

Job/Task Analysis for a Commissioning/ Retro-Commissioning Authority: Public Comment Draft

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Commissioning/Retro-Commissioning Authority Job Description

Commissioning authorities manage the development and implementation of a documented quality assurance process to verify that new or existing buildings function according to the owner's requirements.

A proposed content outline resulting from this Job/Task Analysis follows.

Commissioning/Retro-Commissioning Authority	
A	Analyzing Existing Building
B	Producing Commissioning Documents
C	Managing Commissioning Projects
D	Reviewing Project Documents
E	Verifying Installation
F	Verifying System Performance
G	Educating Project Team

This Job/Task Analysis used input from a broad group of industry practitioners and was facilitated by Professional Testing, Inc. for the National Renewable Energy Laboratory and the U.S. Department of Energy.

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1.0 Introduction

The National Renewable Energy Laboratory secured the services of Professional Testing to help develop a job/task analysis (JTA) for commissioning/retro-commissioning authorities.

JTA is a procedure for analyzing the tasks performed by individuals in an occupation, as well as the knowledge, skills, and abilities required to perform those tasks. Specifically, a JTA can be defined as “any systematic procedure for collecting and analyzing job-related information to meet a particular purpose” (Raymond 2001). JTA can be used to describe, classify, and evaluate jobs; ensure compliance with legal and quasi-legal requirements; develop training, promote worker mobility, plan workforces, increase efficiency and safety, and appraise performance (Brannick et al. 2007).

JTA is traditionally used by secondary and postsecondary educators, test developers, and business, industry, government, and military trainers to help identify core knowledge areas, critical work functions, and skills that are common across a representative sampling of current practitioners.

This project used the “developing a curriculum” (DACUM) method to conduct a JTA. DACUM is an occupational analysis led by a trained facilitator, where practitioners in a specific occupation come together for a multiday workshop to provide input about the specific tasks, knowledge, and skills needed to perform their job.

This document provides draft results of the analysis and will form the basis for a subsequent “industry validation” phase, where a larger group of industry practitioners will evaluate the list of job-related tasks. This group will ensure that the identified tasks and weighting factors accurately represent the job of a commissioning/retro-commissioning authority. This step will also provide an opportunity for industry to identify any missed tasks or any that were included erroneously.

The content presented in this document was created by industry practitioners and is intended to portray the job of a commissioning/retro-commissioning authority as currently practiced.

2.0 Subject Matter Expert Selection Process

Professional Testing helped to establish the criteria for selecting the DACUM panel of subject matter experts (SMEs). To be eligible for the workshop panel, applicants were required to submit an electronic application and to demonstrate that they were active practitioners in their field. To create a representative panel of practitioners, Professional Testing selected SMEs from a larger applicant pool to ensure:

- Geographic diversity
- Representation of a wide range of experience levels (novice to expert)
- No single organization or organization size dominated the group
- All sectors were represented with no single sector dominating (public versus private)
- Diversity of industry-related credentials, represented by the panelists.

Eleven applicants meeting the above criteria were selected to create the commissioning/retro-commissioning authority SME panel.

3.0 Job/Task Analysis Workshop

The commissioning/retro-commissioning authority JTA workshop was held in Denver, Colorado, May 11–13, 2011.

The DACUM Philosophy:

- Practitioners can describe and define their jobs more accurately than anyone else.
- One of the most effective ways to define a job is to describe the tasks practitioners perform.
- All jobs can be effectively and sufficiently described in terms of the tasks successful workers perform.
- All tasks, to be performed correctly, demand certain knowledge, skills, abilities, attributes, and tools.

Day 1 consisted of an introduction to the DACUM process. The trained DACUM facilitator explained the JTA process and provided the SME panel with duty and task statement definitions. A duty reflects a large area of work for a specific profession; multiple tasks describe how to perform each duty. The presentation then shifted to a discussion about commissioning/retro-commissioning authorities, more specifically the “who, how, what, and why” of the profession. The SME panelists compiled this information into a comprehensive list to capture key commissioning/retro-commissioning authority job components.

The next step was to identify duty (or domain) areas. Once the SME panelists reached consensus on the duty areas, they delineated each duty by identifying the required tasks.

On Day 2, the facilitator projected a spreadsheet that contained the identified duty areas and corresponding

task statements. The SMEs were asked to list the steps under each task and to identify the knowledge, skills, abilities, and tools needed to complete each task.

On Day 3, work concluded with the SMEs finalizing an overarching job description for commissioning/retro-commissioning authorities.

4.0 Results

This document presents aspects of a commissioning/retro-commissioning authority, as captured by the 11-member panel during the May 11–13, 2011 JTA workshop in Denver, Colorado. The tables that follow reflect job requirements and are meant to provide a clear understanding and detailed description of the work performed.

5.0 References

Brannick, M. T., Levine, E. L., & Morgeson, F. P. (2007). *Job and work analysis: Methods, research and applications for human resource management*. Thousand Oaks, CA: Sage.

Raymond, M.R. (2001). Job analysis and the specification of content for licensure and certification examinations. *Applied Measurement in Education* 14(4), 369-415.

6.0 Nomenclature

Table 1 provides a list of the acronyms and abbreviations used in this document. In addition to increasing the efficiency of communications, many technical and process acronyms are useful in memory retention and learning. Occupational acronyms are therefore of interest to trainers and curriculum designers.

Table 1: List of Acronyms and Abbreviations

Nomenclature	Definition
BOD	Basis of design
CFR	Current facility requirements
DACUM	Developing a curriculum
EB	Existing building
ECM	Energy conservation measure
F	Fahrenheit
FIM	Facility improvement measure
JTA	Job/task analysis
M&V	Measurement and verification
NIST	National Institute of Standards and Technology
O&M	Operations and maintenance
OPR	Owner's project requirements
PPE	Personal protective equipment
SME	Subject matter expert
TAB	Test, adjust, and balance

7.0 Proposed Content Blueprint

The SMEs rated the list of job-related duties defined during the JTA workshop based on a two-factor scale: the importance of the duty area to overall job performance and the frequency with which duties are performed. The result is a weighted ranking of the duties known as a *content blueprint*.

The proposed content blueprint provides an initial basis from which an assessment (e.g., a certification or licensure examination) may be constructed and provides curriculum developers with a model to align training to the core needs of the occupation.

Table 2: Proposed Content Blueprint for Commissioning/Retro-Commissioning Authorities

Duties and Tasks		Weighting
A	Analyzing Existing Buildings (EB)	15%
1	Review Existing Documentation (EB)	
2	Analyze Existing System Controls (EB)	
3	Perform Surveys	
4	Verify Data (EB)	
5	Analyze Data (EB)	
6	Present Findings (EB)	
B	Producing Commissioning Documents	14%
1	Document OPR/CFR	
2	Develop Commissioning Plan	
3	Develop Commissioning Specifications	
4	Develop Construction Checklists	
5	Create Functional Performance Tests	
6	Compile Commissioning Systems Manual	
7	Develop Final Report	
C	Managing Commissioning Projects	13%
1	Incorporate Commissioning Activities into Project Schedule	
2	Create the Contract	
3	Conduct Commissioning Meetings	
4	Maintain OPR/CFR	
5	Update Commissioning Plan	
6	Maintain Issues Log	
7	Facilitate Issue Resolution	
8	Manage ECM and FIM Implementation Process (EB)	
D	Reviewing Project Documents	13%
1	Review Design Phase Documents (OPR/CFR, BOD, drawings and specifications)	
2	Review Construction Phase Documents (submittals, O&M manuals, and warranty information)	
3	Review Completed Construction Checklist	
4	Review TAB Report	
E	Verifying Installation	15%
1	Conduct Site Observation	
2	Observe Third Party Testing	
3	Observe Equipment Start-up	

Table 2 (Continued): Proposed Content Blueprint for Commissioning/Retro-Commissioning Authorities

Duties and Tasks		Weighting
F	Verifying System Performance	23%
1	Direct Functional Testing (including seasonal and deferred testing)	
2	Verify Trending	
3	Perform Measurement and Verification	
4	Perform End-of-Warranty Review	
G	Educating Project Team	7%
1	Conduct Kick-off Meetings (design phase and construction phase)	
2	Develop Training Program	
3	Transfer Building System Knowledge	
Total		100%

8.0 Knowledge

The SMEs identified and categorized specific types of knowledge needed to be a proficient commissioning/retro-commissioning authority (Table 3). General knowledge areas (calculations, basic measurements, and communications), although not exclusive to this occupation, were also identified using a group consensus process (Table 4). The panelists concluded that a practitioner must master the knowledge in both tables to be competent as a commissioning/retro-commissioning authority.

Table 3: Specialized Knowledge Required of Commissioning/Retro-Commissioning Authorities

Specialized Knowledge	
Basic construction	Energy modeling
Basic engineering calculations	Equipment/operation
Basic report formatting	Engineering economics
Building design	Functional testing
Building operating procedures	Graphical user interfaces
Building operations/documents	Installation practices/standards
Building standards	Instrumentation
Building systems	Maintenance procedures
Building systems design	Measurement instrumentation
Codes/standards requirements	Measurement methods
Commissioning process	Mechanical safety
Construction documents	Metering
Construction process	Operations and maintenance
Construction safety	Organizational structure of facility
Construction scheduling/scheduling software	Performance standards
Construction site operations	Professional liability risk factors
Construction standards	Project management
Contract language	Psychrometrics
Contractual relationships	Project information
Control systems	Sequences of operation
Control theory	Specification format
Controlled hardware devices	Start-up procedures and standards
Cost estimation	System design
Design process/protocol	System operation/maintenance
ECM/FIM	TAB processes
Electrical safety	Testing procedures and standards
Energy benchmarking	Trend setups
Energy billing procedures	Warranty language
Energy management	

Table 4: General Knowledge Required of Commissioning/Retro-Commissioning Authorities

General Knowledge	
Calculations	
Change numbers from fractions into decimals and back	Perform mathematical operations with fractions
Change numbers from percentages into decimals and back	Perform simple math operations of addition
Collect information to solve a problem	Perform simple math operations of division
Compare numbers	Perform simple math operations of multiplication
Figure averages	Perform simple math operations of subtraction
Make rough estimates	Solve formula calculations with more than one unknown
Measure angles	Solve formula calculations with one unknown
Multiply and factor algebraic expressions	Solve percent problems
Perform math operations using exponential numbers	Solve problems with graphs
Perform math operations using signed (positive and negative) numbers	Solve ratio problems
Perform math operations using single and multiple digit numbers	Transfer number sequences from a source into a column
Perform mathematical operations with decimals	Use a calculator
Basic Measurements	
Calculate the perimeter and areas of common figures	Measure linear distances (length, width, etc.)
Convert measurements from one unit to another (English to metric, etc.)	Measure temperature to within 1 degree F
Estimate and approximate measurements	Measure volume (cubic inches, liters, etc.)
Find distances and directions on land maps	Read and apply coefficient measurements indicated in a table or chart
Find the dimensions of an object from a scale drawing	Read and use the scale of a drawing
Make simple scale drawings	Read measurements taken with common measuring tools
Measure area (square inches, square centimeters, etc.)	Read, interpret, and use size/scale relationships
Measure length to 1/4 of an inch	Record measurements, using appropriate unit notations (feet, yards, etc.)
Measure length to 1/8 of an inch	Use tools to measure quantities and solve problems involving measurements
Communications	
Apply assertiveness	Communicate with co-workers and/or business people verbally (telephone, radio)
Ask questions	Evaluate options/alternatives
Communicate using the vocabulary/terminology of a related trade	Evaluate solutions
Communicate with co-workers and/or business people in writing (letters, memos)	Explain procedures
Communicate with co-workers and/or business people verbally (face-to-face)	Find information in catalogs

Table 4 (Continued): General Knowledge Required of Commissioning/Retro-Commissioning Authorities

General Knowledge	
Communications	
Find information in references (machinery handbook, tap/drill charts, etc.)	Read drawings and specifications sheets
Follow verbal job instructions	Read flowcharts
Listen	Read information from tables and graphs (bar, circle, etc.)
Participate in brainstorming	Research information
Present to others	Speak to large groups
Read and follow a map, chart, plan, etc.	Summarize information
Read and follow directions found in equipment manuals and code books	Write reports
Read and interpret directions found on labels, packages, or instruction sheets	Write words and numbers legibly
Read codes (building codes, electrical codes, standards, etc.)	

9.0 Skills, Abilities, and Attributes

A proficient worker possesses key skills, abilities, and attributes that influence job success. Skills are developed through experience and training and may apply to a wide range of tasks; proper skills enable workers to perform their tasks with precision and quality.

Abilities and attributes are more fundamental than knowledge and skills; they represent underlying, enduring traits, both cognitive and physical, that support the successful performance of a wide range of job tasks.

The panelists identified task-specific skills and abilities, as well as broad attributes (e.g., analytic, creative, patient), to define the recommended traits a commissioning/retro-commissioning authority should possess (Table 5).

Human Resource professionals and job analysts often analyze skills, abilities, and attributes to compare jobs in terms of worker characteristics.

Table 5: Skills, Abilities, and Attributes Required of Commissioning/Retro-Commissioning Authorities

Skills, Abilities, and Attributes	
Ability to calibrate sensors	Honest
Ability to read blueprints	Industrious
Ability to read technical documents	Initiative
Accurate/precise	Integrity
Adaptable/flexible	Interpersonal skills
Analytical skills	Interpret test data
Appropriate dresser	Leader
Caring/compassionate	Listening skills
Climb, stoop, crouch	Low voltage electrical skills
Common sense	Manage stress/pressure
Communication skills	Math skills (basic)
Computer skills	Management skills
Confident	Meeting etiquette skills
Conscientious	Meticulous
Cooperative	Multi-tasker
Courteous	Neat
Creative	Negotiation skills
Critical thinker	Non-aggressive
Customer-oriented	Open-minded to change
Data management skills	Organizational skills
Dependable	Patience
Detail-oriented	Persistent
Eager to learn new things	Personal hygiene
Empathetic	Physical stamina
Enthusiasm	Positive attitude
Ethical	Presentation skills
Facilitation skills	Pride in job
Focused	Professional
Free of substance abuse	Punctual
Friendly	Quality focused
Goal-oriented	Read utility bills
Helpful	Respectful

Table 5 (Continued): Skills, Abilities, and Attributes Required of Commissioning/Retro-Commissioning Authorities

Skills, Abilities, and Attributes	
Responsible/accountable	Team player
Safety conscious	Technical communication skills
Schematics interpretation skill	Time management skills
Self-discipline	Tolerant
Sense of humor	Training skills
Sensitive to thoughts of others	Trustworthy
Social skills	Unbiased
Specification writing	Work efficiently (resources)
Tactful	Written communication skills

10.0 Physical Conditions

In any job, the environment in which tasks are completed and the specific physical requirements necessary to complete each task must be understood. Awareness of physical conditions is useful for a variety of purposes, including ergonomic design, safety analysis, and the identification of job elements that are deemed essential functions for compliance with The Americans with Disabilities Act.

Table 6 contains the list of panelist-recommended physical conditions a commissioning/retro-commissioning authority should possess.

Table 6: Physical Conditions Recommended for Commissioning/Retro-Commissioning Authorities

Physical Conditions	
Bend forward frequently	Stoop kneel or crouch
Carry heavy objects while climbing (ladders, scaffolding, etc.)	Talk
Carry objects of up to 25 pounds	Walk
Climb ladders, stairs, poles, etc. using legs and/or arms	Work around or near high voltage power sources or equipment
Crawl or creep	Work around or near magnetic equipment or materials
Detect abnormal noises	Work at heights of 1 to 25 feet above ground or floor level
Feel size, shape and temperature or texture of objects with the hands	Work at heights of 26 to 75 feet above ground or floor level
Handle hot or cold objects	Work in a squatting position for more than five (5) minutes per hour
Hear speech	Work in changing temperatures (in and out of buildings repeatedly)
Hold or move objects using the fingers	Work in confined spaces
Judge depth (the position and distance of objects) with the eyes	Work in damp places (high humidity, some standing water)
Lay on back	Work in dry places (lacking any natural moisture or humidity)
Lift objects from ground to overhead level	Work in dust, oils, fumes, or smells
Lift objects from ground to waist level	Work in high temperatures (85 to 130 degrees F)
Lift objects from waist to overhead level	Work in low temperatures (0 to 45 degrees F)
Pull objects with arms or hands	Work in noisy places (85 decibels or higher with ear protection)
Push objects with arms or hands	Work in one place (no change of work location)
Reach with arms and hands in any direction	Work in stale air (with some oxygen depletion)
See clearly at 20 feet or more (with/without optical assistance)	Work in sub-zero temperatures (0 and lower)
See clearly at 20 inches or less (with/without optical assistance)	Work inside
Sit part of the time	Work on slippery surfaces
Stand all of the time	Work outside
Stand at all (could the work be performed from a sitting position?)	Work while sitting or standing on high roofs, overhangs, or I-beams
Stand part of the time	Work while standing on portable ladders

Table 6 (Continued): Physical Conditions Recommended for Commissioning/Retro-Commissioning Authorities

Physical Conditions	
Work while standing on scaffolding	Work with hands and arms over head level
Work while wearing protective equipment (respirators, hoods, etc.)	Work with or near fiberglass or asbestos materials

11.0 Tools, Equipment, and Resources

Each occupation requires a unique set of support materials. It is important to identify the tools, equipment, and other tangible objects, as well as the resources (e.g., information technologies, codes and standards) required for a worker to effectively accomplish tasks. Table 7 lists the panelist-identified inventory of tools, equipment, and resources necessary to perform the identified tasks.

Table 7: Tools, Equipment, and Resources Used by Commissioning/Retro-Commissioning Authorities

Tools, Equipment, and Resources	
General Tools, Equipment, and Resources	
Attorney	Internet
Calculator	Ladder
Camera	NIST traceable equipment
Codes and standards	Presentation software
Computer	PPE
Data loggers	Projector
Energy modeling software	Psychrometric chart
Hand tools	TAB equipment
Handouts	Technical reference books
Insurance provider	

12.0 DACUM Chart

The DACUM chart (Table 8) is a tabular representation of the JTA. Capital letters identify major job duty areas. Numbers identify tasks, and lowercase letters identify the steps required to accomplish each task. Moving horizontally across the chart, adjacent columns detail (1) specialized knowledge, (2) skills and abilities, and (3) tools, equipment, and resources required to perform each task. The information contained in these columns is related to each task and does not necessarily correspond to a specific step.

The importance of the DACUM chart is to show the relationship between job tasks and the specialized knowledge, skills and abilities, and tools, equipment, and resources required to perform each task. This concept, called *job-relatedness*, is essential to compliance with key legal and professional validity standards pertaining to the use of JTA information in employee selection. Such information is also critical to the development of high-stakes assessments for occupational licensing and certification examinations.

The DACUM chart depicts the job element relationships associated with each task, and can therefore easily be used to assess the relevance of current programs (curriculum), develop instructional objectives and training content, sequence instructional materials, and develop examination, competency, and performance evaluation instruments.

Table 8: DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
A	Analyzing Existing Buildings (EB)			
1	Review Existing Documentation (EB)			
a	Review building operation schedules	<ul style="list-style-type: none"> • Basic engineering calculations • Building operations/documents • Construction documents • Energy benchmarking • Energy billing procedures 	<ul style="list-style-type: none"> • Communication skills • Computer skills • Read blueprints • Read utility bills 	<ul style="list-style-type: none"> • Computer
b	Review O&M manuals			
c	Review as-built or record drawings			
d	Review utility bills			
e	Review existing energy audit reports			
f	Review TAB reports			
g	Review service records			
h	Review maintenance records			
2	Analyze Existing System Controls (EB)			
a	Develop monitoring plan	<ul style="list-style-type: none"> • Control theory • Controlled hardware devices • Equipment/operation • Graphical user interfaces • System design • Trend setups 	<ul style="list-style-type: none"> • Calibrating sensors • Low voltage electrical skills • Schematics interpretation 	<ul style="list-style-type: none"> • NIST traceable equipment
b	Create trends			
c	Collect trend data			
d	Review system graphics			
e	Review sequences of operation			
f	Verify point-to-point mapping			
g	Verify sensor calibration			
3	Perform Surveys			
a	Conduct site inspection	<ul style="list-style-type: none"> • Building systems • Construction safety • ECM/FIM • Energy management • Equipment/operation 	<ul style="list-style-type: none"> • Climb, stoop, crouch • Communication skills • Read blueprints 	<ul style="list-style-type: none"> • Camera • PPE
b	Photograph equipment deficiencies			
c	Verify equipment location			
d	Verify equipment counts			
e	Perform internal inspection of equipment			
f	Document noted equipment deficiencies			
g	Identify potential ECM and FIM			
h	Determine appropriate interviewees			
i	Prepare interview questionnaire			
j	Schedule interviews			
k	Conduct the interviews			
l	Analyze interview data			
m	Document results of interviews			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
A	Analyzing Existing Buildings (EB)			
4	Verify Data (EB)			
a	Measure performance data	<ul style="list-style-type: none"> • Building systems • Electrical safety • Measurement instrumentation • Mechanical safety • TAB process 	<ul style="list-style-type: none"> • Interpret test data 	<ul style="list-style-type: none"> • NIST traceable equipment
b	Determine owner’s current performance expectations			
c	Conduct TAB			
5	Analyze Data (EB)			
a	Collate data	<ul style="list-style-type: none"> • Basic engineering calculations • Engineering economics • Psychrometrics 	<ul style="list-style-type: none"> • Basic math plus algebra • Interpret test data • Technical communication skills 	<ul style="list-style-type: none"> • Computer • Psychrometric chart
b	Perform energy savings calculations			
c	Perform cost/benefit analysis			
d	Interpret results of analyses			
6	Present Findings (EB)			
a	Prepare final report	<ul style="list-style-type: none"> • Project information 	<ul style="list-style-type: none"> • Presentation skills 	<ul style="list-style-type: none"> • Computer • Presentation software • Projector
b	Present findings to owner			
c	Establish next steps			
B	Producing Commissioning Documents			
1	Document OPR/CFR			
a	Schedule stakeholder workshop	<ul style="list-style-type: none"> • Building design • Building operating procedures • Codes/standards requirements 	<ul style="list-style-type: none"> • Communication skills • Facilitation skills 	<ul style="list-style-type: none"> • Computer
b	Draft OPR/CFR document			
c	Obtain stakeholder approval			
d	Incorporate stakeholder changes to drafted document			
e	Issue updated document			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
B	Producing Commissioning Documents			
2	Develop Commissioning Plan			
a	Reference commissioning scope	<ul style="list-style-type: none"> • Basic construction • Building operations/documents • Building systems • Commissioning process • Contractual relationships 	<ul style="list-style-type: none"> • Communication skills • Computer skills 	<ul style="list-style-type: none"> • Computer
b	Obtain project directory			
c	Assemble project team members			
d	Determine roles and responsibilities of project team members			
e	Develop a commissioning activities sequence (flow chart)			
f	Establish communication protocol			
g	Define testing approach			
h	Develop commissioning issues log			
3	Develop Commissioning Specifications			
a	Review commissioning contract	<ul style="list-style-type: none"> • Building systems • Specification format 	<ul style="list-style-type: none"> • Specification writing 	<ul style="list-style-type: none"> • Computer
b	Review OPR/CFR			
c	Obtain sample specifications formatting from architect			
d	Coordinate commissioning specifications with other specification sections			
e	Develop commissioning specifications sections			
f	Submit specifications for approval of project team			
g	Verify commissioning specifications are incorporated into the contract documents			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
B	Producing Commissioning Documents			
4	Develop Construction Checklists			
a	Review drawings and specifications for installation requirements	<ul style="list-style-type: none"> • Codes/standards requirements • Construction standards • Design process/protocol • Installation practices/standards 	<ul style="list-style-type: none"> • Communication skills • Read blueprints • Read technical documents 	<ul style="list-style-type: none"> • Computer
b	Review product submittals for installation requirements			
c	Review manufacturer's installation requirements			
d	Distribute construction checklists			
5	Create Functional Performance Tests			
a	Review drawings and specifications for testing requirements	<ul style="list-style-type: none"> • Control theory • Equipment/operation • Measurement methods • Performance standards • Sequences of operation • System design • System operation/maintenance • Testing procedures and standards 	<ul style="list-style-type: none"> • Organizational skills • Technical communication skills 	<ul style="list-style-type: none"> • Computer
b	Review drawings and specifications for performance requirements			
c	Review contractor submittals for testing requirements			
d	Review contractor submittals for performance requirements			
e	Analyze control sequences			
f	Prepare list of queries for design team			
g	Distribute functional tests for review			
6	Compile Commissioning Systems Manual			
a	Establish table of contents	<ul style="list-style-type: none"> • Building systems • Maintenance procedures 	<ul style="list-style-type: none"> • Organizational skills • Presentation skills 	<ul style="list-style-type: none"> • Computer
b	Review required documentation			
c	Draft commissioning systems manual			
d	Submit systems manual for approval by owner			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
B	Producing Commissioning Documents			
7	Develop Final Report			
a	Write executive summary	<ul style="list-style-type: none"> • Basic report formatting • Codes/standards requirements • Project information 	<ul style="list-style-type: none"> • Organizational skills • Technical communication skills 	<ul style="list-style-type: none"> • Computer
b	Compile commissioning documentation			
c	Submit final report for approval by project team			
d	Submit post-occupancy report			
C	Managing Commissioning Projects			
1	Incorporate Commissioning Activities into Project Schedule			
a	Determine duration of commissioning activities	<ul style="list-style-type: none"> • Construction process • Construction scheduling/scheduling software • Functional testing 	<ul style="list-style-type: none"> • Communication skills • Presentation skills 	<ul style="list-style-type: none"> • Computer
b	Conduct scheduling meeting			
c	Review project critical path schedule			
2	Create the Contract			
a	Develop commissioning scope	<ul style="list-style-type: none"> • Codes/standards requirements • Commissioning • Contract language • Professional liability risk factors 	<ul style="list-style-type: none"> • Negotiation skills 	<ul style="list-style-type: none"> • Attorney • Insurance provider • Internet
b	Negotiate fee schedule			
c	Create terms and conditions			
d	Draft proposed contract			
e	Execute the contract			
3	Conduct Commissioning Meetings			
a	Develop meeting agenda	<ul style="list-style-type: none"> • Commissioning process • Construction process • Design process/protocol 	<ul style="list-style-type: none"> • Communication skills • Facilitation skills • Interpersonal skills • Meeting etiquette • Organizational skills 	<ul style="list-style-type: none"> • Computer • Handouts • Projector
b	Determine meeting participants			
c	Schedule commissioning meeting			
d	Publish meeting minutes			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
C	Managing Commissioning Projects			
4	Maintain OPR/CFR			
a	Identify discrepancies between original project documents and construction changes	<ul style="list-style-type: none"> • Codes/standards requirements • Construction process • Project information 	<ul style="list-style-type: none"> • Read blueprints 	<ul style="list-style-type: none"> • Computer
b	Review potential updates with owner			
c	Update OPR/CFR			
d	Distribute updated OPR/CFR			
5	Update Commissioning Plan			
a	Determine commissioning scope changes	<ul style="list-style-type: none"> • Commissioning process • Project information 	<ul style="list-style-type: none"> • Organizational skills • Written communication skills 	<ul style="list-style-type: none"> • Computer
b	Incorporate changes into commissioning plan			
c	Distribute updated commissioning plan			
6	Maintain Issues Log			
a	Identify new issues	<ul style="list-style-type: none"> • Building systems • Construction process • Design process/protocol 	<ul style="list-style-type: none"> • Interpersonal skills • Management skills • Organizational skills • Written communication skills 	<ul style="list-style-type: none"> • Camera • Computer
b	Record new issues			
c	Incorporate project team comments			
d	Verify issue resolution			
e	Update issue status			
f	Close out resolved issues			
g	Distribute issues log			
7	Facilitate Issue Resolution			
a	Gather stakeholders	<ul style="list-style-type: none"> • Building systems • Construction process • Design process/protocol • Project information 	<ul style="list-style-type: none"> • Interpersonal skills • Management skills • Organizational skills • Written communication skills 	
b	Communicate the issue			
c	Determine appropriate action			
d	Determine responsible parties			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
C	Managing Commissioning Projects			
8	Manage ECM and FIM Implementation Process (EB)			
a	Develop scope of work	<ul style="list-style-type: none"> • Construction process • Construction scheduling/scheduling software • Cost estimation • Design process/protocol • Project management 	<ul style="list-style-type: none"> • Interpersonal skills • Management skills • Organizational skills • Written communication skills 	<ul style="list-style-type: none"> • Computer
b	Obtain proposals for work			
c	Develop contract documents			
d	Monitor project implementation			
D	Reviewing Project Documents			
1	Review Design Phase Documents (OPR/CFR, BOD, drawings and specifications)			
a	Evaluate documents for completeness	<ul style="list-style-type: none"> • Building systems • Codes/standards requirements • Construction documents • Design process/protocol • Operations and maintenance 	<ul style="list-style-type: none"> • Written communication skills 	<ul style="list-style-type: none"> • Codes and standards • Computer • Technical reference books
b	Evaluate documents for conformance to OPR/CFR			
c	Evaluate documents for congruence with commissioning plan			
d	Review consistency between documents			
e	Document review comments			
f	Present review comments to design team			
g	Perform back check reviews			
2	Review Construction Phase Documents (submittals, O&M manuals, and warranty information)			
a	Submit list of required submittals	<ul style="list-style-type: none"> • Building systems • Construction documents • Design process/protocol • Operations and maintenance 	<ul style="list-style-type: none"> • Written communication skills 	<ul style="list-style-type: none"> • Calculator • Computer • Technical reference books
b	Review submittals			
c	Prepare submittal review document			
d	Track status of review comments			
3	Review Completed Construction Checklist			
a	Evaluate the construction checklist for completeness	<ul style="list-style-type: none"> • Building systems • Construction safety • Installation practices/standards 	<ul style="list-style-type: none"> • Crouch, climb, stoop 	<ul style="list-style-type: none"> • Camera • PPE
b	Verify checklist against installation			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
D	Reviewing Project Documents			
4	Review TAB Report			
a	Compare TAB report to design values	<ul style="list-style-type: none"> • Basic engineering calculations • Building systems • TAB processes 	<ul style="list-style-type: none"> • Basic math 	<ul style="list-style-type: none"> • Calculator • TAB equipment
b	Perform sample field verification			
E	Verifying Installation			
1	Conduct Site Observation			
a	Schedule site visit	<ul style="list-style-type: none"> • Building systems • Codes/standards requirements • Construction safety • Construction site operations • Design process/protocol • Installation practices/standards 	<ul style="list-style-type: none"> • Communication skills • Crouch, climb, stoop • Interpersonal skills 	<ul style="list-style-type: none"> • Camera • Hand tools • Ladder • PPE
b	Observe equipment and installation			
c	Review mock-ups			
d	Document observations			
e	Review construction checklist progress			
f	Produce site observation report			
g	Distribute site observation report			
2	Observe Third Party Testing			
a	Review third party test procedure	<ul style="list-style-type: none"> • Building systems • Testing procedures and standards 	<ul style="list-style-type: none"> • Communication skills • Crouch, climb, stoop • Interpersonal skills 	<ul style="list-style-type: none"> • Camera • PPE
b	Coordinate with testing schedule			
c	Witness the testing			
d	Document third party testing observations			
e	Review third party testing report			
3	Observe Equipment Start-Up			
a	Review contractor's start-up plan	<ul style="list-style-type: none"> • Building systems • Start-up procedures and standards 	<ul style="list-style-type: none"> • Communication skills • Crouch, climb, stoop • Interpersonal skills 	<ul style="list-style-type: none"> • Camera • PPE
b	Coordinate with start-up schedule			
c	Witness the start-up			
d	Document start-up observations			
e	Review completed manufacturer's checklist			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
F	Verifying System Performance			
1	Direct Functional Testing (including seasonal and deferred testing)			
a	Verify system readiness for testing	<ul style="list-style-type: none"> • Building systems • Construction procedures • Equipment/operation • Testing procedures and standards 	<ul style="list-style-type: none"> • Analytical skills • Communication skills • Crouch, climb, stoop • Interpersonal skills 	<ul style="list-style-type: none"> • Camera • Data loggers • Hand tools • Ladder • NIST testing equipment • PPE
b	Schedule functional testing			
c	Conduct functional testing			
d	Record functional test results			
2	Verify Trending			
a	Execute trending plan	<ul style="list-style-type: none"> • Building systems • Construction safety • Control systems • Metering 	<ul style="list-style-type: none"> • Analytical skills • Data management skills 	<ul style="list-style-type: none"> • Computer • Data loggers
b	Analyze trend data			
3	Perform Measurement and Verification			
a	Develop an M&V plan	<ul style="list-style-type: none"> • Building systems • Energy modeling • Engineering economics • Instrumentation • System design 	<ul style="list-style-type: none"> • Analytical skills • Computer skills • Written communication 	<ul style="list-style-type: none"> • Computer • Data loggers • Energy modeling software
b	Analyze data			
c	Produce M&V report			
4	Perform End-of-Warranty Review			
a	Identify appropriate parties	<ul style="list-style-type: none"> • Organizational structure of facility • Systems operation • Warranty language 	<ul style="list-style-type: none"> • Analytical skills • Communication skills • Crouch, climb, stoop • Interpersonal skills 	<ul style="list-style-type: none"> • Camera • Data loggers • Hand tools • Ladder • NIST testing equipment • PPE
b	Schedule the site visit			
c	Interview O&M personnel and occupants			
d	Review work order system for complaints			
e	Review equipment service logs			
f	Identify outstanding warranty issues			

Table 8 (Continued): DACUM Chart for Commissioning/Retro-Commissioning Authorities

	Duties, Tasks, and Steps	Special Knowledge	Skills and Abilities	Tools, Equipment, and Resources
G	Educating Project Team			
1	Conduct Kick-off Meetings (design phase and construction phase)			
a	Describe commissioning process and benefits	<ul style="list-style-type: none"> • Commissioning process • Construction process • Design process/protocol 	<ul style="list-style-type: none"> • Communication skills • Organizational skills • Presentation skills 	<ul style="list-style-type: none"> • Computer • Handouts • Projector
b	Communicate roles and responsibilities			
c	Explain the communication protocol			
2	Develop Training Program			
a	Interview O&M staff	<ul style="list-style-type: none"> • Building standards • System operation/maintenance 	<ul style="list-style-type: none"> • Communication skills • Interpersonal skills • Presentation skills 	<ul style="list-style-type: none"> • Computer
b	Identify training needs			
c	Prepare training agendas			
d	Review training plan			
3	Transfer Building System Knowledge			
a	Facilitate training walk-throughs	<ul style="list-style-type: none"> • Building standards • Construction safety • Project information • System operation/maintenance 	<ul style="list-style-type: none"> • Communication skills • Interpersonal skills • Presentation skills • Training skills 	<ul style="list-style-type: none"> • Computer • Handouts • PPE • Projector
b	Observe O&M staff training			
c	Verify training completion			
d	Conduct lessons-learned workshops			

DACUM PERFORMED FOR:

National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, Colorado 80401

DACUM PERFORMED BY:

Professional Testing, Inc.
7680 Universal Blvd., Suite 300
Orlando, Florida 32819

DACUM FACILITATORS:

Lynn C. Webb, Ed. D.
Professional Testing, Inc.

Tiffany Smith, ABD
Professional Testing, Inc.

DACUM PANEL:

David Cantrill
Commissioning and Green Building Solutions
Jackson, MS

Mark Miller
Strategic Building Solutions, LLC
Old Saybrook, CT

Gretchen Coleman
Gretchen Coleman Commissioning Group
Roanoke, Virginia

Matt Nelson
Commissioning and Green Building Solutions
Cleveland, Ohio

J. David Davenport
RTKL Associates, Inc.
Baltimore, MD

Kirt Pickerign
MEP Associates, LLC
Eau Claire, WI

Richard Farkas
Dynamic Commissioning Solutions, Inc. /
PROMETRICS Worldwide, LLC
Las Vegas, NV

Kenny Reed
M.E. GROUP Inc.
Lincoln, NE

Peter Keithly
TEAM Commissioning Associates
Seattle, Washington

Maia Speer
Guttman & Blaevoet
San Francisco, CA

Rick Lasser
Arup
Los Angeles, CA

NREL Staff:

Daniel Studer
Golden, CO