consecutive days.

Functional Testing Plan

As determined from the site assessment and from the monitored data, some equipment will be manually tested through various modes of operation. Detailed test procedure forms will be developed describing each specific procedure and the expected or correct response. These procedure forms will direct the testing and be used to document the results.

The monitoring and testing plan and procedures are submitted to the Facility Manager, and to the Controls Vendor if needed, for approval.

5. Implement Monitoring and Testing

Monitoring

The commissioning provider provides a detailed request for required trend logs to the facility staff or to the Controls Vendor, who execute the trends and provide the data to the Provider in the requested format (hard copy columnar or electronic). The provider programs the dataloggers and installs them with the assistance of the facility staff. Facility staff will be responsible to actually install current transformers and watt transducers on wiring inside electrical cabinets. Facility staff are responsible to remove the sensors and dataloggers, package them and send them back to the provider for analysis after the end of the monitoring period.

Functional Testing

The commissioning provider oversees and conducts manual tests on selected equipment, with the assistance of facility staff and Controls Vendor as needed. Manual tests will be comprised of changing parameters, setpoints or conditions and observing and documenting the system or equipment response through various modes and conditions (both simulated and real).

For equipment that is being monitored with sufficient points, manual testing may be accomplished by changing the parameters, etc. during the monitored period. The monitored data is then examined and used to document and verify correct or incorrect operation.

6. Analyze Monitoring and Testing Data and Determine Which O&M Opportunities are Most Cost Effective to Implement

Once the data is gathered from monitoring and testing, the commissioning provider analyzes the findings by comparing actual equipment operation to appropriate operation and to the control sequences (when available). Deficiencies and improvements are identified and documented.

The list of O&M opportunities is prioritized by the owner and the commissioning provider. Factors taken into account will be the impacts on: operations, comfort, energy savings, IAQ, asset value and the cost of the fix. The commissioning provider will provide rough estimates of energy savings and installation costs for this analysis.

7. Implement O&M Improvements

Change as appropriate, if commissioning provider will be financing and/or overseeing the improvements.

The owner will finance and oversee the installation of the improvements, with some assistance in a review and consulting mode by the commissioning provider. Work may be completed by in-house as well as by contracted parties. Improvements will include, for selected equipment, the correction of unclear or incorrect documentation of control

sequences of operation and to create the written sequences where they don't exist; and a listing of recommended training for facility staff.

Systems will be manually retested to verify the completeness of the fix, as appropriate and as needed. Appropriateness and need will be determined based on the complexity and magnitude of impacts of the fix and the cost of retesting. The dataloggers [will, will not] be installed after improvements are made to verify the fixes and for assisting in making energy savings calculations of the improvements.

8. Consider Energy-Efficient Capital Improvements

The list of possible cost-effective capital improvements to equipment that became obvious to the commissioning provider during the preceding work will be evaluated by the owner and commissioning provider. Implementation will not be a part of the scope of this project.

9. Commissioning Final Report

The commissioning provider will prepare a final report that generally includes the following information:

- Executive summary
- Project background
- Building / systems listing and general description
- Scope of the commissioning project
- The "master list" of improvements with a description of which improvements were implemented
- A cost/savings analysis based on the rough estimates of savings and the actual improvement costs for each improvement implemented (where applicable)
- List of recommended capital improvements

In Appendix

- The commissioning plan
- The filled-out operations initial site assessment forms
- The EMCS trending plan and logger diagnostic / monitoring plan and annotated results
- All completed functional tests and results
- Corrected and created sequences of operation

List energy savings calculation method as appropriate.

The estimates of energy savings for the final report will be developed using [engineering hand calculations, spreadsheet calculations, spreadsheet bin analysis, bin computer simulation, hourly computer simulation].

Additional Commissioning Tasks

The following tasks will also be completed by the commissioning provider.

List as appropriate.

1. Finalize an O&M plan outline, including examining and enhancing the current maintenance service contract procedures.
2. Develop a list of required O&M documentation and a systems operations manual, including full written sequences of operation for equipment that still may be missing documentation of its sequences.
3. Develop an energy efficiency plan and policy, including strategies for obtaining management buy-in.
4. Develop guidelines for implementing a preventative maintenance plan.
5. Develop a comprehensive training plan. Or, develop recommendations for appropriate building staff to attend training in general O&M concepts and for specific equipment and systems. This will include both building operators and facility managers or owners.
6. Develop guidelines and recommendations for incorporating an energy accounting and tracking system.
7. Develop a list of operational strategies for the owner to incorporate in the future.
8. Develop an operations assessment program and systems tune-up and recommissioning schedule.

General Schedule

An initial draft schedule is given here. The dates may change somewhat as the project progresses. The task list gives a good indication of the general scope of work and the order in which it will be undertaken. A detailed schedule will be developed by the Commissioning Provider. As work progresses, all parties will be notified of any schedule changes that may affect their specific tasks.

Commissioning Formal Written Work Products

There are a number of formal written work products. All are generated by the commissioning provider, except the filling out of the authorization protocols (Form B-6); the filling out of the prefunctional checklists by facility staff and the printing of columnar format trend logs by the facility staff or controls vendor. Form B-4 in Appendix B provides further details on the products.

Table 1. Initial Schedule

Task	Start Date	End Date
A. Identify Primary Objectives		
B. Obtain a General Overview of Building and Review Documentation		
C. Develop Site-Specific Commissioning Plan		
1. Perform the operations initial site assessment		
2. Execute prefunctional checklists		
3. Develop a List of O&M Deficiencies / Opportunities		
4. Develop a Diagnostic Monitoring and Functional Testing Plan		
5. Implement Monitoring and Testing		
6. Analyze the Monitoring and Testing Data and Determine Which O&M Opportunities are Most Cost Effective		
7. Implement O&M Improvements		
7a. Retest to Verify Fixes		
8. Recommend Energy-Efficient Capital Improvements		
9. Commissioning Final Report		