

# Model Commissioning Plan and Guide Specifications

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Version 2.04 was distributed by Peci in 1997 and by USDOE in 1998, with USDOE referenced in the footer of each file. Since that version, changes and additions have been made by Peci without review by USDOE; subsequently in Version 2.05 the reference to USDOE has been removed from the footers. Individual files may have been updated without changing the overall version number. An up-to-date history of changes is found in the file history. \_\_\_.

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## **Acknowledgments**

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*—Karl Stum*

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# Model Commissioning Plan and Guide Specifications

## Overview

**Commissioning.** Commissioning (Cx) is a systematic process of ensuring that building systems perform interactively according to the design intent and the owner's operational needs. This is achieved beginning in the design phase by documenting the design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance, operation and maintenance (O&M) documentation verification and the training of operating personnel.

### **Objectives**

The objectives of the Model Commissioning Plan and Guide Specifications are to:

During design:

1. Ensure that the design team applies commissioning concepts to the design, e.g., clear and complete design intent documentation is developed and commissioning-focused design reviews are conducted.
2. Ensure that the design team prepares commissioning specifications and a commissioning plan for inclusion in the bid construction documents.

Meeting these objectives during design prepares the way so that the:

- Contractors can accurately bid the commissioning work.
- Contractors can understand how to efficiently execute the commissioning process.
- There is a systematic, efficient and enforceable method to accomplish the commissioning objectives.
- The commissioning objectives are met. At the building level these objectives include:
  - Ensure that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
  - Verify and document proper performance of equipment and systems.
  - Ensure that O&M documentation left on site is complete.
  - Ensure that the Owner's operating personnel are adequately trained.

### **General Overview**

The *Model Commissioning Plan and Guide Specification* is not intended to be a workbook or a manual on commissioning. Little background information on commissioning approaches, narrative of the commissioning process, costs and benefits of commissioning, etc. is included. This information is readily available in a number of other publications. The model plan and guide specifications were developed to provide those who are ready to incorporate commissioning, boilerplate-type language, content, format and forms for specifying and executing the commissioning process, so that they do not have to start from "scratch."

The *Model Commissioning Plan and Guide Specifications* generally follow the guidelines described in the ASHRAE document, *The HVAC Commissioning Process* referenced at the end of this overview. A number of other documents were used, as referenced, along with the authors' own commissioning experience. The *Model Commissioning Plan and Guide Specifications* were developed to be as generic as possible— though they were tailored to fit the management structure of General Services Administration (GSA), Region 10— for conventional design / spec / bid construction. Refer to the introduction to Part III Commissioning Guide Specifications for additional details on management structure assumptions.

The term “model” in model commissioning plan means that the commissioning plan is intended to be broadly representative of what a commissioning plan should actually look like. The commissioning plans have been developed to be somewhat generic and yet be structured so as to be easily adaptable to specific projects.

The term “guide” in guide specifications means that the commissioning specifications represent recommended language intended to be broadly applicable. The architect and design engineer, along with the commissioning authority, adapt this guide specification to incorporate commissioning into their projects.

The model plan and guide specifications were developed for larger, more complex projects and systems. A more streamlined commissioning approach may be appropriate for buildings less than 70,000 sf with simple equipment (packaged equipment and controls, no building automation system, etc.).

### **Document Organization**

The Model Commissioning Plan and Guide Specifications are comprised of the following four separate documents designated as “parts.”

- Part I. *Commissioning Requirements–Design Phase*
- Part II. *Model Commissioning Plan–Design Phase*
- Part III. *Commissioning Guide Specifications*
- Part IV. *Model Commissioning Plan–Construction Phase*

A brief description of each part follows:

#### **Part I. Commissioning Requirements—Design Phase**

The *Commissioning Requirements–Design Phase* are requirements relating to commissioning which the design team is required to carry out during the development of the contract documents. The requirements include a listing of the responsibilities for each member of the design team. In addition, for perspective it lists the responsibilities of all players during the construction phase. This document is intended to be included in the request for proposal (RFP) for architectural/engineering (A/E) services and for prospective commissioning authorities, after having the appropriate check boxes and blanks filled in by the Owner. The list of requirements provide little detail, as they point to the fully explained procedures in the *Model Commissioning Plan—Design Phase*. In the Appendix to Part I, a sample RFP for a commissioning authority is provided. (Part I length: Requirements and appendices 31 pgs)

#### **Part II. Model Commissioning Plan—Design Phase**

The *Model Commissioning Plan–Design Phase* guides the commissioning activities during the design phase. It provides details of responsibilities called out in Part I, *Commissioning Requirements–Design Phase* for the architect, design engineers, commissioning authority, construction and project managers. The plan describes the duties of the A/E team and commissioning authority in developing the site-specific

commissioning specifications and for developing the first two drafts of the *Commissioning Plan—Construction Phase*. (Part II length: Plan and appendices 85 pgs)

### **Part III. Commissioning Guide Specifications**

The commissioning guide specifications contain recommended language that describes both the requirements and the process to incorporate commissioning into the construction specifications. All divisions and sections that relate to commissioning include language to ensure that the contractors are clearly informed regarding their commissioning responsibilities. Adequate explanation of the commissioning process is also provided. In addition, prefunctional checklists and sample functional tests are included for the many common types of equipment and systems. (Part III length: Specifications ~132 pgs, prefunctional checklists ~100 pgs, functional tests ~126 pgs)

### **Part IV. Commissioning Plan—Construction Phase**

The *Commissioning Plan—Construction Phase* is developed in draft form for the specific project during the design phase. During the design phase, the plan provides direction for the development of the site-specific commissioning specifications by the design team. During the construction phase, the plan provides direction for the commissioning tasks during construction. The plan focuses on providing support to the specifications and provides forms for application of the commissioning process. (Plan 16 pgs, forms 40 pgs)

### **Limitations**

The Model Commissioning Plan and Guide Specifications do not cover specific commissioning testing requirements, checklists, or sample functional tests for the following. However, the process described herein, particularly in Section 17100, can apply to any equipment.

- Plumbing fixtures and equipment (other than heating and cooling water piping)
- Architectural features, finishes and hardware
- Interstitial cavity differential pressure gradients and moisture control
- Laboratory fume hoods and clean rooms
- Medical gas systems
- Sound and vibration control for various equipment
- Electrical system components, sometimes covered by municipal inspections (grounding, transformers, switchboards, etc.)

### **Document Use by Owners**

All documents have been provided on electronic disk for adapting. All four parts of the *Model Commissioning Plan and Guide Specifications* are intended to be used together during the design phase. If formal commissioning is not going to be incorporated during design, some of the commissioning concepts and tasks from Parts I and II could still be assigned to the design team. At minimum, the sections on the development of commissioning specifications for construction should be completed during design (*Part II, Commissioning Plan—Design Phase, Task 6*).

The recommended procedure for the owner using the *Model Commissioning Plan and Guide Specifications* starts in or before the design phase, as follows:

Step 1. Before beginning design, the owner uses the commissioning authority solicitation documents in Appendix 1 of *Part I, Commissioning Requirements—Design Phase* to obtain the services of a

commissioning authority. The owner may obtain the commissioning services for just the design phase or may choose to retain the commissioning authority during the construction phase as well. However, though the scope and cost of the construction phase may need to be finalized later during design, after more is known about the equipment being commissioned. Also, the owner may choose to have the construction phase commissioning authority hired under the construction management contractor, who may not be known during design, i.e., there may end up being one commissioning authority for design and one for construction.

Step 2. The commissioning authority and the owner fill out an initial draft of the *Commissioning Plan—Design Phase* (in Part II).<sup>\*</sup> Full directions are provided at the beginning of the plan.

Step 3. The commissioning authority and the owner edit and adapt the *Commissioning Requirements—Design Phase* (in Part I) to be appropriate for the specific project.<sup>\*</sup>

<sup>\*</sup>If the commissioning authority is not formally engaged yet, the owner may complete this step on their own or may use the temporary consulting services of a commissioning authority or qualified engineer.

Step 4. The adapted *Commissioning Requirements—Design Phase* (Part I) and the filled-in *Commissioning Plan—Design Phase* (Part II), along with the as-is *Guide Specifications* (Part III) and as-is *Commissioning Plan—Construction Phase* (Part IV) are provided to the design firms in the solicitation for their services. Due to the size of these documents, it may be appropriate to distribute the documents after short listing firms is completed.

Step 5. In the owner's contract with the design team, the owner explicitly includes Parts I and II (*Commissioning Requirements—Design Phase* and *Commissioning Plan—Design Phase*). The contract also refers to Part III and Part IV (*Guide Specifications* and *Commissioning Plan—Construction Phase*), as reference material.

Step 6. The owner may perform Steps 1-5 without a commissioning authority on board. However, by the beginning of design if the owner has not engaged a design phase commissioning authority, they should do so now, following Step 1.

Step 7. The selected design firm uses Parts I, II, III and IV during design as they follow the *Commissioning Plan—Design Phase* (Part II). The design team develops clear design documentation, incorporate commissioning specifications into the main building specifications using the guide specifications (Part III), and create two drafts of the *Commissioning Plan—Construction Phase*, specific to this project. The owner participates in this process according to the design-phase plan.

Step 8. The owner includes the second draft of the *Commissioning Plan—Construction Phase* (Part IV) along with the construction specifications that include commissioning specifications in the construction bid documents.

Step 9. The owner makes sure all contract language referring to testing, milestones, etc. are consistent with the commissioning specifications in the bid documents, paying special attention to any exclusions.

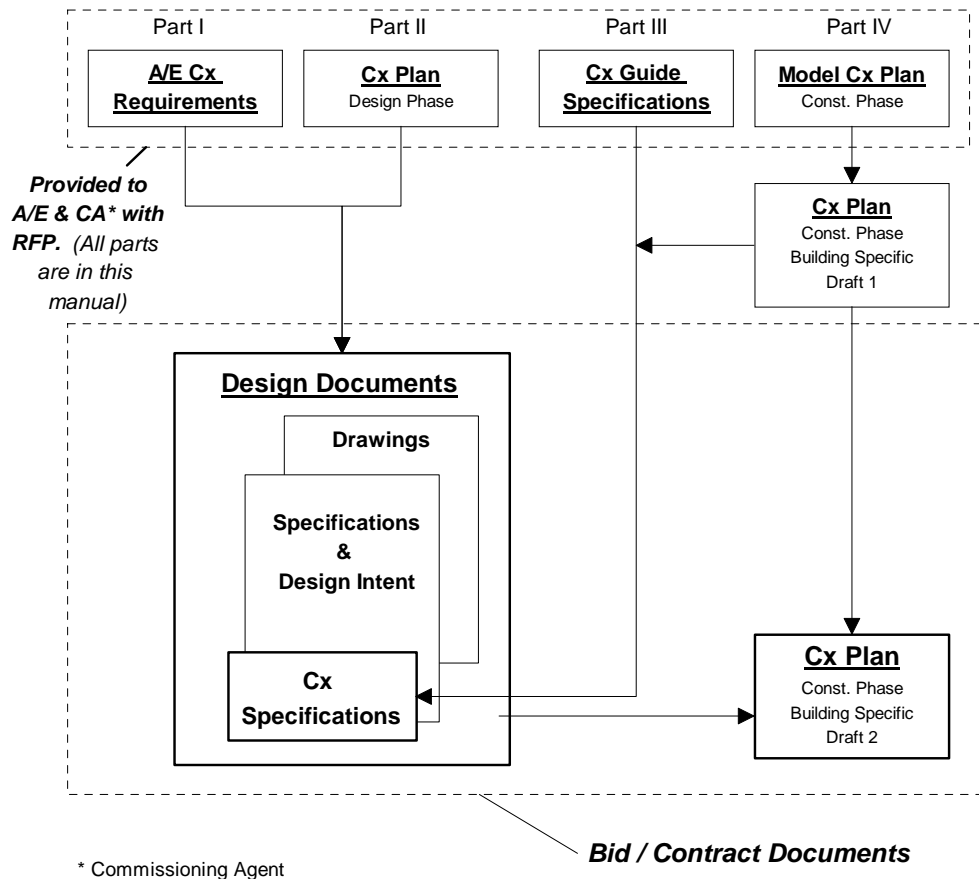
Step 10. The owner makes final contractual agreements with the commissioning authority for the construction phase.

Step 11. The commissioning process is executed per the bid commissioning specifications and commissioning plan.

Step 12. The CA uses the commissioning forms and sample checklists and tests from the original documents of Parts III and IV (*Guide Specifications* and *Commissioning Plan--Construction Phase*) to develop documents and forms appropriate for this project.

The following graphic illustrates the above process.

### Commissioning (Cx) Contract Document Development



### Copyright

This work is in the public domain and may be copied and distributed at will. However, once files have been edited they should have the reference to PECEI and USDOE removed from the footers. When appropriate, referencing the source of the documents would be appreciated.

### Electronic Format

All parts of the Model Commissioning Plan and Guide Specifications have been included on diskette for modification, adaptation and use, as necessary. The commissioning plans are provided as one document each. The appendices of each plan are included as separate documents. Each of the forms in the Appendix of the construction phase commissioning plan is included as a separate document file, as is each individual section of the specifications. The file format is Word 6.0 for Windows 3.1 with a few forms in Excel 5.0 for Windows. Filenames are included in the footer for reference in all hard copies. For ease of access, all electronic files have been archived into a few master files that will automatically extract the files into seven automatically created directories, as described in the *readme\_.txt* file.



## Order of Electronic Files

The following list of files corresponds to the order of the documents in the hardcopy of the *Model Commissioning Plan and Guide Specifications*. Preceding the file listing for each section is the subdirectory where the electronic files are contained, after being expanded.

Directory: \DESIREQR.PT1 (The underscore in the file name extension is a place holder for the version number.)

**Model Commissioning Plan and Guide Specifications Overview** ..... ALL\_OVR.VU\_

--Insert a divider tab: "Part I, Design Requirements"

**Part I: Commissioning Requirements—Design Phase** .....DES\_REQR.V\_\_

--Insert a divider tab: "App. 1, CA Solicitation"

Appendix 1: Solicitation for Commissioning Authority Services.....CA\_RFP.V\_\_

Exhibit 5: Commissioning Firm Experience..... CA\_INFOR.V\_\_

Exhibit 6: Commissioning Project Experience Listing ..... CAEXPER2.XLS

--Insert a divider tab: "Part II, Cx Plan--Design"

Directory: \DESIPLAN.PT2

**Part II: Model Commissioning Plan—Design Phase** ..... DESIPLAN.V\_\_

Appendix 1: Design Documentation Format—Instructions..... INSTRUCT.V\_\_

Design Documentation Format ..... D\_INTENT.V\_\_

Appendix 2: Fire & Emergency Power Response Matrix ..... RESPNSM.TRX

Appendix 3: Commissioning for Indoor Air Quality Checklist ..... DPLANAP3.V\_\_

--Insert a divider tab: "Part III, Guide Specs"

Directory: \GIDESPEC.PT3

**Part III: Commissioning Guide Specifications Overview**..... SPEC\_OVR.V\_\_

--Insert a divider tab: "Division 1"

Section 00800: Supplementary Conditions..... 00800.V\_\_

Section 01040, Version A: Coordination..... 01040A.V\_\_

Section 01040, Version B: Coordination ..... 01040B.V\_\_

Section 01300: Submittals ..... 01300.V\_\_

Section 01700: Project Close-Out..... 01700.V\_\_

Section 01730: Operations and Maintenance Data ..... 01730.V\_\_

--Insert a divider tab: "Division 15"

Section 15010: Mechanical—General Provisions ..... 15010.V\_\_

Section 15950: Automatic Controls..... 15950.V\_\_

Section 15990: Test, Adjust and Balance ..... 15990.V\_\_

Section 15995: Mechanical Systems Commissioning ..... 15995.V\_\_

Section 15997: Mechanical Testing Requirements..... 15997.V\_\_

Section 15998: Prefunctional Checklists—Mechanical & Electrical ..... 15998.V\_\_

Section 15999: Sample Functional Test Procedures—Mechanical ..... 15999.V\_\_

--Insert a divider tab: "Division 16"

Section 16010: Electrical—General Provisions..... 16010.V\_\_

Section 16995: Electrical Systems Commissioning..... 16995.V\_\_

Section 16997: Electrical Testing Requirements ..... 16997.V\_\_

Section 16998: Prefunctional Checklists—Electrical ..... 16998.V\_\_

Section 16999: Sample Functional Test Procedures..... 16999.V\_\_

--Insert a divider tab: "Division 17"

Section 17100: Commissioning Requirements ..... 17100.V\_\_

--Insert a divider tab: "Part IV, Cx Plan-Const. Phase"

Directory: \CONSPLAN.PT4

**Part IV: Model Commissioning Plan—Construction Phase** .....CONSPLAN.V\_\_

--Insert a divider tab: "Construction Forms"

Directory: \CONFORMS.PT4 (The file name extension refers to the Form ID number)

Appendix 1: Construction Phase Application Forms (29 files)

C-1: Commissioning Issues Log .....	ISSULOG2.C01
C-2: Request for Documentation and Record of Submissions .....	DOCREQC2.XLS
C-3a: Commissioning Test or Review Approval.....	APROVAL4.C3A
C-3b: Commissioning Prefunctional Check Submittal / Approval.....	SUBMITPC.C3B
C-3c: Commissioning Transmittal.....	TRANSMIT.C3C
C-3d: Commissioning Request for Information .....	INFOREQ.C3D
C-3e: Commissioning Memorandum.....	MEMORAND.C3E
C-3f: Commissioning Submittal for Sequences and Test Forms.....	SUBFTFRM.C3F
C-3g: Generic Commissioning Document / Test Submittal / Review Form .....	SUBMITAL.C3G
C-4: Commissioning Progress Report .....	PROGREPT.C04
Training: Project Training and Orientation Procedures.....	TRAINPRO.CED
C-5a: Overall Staff Training and Orientation Plan .....	TRAINPLN.C5A
C-5b: Training and Orientation Agenda.....	TRAINAGE.C5B
C-5c: Staff Training and Orientation Record .....	TRAINREC.C5C
C-6: Commissioning Corrective Action Report .....	CORECTON.C06
C-7: Commissioning Progress Record.....	RECORDC7.XLS
C-8: Plan and Documentation Requirements for Startup and Initial Checkout...	STARTPLN.C08
C-9: Detailed Commissioning Schedule (blank) .....	TIMEBLC9.XLS
C-10: Detailed Commissioning Schedule (filled in).....	TIMEFC10.XLS
C-11a: Commissioning Functional Testing Plan Overview .....	FTOVRVU.11a
C-11b: Commissioning Functional Testing Status Record.....	FTSTATUS.11b
C-12: Phasing of Commissioning Testing.....	PHASES.C12
C-13: Owner-Contracted Tests .....	OWNRTEST.C13
C-14: Facility Staff Participation in Commissioning .....	STAFFPART.C14
C-15: Functional Testing Scope Outline (example) .....	SCOPEFIL.C15
C-16: Commissioning Formal Written Work Products .....	PRODUCTS.C16
C-17: Commissioning Record Notebook Format .....	BOOK_C17.XLS
C-18: Trending and Monitoring Request Form .....	TRENDREQ.XLS

Appendix 2: Document and Test Development Flow Charts, Submittal Maps ..... PT4\_APP2.V03

## Prefunctional Checklist Forms

--Insert a divider tab: "Prefunctional Checklists"

Directory: \PREFUNCT.PT3 ("PC" in the file name extension refers to Prefunctional Checklist. The underscore is a placeholder for the current version #.)

Prefunctional checklists title page .....	PC_TITLE.V_
Air handler unit.....	AHU.PC_
Air-cooled Condenser and Compressor .....	AIRCNSDR.PC_
Boiler .....	BOILER.PC_
Calibration instructions (sensors and actuators) .....	CALIBDIR.PC_
Chiller .....	CHILLER2.PC_
Sample chiller system startup documentation plan.....	CHILRDOC.PC_
Chilled Water Piping .....	CHWPIPE.PC_
Computer Room AC Unit .....	COMPUTAC.PC_
Condenser Water Piping .....	CDWPIPE.PC_
Controls System (BAS) .....	CONTROLS.PC_
Cooling Tower.....	COOLTWR.PC_
Exhaust Fan.....	EXH_FAN.PC_
Fan Coil Unit .....	FANCOILU.PC_
Heating Water Piping.....	HWPIPE.PC_
Packaged Rooftop Unit.....	PKGUNIT.PC_
Pump (water).....	PUMP.PC_
Start-up Documentation Plan Template .....	STARTPLN.C06
TAB agenda checklist.....	TABPLAN.PC_
Terminal Unit.....	TU_PC05.XLS
Variable Frequency Drive.....	VFD.PC_

## Sample Functional Test Forms

--Insert a divider tab: "Functional Test Forms"

Directory: \FUNCTEST.PT3 ("FT" in the file name extension refers to Functional Test. The underscore is the version #.)

Functional test form title page .....	FT_TITLE.V_
Air Compressor (for smoke dampers).....	AIRCOMPR.FT_
Air Handler Unit (cooling unit only) .....	AHU_COOL.FT_
Air-Side Economizer .....	ECONTEST.FT_
Cabinet Unit Heater .....	CABUNHTR.FT_
Chilled Water Sequence of Operations.....	CHILRSEQ.009
Chiller Functional Test .....	CHILLER.FT_
Fan Coil (heating) .....	HTFNCOIL.FT_
Fin Tube Radiator .....	FINTUBE.FT_
Packaged Rooftop DX Air Conditioning Unit.....	PKG_RTU.FT_
Packaged Boiler Control Sequences (not included in hard copy) .....	BOILRSEQ.00_
Packaged Boiler Functional Test .....	BOILERHW.FT_
Multiple Boiler System Functional Test (not included in hard copy) .....	BOILERSYS.FT_
Service Water Heater (Gas) .....	SRVC_WH.FT_
Small Service Hot Water Circulating Pumps.....	SMLCPUMP.FT_
Split Air Conditioning Unit .....	SPLIT_AC.FT_
TAB Checkout .....	TAB.FT_
Terminal Unit--HW Reheat Single Duct .....	TU_REHET.FT_
Terminal Unit--Dual Duct.....	TU_DDVAV.FT_
Terminal Unit--Dual Duct Fan (Series) .....	TU_DDFAN.FT_

Terminal Unit--Cooling Only VAV Single Duct.....	TU_CLG.FT_
Unit Heater.....	UNIT_HTR.FT_
Variable Speed Drive (fan application) .....	VDFAN.FT_
Variable Speed Drive (pump application) .....	VDPUMP.FT_
Emergency Power System and UPS .....	E-POWER.FT_
Emergency Power System and UPS (larger UPS test; not included in hard copy)....	E-POWBIG.FT_
Exterior Lighting Controls.....	EXTLIGHT.FT_
Lighting Sweep Controls .....	SWEEP.FT_

## Reference Sources

The primary sources used for the development of these commissioning plans and specifications were (listed by date):

1. Heinz, John A., Rick Casault and Phoebe Caner, *The Building Commissioning Handbook*, The Association of Higher Education Facilities Officers (APPA), 1996.
2. *Building Commissioning Guide*, Enviro-Management & Research, Inc., 1996.
3. *The HVAC Commissioning Process*, ASHRAE Guideline 1-1996.
4. Electrical Engineering Building Commissioning Specifications, Notkin Engineering/ University of Washington, 1995.
5. Caner, Phoebe, *Commissioning the Building Automation System of the Physics/Astronomy Building: A Case Study*, University of Washington, 1995.
6. *Systems Commissioning Procedures*, US Army Corp of Engineers, 1995.
7. Chamberlin, G. A. and D. M. Schwenk, *Standard HVAC Control Systems Commissioning and Quality Verification User Guide*. USACERL, FEAP-UG-FE-94/20, September 1994.
8. GSA Portland, Oregon Federal Courthouse Specifications, general commissioning section and controls testing sections, 1994.
9. Dunn, Wayne A., *C-2000 Quality Guideline, Commissioning Specifications*, Canadian Department of Energy Mines and Resources, 1994.
10. *Contractor Quality Control and Commissioning Program*, Montgomery County, Maryland, 1993.
11. General Commissioning Guide Specifications, University of Washington Facility Management Office, September 1993.
12. Kao, James Y., U.S. Department of Commerce, *HVAC Functional Inspection and Testing Guide*, March 1992
13. *Building Commissioning Guidelines*, PECCI/Bonneville Power Administration, 1992.
14. Misc. specifications, guidelines and tests developed by PECCI, 1990-1996.

## Additional Sources for Commissioning Guidelines, Guide Specifications and Sample Functional Performance Tests

Last Updated: 2/4/98s

Source	Guide- lines	Guide Specs	Sample Tests
<i>Model Commissioning Plan and Guide Commissioning Specifications</i> , USDOE/PECI, 1997. NTIS: # DE 97004564 1-800-553-6847. Peci Web site: <a href="http://www.peci.org">http://www.peci.org</a>	*Some D, c	*YES D, C	*YES
<i>The HVAC Commissioning Process</i> , ASHRAE Guideline 1-1996, 1996. ASHRAE Publications Dept., 1791 Tullie Circle, NE, Atlanta, GA 30329.	Yes d, C	Some d, c	No
<i>Engineering and Design Systems Commissioning Procedures</i> , U.S. Army Corps of Engineers, 1995 (ER 1110-345-723). Department of the Army, U.S. Army Corps of Engineers, Washington, DC 20314-1000.	Some d, c	Some d, c	No
<i>Commissioning Specifications</i> , C-2000 Program, Canada, 1995. C-2000 Program, Energy Mines & Resources, Energy Efficiency Division, 7th Floor, 580 Booth St., Ottawa, Ontario, Canada K1A 0E4.	No	*YES C	No
<i>Building Commissioning Guide</i> , U.S. General Services Administration and USDOE, 1995. Prepared by Enviro-Management & Research, Inc. 703-642-5310.	Yes D, C	No	No
<i>Commissioning Guide Specification</i> , Facility Management Office, Univ. of Washington, 1993-6. <a href="http://weber.u.washington.edu/~fmesweb/">http://weber.u.washington.edu/~fmesweb/</a>	No	*YES C	Some
<i>Commissioning Guidelines, Instructions for Architects and Engineers</i> , State of Washington, 1995. Dept. of General Administration, Div. of Engineering & Architectural Services, (360) 902-7272.	Yes d, c	No	No
<i>Commissioning of HVAC Systems</i> , seminar/workshop training materials, Univ. of Wisconsin, Madison, 1994. 800-462-0876 or 608-262-2061	Some C	Some C	Some
<i>Laboratory HVAC Systems: Design, Validation and Commissioning</i> , ASHRAE collection of 11 papers, 1994. And, <i>Commissioning Smoke Management Systems</i> , ASHRAE Guideline 5-1994. ASHRAE Publications Dept., 1791 Tullie Circle, NE, Atlanta, GA 30329.	Yes C		
<i>Standard HVAC Control Systems Commissioning and Quality Verification User Guide</i> , U.S. Army Const. Engineering Research Laboratories, 1994. Facilities Engineering Applications Program, U.S. Army Engineering and Housing Support Center, Ft. Belvoir, VA 22060-5516. FEAP-UG-GE-94/20.	No	No	Yes
<i>Contractor Quality Control and Commissioning Program—Guidelines and Specification</i> , Montgomery County Gov., State of Maryland, 1993. 301-217-6071.	*Yes c	*YES C	*Some
<i>Procedural Standards for Building Systems Commissioning</i> , National Environmental Balancing Bureau (NEBB), 1993. NEBB, 1385 Piccard Drive, Rockville, MD 20850. 301-977-3698	Yes d, c	Some d, c	Some

\* Denotes that the documents are available on electronic disk.

D = for design phase, C = for construction phase.

All CAPS denotes document is more comprehensive than lower case.

Cont.--

Source	Guidelines	Guide Specs	Sample Tests
<i>HVAC Systems Commissioning Manual</i> , Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), 1993. SMACNA, 4201 Lafayette Center Dr., Chantilly, VA 22021.	Yes c	Some c	Some
<i>Guide Specification for Military Construction—Commissioning of HVAC Systems</i> , Department of the Army, U.S. Army Corps of Engineers, January, 1993. Department of the Army, U.S. Army Corps of Engineers, Washington, DC 20314-1000	No	*Some c	*YES
<i>Commissioning Guide</i> , Public Works Canada, Western Region, 1993. 403-497-3770.	Some d, c	Yes d, C	No
<i>Building Commissioning Guidelines</i> , Bonneville Power Administration/PECI, 1992. 503-230-7334.	YES d, C	Some c	Some
<i>The Building Commissioning Handbook</i> , The Association of Higher Education Facilities Officers (APPA), written by John Heinz and Rick Casault, 1996. APPA, 1643 Prince Street, Alexandria, VA 22314.	YES d, C	YES C	No
<i>HVAC Functional Inspection and Testing Guide</i> , U.S. Dept. of Commerce and the General Services Administration, 1992. NTIS: 800-553-6847.	No	No	YES
<i>Thermal Energy Storage (TES) Commissioning Guidelines</i> , California Institute for Energy Efficiency, San Diego State University, 1991. San Diego State University, Energy Engineering Institute, San Diego, CA 92182.	Yes C	No	Yes
<i>AABC Master Specification</i> , Associated Air Balance Council (Primarily for how the TAB fits into the commissioning process) AABC National Headquarters, 202-737-0202.	No	*Yes d, C	No

\* Denotes that the documents are available on electronic disk.

D = for design phase, C = for construction phase.

All CAPS denotes document is more comprehensive than lower case.

## Web Sites Containing Commissioning Information

Florida Design Initiative	<a href="http://fcn.state.fl.us/fdi/fdi_home.html">http://fcn.state.fl.us/fdi/fdi_home.html</a>
NEBB	<a href="http://www.mcaa.org/nebb/bsc-man.htm">http://www.mcaa.org/nebb/bsc-man.htm</a>
Oregon Office of Energy	<a href="http://www.cbs.state.or.us/external/ooe/cons/bldgcx.htm">http://www.cbs.state.or.us/external/ooe/cons/bldgcx.htm</a> (among other things, it contains the full text of "Commissioning for Better Buildings in Oregon")
PECI	<a href="http://www.peci.org">http://www.peci.org</a>
Texas A&M Energy Systems Lab	<a href="http://www-esl.tamu.edu">http://www-esl.tamu.edu</a>
University of Washington	<a href="http://weber.u.washington.edu/~fsesweb/">http://weber.u.washington.edu/~fsesweb/</a>
USDOE / FEMP	<a href="http://eren.doe.gov/femp/facbuild.htm">http://eren.doe.gov/femp/facbuild.htm</a> (among other things, it contains the full text of USDOE / GSA "Building Commissioning Guide")