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NATIONAL RENEWABLE ENERGY LABORATORY



Job Task Analysis

Building Commissioning Professional

November 2013 — December 2014

Cynthia Woodley and Christine DePascale
Professional Testing, Inc.
Orlando, Florida

NREL Technical Monitor: Charles Kurnik

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Subcontract Report
NREL/SR-7A40-62383
January 2015

Contract No. DE-AC36-08GO28308

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Prepared under Subcontract No. AXL-4-42107-01

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Executive Summary

This report describes the process for and results of a comprehensive Job Task Analysis (JTA) of Building Commissioning Professionals. This study was performed by Professional Testing on behalf of the National Renewable Energy Laboratory. The competency (domains, tasks, and associated knowledge) list, which defines the work performed by practitioners, was initially developed by a representative panel of practitioners during a meeting held on February 19–21, 2014, in Orlando, Florida. After the job tasks and associated knowledge and skills were identified, a validation survey was conducted of the finding of the JTA and the results of the validation study were reviewed by a representative panel of practitioners during a conference call held on June 6, 2014. The committee finalized the JTA and examination blueprints for the Building Commissioning credential scheme based on the survey results.

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Acronyms

AHJ	Authority Having Jurisdiction
BAS	Building Automation System
BIM	Building Information Modeling
BOD	Basis of Design
BOP	Building Operating Plan
CFR	Current Facility Requirements
CMMS	Computerized Maintenance Management System
CSI	Construction Specification Institute
Cx	Commissioning
DACUM	Developing a Curriculum
DOE	U.S. Department of Energy
EB	Existing Building
ECM	Energy Conservation Measures
EHS	Environmental, health, and safety
FIM	Facility Improvement Measures
FPT	Functional Performance Testing
HVAC	Heating, Ventilation, and Air Conditioning
HVAC&R	Heating, Ventilation, Air Conditioning, and Refrigeration
IEQ	Indoor Environment Quality
IOM	Installation and Operation Manuals
JTA	Job Task Analysis
M&V	Measurement and Verification
NB	New Building

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NIBS	National Institute of Building Sciences
NREL	National Renewable Energy Laboratory
O&M	Operations and Maintenance
OPR	Owner's Project Requirements
PFC	Prefunctional Checklists
PPE	Personal Protective Equipment
ROI	Return On Investment
SD	Standard deviation
SEM	Standard error of the mean
SME	Subject matter expert
TAB	Testing Adjusting Balancing
VE	Value Engineering

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1 Introduction

The National Renewable Energy Laboratory (NREL), in conjunction with the National Institute of Building Sciences (NIBS) and the U.S. Department of Energy (DOE), led a study to identify the critical duties and tasks required of Building Commissioning Professionals. Professional Testing, Inc., used the DACUM (Developing a Curriculum) process to conduct a Job Task Analysis (JTA) and identify the competencies.

A panel of subject matter experts (SMEs) was selected by NIBS and convened by Professional Testing for a 3-day meeting held February 19–21, 2014, in Orlando, Florida. The competencies identified during the meeting were then validated via a survey. This report reflects the completion and results of the study, and is organized with Section 2 containing the proposed final content outline, and the later sections containing the details of the JTA development process, including results of the validation survey.

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2 Final Building Commissioning Professional DACUM/Job/Task Analysis

2.1 Building Commissioning Professional Job Description

The Building Commissioning Professional is an individual who leads, plans, coordinates and manages a commissioning team to implement commissioning processes in new and existing buildings.

2.2 Job/Task Analysis DACUM Chart for Building Commissioning Professional

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

Table 1. Duties and Tasks of Building Commissioning Professional

Duties and Tasks			Final Weight	Final Items
A		**Managing Commissioning Projects**	**18%**	**22**
	1	Identify the scope of the project	~1%	1 to 2
	2	Develop a commissioning team	~1%	1 to 2
	3	Manage a commissioning budget	~1%	1 to 2
	4	Identify commissioning deliverables	~1%	1 to 2
	5	Participate in VE activities	~1%	1 to 2
	6	Review project documents	~1%	1 to 2
	7	Monitor the construction/project schedule	~1%	1 to 2
	8	Participate in project meetings	~1%	1 to 2
	9	Conduct commissioning meetings	~1%	1 to 2
	10	Track deficiencies (issues log)	2%	2
	11	Facilitate risk assessment as it relates to commissioning activities	2%	2
	12	Assess pass/fail criteria for functional test results	3%	4
	13	Identify tasks for completion of commissioning processes	2%	2
B		**Preparing Commissioning Documentation**	**19%**	**23**
	1	Assist in developing the OPR/CFR	~1%	1 to 2
	2	Create system/equipment list	~1%	1 to 2
	3	Create commissioning process tracking metrics	~1%	1 to 2
	4	Develop the commissioning plan	2%	2
	5	Develop commissioning schedules	~1%	1 to 2
	6	Develop communications plans	~1%	1 to 2
	7	Create commissioning specifications	~1%	1 to 2
	8	Write system verification checklists	2%	2
	9	Create FPTs	3%	4
	10	Determine site visit protocols (logistics)	0%	0
	11	Develop issues logs	~1%	1 to 2
	12	Document commissioning meetings	~2%	1 to 2

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Duties and Tasks			Final Weight	Final Items
	13	Write commissioning reports	2%	2
	14	Create systems manuals	~1%	1 to 2
	15	Develop end of warranty review process	~1%	1 to 2
C		**Conducting Commissioning Activities**	**24%**	**29**
	1	Plan commissioning construction activities	~7%	7 to 8
	2	Monitor commissioning construction activities	~7%	7 to 8
	3	Facilitate the completion of construction checklists	3%	4
	4	Facilitate the acceptance phase	~7%	7 to 8
D		**Managing Training Activities**	**4%**	**5**
	1	Develop training plan	2%	2
	2	Facilitate training coordination meeting	~1%	1 to 2
	3	Facilitate training activities	~1%	1 to 2
	4	Conduct training follow-up activities	0%	0
E		**Completing Warranty Phase Activities**	**5%**	**6**
	1	Facilitate off-season testing	~1%	1 to 2
	2	Troubleshoot facility issues	~1%	1 to 2
	3	Measure energy performance	2%	3
	4	Facilitate end of warranty meeting	~1%	1 to 2
F		**Conducting Existing Building Commissioning**	**23%**	**28**
	1	Determine scope of project	~2%	1 to 2
	2	Conduct a building performance assessment	3%	4
	3	Prepare a CFR	~2%	1 to 2
	4	Conduct a systems assessment	3%	4
	5	Conduct a site investigation	3%	4
	6	Recommend corrections and improvements	3%	4
	7	Oversee implementation of corrective measures	3%	4
	8	Conduct performance verifications	4%	5
G		**Conducting On-Going Commissioning**	**7%**	**8**
	1	Measure IEQ performance	~1%	1 to 2
	2	Evaluate building systems performance	~1%	1 to 2
	3	Review building operating plan	~1%	1 to 2
	4	Review maintenance activities	~1%	1 to 2
	5	Accommodate space/function changes	~1%	1 to 2
	6	Implement corrective actions	~1%	1 to 2
	7	Publish measurement and performance results to stakeholders	~1%	1 to 2
Total			**100%**	**120**

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Table 2. Areas of Specialized Knowledge Required for Building Commissioning Professional

Specialized Knowledge	
BAS or monitoring systems	Basic construction
BIM	Budgeting
Building maintenance	Building operations
Building sciences	Building systems (see Table 3)
Climate zone variations	CMMS
Commissioned systems knowledge	Construction contracting
Construction budgets and costs	Construction estimating
Construction documents and specifications	Construction methods and concepts
Construction management processes	Contract knowledge
Construction scheduling	Control systems
Controls theory and operations	Cx budgeting
Controls graphics	Cx processes and procedures
Cx manpower requirements	Cx schedules
Cx reporting documentation	Cx team member requirements
Cx sequence of events	Design documents
Data normalization (weather, days of the month, etc.)	Divisions used in construction specifications
Developing ROIs	Economic analyses
Documentation protocols	Energy management fundamentals
Energy calculations	Energy performance
Energy modeling	Engineering principles
Energy use analysis	Evidence collection
Environmental sustainability and efficiency goals	Facilities management
Expected equipment performance	Fault diagnostic knowledge
Failure mode analysis	General construction process knowledge
Functional testing procedures, equipment, and results	IEQ
How system components work together	Integration protocols
Incentive programs	Life-span cost and quality
Issue resolution process	Maintainability, access, and operational requirements
M&V methodologies	Maintenance issues
Maintenance contracts	Maintenance procedures and roles
Maintenance management systems	Manufacturers of Cx equipment
Manpower utilization	Metering
Needs assessment processes	Methodology to inspect systems
Occupancy impacts	O&M Procedures
OPR	Operations within the facility
Owner's operational configuration and personnel	Potential EHS hazards and risks
	Project documents
Prevailing commissioning pricing structures	Project management
Project knowledge	Project objectives, goals, and purpose
Project management process	Records/document management
Proportional balancing	Required construction and installation tests
Regression modeling	ROI analysis
Risk assessment and management	Sampling protocols and procedures
Safety practices	Scheduling
	Sequence of construction activities
Scope of work	Service contracts

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Specialized Knowledge	
Sequence of operations	Space usage and occupancy schedules
Site safety	Spreadsheet development
Special tests (TAB, etc.)	Startup requirements
Submetering	Successful training outcomes
Substantial completion and final completion	System operations
Survey techniques	Systems engineering
Systems understanding	Systems interactions and integration
Test development	TAB
Testing equipment and procedures	Testing durations
Testing sequencing	Testing procedures
Testing, training, design, and construction requirements	Testing standards
Training facilitation	Training evaluation
Training plans	Training methodologies
Trend data	Trend analysis
Troubleshooting techniques	Troubleshooting methodologies
Unique requirements for facility usage	Typical site visit protocols
Utility rate structures and schedules	Utility bill structures
Various control technologies (new and legacy)	Utility rebate incentives
Warranties	Warranty provisions

Table 3. Building Systems Required for Building Commissioning Professional

Building Systems
Air distribution system
Access controls systems
Audiovisual systems
Automated windows and blinds systems
BAS
Building control system
Building envelope
Chilled water system
Combined heat and power system
Communication systems
Condenser water system
Conveying systems
Domestic hot water system
Electrical power quality monitoring system
Electrical power system and emergency power system
Emergency communication systems
Energy metering and monitoring system
Energy recovery system
Fire alarm system
Fire protection (sprinkler) system
Fuel oil system

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Building Systems
Gray and black water systems
HVAC control system
HVAC system or HVAC&R system
Irrigation systems
Information technology systems
Laboratory gas system
Life safety system
Lighting control system
Lighting system
Low-temperature refrigeration system
Medical gas systems
Nurse call systems
Plumbing systems
Pneumatic tube systems
Potable cold water system
Public address systems
Pumps and pumping systems
Renewable energy system (combined heat and power, photovoltaics, wind, thermal, etc.)
Security systems
Smoke evacuation systems
Space scheduling systems
Steam and hot water system (heating)
Steam distribution system
Variable speed (frequency) drive system
Vertical transportation systems
Water distribution and control system

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Table 4. Areas of General Knowledge Required for Building Commissioning Professional

General Knowledge
Calculations
Collect information to solve a problem
Perform simple math operations of addition
Perform simple math operations of subtraction
Perform simple math operations of multiplication
Perform simple math operations of division
Transfer number sequences from a source into a column
Compare numbers
Perform math operations using single and multiple digit numbers
Use a calculator
Perform mathematical operations with fractions
Perform mathematical operations with decimals
Make rough estimates
Figure averages
Perform math operations using signed (positive and negative) numbers
Solve ratio problems
Multiply and factor algebraic expressions
Solve problems with graphs
Solve percent problems
Change numbers from percentages into decimals and back
Change numbers from fractions into decimals and back
Solve formula calculations with one unknown
Perform math operations using exponential numbers
Measure angles
Basic Measurement
Record measurements using appropriate unit notations (feet, yards, etc.)
Read and use the scale of a drawing
Use tools to measure quantities and solve problems involving measurements
Measure temperature to within 1°F
Find the dimensions of an object from a scale drawing
Read measurements taken with common measuring tools
Read, interpret, and use size-scale relationships
Measure area (square inches, square centimeters, etc.)
Measure volume (cubic inches, liters, etc.)
Make simple scale drawings
Estimate and approximate measurements
Measure linear distances (length, width, etc.)
Find distances and directions on land maps
Calculate the perimeter and areas of common figures

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General Knowledge
Basic Measurement (continued)
Read and apply coefficient measurements indicated in a table or chart
Measure weights using devices calibrated in pounds
Measure length to 1/4 of an inch
Measure length to 1/8 of an inch
Measure board feet
Convert measurements from one unit to another (English to metric, etc.)
Measure weights using devices calibrated in ounces
Measure length to 1/16 of an inch
Communications
Write reports
Ask questions
Communicate using the vocabulary/terminology of a related trade
Communicate with coworkers and/or business people verbally (face-to-face)
Communicate with coworkers and/or business people verbally (telephone, radio)
Listen
Communicate with coworkers and/or business people in writing (letters, memos)
Read and follow directions found in equipment manuals and code books
Read and interpret directions found on labels, packages, or instruction sheets
Read drawings and specifications sheets
Summarize information
Explain procedures
Follow verbal job instructions
Participate in brainstorming
Present to others
Read flowcharts
Research information
Write words and numbers legibly
Evaluate solutions
Find information in references (machinery handbook, tap/drill charts, etc.)
Read codes (building codes, electrical codes, standards, etc.)
Read information from tables and graphs (bar, circle, etc.)
Speak to large groups
Evaluate options/alternatives
Find information in catalogs
Read and follow a map, chart, plan, etc.
Apply assertiveness
Read statistical data
Compare names

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Table 5. Skills and Abilities Required for Building Commissioning Professional

Ability to assess building performance	Ability to assess timeframes for construction and commissioning
Ability to communicate technical information to others	Ability to conduct a needs assessment
Ability to conduct a root cause analysis	Ability to create a matrix
Ability to create checklists	Scheduling skills
Ability to deal with difficult people	Ability to determine appropriate sampling procedures
Ability to determine manpower requirements from scope of work	Ability to prioritize
Ability to distinguish between systems, equipment, and components	Ability to identify specialty workers needed
Ability to read and interpret construction documents	Ability to interpret scope of work
Ability to interpret the TAB report	Ability to interpret trends
Ability to read and interpret utility bills, rate structures, and utility contracts	Ability to perform document discovery
Ability to photograph evidence	Ability to review controls graphics
Ability to serve as a mediator between owners, contractors, and others	Ability to train others
Ability to use collaborative meeting tools (e.g., web conferencing, teleconferences)	Ability to work with difficult people
Ability to write meeting minutes	Analytical skills
Basic math skills	Basic accounting skills
Commissioning plan development skills	Computer skills
Construction skills	Cost estimating skills
Documentation skills	Facilitation skills
Financial skills (ROI, etc.)	Follow-up techniques
Forensic skills	Interpersonal skills
Interviewing skills	Investigation skills
Leadership skills	Listening skills
Management skills	Meeting management skills
Multimedia skills	Negotiation skills
Organizational skills	Patience
Persistence	Physical attributes
Physical mobility	Plan reading skills
Presentation skills	Project management skills
Reading ability	Report writing skills
Research skills	Scheduling skills
Team building skills	Time management skills
Troubleshooting skills	Verbal communication skills
Written communication skills	

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Table 6. Attitudes Required for Building Commissioning Professional

Critical thinker	Good time manager
Honest	Manage stress/pressure
Quality focused	Adaptable/flexible
Trustworthy	Free of substance abuse
Customer oriented	Initiative
Detail oriented/attention to detail	Lack of prejudice (bias)
Ethical	Leader
Integrity	Positive attitude
Organized	Respectful/empathetic
Common sense	Tactful
Analytic	Work efficiently (resources)
Professional	Work efficiently (time)
Responsible/accountable	Conscientious
Work in teams	Eager to learn new things/curiosity
Accurate/precise	Industrious
Persistent	Meticulous
Team player	Multitasker
Dependable	Self-motivated
Focused	Enthusiasm
Punctual	Goal oriented
Confident	Open to change
Pride in job	Tolerant
Safety conscious	Helpful
Self-control	Patience
Self-discipline	Social skills
Cooperative	Independent
Good listener	

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Table 7. Physical Conditions Required for Building Commissioning Professional

Physical Conditions
Position—How important is it that one can . . .
Stand part of the time
Work in a squatting position for more than 5 minutes per hour
Bend forward frequently
Stoop kneel or crouch
Stand all of the time
Mobility—How important is it that one can . . .
Walk
Climb ladders, stairs, poles, etc. using legs and arms
Crawl or creep
Lifting—How important is it that one can . . .
Carry objects of up to 25 pounds
Lift objects from ground to waist level
Arm/Hand Use—How important is it that one can . . .
Reach with arms and hands in any direction
Feel size, shape, and temperature or texture of objects with the hands
Hold or move objects using the fingers
Work with hands and arms over head level
Hold or move objects using the hands but not the fingers
Pull objects with arms or hands
Push objects with arms or hands
Senses—How important is it that one can . . .
Talk
Hear speech
Detect abnormal noises
See clearly at 20 inches or closer (with/without optical assistance)
See and discriminate colors
Judge depth (the position and distance of objects) with the eyes
See clearly at 20 feet or further (with/without optical assistance)
Working Conditions—How important is it that one can . . .
Work outside
Work inside
Work while standing on portable ladders
Work while standing on scaffolding
Work at heights of 1 to 25 feet above ground or floor level
Work while wearing protective equipment (respirators, hoods, etc.)
Work in changing temperatures (in and out of buildings repeatedly)
Work in noisy places (85 decibels or higher with ear protection)
Work in confined spaces

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Physical Conditions
Work around or near high-voltage power sources or equipment
Work around or near magnetic equipment or materials
Work at heights of 26 to 75 feet above ground or floor level
Work in high temperatures (85°–130°F)
Work in damp places (high humidity, some standing water)
Work in dry places (lacking any natural moisture or humidity)
Work in dust, oils, fumes, or smells
Work on slippery surfaces
Work in one place (no change of work location)
Work in low temperatures (0°–45°F)
Work while sitting or standing on high roofs, overhangs, or I-beams
Handle hot or cold objects
Work at heights of 76 feet or higher above ground or floor level
Work in stale air (with some oxygen depletion)
Work in subzero temperatures (0°F and lower)

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Table 8. Tools, Equipment, and Resources Required for Building Commissioning Professional

Attendance sheets	BAS
BOD	BOPs
Building operators	Building records and documents
CMMS	Codes, regulations, standards and guidelines (see Table 9)
Cx documentation and systems manuals	Cx guidelines and standards
Cx process scope	Cx progress reports
Cx team members	Computer and software (see Table 10)
Computerized control systems	Construction checklists
Construction drawings and documents	Construction management systems
CSI	Cx tools and equipment (see Table 11)
Energy coordinator or manager	Equipment lists
Evaluation form	Facility guides
Flipcharts and markers	Industrial hygienist
Instruction space (classrooms, etc.)	Integrated issues log
Internet	Issues resolution logs
Maintenance contracts	Maintenance staff
Manufacturers' data	Manufacturers' documentation
Manufacturers' guidelines and materials	O&M manuals
OPR	PPE (see Table 12)
Preventative maintenance schedule	Previous training programs
Project completion matrix	Project schedules
Project specifications	Record drawings
Safety plans	Scheduling software
Sign-in sheets	Site safety requirements
Specification development software (MasterSpec, etc.)	Staffing plans
Teaching equipment (projectors, etc.)	Teaching materials
Technology tools (see Table 13)	Training agendas
Training evaluation data (comments, surveys, etc.)	Training facilities
Training materials	Training records
Trend data	Utility bills
Utility meters	Utility rate data
Warranty documents	Writing instruments

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Table 9. Codes, Standards, Regulations, and Guidelines Required for Building Commissioning Professional

Commissioning Standards and Guidelines	
ASHRAE Guidelines	
Guideline 0	The Cx Process
Guideline 1.1	HVAC&R Technical Requirements for the Cx Process
Guideline 1.5	The Cx Process for Smoke Control Systems
Guideline 0.2	The Existing Building Cx Process
ASHRAE Standards	
Standard 202	Cx Process for Buildings and Systems
Illuminating Engineering Society	
IES DG-29-11	The Cx process applied to lighting and control systems
NFPA - 3	Recommended Practice on Cx and Integrated Testing of Fire Protection and Life Safety Systems
ASHE Guidelines	Health Facility Cx Guidelines
NIBS	Guideline 3 -- Exterior enclosures
Sources of information	AABC Commissioning Group (ACG)
	Association of Energy Engineers (AEE)
	American Institute of Architects (AIA)
	American National Standards Institute (ANSI)
	Association of Physical Plant Administrators (APPA)
	Army Corp of Engineers
	Association of Healthcare Engineering (ASHE)
	American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
	American Society of Plumbing Engineers (ASPE)
	American Society of Testing and Materials (ASTM)
	Building Commissioning Association (BCA)
	California Commissioning Collaborative (CCC)
	California Energy Commission (CEC)
	Cost estimating guides
	Department of Energy (DOE)
	Energy Independence and Security Act (EISA 2007)
	Environmental Protection Agency (EPA)
	International Performance Measurement and Verification Protocol (EVO-IPMVP)
	Federal Energy Management Program (FEMA)
	Green Globes
	General Services Administration Commissioning Guide
	International Code Council (ICC)
	Institute of Electrical and Electronics Engineers (IEEE)
	Illuminating Engineering Society

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Commissioning Standards and Guidelines	
	International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)
	National Environmental Balance Bureau (NEBB)
	National Electrical Code (NEC)
	National Electrical Contractors Association (NECA)
	National Electrical Testing Association (NETA)
	National Fire Protection Association (NFPA)
	National Institute of Building Sciences (NIBS)
	National Institute of Standards and Technology (NIST)
	Occupational Safety and Health Administration (OSHA)
	Portland Energy Conservation Inc. (PECI)
	Pacific Northwest National Laboratory (PNNL)
	Sustainable Airport Manual
	Testing and Balancing Bureau (TABB)

Table 10. Software for Building Commissioning Professional

Computer-aided drafting software
BIM and related software
BAS
Building energy modeling software
Computer-aided facility management
CMMS
Construction management software
Data analysis software
Energy management system
ENERGY STAR Portfolio Manager
Integrated work management system
Project management software
Scheduling management software
Spreadsheets/word processing/presentation (Microsoft)

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Table 11. Commissioning Tools and Equipment Required for Building Commissioning Professional

General Tools	Specialized Tools
Adjustable pliers	Anemometer
Adjustable wrench	Balometer
Allen wrenches	Blower door test equipment
Channel locks	Boroscope
Combination wrenches	Calibration equipment
Extension magnet	Circuit tracer
Flashlight	Computer test equipment
Inspection mirror	Combustion analyzing instruments
Labeling machine	Digital thermometer (surface and air)
Ladders	Dosimeter
Laser levels	Electrical meters
Locking pliers	Flow meters
Lock-out/tag-out equipment	Gas analyzers
Markers	Hydrometer
Measuring devices	Hygrometer
Multimeter	Infrared thermometer
Nut drivers	Light meters
Pipe wrenches	Manometer
Pliers	Megohmmeter
Pocket knife	Moisture meter
Pocket level	Power analyzer
Rain gear	Psychrometers
Ratchets	Refractometer
Rubber mallet	Refrigerant gauges
Screw drivers	Refrigeration test equipment
Small power tools (hand electric drill)	Smoke stick
Socket sets	Sound meters
Square	Stroboscope
Stop watch	Tachometers
Tape measure	Temperature measuring device
Torque wrench	Thermal imaging camera
Wire Brush	Velometer
Wire cutters	Vibration analysis instrument
Wire nuts	

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Electrical Tools	Testing and Balancing Tools (TAB)
Amp probe	Air data meter
Electrical gloves	Differential pressure gauges
Electrical multimeter	Flow hoods
Electrical tape	Flow measuring device
Electrically insulated tools	Flow tree
Fake smoke	Hydro data meter
Ground fault circuit interrupter-equipped extension cords	Magnehelic gauges
Plumbing Tools	Pitot tubes
Backflow preventer test equipment	Thermometers
Peppermint test equipment	
Pressure test plugs	

Table 12. PPE Required for Building Commissioning Professional

Arc flash protection (NFPA 70e)
Back protection
Dust masks
Eye protection/safety glasses
Face shield
Fall protection
Gloves
Hardhat
Hearing protection (plugs and muffs)
Respirator
Rubber boots
Safety harnesses
Vests
Work shoes (toe and shank protection)

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Table 13. Technology Tools Required for Building Commissioning Professional

Technology Tools	
Computer with	Spreadsheet applications
	Internet access
	Word processing applications
	Data storage
	Graphics software
	External data storage/backup
Data gathering	Data loggers with sensors (t/h/kw/on-off)
	Thermal imaging
	Vibration analysis
	Direct digital controls
Smart phone with	Camera
	Internet access
	Two-way communications
	Video recording/transmitting
	Wifi access
Tablet computer	

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Table 14. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Managing Commissioning Projects

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Identify the Scope of the Project					
Acquire scope of work documents	X	X	• Building systems (see Table 3) • Construction scheduling • Cx manpower requirements • Cx processes and procedures • Cx schedules • Cx sequence of events • Cx team member requirements • Records/document management • Scope of work	• Management skills • Ability to read and interpret construction documents • Attention to detail • Computer skills • Plan reading skills • Project management skills • Verbal communication skills • Written communication skills	• Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • Safety plans
Develop list of tasks	X	X			
Review systems to be commissioned	X	X			
Identify type of building to be commissioned or recommissioned	X	X			
Identify deliverables	X	X			
Determine data/record management	X	X			
Develop a Cx Team					
Determine in-house team capabilities	X	X	• Construction contracting	• Ability to deal with difficult people • Ability to determine manpower requirements from scope of work • Ability to identify specialty workers needed • Interpersonal skills • Organizational skills • Team building skills • Verbal communication skills • Written communication skills	• Commissioning team members
Determine required roles and responsibilities	X	X			
Identify stakeholders	X	X			
Identify contact information for project team members	X	X			
Identify needs for outside consultants	X	X			
Select commissioning team	X	X			
Identify service maintenance providers	X	X			
Determine information technology requirements for project	X	X			
Manage a Commissioning Budget					
Review fees	X	X	• Prevailing commissioning pricing structures	• Scheduling skills • Management skills • Attention to detail • Basic accounting skills • Computer skills • Documentation skills • Project management skills	• Computer and software (see Table 10) • Safety plans
Review tasks	X	X			
Evaluate overall project budget	X	X			
Develop Cx project execution plan and timelines	X	X			
Recalibrate project plan	X	X			
Evaluate invoices from consultants	X	X			
Analyze costs against budget	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Account for project costs that might affect budget	X	X		• Verbal communication skills • Written communication skills	
Assist contractors in developing their commissioning budgets	X	X			
Identify Cx Deliverables					
Identify building systems	X	X	• Building systems (see Table 3) • Cx processes and procedures	• Ability to create a matrix • Scheduling skills • Computer skills • Time management skills • Written communication skills	
Identify components and equipment associated with building systems	X	X			
Identify tasks associated with each component (what tests you will perform, etc.)	X	X			
Document deliverables	X	X			
Identify deliverable timeline and schedule	X	X			
Participate in VE Activities					
Conduct ROI analysis	X		• Construction budgets and costs • Economic analyses • OPR • ROI analysis • Scheduling	• Cost estimating skills • Independence • Interpersonal skills • Negotiation skills • Presentation skills	
Evaluate recommendations and alternatives	X				
Associate budgets with recommendations and alternatives	X				
Interpret value of impact on OPR	X				
Review Project Documents					
Review OPR/CFR	X	X	• BAS or monitoring systems • BIM • Building systems (see Table 3) • Construction documents and specifications • Construction scheduling • Contract knowledge • Design documents • Project documents • Sampling protocols and procedures • Sequence of operations	Reading ability	Codes, regulations, standards, and guidelines (see Table 9)
Review BOD	X	X			
Review division of responsibilities	X	X			
Review other team member responsibilities	X	X			
Review legal contract documents	X	X			
Review design documents	X	X			
Design suggestions for modifications	X	X			
Verify project is to code	X	X			
Review BIM models	X				
Review submittals	X	X			
Review factory witness tests	X				
Review schedules	X	X			
Review sequence of operations	X	X			
Review training materials	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Review installation documents	X	X			
Review contractor startup reports	X	X			
Review mechanical acceptance testing forms	X	X			
Validate BAS software	X	X			
Review TAB report	X	X			
Review operation manuals	X	X			
Review record documents (as-builts)	X	X			
Review previous Cx reports		X			
Review utility bills		X			
Review maintenance records		X			
Review trend logs	X	X			
Review existing contracts (with utilities, chilled water, steam, etc.)		X			
Review O&M contracts	X	X			
Review BAS contracts	X	X			
Monitor the Construction/Project Schedule					
Obtain master construction schedule	X		• Scheduling • Sequence of construction activities • Testing sequencing	• Ability to assess timeframes for construction and commissioning • Interpersonal skills • Negotiation skills	• Scheduling software
Create project schedule		X			
Maintain project schedule		X			
Insert commissioning milestones and durations into master construction schedule	X				
Obtain updated schedules	X				
Attend construction/project meetings	X	X			
Communicate need for adjustments to schedules	X	X			
Participate in Project Meetings					
Attend prebid meetings	X		• General construction process knowledge	• Interpersonal skills • Patience • Verbal communication skills • Written communication skills	
Attend postbid meetings	X				
Attend construction progress meetings	X				
Attend training meetings	X				
Attend near-end-of-warranty meetings	X				
Review meeting minutes	X				

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Conduct Cx Meetings					
Schedule meeting	X	X	• Cx processes and procedures • General construction process knowledge	• Ability to use collaborative meeting tools (e.g., Web conferencing, teleconferences) • Ability to use collaborative meeting tools (e.g., Web conferencing, teleconferences) • Ability to write meeting minutes • Leadership skills • Organizational skills • Presentation skills • Written communication skills	• Computer and software (see Table 10) • Cx tools and equipment (see Table 11) • Internet
Prepare agenda for meeting	X	X			
Facilitate design Cx kickoff meeting	X				
Facilitate construction Cx kickoff meeting	X				
Facilitate Cx meetings	X	X			
Facilitate sequence of operation review meetings	X	X			
Write meeting minutes	X	X			
Distribute meeting minutes	X	X			
Track Deficiencies (Issues Log)					
Identify issues	X	X	• Building sciences • Building systems (see Table 3) • Construction documents and specifications • Engineering principles • General construction process knowledge • OPR	• Ability to read and interpret construction documents • Ability to work with difficult people • Attention to detail • Computer skills • Forensic skills • Interpersonal skills • Troubleshooting skills	• Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • Construction management systems • Integrated issues log • PPE (see Table 12) • Site safety requirements
Characterize identified issue	X	X			
Participate in resolution process for identified issue	X	X			
Track identified issue	X	X			
Verify resolution of issues	X	X			
Resolve document issues	X	X			
Facilitate Risk Assessment As It Relates to Cx Activities					
Review Cx plan, testing approaches, and protocols	X	X	• Commissioned systems knowledge • Cx processes and procedures • Potential EHS hazards and risks • Project management process • Risk assessment and management	• Basic accounting skills • Facilitation skills • Team building skills	• Codes, regulations, standards, and guidelines (see Table 9) • Manufacturers' documentation
Facilitate safety review	X	X			
Conduct integrative testing	X	X			
Monitor Cx schedules	X	X			
Monitor construction schedules	X				
Review communication protocols (e.g., two-way radios)	X	X			
Participate in risk mitigation	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Review budgets as related to Cx activities	X	X	• Safety practices • Testing equipment and procedures • Testing standards		
Review project management for risk mitigation as related to Cx activities	X	X			
Assess Pass/Fail Criteria for Functional Test Results					
Document Cx team participants	X	X	• Functional testing procedures, equipment, and results • Sequence of operations • Systems interactions and integration • Trend analysis	• Ability to read and interpret construction documents • Ability to interpret trends	• BAS • Codes, regulations, standards, and guidelines (see Table 9) • Cx tools and equipment (see Table 11) • Technology tools (see Table 13)
Complete functional tests	X	X			
Review functional tests results	X	X			
Review issues log	X	X			
Recommend whether findings are compliant with OPR/CFR	X				
Send results to design authority					
Identify Tasks for Completion of the Cx Process					
Verify completion of resolution of issue log	X	X	• General construction process knowledge	• Report writing skills • Ability to interpret scope of work	• Project completion matrix • CMMS
Complete commissioning report	X	X			
Review owner's turnover criteria for commissioning project	X	X			
Schedule off-season mode testing	X				
Schedule end-of-warranty meeting	X				
Schedule off-season training	X				

Table 15. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Preparing Commissioning Documentation

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Assist in Developing the OPR/CFR					
Conduct interview with owner staff and commissioning team	X	X	• Building systems (see Table 3) • Climate zone variations • Environmental sustainability and efficiency goals • IEQ • Life-span cost and quality • Maintainability, access, and operational requirements	• Ability to determine appropriate sampling procedures • Facilitation skills • Verbal communication skills • Written communication skills	• Construction drawings and documents • BOD • Codes, regulations, standards, and guidelines (see Table 9) • Cx documentation and systems manuals
Develop OPR/CFR criteria matrix for commissioned systems	X	X			
Assist in drafting OPR/CFR	X	X			
Review draft OPR/CFR	X	X			
Update OPR/CFR draft	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
			• Project objectives, goals, and purpose • Space usage and occupancy schedules • Unique requirements for facility usage		• Cx process scope • Cx progress reports • Project schedules
Create a System/Equipment List					
Review Cx scope of work	X	X		• Ability to distinguish between systems, equipment, and components • Ability to read and interpret construction documents • Ability to perform document discovery • Computer skills • Organizational skills	• Computer and software (see Table 10) • CMMS
Review schedule of commissioned equipment	X	X			
Review drawings, specifications, and addenda	X	X			
Review existing building record documents		X			
Compare drawings, specifications, and BOD for compliance with OPR/CFR	X	X			
Identify systems and equipment	X	X			
Document selected systems and equipment	X	X			
Create a Cx Process Tracking Matrix					
Identify systems to be commissioned	X	X	• Cx processes and procedures • Scope of work • Systems engineering	• Ability to read and interpret construction documents • Ability to use collaborative meeting tools (e.g., Web conferencing, teleconferences) • Computer skills • Verbal communication skills • Written communication skills	• Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • Construction drawings and documents • Cx tools and equipment (see Table 11) • Equipment lists • Project schedules • Project specifications
Identify tasks to be completed on each system	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Develop the Cx Plan					
Determine roles and responsibilities of Cx team members	X	X	• Cx processes and procedures	• Analytical skills • Commissioning plan development skills • Project management skills • Verbal communication skills • Written communication skills	• Codes, regulations, standards, and guidelines (see Table 9)
Provide contact list for Cx team members	X	X			
Establish communication protocol	X	X			
Establish document distribution protocols	X	X			
Provide detailed description of Cx process activities	X	X			
Develop schedule of Cx process activities	X	X			
Determine appropriate sampling proced-ures and methodology in collaboration with commissioning team	X	X			
Provide examples of documentation	X	X			
Document design documentation evaluation procedures	X	X			
Describe Cx process activities	X	X			
Describe system verification procedures	X	X			
Describe testing procedures performed by Cx team	X	X			
Describe systems integration testing procedures	X	X			
Develop training plan for systems being created	X	X			
Describe system manual requirements	X	X			
Describe site observation procedures and documentation	X	X			
Issue resolution log formats	X	X			
Describe Cx progress reports	X	X			
Provide list of systems to be commissioned	X	X			
Describe procedures to mitigate issues that are not compliant with OPR/CFR	X	X			
Issue draft Cx plan for review and comments	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Review Cx plan	X	X			
Update Cx plan	X	X			
Develop Cx Schedules					
Acquire scope of work	X	X	• Construction scheduling • Construction methods and concepts • Cx processes and procedures • Manpower utilization • Testing durations	• Interpersonal skills • Negotiation skills	• Cx tools and equipment (see Table 11) • Computer and software (see Table 10)
Acquire project schedule	X	X			
Develop Cx duration schedules	X	X			
Assign sequence of activities	X	X			
Determine team assignments for activities	X	X			
Identify milestones	X	X			
Identify deliverables	X	X			
Identify critical path	X	X			
Create Cx schedule	X	X			
Work with contractor to integrate Cx schedule into construction/project schedule	X				
Identify resources that will be required	X	X			
Develop Communications Plans					
Determine meeting frequencies	X	X		• Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 11) • Computer and software (see Table 10)
Review the scope of work	X	X			
Obtain contact list	X	X			
Determine communication methods (phones, etc.)	X	X			
Establish distribution list	X	X			
Create Commissioning Specifications					
Review scope of work	X		• Cx processes and procedures • Divisions used in construction specifications • Sampling protocols and procedures	• Interpersonal skills • Verbal communication skills • Written communication skills	• CSI • Specification development software (MasterSpec, etc.)
Prepare project-specific commissioning specifications	X				
Review OPR	X				
Incorporate Cx specifications into the bid document	X				
Establish protocols for retesting and associated costs	X				
Establish sampling protocols	X				
Create sample Cx documents to include in specifications	X				

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Write System Verification Checklists					
Identify systems to be commissioned	X		• Building systems (see Table 3) • Construction methods and concepts • Methodology to inspect systems • Scope of work • Testing, training, design, and construction requirements	• Ability to create checklists • Ability to read and interpret construction documents	• Computer and software (see Table 10)
Review drawings, specifications, submittals, requests for information, and addenda	X				
Obtain IOMs	X				
Review IOMs	X				
Review details in drawings (schematics, one-line diagrams, etc.)	X				
Review sequence of operations	X				
Prepare draft checklists	X				
List materials, components, and installation techniques required by construction documents	X				
Conduct control point-to-point and positional checks and calibration	X				
Create FPTs					
Review sequence/modes of operations	X	X	• BAS or monitoring systems • Building systems (see Table 3) • Controls graphics • Controls theory and operations • How system components work together • Integration protocols • Trend analysis	• Ability to interpret trends • Ability to review controls graphics	• BAS • Computer and software (see Table 10) • Cx tools and equipment (see Table 11)
Review project documents	X	X			
Review BAS documents	X	X			
Review steps involved in performing FPTs	X	X			
Develop FPT steps	X	X			
Determine equipment and systems integration	X	X			
Develop acceptance criteria	X	X			
Conduct risk assessment	X	X			
Determine various scenarios for FPTs	X	X			
Determine load simulation equipment needed	X	X			
Determine equipment/tool/instrument requirements	X	X			
Determine Cx team members and their responsibilities	X	X			
Determine interface and integration requirements	X	X			
Determine timing and schedule for	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
execution of FPTs					
Determine precursors for testing (scheduling)	X	X			
Include safety tests and verify hardware or software driven per specifications	X	X			
Include alarms, notifications, and reports	X	X			
Determine trending criteria	X	X			
Determine Site Visit Protocols (Logistics)					
Review safety protocols and procedures	X	X	• Documentation protocols • Evidence collection • Typical site visit protocols	• Ability to photograph evidence • Attention to detail • Curiosity • Interpersonal skills • Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 11) • PPE (see Table 12)
Review site access and security	X	X			
Review communication protocols	X	X			
Develop site visit schedules, durations, and intervals	X	X			
Collect evidence (digital photos, etc.)	X	X			
Determine documentation protocols	X	X			
Coordinate with contractor/site personnel	X	X			
Conduct previsit reviews of drawings, trends, etc.	X	X			
Determine site visit agenda (formal or informal)	X	X			
Distribute site visit agenda	X	X			
Identify goals of the site visit	X	X			
Create site visit (field) reports	X	X			
Determine distribution protocols for reports	X	X			
Determine deficiencies to be placed on issues logs	X	X			
Develop Issues Logs					
Determine if there is a separate design team log versus a construction log	X		• Spreadsheet development	• Computer skills • Verbal communication skills • Written communication skills	• Computer and software (see Table 10)
Determine issues log format	X	X			
Determine conformity with design team punch lists	X				
Determine distribution list and protocols	X	X			
Determine feedback procedures	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Identify responsible parties for issues	X	X			
Document Cx Meetings					
Develop meeting agendas	X	X	• Construction management processes • Project knowledge	• Computer skills • Facilitation skills • Meeting management skills • Presentation skills • Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 11) • Computer and software (see Table 10)
Develop list of meeting attendees	X	X			
Create sign-in sheets	X	X			
Determine meeting locations and logistics	X	X			
Prepare meeting minutes	X	X			
Set up conference call numbers	X	X			
Distribute meeting minutes	X	X			
Send out meeting invitations	X	X			
Write Cx Reports					
Compile all Cx documentation	X	X	• Building systems (see Table 3) • Cx processes and procedures • Cx reporting documentation • Required construction and installation tests • Special tests (TAB, etc.) • Startup requirements	• Ability to interpret the TAB report • Computer skills • Interpersonal skills • Organizational skills • Presentation skills • Report writing skills • Verbal communication skills • Written communication skills	• CMMS • Computer and software (see Table 10)
Determine deliverables	X	X			
Determine the distribution list	X	X			
Obtain documents from others (startup reports, TAB reports, special tests, etc.)	X	X			
Develop executive summary, including details of test results	X	X			
Create table of contents	X	X			
Determine report delivery method (pdf, paper, CMMS, etc.)	X	X			
Determine format for report (report body)	X	X			
Include in report location of OPR/CFR and BOD documents	X	X			
Include list of required deferred testing and off-season mode testing	X	X			
Include list of required deferred training	X				
Distribute draft Cx report for review	X	X			
Finalize Cx report	X	X			
Create Systems Manuals					
Collect O&Ms	X	X	• Building systems (see Table 3) • Manufacturers of Cx equipment • Owner's operational	• Ability to assess building performance • Organizational skills • Verbal communication skills	• Computer and software (see Table 10) • Construction drawings and documents
Review sequence of operations	X	X			
Create facility guide/BOP (schedule, set points, etc.)	X	X			
Collect training materials	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Include original FPTs	X	X	configuration and personnel • Sequence of operations • Systems interactions and integration	• Written communication skills	• Facility guides • Issues resolution logs • Manufacturers' data • Preventative maintenance schedule • Training materials • Training records • Utility bills • Warranty documents
Include blank FPTs for future use	X	X			
Include OPR/CFR	X	X			
Include BOD	X	X			
Include building and equipment specifications	X	X			
Include copies of warranties	X				
Include list of contractors and consultants	X	X			
Include training records	X	X			
Include copy of final Cx process plan	X	X			
Include copy of Cx design and submittal review reports	X				
Include copy of testing and startup reports	X				
Include copy of evaluation checklists	X	X			
Include copy of testing checklists for commissioned systems and assemblies	X	X			
Include copies of issues and resolutions logs	X	X			
Include copies of item resolution plan for any open items	X	X			
Obtain owner approval (sign-off)	X	X			
Include recommendations for ongoing Cx		X			
Identify spare parts list	X				
Develop End-of-Warranty Review Processes					
Identify Cx team members to participate	X		• Substantial completion and final completion • Warranty provisions	• Written communication skills	• Computer and software (see Table 10) • Internet • Warranty documents
Identify equipment/systems warranties	X				
Establish acceptance dates	X				
Identify modifications to facility systems	X				
Verify punch lists and issues log items are resolved	X				
Identify extended/voided warranties	X				
Verify owner and occupant satisfaction with building conditions	X				
Create end-of-warranty review report	X				

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
format					
Document warranty expiration dates	X				

Table 16. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Conducting Commissioning Activities

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Plan Cx Construction Activities					
Assist in updating OPR	X		• Basic construction • Building systems (see Table 3) • Project knowledge • Safety practices • Scope of work	• Scheduling skills • Leadership skills • Organizational skills • Verbal communication skills • Written communication skills	• Codes, regulations, standards, and guidelines (see Table 9) • Cx tools and equipment (see Table 11)
Review BOD/request for information/SK addenda	X				
Review commissioning plan and schedule	X				
Update Cx plan	X				
Coordinate Cx activities with construction	X				
Review control sequencing	X				
Plan controls integration meeting (fire alarm, life safety, etc.)	X				
Plan BAS and TAB meetings	X				
Review TAB plan	X				
Align commissioning schedule with occupied schedule	X				
Schedule kickoff meeting	X				
Plan onsite access	X				
Plan responses to emergencies	X				
Monitor Cx Construction Activities					
Monitor TAB	X		• Building systems (see Table 3) • Construction documents and specifications • Construction methods and concepts • Proportional balancing	• Ability to photograph evidence • Attention to detail • Documentation skills • Interpersonal skills • Physical attributes	• Codes, regulations, standards, and guidelines (see Table 9) • Cx tools and equipment (see Table 11) • PPE (see Table 12)
Monitor construction installations	X				
Conduct controls integration meeting (fire alarm, life safety, etc.)	X				
Coordinate BAS and TAB meetings	X				
Monitor site housekeeping conditions	X				
Monitor equipment storage conditions	X				

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Conduct site visits	X		• Site safety	• Verbal communication skills • Written communication skills	
Monitor compliance with manufacturers' installation requirements	X				
Witness special tests	X				
Attend progress and coordination meetings	X				
Check construction for damage, leaks, etc.	X				
Check maintenance access to building system components	X				
Check for maintainability of building system components	X				
Determine owner's requirements regarding coordination with AHJ	X				
Witness startup activities	X				
Facilitate the Completion of Construction Checklists					
Review mechanical testing forms (CA Title 24)	X		• Building systems (see Table 3) • Construction methods and concepts • Issue resolution process • Scope of work • Training methodologies	• Computer skills • Construction skills • Interpersonal skills • Organizational skills • Persistence • Verbal communication skills • Written communication skills	• Codes, regulations, standards, and guidelines (see Table 9) • Construction checklists • Writing instruments
Review other building system component testing forms	X				
Prepare construction checklists	X				
Train Cx team on construction checklists	X				
Conduct site observations back-check	X				
Review completion of construction checklists	X				
Identify issues needing resolution	X				
Facilitate issues resolution	X				
Track overall progress of construction checklists	X				
Facilitate the Acceptance Phase					
Witness/execute point-to-point checks	X		• Building systems (see Table 3) • Control systems • Failure mode analysis • Operations within the facility • Risk assessment and	• Computer skills • Construction skills • Interpersonal skills • Organizational skills • Persistence	• Cx tools and equipment (see Table 11) • Manufacturers' guidelines and materials
Perform TAB verification to design tolerance requirements	X				
Conduct functional performance tests according to manufacturers' guidelines	X				
Set up/review trending	X				

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Perform integrated system testing	X		management • Safety practices • TAB • Trend analysis	• Physical mobility • Verbal communication skills • Written communication skills	

Table 17. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Managing Training Activities

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Develop a Training Plan					
Review scope of work	X	X	• Building operations • Building systems (see Table 3) • Records/document management • Safety practices • Training methodologies	• Ability to communicate technical information to others • Ability to serve as a mediator between owners, contractors, and others • Ability to train others • Empathy • Verbal communication skills • Written communication skills	• BAS • Computerized control systems • Manufacturers' guidelines and materials • O&M manuals • PPE (see Table 12) • Previous training programs • Training agendas • Training facilities • Training materials
Review or request contractor's curriculum	X	X			
Discuss training expectations with owner	X	X			
Conduct gap analysis of capabilities of staff to identify needed training	X	X			
Identify stakeholders and roles and responsibilities	X	X			
Review project/construction documents	X				
Develop training schedule	X	X			
Identify needed training for specific individuals	X	X			
Identify resource and space requirements for training	X	X			
Identify other training logistics	X	X			
Identify manufacturers' training	X	X			
Prepare handouts and other training materials	X	X			
Identify training prerequisite materials such as O&M manuals and record drawings	X	X			
Identify training recording requirements (video, etc.) per specifications	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Verify instructor qualifications	X	X			
Coordinate training schedule (training and O&M startup are not on same day, etc.)	X	X			
Engage stakeholders in planning training activities	X	X			
Create training matrix of required training (logs, etc.)	X	X			
Look for opportunities to advance training	X	X			
Identify acceptance criteria	X	X			
Review O&M staff participation in FPTs	X	X			
Verify safety instruction is included where appropriate	X	X			
Identify off-season mode training requirements	X	X			
Facilitate the Training Coordination Meeting					
Review curriculum	X	X	• Building operations • Building systems (see Table 3) • Facilities management • Records/document management • Training methodologies	• Facilitation skills • Interpersonal skills • Presentation skills • Verbal communication skills • Written communication skills	• Flipcharts and markers • Instruction space (classrooms, etc.) • Teaching equipment (projectors, etc.)
Introduce training plan	X	X			
Review agenda	X	X			
Inform participants about training	X	X			
Discuss roles and responsibilities for training	X	X			
Obtain syllabi for training	X	X			
Review training specifications	X	X			
Coordinate the owner's participation	X	X			
Finalize schedule	X	X			
Discuss acceptance criteria	X	X			
Plan for persistence					
Facilitate Training Activities					
Document training attendance	X	X	• Building systems (see Table 3) • Successful training outcomes • Training facilitation	• Facilitation skills • Presentation skills • Team building skills • Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 9) • Evaluation form • Instruction space (classrooms, etc.)
Implement the training plan	X	X			
Document owner training	X	X			
Verify the training is effective	X	X			
Interject whole-building and system knowledge pertaining to system to facilitate learning	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Coordinate integration of all parties involved in training	X	X			• Sign-in sheets • Teaching materials
Obtain copy of all training materials/ videos to be placed into systems manual	X	X			
Determine requirements for supplemental materials	X	X			
Conduct off-season mode training	X	X			
Identify lessons learned related to training	X	X			
Conduct Training Follow-Up Activities					
Verify owner training has been completed	X	X	• Building systems (see Table 3) • Training evaluation • Training plans	• Follow-up techniques • Interviewing skills • Organizational skills • Verbal communication skills • Written communication skills	• Attendance sheets • Building operators • Staffing plans • Training evaluation data (comments, surveys, etc.)
Evaluate effectiveness of training	X	X			
Verify training acceptance criteria were met	X	X			
Interview staff	X	X			
Distribute supplemental materials	X	X			
Ensure new personnel have completed training	X	X			
Verify accessibility of training materials	X	X			
Identify follow-up training requirements	X	X			
Submit archive training materials to owner	X	X			
Identify lessons learned related to training	X	X			

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Table 18. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Completing Warranty Phase Activities

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Facilitate Off-Season Testing					
Facilitate incomplete or deferred tests	X		• Building systems (see Table 3) • Control systems • Failure mode analysis • Functional testing procedures, equipment, and results • Operations within the facility • Risk assessment and management • Safety practices • TAB • Trend analysis	• Attention to detail • Computer skills • Construction skills • Interpersonal skills • Interviewing skills • Organizational skills • Persistence • Physical mobility • Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 11) • Manufacturers' guidelines and materials
Schedule tests when conditions are appropriate	X				
Identify participants	X				
Interview occupants	X				
Identify testing logistics (occupant convenience, etc.)	X				
Collect startup reports	X				
Review system manufacturer and verification checklists	X				
Update issues logs	X				
Document testing results	X				
Set up trends	X				
Analyze test data	X				
Troubleshoot Facility Issues					
Collect tenant complaint information	X		• Building systems (see Table 3) • Fault diagnostic knowledge • OPR • Systems understanding • Trend data • Troubleshooting techniques	• Documentation skills • Forensic skills • Interviewing skills • Research skills • Troubleshooting skills • Verbal communication skills • Written communication skills	• Cx tools and equipment (see Table 11)
Query CMMS/work orders	X				
Review trend data and alarms	X				
Interview maintenance staff	X				
Interview building owners	X				
Review equipment for proper operation	X				
Document issues and resolutions	X				
Investigate and analyze issues	X				
Resolve issues or make recommendations for solutions	X				
Verify warranty issue resolution	X				
Verify completion of punch lists/issue logs					

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Measure Energy Performance					
Assist with calibrating energy model	X		• Energy management fundamentals • Energy modeling • Expected equipment performance • OPR • Submetering • Utility rate structures and schedules	• Ability to read and interpret utility bills, rate structures, and utility contracts • Computer skills • Basic math skills	• Computer and software (see Table 10) • Cx tools and equipment (see Table 11) • Energy coordinator or manager • Utility bills • Utility meters
Review utility data	X				
Establish actual building energy performance baseline	X				
Evaluate submeter trends	X				
Evaluate M&V	X				
Review energy performance tracking program	X				
Analyze power factor performance	X				
Make system improvement recommendations	X				
Optimize building performance					
Facilitate the End-of-Warranty Meeting					
Interview owner, occupants, and operators	X		• Building operations • Building systems (see Table 3) • CMMS • IEQ • O&M procedures • Warranties	• Interviewing skills • Listening skills • Verbal communication skills • Written communication skills	• Building records and documents • Computer and software (see Table 10) • Cx tools and equipment (see Table 11) • Maintenance staff • OPR • Warranty documents
Review systems manuals and systems operations	x				
Review the warranty matrix	x				
Participate in lessons learned	x				
Review CMMS systems	x				
Create attendance list	x				
Review service contracts	x				
Prepare meeting minutes	x				
Distribute documentation, including minutes	x				
Create agendas	x				
Distribute agendas	x				
Assess occupant comfort	x				
Conduct IEQ assessment	x				
Schedule meeting and invite attendees	x				
Review BOPs, schedules, and set points	x				
Update the Cx report (addenda or supplemental report)	x				
Update systems manuals	x				

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Table 19. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Conducting Existing Building Commissioning

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Determine the Scope of the Project					
Determine project goals and objectives		X	• M&V methodologies • Building systems (see Table 3) • Cx budgeting • Cx processes and procedures • Energy performance • Incentive programs • Needs assessment processes	• Ability to conduct a needs assessment • Analytical skills • Interviewing skills • Organizational skills • Verbal communication skills	• Cx tools and equipment (see Table 11)
Interview owner		X			
Determine scope of work		X			
Analyze building, systems, and equipment		X			
Prioritize goals and objectives		X			
Determine if incentive funding is available		X			
Determine M&V requirements		X			
Determine metering requirements		X			
Develop existing Cx team		X			
Conduct a Building Performance Assessment					
Review available building documentation		X	• Budgeting • Building operations • Building systems (see Table 3) • Energy use analysis • Maintenance procedures and roles • Utility bill structures	• Computer skills • Interpersonal skills • Interviewing skills • Basic math skills • Research skills • Verbal communication skills • Written communication skills	• BAS • Cx tools and equipment (see Table 11) • O&M manuals
Request and review CFR		X			
Obtain utility bills		X			
Identify missing system documentation		X			
Begin outlining CFR if one does not exist		X			
Research systems where documentation does not exist		X			
Obtain BOP		X			
Review other specialized facility-specific documents and reports (asbestos, containment plans, infection control plans, etc.)		X			
Conduct ENERGY STAR performance analysis		X			
Obtain and review previous Cx reports		X			
Establish existing building performance baselines		X			
Inspect equipment		X			
Determine building automation capabilities		X			
Evaluate single point-of-failure analysis		X			
Establish Cx team		X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Estimate improvement potentials		X			
Interview occupants and O&M staff		X			
Review recent modifications and upgrades					
Prepare a CFR					
Identify specific building systems and equipment		X	• Building systems (see Table 3) • Engineering principles • Maintenance contracts • Safety practices • Service contracts • System operations	• Analytical skills • Written communication skills	• BOPs • Codes, regulations, standards, and guidelines (see Table 9)
Determine operations strategies, parameters, set points, and schedules		X			
Determine space allocation and usage		X			
Determine emergency and safety modes of operation		X			
Determine performance goals		X			
Determine training requirements		X			
Determine operations team schedule		X			
Determine occupancy levels and schedules					
Conduct a Systems Assessment					
Review building systems		X	• Building operations • Building systems (see Table 3) • CMMS • Maintenance contracts • Maintenance issues	• Interviewing skills	• Codes, regulations, standards, and guidelines (see Table 9)
Identify deferred maintenance issues		X			
View operating procedures		X			
Review previously identified or known operating failures		X			
Identify FIMs/ECMs		X			
Create master log of deficiencies		X			
Identify new and recently upgraded equipment/systems		X			
Conduct field check of control sensor calibration		X			
Review alarm logs		X			
Review reports associated with fire life safety		X			
Review systems to verify compliance with applicable life safety codes		X			
Review maintenance contracts		X			
Review troubleshooting logs		X			
Review controls contracts		X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Deploy data loggers		X			
Determine locations for data loggers		X			
Review CMMS		X			
Finalize list of equipment to be tested		X			
Walk facility with O&M and facility management staff		X			
Conduct a Site Investigation					
Review functional performance testing procedures with building operations team		X	• Building systems (see Table 3) • Risk assessment and management • Safety practices • Sequence of operations • Test development • Testing procedures • Trend analysis • Troubleshooting methodologies	• Ability to conduct a root cause analysis • Ability to train others • Analytical skills • Attention to detail • Interpersonal skills • Investigation skills • Negotiation skills • Research skills	• Cx tools and equipment (see Table 11)
Conduct functional performance testing		X			
Download data loggers		X			
Analyze data logger data		X			
Identify equipment and system issues		X			
Develop testing strategies for building and systems		X			
Conduct root cause analysis		X			
Analyze results from FPTs and determine if additional tests are required		X			
Implement quick fixes if approved		X			
Update master list of deficiencies		X			
Update development of FIMs and ECMs		X			
Recommend Corrections and Improvements					
Develop FIMs and ECMs		X	• Building systems (see Table 3) • Construction estimating • Construction scheduling • Developing ROIs • Energy calculations • Occupancy impacts • Risk assessment and management • Utility rebate incentives	• Ability to prioritize • Computer skills • Financial skills (ROI, etc.) • Interpersonal skills • Management skills • Basic math skills • Presentation skills • Report writing skills • Time management skills	• Computer and software (see Table 10) • Cx tools and equipment (see Table 11)
Calculate benefits of implementing measures		X			
Determine ROI		X			
Determine execution schedule and personnel		X			
Determine budgets and potential for incentives		X			
Develop scope for recommendations, FIMs, and ECMs		X			
Present recommendations to owner and O&M staff		X			
Determine responsibilities of stakeholders for maintenance/repairs/ improvements		X			
Prioritize corrections and improvements		X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Determine action plan with owner		X			
Determine training requirements		X			
Update M&V requirements		X			
Oversee the Implementation of Corrective Measures					
Manage implementation of FIM or ECM projects		X	• BAS or monitoring systems • Building systems (see Table 3) • Construction scheduling • Cx processes and procedures	• Scheduling skills • Analytical skills • Interpersonal skills • Physical attributes • Research skills • Verbal communication skills • Written communication skills	• BOPs • Codes, regulations, standards and guidelines (see Table 9) • Cx tools and equipment (see Table 11)
Commission corrections		X			
Implement low-cost/no-cost items		X			
Develop schedules		X			
Update CFR		X			
Update BOP		X			
Conduct training of operators, owners, and occupants		X			
Optimize controls operating parameters or set points		X			
Conduct Performance Verifications					
Review trending/data loggers		X	• Building systems (see Table 3) • M&V methodologies • Metering • Scope of work • Utility rate structures and schedules • Various control technologies (new and legacy)	• Analytical skills • Report writing skills	• BOPs • Codes, regulations, standards and guidelines (see Table 9) • Cx tools and equipment (see Table 11)
Redeploy data loggers		X			
Obtain new measurements		X			
Compile improvement matrix		X			
Review utility data and submeters		X			
Compare current data to original preproject baseline		X			
Interview occupants		X			
Calculate actual and projected savings		X			
Summarize lessons learned		X			
Update CFR		X			
Update BOP		X			
Review and conduct additional training		X			
Prepare draft report for comments		X			
Prepare final report		X			
Assist in obtaining incentives		X			
Make recommendations for ongoing Cx		X			

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Table 20. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Conducting Ongoing Commissioning

Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Measure IEQ Performance					
Conduct occupant survey	X	X	• BAS or monitoring system • Control systems • IEQ	• Interviewing skills	• Cx tools and equipment (see Table 11) • Industrial hygienist
Obtain IEQ measurements	X	X			
Review BAS trend logs	X	X			
Review complaints	X	X			
Prepare IEQ draft report	X	X			
Evaluate Building Systems Performance					
Obtain and review utility bills	X	X	• Building systems (see Table 3) • Control systems • Data normalization (weather, days of the month, etc.) • Energy management fundamentals • Maintenance management systems • Regression modeling	• Ability to manage resources • Basic math skills • Presentation skills • Written communication skills	• CMMS • Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • Cx tools and equipment (see Table 11) • Trend data • Utility bills • Utility rate data
Review BAS trend logs	X	X			
Review submetering data	X	X			
Compare current baseline to past and industry baselines	X	X			
Review maintenance logs	X	X			
Review CMMS work orders	X	X			
Perform normalized data analysis	X	X			
Identify major changes	X	X			
Report degradation of savings	X	X			
Review the Building Operating Plan					
Conduct analysis of current BOP to original BOP	X	X	• Building operations • Building maintenance	• Interpersonal skills • Verbal communication skills	• BOPs
Identify changes	X	X			
Update BOP	X	X			
Review training activities	X	X			
Review Maintenance Activities					
Review CMMS	X	X	• CMMS • Maintenance contracts • Maintenance procedures and roles • Survey techniques	• Interviewing skills • Verbal communication skills • Written communication skills	• CMMS • Maintenance contracts • O&M manuals
Review O&M contract	X	X			
Review maintenance plans	X	X			
Survey occupants/tenants	X	X			
Interview maintenance personnel	X	X			
Conduct field investigation to determine deferred maintenance items	X	X			

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Duties, Tasks, and Steps	NB	EB	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Accommodate Space/Function Changes					
Identify space/function changes	X	X	• BAS or monitoring systems • Building systems (see Table 3) • Facilities management	• Ability to read and interpret construction documents	• BAS • Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • OPR • Record drawings
Update OPR/CFR	X	X			
Review as-built drawings	X	X			
Review BAS for updates	X	X			
Recommend system modifications	X	X			
Implement Corrective Actions					
Identify corrective actions	X	X	• BAS operations • Building systems (see Table 3) • Facilities management • Project management	• Attention to detail	• BAS • Codes, regulations, standards, and guidelines (see Table 9) • Computer and software (see Table 10) • Cx tools and equipment (see Table 11) • OPR
Conduct follow-up training	X	X			
Change BAS parameters	X	X			
Repair equipment deficiencies	X	X			
Update the BOP	X	X			
Commission major system modifications	X	X			
Publish Measurement and Performance Results to Stakeholders					
Prepare progress reports	X	X		• Multimedia skills • Presentation skills • Report writing skills	• Computer and software (see Table 10) • Internet
Distribute reports to stakeholders	X	X			
Meet with stakeholders	X	X			
Present results	X	X			

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3 Examination Blueprint

The Final Proposed Examination Blueprint for Building Commissioning Professional is shown below in Table 21. The exam blueprint identifies subject matter areas covered on a certification exam. Table 21 column headings are defined as follows:

Duties and Tasks: Description of the work

Analytical Weights: The weights calculated by taking the average of the tabulated individual ratings on frequency and importance (2 times importance plus frequency). See Section 6.2.

Holistic Weights: These are the weights calculated by taking the average the individual responses regarding the overall percentage that should be in each of the Duties and Tasks. See Section 6.2.

Final Weight: These are the weights agreed upon by the JTA committee during the post-validation study webinar. See Section 6.

Final Items: These are the quantity of items (i.e., test questions) that should be on each examination in each of the categories as agreed to by the JTA committee during the post-validation study webinar.

Table 21. Final Proposed Examination Blueprint for Building Commissioning Professional

Duties and Tasks	Analytical Weights	Holistic Weights	Final Weight	Final Items
Managing Commissioning Projects	**25%**	**14%**	**18%**	**22**
Identify the scope of the project	2%		1%	1 to 2
Develop a commissioning team	2%		1%	1 to 2
Manage a commissioning budget	2%		1%	1 to 2
Identify commissioning deliverables	2%		1%	1 to 2
Participate in VE activities	1%		1%	1 to 2
Review project documents	2%		1%	1 to 2
Monitor the construction/project schedule	2%		1%	1 to 2
Participate in project meetings	2%		1%	1 to 2
Conduct commissioning meetings	2%		1%	1 to 2
Track deficiencies (issues log)	2%		2%	2
Facilitate risk assessment as it relates to commissioning activities	1%		2%	2
Assess pass/fail criteria for functional test results	2%		3%	4
Identify tasks for completion of commissioning processes	2%		2%	2
Preparing Commissioning Documentation	**28%**	**17%**	**19%**	**23**
Assist in developing the OPR/CFR	2%		1%	1 to 2
Create system/equipment list	2%		1%	1 to 2
Create commissioning process tracking matrices	2%		1%	1 to 2
Develop the commissioning plan	2%		2%	2

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Duties and Tasks	Analytical Weights	Holistic Weights	Final Weight	Final Items
Develop commissioning schedules	2%		1%	1 to 2
Develop communications plans	2%		1%	1 to 2
Create commissioning specifications	2%		1%	1 to 2
Write system verification checklists	2%		2%	2
Create FPTs	2%		3%	4
Determine site visit protocols (logistics)	2%		0%	0
Develop issues logs	2%		1%	1 to 2
Document commissioning meetings	2%		1%	1 to 2
Write commissioning reports	2%		2%	2
Create systems manuals	1%		1%	1 to 2
Develop end of warranty review processes	1%		1%	1 to 2
Conducting Commissioning Activities	8%	28%	24%	29
Plan commissioning construction activities	2%		7%	7 to 8
Monitor commissioning construction activities	2%		7%	7 to 8
Facilitate the completion of construction checklists	2%		3%	4
Facilitate the acceptance phase	2%		7%	7 to 8
Managing Training Activities	**5%**	**7%**	**4%**	**5**
Develop training plan	1%		2%	2
Facilitate training coordination meeting	1%		1%	1 to 2
Facilitate training activities	1%		1%	1 to 2
Conduct training follow-up activities	1%		0%	0
Completing Warranty Phase Activities	**6%**	**7%**	**5%**	**6**
Facilitate off-season testing	2%		1%	1 to2
Troubleshoot facility issues	2%		1%	1 to 2
Measure energy performance	1%		2%	3
Facilitate end of warranty meeting	1%		1%	1 to 2
Conducting Existing Building Commissioning	**16%**	**18%**	**23%**	**28**
Determine Scope of Project	2%		2%	1 to 2
Conduct a building performance assessment	2%		3%	4
Prepare a CFR	2%		2%	1 to 2
Conduct a systems assessment	2%		3%	4
Conduct a site investigation	2%		3%	4
Recommend corrections and improvements	2%		3%	4
Oversee implementation of corrective measures	2%		3%	4
Conduct performance verifications	2%		4%	5
Conducting On-going Commissioning	12%	11%	7%	8
Measure IEQ performance	1%		1%	1 to 2
Evaluate building systems performance	2%		1%	1 to 2
Review building operating plan	2%		1%	1 to 2
Review maintenance activities	2%		1%	1 to 2

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Duties and Tasks	Analytical Weights	Holistic Weights	Final Weight	Final Items
Accommodate space/function changes	1%		1%	1 to 2
Implement corrective actions	2%		1%	1 to 2
Publish measurement and performance results to stakeholders	2%		1%	1 to 2
	100%		100%	120

To arrive at this final blueprint, the JTA committee was asked to consider the tabulated frequency and importance scales together with the holistic weights.

Respondents were asked to provide a holistic weighting to the domain areas. Based on the responses, an examination blueprint was calculated for each domain. This information appears in Table 22.

Table 22. Summary of Respondent Holistic Ratings

Domain	%
Managing Commissioning Projects	13.84%
Preparing Commissioning Documentation	17.23%
Conducting Commissioning Activities	27.59%
Managing Training Activities	6.86%
Completing Warranty Phase Activities	6.73%
Conducting Existing Building Commissioning	17.50%
Conducting On-going Commissioning	10.50%

The remainder of this document describes the process for conducting the job task analysis and administering the validation survey.

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4 Job Task Analysis and Survey Validation

NIBS and NREL organized a group of panelists consisting of 14 SMEs representing Building Commissioning Professionals to conduct a JTA using the DACUM methodology. The 14 experts are listed in Table 23.

Table 23. List of DACUM JTA Participants

Rick Belanger	Dianous LLC Indianapolis, IN
James Bochat	Commissioning Concepts Phoenix, AZ
Michael Chelednik, AIA	URS Corp New York, NY
Song Deng, PE, CBCP, CMVP, REP	Building Energy Efficiency, LLC (Bee)/ Association of Energy Engineers (AEE) Austin, TX
Michael C. English, PE, CCP	Horizon Engineering Associates, LLP New York, NY
Rick Farrington	HDR/NEBB Orting, WA
Patrick Fee	GSA/PBS Washington, DC
Mark L. Froehlich, CPMP	Efficient Automation & Controls (EAAC) Round Rock, TX
Saverio Grosso	ENERActive Solutions New York, NY
John R. Hamilton	Testing Adjusting and Balancing Bureau (TABB) Fairfax, VA
James I. Magee	AABC Commissioning Group Washington, DC
Mathew Park, RA	New York City Department of Design & Construction Long Island City, NY
John D. Villani	Grumman/Butkus Associates Evanston, IL
Stephen R. Wiggins	Newcomb & Boyd Atlanta, GA

The DACUM JTA meeting was facilitated by Dr. Cynthia Woodley, psychometrician, and Ms. Tracey Paschal, project manager with Professional Testing, Inc. The 3-day meeting developed a list of seven domains or duties and 55 tasks through group discussions.

4.1 Survey Development

The task list was used to build a survey that was delivered using an online mechanism. The survey consisted of two major sections: Demographic Information and Building Commissioning Professional Tasks. The draft survey was shared with NREL/NIBS/DOE staff for initial review and then NIBS volunteered to send the survey to appropriate respondents. Appendix A includes a copy of the survey.

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4.2 Survey Dissemination

NIBS sent out the survey to several Building Commissioning Professionals. The survey was open for approximately 30 days in the spring of 2014 for data collection, during which time email reminders were sent. The final dataset included 376 respondents, some of whom did not complete the survey.

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5 Results

All data were included in the analyses, since people who skipped a question or task rating may have done so either accidentally or because they felt that the item was not applicable to their position. The sample size is large enough (376) to allow reasonable confidence in the results. Results from the demographics questions will be presented first.

5.1 State of Primary Employment

The largest number of respondents reported working in multiple states or "other" for which they wrote in responses. The states with the largest numbers of respondents were Virginia (7.6%, n = 24), California (6.3%, n = 20), Washington State (6.3%, n = 20), and Texas (5.7%, n = 18). Table 24 provides the summary.

Table 24. State of Employment of Respondents

State	%	#	State	%	#
Other (please specify)	17.3%	52	**Massachusetts**	0.9%	3
Multiple States	9.8%	31	**Mississippi**	0.9%	3
Virginia	7.6%	24	**Missouri**	0.9%	3
California	6.3%	20	**Montana**	0.9%	3
Washington	6.3%	20	**Oklahoma**	0.9%	3
Texas	5.7%	18	**Alabama**	0.6%	2
Florida	5.1%	16	**Kentucky**	0.6%	2
Pennsylvania	4.4%	14	**New Jersey**	0.6%	2
New York	4.1%	13	**New Mexico**	0.6%	2
Illinois	3.8%	12	**North Dakota**	0.6%	2
Colorado	3.5%	11	**South Dakota**	0.6%	2
Georgia	3.5%	11	**Utah**	0.6%	2
North Carolina	3.5%	11	**Delaware**	0.3%	1
Oregon	3.5%	11	**Hawaii**	0.3%	1
Maryland	3.2%	10	**Louisiana**	0.3%	1
Michigan	2.8%	9	**Nebraska**	0.3%	1
Ohio	2.8%	9	**South Carolina**	0.3%	1
Minnesota	2.2%	7	**Iowa**	0.0%	0
Arkansas	1.9%	6	**Kansas**	0.0%	0
Connecticut	1.9%	6	**Maine**	0.0%	0
Tennessee	1.6%	5	**Nevada**	0.0%	0
Idaho	1.3%	4	**New Hampshire**	0.0%	0
Indiana	1.3%	4	**Rhode Island**	0.0%	0
Wisconsin	1.3%	4	**Vermont**	0.0%	0
Alaska	0.9%	3	**West Virginia**	0.0%	0
Arizona	0.9%	3	**Wyoming**	0.0%	0
Answered question		**316**			

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Table 25 contains a list of the write-in comments associated with "other." Several of the write-in comments were states for which the respondents could have checked participant states. However, Table 25 highlights international locations where respondents work (yellow highlight).

Table 25. List of "Other" Write-In Comments

"Other" Write-in Comments	
Alabama	All 50
MD, NC	Maryland
Puerto Rico	Canada
IA, GA, AL, SC, SD	& Texas
Greece	Saudi Arabia
Ontario	Riyadh - Saudi Arabia
Global	Ga, Ala, NC SC, TN
National Service	Maryland
AR, OK	work nationally
New Mexico	Victoria Australia
Singapore	New Jersey
New York	Australia
California, New Mexico and PA	Illinois
Washington, DC	Idaho, Montana, Oregon
India	NY, CT, PA, IL, IN, MI,RI, MA
Hong Kong	Capitol Hill DC
Kentucky	Maryland, Virginia, Washington, DC
Ontario	The Netherlands
Egypt & Middle East	DC
International	Italy
Washington	Egypt
Minnesota	DC
Georgia	Israel
VA, DC	Mexico

5.2 Highest Level of Education

Respondents were asked about the highest level of education reached. The majority indicated completing a Bachelor's degree (48.5%, n = 180) followed by a two years of college or technical school (20.5%, n = 76). Table 26 and Figure 1 depict this information.

Table 26. Highest Level of Education

What is your highest level of education?		
Answer Options	**Response Percent**	**Response Count**
Less than High School	0.0%	0
High School or Equivalent	3.2%	12
Some College	10.2%	38
Two Years of College/Technical School/Community College	20.5%	76
Bachelor's Degree	48.5%	180
Graduate Degree	17.5%	65
Answered question		**371**

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Figure 1. Highest level of education

5.3 Years of Energy Experience

Respondents were asked to identify the number of years of experience they had in an energy-related industry (all jobs combined), not necessarily specifically as a Building Commissioning Professional. The majority of respondents (57.3%, n = 211) had more than 21 years of experience. Table 27 and Figure 2 depict this information.

Table 27. Years of Energy Experience

How many years of experience do you have in an energy related industry (all jobs combined)?		
Answer Options	**Response Percent**	**Response Count**
5 years or less	7.1%	26
6–10 years	12.0%	44
11–15 years	10.6%	39
16–20 years	13.0%	48
21 or more years	57.3%	211
Answered question		**368**

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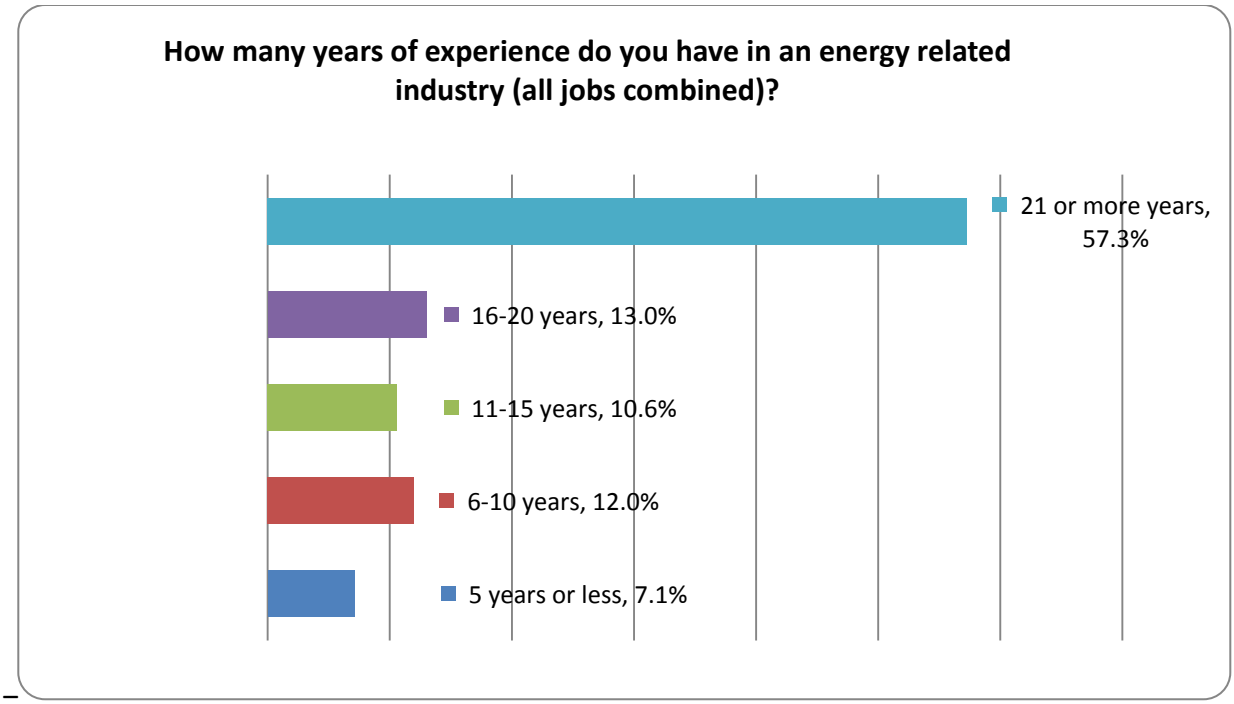


Figure 2. Years of energy experience

5.4 Years of Building Commissioning Experience

Respondents were asked how many years of experience they had specifically as Building Commissioning Professionals. Even though the majority had more than 21 years of experience in an energy-related field, the majority (31.2%, n = 115) had fewer than 10 years of experience as Building Commissioning Professionals. And 25.5% (n = 94) had fewer than 5 years of experience. Together this represents more than 55% (56.7%, n = 209) of the respondents having fewer than 10 years of experience as Building Commissioning Professionals. The SMEs who reviewed the results of the validation study was asked if this represented a shortcoming in the type of individuals who responded to the survey and if additional respondents with more experience should be targeted. The SMEs felt this was not necessary and believed the responses to be reflective of the industry. They felt that Building Commissioning as an occupation is a relatively new field, and although a majority had more than 21 years of experience in an energy-related field, the majority having fewer than 10 years of experience as Building Commissioning Professionals reflected the fact that this is a fairly new profession. Table 28 and Figure 3 reflect this information.

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Table 28. Years of Experience Specifically as a Building Commissioning Professional

How many years of experience do you have specifically as a Building Commissioning Professional?		
Answer Options	**Response Percent**	**Response Count**
none	1.4%	5
5 years or less	25.5%	94
6–10 years	31.2%	115
11–15 years	18.7%	69
16–20 years	12.5%	46
21 or more years	10.8%	40
Answered question		**369**

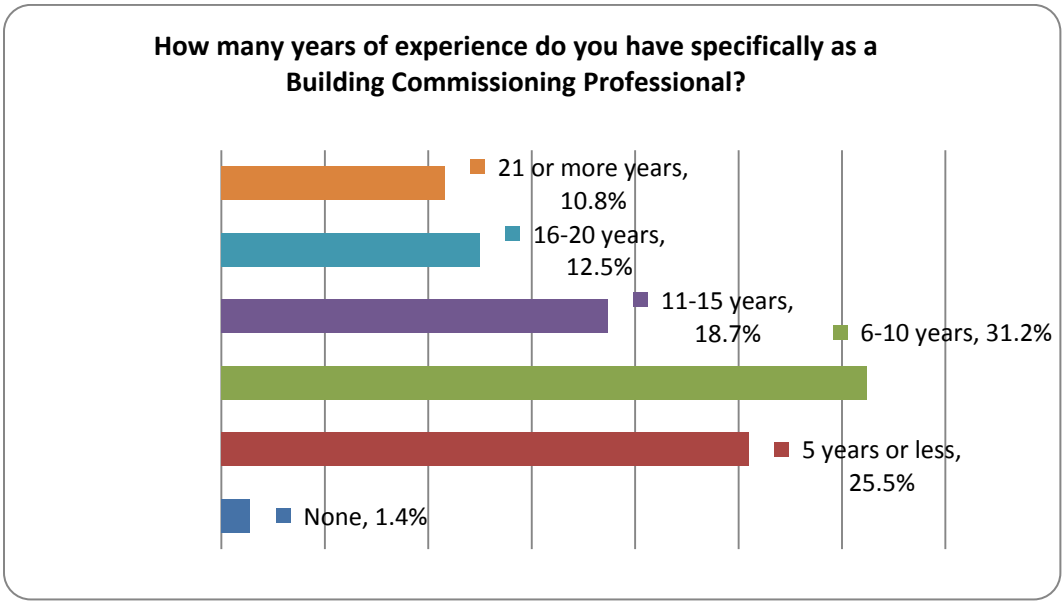


Figure 3. Years of experience specifically as a building commissioning professional

5.5 Work Sector

Respondents were asked whether they worked in a private or public (government) work sector. A majority (74.1%, n = 274) indicated they worked in a private sector. Table 29 and Figure 4 reflect this information.

Table 29. Sector in Which Respondent Works

In which sector do you currently work?		
Answer Options	**Response Percent**	**Response Count**
Public (government at any level)	25.9%	96
Private	74.1%	274
Answered question		**370**

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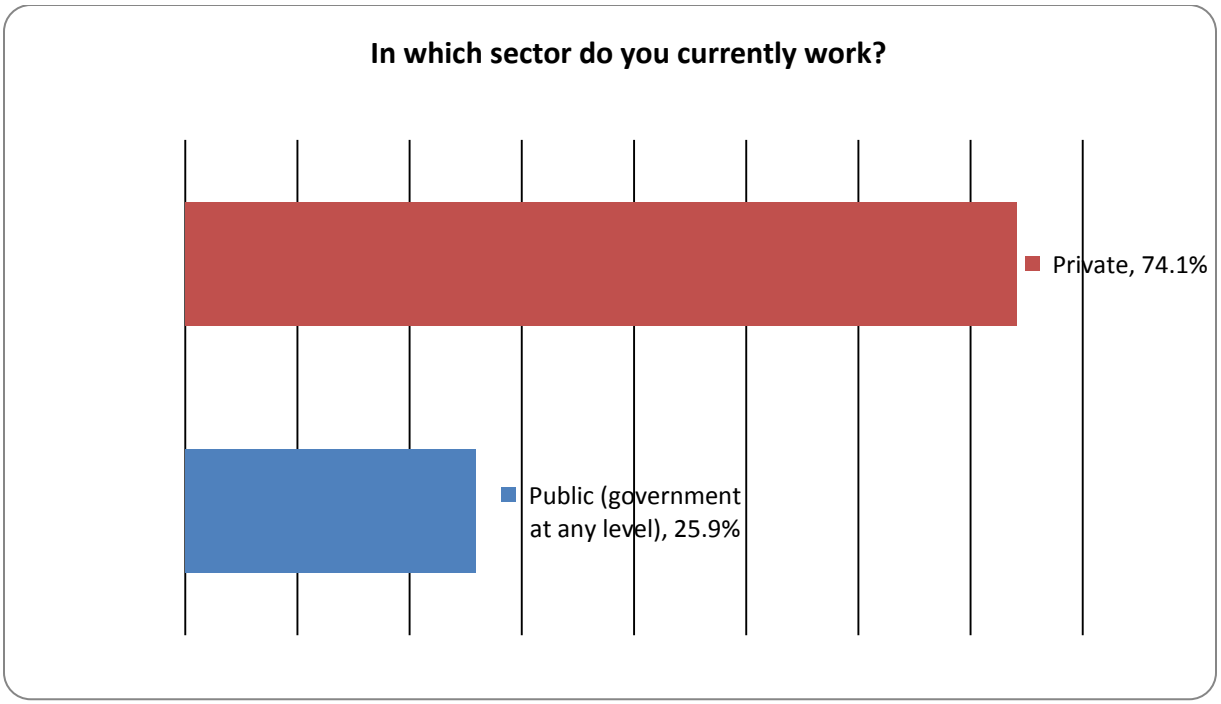


Figure 4. Sector in which respondent works

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6 Post-Survey Conference Call and Webinar

Based on this information, Professional Testing, Inc., facilitated a conference call on June 6, 2014, to review and discuss the survey results. The meeting began with a review of the demographic question results to confirm that the sample appeared to be representative of the industry. The attending Building Commissioning SMEs agreed that the group of respondents was representative of the industry. They then reviewed the tasks that were flagged for potential elimination. The resolution of this conference call was to remove none of the competency statements.

6.1 Adequacy of Respondent Demographics

Based on the results of the demographic data, the JTA Committee felt that the respondents were demographically representative and in fact the correct target population was reached.

6.2 Job Task Ratings

Fifty-five tasks were included in the final version of the validation survey. These tasks were grouped based on the seven content domains to be covered by the Building Commissioning examination scheme. The survey used a four-point rating scale for importance of task performance, using the following scale:

1 Not important
2 Somewhat important
3 Important
4 Very important

In addition to the rating scale for task importance, the survey used a six-point rating scale for the frequency of the task, using the following scale:

1 Never
2 1% to 25% of the time
3 26% to 50% of the time
4 51% to 75% of the time
5 76% to 99% of the time
6 100% of the time

Responses were tabulated, and means, standard deviations (SDs), and standard errors of the mean (SEMs) were calculated for the frequency and the importance scales. This information appears in Table 30.

In Table 30, tasks in red represent tasks with less than 2.0 on frequency AND importance. The SMEs considered these tasks during the follow up webinar to determine whether they should be dropped. The SMEs determined all tasks were needed.

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Table 30. Means, SDs and SEM of Rating Scale Responses

Duties and Tasks	Frequency			Importance		
	Means	SD	SEM	Means	SD	SEM
Managing Commissioning Projects						
Identify the scope of the project	3.68	1.68	0.08	2.61	0.71	0.05
Develop a commissioning team	3.65	1.52	0.08	2.47	0.70	0.05
Manage a commissioning budget	3.66	1.58	0.08	2.27	0.78	0.06
Identify commissioning deliverables	4.11	1.27	0.07	2.62	0.56	0.05
Participate in VE activities	1.89	1.32	0.07	1.66	0.92	0.06
Review project documents	4.05	1.25	0.07	2.70	0.50	0.04
Monitor the construction/project schedule	3.55	1.42	0.07	2.16	0.78	0.06
Participate in project meetings	3.13	1.34	0.07	1.95	0.78	0.06
Conduct commissioning meetings	4.10	1.27	0.07	2.59	0.60	0.05
Track deficiencies (issues log)	4.54	1.05	0.06	2.76	0.49	0.04
Facilitate risk assessment as it relates to commissioning activities	2.31	1.60	0.08	1.62	0.94	0.06
Assess pass/fail criteria for functional test results	4.25	1.24	0.07	2.66	0.62	0.05
Identify tasks for completion of commissioning processes	4.31	1.18	0.07	2.64	0.54	0.05
Preparing Commissioning Documentation						
Assist in developing the OPR/CFR	2.43	1.40	0.07	2.16	0.85	0.06
Create system/equipment list	3.67	1.61	0.08	2.28	0.86	0.06
Create commissioning process tracking matrices	3.16	1.61	0.08	1.94	0.90	0.06
Develop the commissioning plan	4.39	1.16	0.07	2.61	0.66	0.05
Develop commissioning schedules	3.60	1.37	0.07	2.14	0.82	0.06
Develop communications plans	3.12	1.60	0.08	1.93	0.87	0.06
Create commissioning specifications	2.85	1.51	0.08	2.23	0.84	0.06
Write system verification checklists	3.98	1.29	0.07	2.42	0.74	0.05
Create FPTs	4.30	1.22	0.07	2.72	0.55	0.05
Determine site visit protocols (logistics)	3.19	1.54	0.08	1.79	0.89	0.06
Develop issues logs	4.46	1.12	0.07	2.73	0.50	0.04
Document commissioning meetings	3.94	1.35	0.07	2.29	0.74	0.05
Write commissioning reports	4.45	1.15	0.07	2.60	0.62	0.05
Create systems manuals	2.59	1.39	0.07	1.88	0.85	0.06
Develop end of warranty review processes	2.58	1.48	0.08	1.85	0.83	0.06
Conducting Commissioning Activities						
Plan commissioning construction activities	3.68	1.40	0.07	2.27	0.79	0.06
Monitor commissioning construction activities	3.83	1.30	0.07	2.29	0.69	0.05
Facilitate the completion of construction checklists	3.39	1.49	0.08	2.11	0.87	0.06
Facilitate the acceptance phase	4.00	1.34	0.07	2.56	0.67	0.05
Managing Training Activities						
Develop training plan	2.38	1.47	0.08	1.90	0.86	0.06
Facilitate training coordination meeting	2.36	1.41	0.07	1.74	0.85	0.06
Facilitate training activities	2.48	1.41	0.07	1.88	0.82	0.06
Conduct training follow-up activities	1.89	1.48	0.08	1.58	0.87	0.06
Completing Warranty Phase Activities						
Facilitate off-season testing	2.78	1.52	0.08	2.10	0.83	0.06
Troubleshoot facility issues	3.19	1.47	0.08	2.37	0.73	0.05
Measure energy performance	1.89	1.41	0.08	1.87	0.89	0.06
Facilitate end of warranty meeting	2.21	1.64	0.08	1.77	0.89	0.06
Conducting Existing Building Commissioning						
Determine Scope of Project	3.99	1.43	0.08	2.71	0.57	0.05

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Duties and Tasks	Frequency			Importance		
	Means	SD	SEM	Means	SD	SEM
Conduct a building performance assessment	3.79	1.43	0.08	2.53	0.64	0.05
Prepare a CFR	3.24	1.59	0.08	2.23	0.78	0.06
Conduct a systems assessment	3.91	1.36	0.07	2.55	0.60	0.05
Conduct a site investigation	4.17	1.31	0.07	2.70	0.52	0.05
Recommend corrections and improvements	4.27	1.20	0.07	2.71	0.49	0.04
Oversee implementation of corrective measures	2.99	1.44	0.08	2.25	0.79	0.06
Conduct performance verifications	3.57	1.45	0.08	2.59	0.58	0.05
Conducting Ongoing Commissioning						
Measure IEQ performance	2.43	1.62	0.08	1.99	0.79	0.06
Evaluate building systems performance	3.52	1.54	0.08	2.49	0.66	0.05
Review building operating plan	3.08	1.65	0.08	2.27	0.73	0.06
Review maintenance activities	2.91	1.60	0.08	2.11	0.79	0.06
Accommodate space/function changes	2.32	1.63	0.08	1.83	0.86	0.06
Implement corrective actions	2.92	1.63	0.08	2.30	0.78	0.06
Publish measurement and performance results to stakeholders	2.95	1.84	0.09	2.23	0.90	0.06

Responses to frequency and importance rankings were combined by doubling the importance and adding the frequency to arrive at a single scale. Table 31 shows the tabulated results.

6.3 Tasks or Knowledge Missing

Survey respondents were asked if they felt any tasks or knowledge was missing from the JTA. Appendix B lists all the write-in responses. The JTA Committee reviewed all the comments and determined that no additional content below should be added to the JTA.

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Table 31. Combined Frequency and Importance Scales

Duties and Tasks	Frequency			Importance			Combined Ratings	Overall Weights
	Means	SD	SEM	Means	SD	SEM		
Managing Commissioning Projects								
Identify the scope of the project	3.68	1.68	0.08	2.61	0.71	0.05	8.90	2.06%
Develop a commissioning team	3.65	1.52	0.08	2.47	0.70	0.05	8.59	1.99%
Manage a commissioning budget	3.66	1.58	0.08	2.27	0.78	0.06	8.20	1.90%
Identify commissioning deliverables	4.11	1.27	0.07	2.62	0.56	0.05	9.35	2.16%
Participate in VE activities	1.89	1.32	0.07	1.66	0.92	0.06	5.22	1.21%
Review project documents	4.05	1.25	0.07	2.70	0.50	0.04	9.46	2.19%
Monitor the construction/project schedule	3.55	1.42	0.07	2.16	0.78	0.06	7.88	1.82%
Participate in project meetings	3.13	1.34	0.07	1.95	0.78	0.06	7.03	1.62%
Conduct commissioning meetings	4.10	1.27	0.07	2.59	0.60	0.05	9.28	2.15%
Track deficiencies (issues log)	4.54	1.05	0.06	2.76	0.49	0.04	10.06	2.33%
Facilitate risk assessment as it relates to commissioning activities	2.31	1.60	0.08	1.62	0.94	0.06	5.55	1.28%
Assess pass/fail criteria for functional test results	4.25	1.24	0.07	2.66	0.62	0.05	9.57	2.21%
Identify tasks for completion of commissioning processes	4.31	1.18	0.07	2.64	0.54	0.05	9.58	2.22%
Preparing Commissioning Documentation								
Assist in developing the OPR/CFR	2.43	1.40	0.07	2.16	0.85	0.06	6.76	1.56%
Create system/equipment list	3.67	1.61	0.08	2.28	0.86	0.06	8.24	1.90%
Create commissioning process tracking matrices	3.16	1.61	0.08	1.94	0.90	0.06	7.03	1.63%
Develop the commissioning plan	4.39	1.16	0.07	2.61	0.66	0.05	9.60	2.22%
Develop commissioning schedules	3.60	1.37	0.07	2.14	0.82	0.06	7.89	1.82%
Develop communications plans	3.12	1.60	0.08	1.93	0.87	0.06	6.98	1.61%
Create commissioning specifications	2.85	1.51	0.08	2.23	0.84	0.06	7.32	1.69%
Write system verification checklists	3.98	1.29	0.07	2.42	0.74	0.05	8.82	2.04%
Create FPTs	4.30	1.22	0.07	2.72	0.55	0.05	9.75	2.25%
Determine site visit protocols (logistics)	3.19	1.54	0.08	1.79	0.89	0.06	6.77	1.57%
Develop issues logs	4.46	1.12	0.07	2.73	0.50	0.04	9.93	2.29%
Document commissioning meetings	3.94	1.35	0.07	2.29	0.74	0.05	8.52	1.97%
Write commissioning reports	4.45	1.15	0.07	2.60	0.62	0.05	9.65	2.23%
Create systems manuals	2.59	1.39	0.07	1.88	0.85	0.06	6.35	1.47%
Develop end of warranty review processes	2.58	1.48	0.08	1.85	0.83	0.06	6.29	1.45%
Conducting Commissioning Activities								
Plan commissioning construction activities	3.68	1.40	0.07	2.27	0.79	0.06	8.22	1.90%
Monitor commissioning construction activities	3.83	1.30	0.07	2.29	0.69	0.05	8.40	1.94%
Facilitate the completion of construction checklists	3.39	1.49	0.08	2.11	0.87	0.06	7.61	1.76%

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Duties and Tasks	Frequency			Importance			Combined Ratings	Overall Weights
	Means	SD	SEM	Means	SD	SEM		
Facilitate the acceptance phase	4.00	1.34	0.07	2.56	0.67	0.05	9.12	2.11%
Managing Training Activities								
Develop training plan	2.38	1.47	0.08	1.90	0.86	0.06	6.19	1.43%
Facilitate training coordination meeting	2.36	1.41	0.07	1.74	0.85	0.06	5.83	1.35%
Facilitate training activities	2.48	1.41	0.07	1.88	0.82	0.06	6.23	1.44%
Conduct training follow-up activities	1.89	1.48	0.08	1.58	0.87	0.06	5.05	1.17%
Completing Warranty Phase Activities								
Facilitate off-season testing	2.78	1.52	0.08	2.10	0.83	0.06	6.98	1.61%
Troubleshoot facility issues	3.19	1.47	0.08	2.37	0.73	0.05	7.92	1.83%
Measure energy performance	1.89	1.41	0.08	1.87	0.89	0.06	5.63	1.30%
Facilitate end of warranty meeting	2.21	1.64	0.08	1.77	0.89	0.06	5.75	1.33%
Conducting Existing Building Commissioning								
Determine Scope of Project	3.99	1.43	0.08	2.71	0.57	0.05	9.41	2.18%
Conduct a building performance assessment	3.79	1.43	0.08	2.53	0.64	0.05	8.85	2.05%
Prepare a CFR	3.24	1.59	0.08	2.23	0.78	0.06	7.70	1.78%
Conduct a systems assessment	3.91	1.36	0.07	2.55	0.60	0.05	9.02	2.09%
Conduct a site investigation	4.17	1.31	0.07	2.70	0.52	0.05	9.58	2.22%
Recommend corrections and improvements	4.27	1.20	0.07	2.71	0.49	0.04	9.69	2.24%
Oversee implementation of corrective measures	2.99	1.44	0.08	2.25	0.79	0.06	7.48	1.73%
Conduct performance verifications	3.57	1.45	0.08	2.59	0.58	0.05	8.75	2.02%
Conducting On-going Commissioning								
Measure IEQ performance	2.43	1.62	0.08	1.99	0.79	0.06	6.40	1.48%
Evaluate building systems performance	3.52	1.54	0.08	2.49	0.66	0.05	8.50	1.97%
Review building operating plan	3.08	1.65	0.08	2.27	0.73	0.06	7.63	1.76%
Review maintenance activities	2.91	1.60	0.08	2.11	0.79	0.06	7.12	1.65%
Accommodate space/function changes	2.32	1.63	0.08	1.83	0.86	0.06	5.98	1.38%
Implement corrective actions	2.92	1.63	0.08	2.30	0.78	0.06	7.52	1.74%
Publish measurement and performance results to stakeholders	2.95	1.84	0.09	2.23	0.90	0.06	7.41	1.71%
							432.51	100.00%

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7 Conclusions and Next Steps

The JTA is the first step in the test development process; it is the primary source of evidence for the examination's validity. The final DACUM JTA is now validated and may be used by training organizations to develop training programs and by a certification body or scheme committee to develop a certification scheme. The final DACUM JTA for Building Commissioning Professionals appears in Table 23.

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Appendix A: Building Commissioning Professional Validation Study Survey

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Commercial Workforce Credentialing Council Job Task Analysis Validation

Welcome!

The National Institute of Building Sciences Commercial Workforce Credentialing Council and industry stakeholders have a project to improve the quality and consistency of commercial buildings workforce training and certification programs for four key energy-related jobs.

In support of this project, the National Institute of Building Sciences (NIBS), and Professional Testing, Inc. are seeking members of the commercial buildings industry to participate in a nationwide research study validating job task analyses (JTAs) of four key energy-related jobs in the commercial buildings sector. The JTA is a procedure for analyzing the tasks performed by individuals in a specific job, as well as the knowledge, skills, and abilities necessary to perform those tasks. JTAs are critical elements of quality training programs and professional certifications.

Current industry practitioners whose work falls into one or more of the following job categories may complete a validation study by **April 25, 2014**. Each energy-related job area survey is nine pages. For each survey you will rate the frequency and importance of the work activities associated with each area of responsibility. Participation should take approximately 30–45 minutes and individuals may complete more than one validation study, if applicable. When determining applicability, practitioners should focus on the details of the job descriptions rather than on the job title, as job titles frequently vary from one employer to another.

You do not have to respond to all surveys however we ask you to please finish any survey you start.

If you do not have time to complete the survey in one sitting, you can stop and complete the survey later (provided you use the same computer and have cookies enabled on that computer). The survey will resume where you stopped. If you do not have cookies enabled, the survey will start over from the beginning again.

Your responses will be kept confidential, and we appreciate your assistance. If you have any difficulty responding to this survey, please contact NIBS at dsmith@nibs.org.

On the next page you will be given the opportunity to select the energy-related job survey you are interested in responding to.

Commercial Workforce Credentialing Council Job Task Analysis Validation

*** Following is a description of the remaining surveys you may respond to. Please review the job descriptions and select the survey for which you feel most qualified. Please select the survey for which you wish to respond:**

- Energy Manager - Responsible for managing and continually improving energy performance in commercial buildings by establishing and maintaining an energy program management system that supports the mission and goals of the organization.
- Building Energy Auditor - Energy solutions professional who assesses building systems and site conditions; analyzes and evaluates equipment and energy usage; and recommends strategies to optimize building resource utilization.
- Building Commissioning Professional - Leads, plans, coordinates and manages a commissioning team to implement commissioning processes in new and existing buildings.

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Please answer the following background questions. Your responses will be kept confidential and this information will only be used for statistical purposes.

In which state do you primarily work?

Other (please specify)

What is your highest level of education?

- Less than High School
- High School or Equivalent
- Some College
- Two Years of College/Technical School/Community College
- Bachelor's Degree
- Graduate Degree

How many years of experience do you have in an energy related industry (all jobs combined)?

- 5 years or less
- 6-10 years
- 11-15 years
- 16-20 years
- 21 or more years

How many years of experience do you have specifically as a Building Commissioning Professional?

- none
- 5 years or less
- 6-10 years
- 11-15 years
- 16-20 years
- 21 or more years

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In which sector do you currently work?

- ○ Public (government at any level)
- ○ Private

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Instruction Page

In the following pages, you will be asked to think about tasks that a Building Commissioning Professional does and to indicate the frequency with which a Building Commissioning Professional performs each task on a job. Then, considering the same task statement, you will be asked to indicate how important it is that a Building Commissioning Professional knows how to do each of these tasks. To respond click the drop down menu and select your response.

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When a Building Commissioning Professional is Managing Commissioning Projects, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Identify the scope of the project		
Develop a commissioning team		
Manage a commissioning budget		
Identify commissioning deliverables		
Participate in VE activities		
Review project documents		
Monitor the construction/project schedule		
Participate in project meetings		
Conduct commissioning meetings		
Track deficiencies (issues log)		
Facilitate risk assessment as it relates to commissioning activities		
Assess pass/fail criteria for functional test results		
Identify tasks for completion of commissioning processes		

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Commissioning Professional is Preparing Commissioning Documentation, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Assist in developing the OPR/CFR		
Create system/equipment list		
Create commissioning process tracking matrices		
Develop the commissioning plan		
Develop commissioning schedules		
Develop communications plans		
Create commissioning specifications		
Write system verification checklists		
Create FPTs		
Determine site visit protocols (logistics)		
Develop issues logs		
Document commissioning meetings		
Write commissioning reports		
Create systems manuals		
Develop end of warranty review processes		

When a Building Commissioning Professional is Conducting Commissioning Activities, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Plan commissioning construction activities		
Monitor commissioning construction activities		
Facilitate the completion of construction checklists		
Facilitate the acceptance phase		

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Commissioning Professional is Managing Training Activities, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Develop training plan		
Facilitate training coordination meeting		
Facilitate training activities		
Conduct training follow-up activities		

When a Building Commissioning Professional is Completing Warranty Phase Activities, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Facilitate off-season testing		
Troubleshoot facility issues		
Measure energy performance		
Facilitate end of warranty meeting		

When a Building Commissioning Professional is Conducting Existing Building Commissioning, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Determine Scope of Project		
Conduct a building performance assessment		
Prepare a CFR		
Conduct a systems assessment		
Conduct a site investigation		
Recommend corrections and improvements		
Oversee implementation of corrective measures		
Conduct performance verifications		

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Commissioning Professional is <u>Conducting On-going Commissioning</u>, please indicate how frequently this task is performed on the job and how important this task is to a Building Commissioning Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Commissioning Professional?
Measure IEQ performance		
Evaluate building systems performance		
Review building operating plan		
Review maintenance activities		
Accommodate space/function changes		
Implement corrective actions		
Publish measurement and performance results to stakeholders		

Commercial Workforce Credentialing Council Job Task Analysis Validation

Review the specialized knowledge below and indicate the depth of knowledge that is required of a Building Commissioning Professional.

	No knowledge needed	Some knowledge needed	Moderate knowledge needed	Extensive knowledge needed
BAS operations	○	○	○	○
Basic accounting knowledge	○	○	○	○
Basic construction	○	○	○	○
BIM	○	○	○	○
Budgeting	○	○	○	○
Building maintenance	○	○	○	○
Building operations	○	○	○	○
Building science	○	○	○	○
Building systems	○	○	○	○
Business operations models	○	○	○	○
Climate zone variations	○	○	○	○
CMMS	○	○	○	○
Commissioned systems knowledge	○	○	○	○
Commissioning process	○	○	○	○
Construction budgets and costs	○	○	○	○
Construction contracting	○	○	○	○
Construction documents and specifications	○	○	○	○
Construction estimating	○	○	○	○
Construction management processes	○	○	○	○
Construction methods and concepts	○	○	○	○
Construction scheduling	○	○	○	○
Contract knowledge	○	○	○	○
Contractual labor issues and structures	○	○	○	○
Control systems	○	○	○	○
Controls graphics	○	○	○	○
Controls theory and operations	○	○	○	○
Commissioning budgeting	○	○	○	○
Commissioning manpower requirements	○	○	○	○

Commercial Workforce Credentialing Council Job Task Analysis Validation

Commissioning processes and procedures				
Commissioning reporting documentation				
Commissioning schedules				
Commissioning sequence of events				
Commissioning team member requirements				
Data normalization (weather, days of the month, etc.)				
Design documents				
Developing ROIs				
Divisions used in construction specifications				
Documentation protocols				
Economic analyses				
Energy calculations				
Energy management fundamentals				
Energy modeling				
Energy performance				
Energy use analysis				
Engineering principles				
Environmental sustainability and efficiency goals				
Evidence collection				
Expected equipment performance				
Facilities management				
Failure mode analysis				
Fault diagnostic knowledge				
Functional testing procedures, equipment, and results				
General construction process knowledge				
How system components work together				
IEQ				
Incentive programs				

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Integration protocols				
Issue resolution process				
Life-span cost and quality				
M&V				
Maintainability, access, and operational requirements				
Maintenance contracts				
Maintenance issues				
Maintenance management systems				
Maintenance procedures				
Manpower utilization				
Manufacturers of commissioning equipment				
Metering				

Commercial Workforce Credentialing Council Job Task Analysis Validation

Review the specialized knowledge below and indicate the depth of knowledge that is required of a Building Commissioning Professional.

	No knowledge needed	Some knowledge needed	Moderate knowledge needed	Extensive knowledge needed
Methodology to inspect systems	○	○	○	○
Needs assessment processes	○	○	○	○
O&M Procedures	○	○	○	○
Occupancy impacts	○	○	○	○
Operating techniques	○	○	○	○
OPR	○	○	○	○
Owner's operational configuration and personnel	○	○	○	○
Potential environmental, health, and safety (EHS) hazards and risks	○	○	○	○
Prevailing commissioning pricing structures	○	○	○	○
Project documents	○	○	○	○
Project knowledge	○	○	○	○
Project management	○	○	○	○
Project management process	○	○	○	○
Project objectives, goals, and purpose	○	○	○	○
Proportional balancing	○	○	○	○
Records/document management	○	○	○	○
Regression modeling	○	○	○	○
Required construction and installation tests	○	○	○	○
Risk assessment and management	○	○	○	○
ROI analysis	○	○	○	○
Safety issues and requirements	○	○	○	○
Sampling protocols and procedures	○	○	○	○
Sampling techniques	○	○	○	○
Scheduling	○	○	○	○
Scope of work	○	○	○	○
Sequence of construction	○	○	○	○

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activities				
Sequence of operations				
Service contracts				
Site safety				
Space usage and occupancy schedules				
Special tests (TAB, etc.)				
Spreadsheet development				
Start up requirements				
Statistical modeling				
Structure of contracts				
Submetering				
Substantial completion and final completion				
Successful training outcomes				
Survey techniques				
System operations				
Systems engineering				
Systems integration				
Systems interactions and integration				
Systems understanding				
TAB				
Test development				
Testing durations				
Testing equipment and procedures				
Testing procedures				
Testing sequencing				
Testing standards				
Testing, training, design and construction requirements				
Training evaluation				
Training facilitation				
Training methodologies				
Training plans				
Trend analysis				
Trend data				

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Troubleshooting methodologies				
Troubleshooting techniques				
Typical site visit protocols				
Unique requirements for facility usage				
Utility bill structures				
Utility rate structures				
Utility rebate incentives				
Various control technologies (new and legacy)				
Warranties				
Warranty provisions				

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Are there any job related tasks that are missing from this survey?

- ○ No
- ○ Yes

If yes, what?

Is there any knowledge that we did not include in this survey that should have been included?

- ○ No
- ○ Yes

If yes, what?

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If a certification examination were to be developed based on this information, please enter the percentage of the exam that should be devoted to each of the content areas listed below.

(Note: Your responses should add up to 100.)

Managing Commissioning Projects	
Preparing Commissioning Documentation	
Conducting Commissioning Activities	
Managing Training Activities	
Completing Warranty Phase Activities	
Conducting Existing Building Commissioning	
Conducting On-going Commissioning	

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* **Do you wish to respond to another survey?**

- ○ Yes
- ○ No

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- Building Energy Auditor - Energy solutions professional who assesses building systems and site conditions; analyzes and evaluates equipment and energy usage; and recommends strategies to optimize building resource utilization.
- Building Operations Professional - Manages the maintenance and operation of building systems and installed equipment, and performs general maintenance to maintain the building's operability, optimize building performance, and ensure the comfort, productivity and safety of the building occupants.

Commercial Workforce Credentialing Council Job Task Analysis Validation

Thank you! We appreciate your input!

You have completed the survey, and we really appreciate the time you have taken to share your job with us! NIBS and Professional Testing would like to thank you for taking the time to help.

Appendix B: List of Write-In Comments

- 1) Coordination of Cx site visit scheduling with construction trades scheduling. Scheduling at appropriate times to gauge project progress prior to pivotal changes which may pose challenges; e.g., ceiling grid installation, accoutrements, invasive structures which may cause access issues. Planning, prioritizing events in hierarchical order as needed per given project issues - unforseen developments, force majeure, etc.- which vary substantially from project to project. 2) Performance / Verification / Witness of Duct Leakage testing by qualified independent verifier or Cx team member. 3) Building Envelope / Enclosure / Compartment testing.
- 1. Performance Bench-marking.
- Ability to built teams and trust among stakeholders
- Building envelope testing strategies Data trending and analysis
- Commissioning specification writing.
- Communication Skills
- Communication skills
- Communication skills - it is paramount that a commissioning provider be able to communicate with a wide variety of stakeholders, from architects / engineers to various skilled trades, etc.
- Conflict Management
- Coordination with the various contractors that are involved, particularly the controls contractor.
- Design and submittal review processes.
- Design Review Oversees development of BOD Witness TAB activities
- Design Review Envelope inspections Site Visit Reporting
- Design review at the following stages: 25% design 50% design 75% design 100% construction
- Design review capability System analysis review during design
- Design review of project documents.
- Device/sensor calibration, control logic
- Diagnostic Testing
- didn't see anything in there about knowing about LEED, IAQ, MEP design, ASHRAE standards such as minimum ventilation requirements
- Document Review (O&M manuals, submittal reviews, etc.) Technical Writing (Systems Manuals, etc.)
- Document review procedures.
- Electrical testing
- Engineering Design Experience.
- Interviews with owner, operator, and building occupants. This is extremely critical in developing a CFR for a retro-commissioning project.
- Is that the applicant is currently commissioning or TAB certified by one of the three body's TAB firm Certified by one of the following: (AABC, NEBB, & TABB) Cx firm Certified by one of the following: (ACG, NEBB, & TABB) As a supervisor, test and balance engineer or commissioning authority and have documented experience in trade performing TAB and/or Cx activities.
- It asked for Create System Manuals, Usually a Cx professional reviews system manuals and makes recommendations. The manufacturers and installers create the system manuals. Therefore review of System Manuals should be included.
- Managing internal strife (within Cx organization)
- maybe
- More on issue resolution and report documentation

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- Most Cx issues are the result of poor design by the MEP, refusal to take responsibility, and incompletely communicating the design to the contractor. The CxA must specify required design submittals and the scheduling of those submittals. It's not enough to review plans and specs; the CxA must review the calculations that go into the design. If the CxA is responsible for verifying the design meets the OPR energy goals, he must review the energy model as well. A well specified control system is key, but rre. The MEP must provide controls diagrams, sequences, and a points database indicating point source (sensor or BACnet), set points, alarm points, alarm results (shutdown or alarm, manual or auto reset), and points to be trended and points on the GUI.
- People skills. Important to know how to communicate with the other Cx team members to keep a cooperative spirit
- Performance of peer review of the M/E/P design drawings and specifications. interaction with contractors and designers
- Performing Quick fixes during Retro Commissioning
- Proficiency with construction scheduling software such as Primavera. Knowledge of programming fundamentals (i.e. C++ & Basic). Extensive low, medium and high voltage electrical fundamentals and safety regulations in accordance to NEC and OSHA (NIOSH).
- Quick fixes methodologies; conducting no cost/low cost measures protocols.
- Relationship building, communication skills, multi-tasking, writing skills
- sampling should not be allowed
- Site visit frequency Importance of witnessing startups
- Stand Alone Specification Sections for Mock ups Specification for Building Enclosure Commissioning submittal review shop drawing review mock up shop drawing review first work by site crews Site Specific Performance Verification Plan Self Audits
- Submittal Reviews TAB Verification
- TAB was mentioned but not specifically the task of TAB Verification. We perform this on every Cx project.
- Technical commissioning of building systems. Meaning, actual measurement and testing rather than checklists.
- Technical knowledge of systems, such as Test & Balance DETAILED knowledge of how to test & balance a system. There is more to a TAB review than looking at a final report. A CxA needs to know if the procedures being implemented are correct. The CxA needs field experience to be able to look at an installation in progress and identify potential problems. The need to have the ability to proactively identify future issues BEFORE equipment is running. A CxA brings zero value to a project if they merely identify something isn't working on an issues log and send it out to the project team. For problems uncovered during testing, the CxA needs to have the technical background help facilitate solutions....."this item failed because of X, and needs to be corrected in X manner."
- Terrence Rollins, MBA, CEM, CDSM, CSDP RHC Global Energy Solutions trollins@earthlink.net AEE Regional Energy Professional of the Year 2013 I recently witnessed a group that did not have experience to monitor a commissioning agent on a confidential government contract. I was not involved in the project, knew the building was not ready for turnover, and wrote a lean six sigma regarding the project, which was used and stooped the premature move in by the customer. A question could read: Have you as a energy manager commissioned a facility, or energy project over the past 5, 10, 15 or 20 years? If not, Why?
- The interaction between the TAB, DDC, Mechanical/Electrical contractors and the Cx authority. this is very important. Also, the lack of owners involvement in the most of the Cx jobs I've done.

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- The Survey does not address continuous updating the original commissioning plan during the life of the project.
- The understanding of how the systems are designed as this is a large tool for CxA
- This may be covered by default in the other categories,,,,, but it seems like every project requires a “Variance Evaluation” from the CxA. Where something (sequence, system, piece of equipment, etc.) is never going to provide 100% match of expectations. The CxA is a critical component in determining if final results are acceptable and if/how the results effect other areas.
- Verify calibration and TAB test procedures
- You guys are hung-up on Energy, so is the untied states. Energy is important but what if the Owners Project Requirement (OPR) is not concerned with energy conservation? Your survey and professional organizations (NEBB) are hung up on "selling" training courses during the recession. All the professional certification that have been created in the last 10 years LEED_AP, Certified Commissioning Professional, Certified Energy Manager (plus all the other courses by AEE) do not strengthen the industry. I was working with two LEEP_AP and CEM yesterday that could not find their way through a 410a refrigeration cycle to conduct the seasonal start-up on air handlers they both have decision making roles with a public agency in New York City. The survey should focus on what the individual skill set and experience needed to effectively restore a Building Management System (BMS) to it original operational status at the time of new. Once the BMS status has been restored the data that is logged to indicate energy efficiency maybe be recorded and acted upon. I would challenge anyone national that once this has been achieved this is the largest single energy optimization project that will be gained in the building.
- You named a lot, I think you have them covered
- 1) Knowledge of what clearly constitutes a "layman" versus what type of qualified profesional is needed to perform Cx tasks as a member of a Cx team where a specific skill set is deemed necessary. 2) Knowledge of building power consumption as it relates to Power Factor as well as Efficiency; overall Mechanical Efficiency of a building and its components which would cause Power Factors to be deemed lacking or insufficient. 3) Knowledge of Heat Flow Fundamentals and how these pertain to "Effectiveness" in heat exchange systems, and not only "Efficiency" of HVAC and related systems. 4) Knowledge of acknowledged failures in current technologies, obsolete testing and control methods, and other shortcomings which could adversely affect building performance for predictable outcomes as firmly established on record or in general Engineering principles through research, or as may otherwise be readily noted on historical record and case studies. 5) Some electrical knowledge as related to High and Low Voltage transformers, line gauge, assessing line losses, and appropriate sizing of these components for what will ultimately determine the given Building's final power draw after Cx has been completed. 6) Basic knowledge of legal procedures and protocols which must be followed from initial steps to preservation of any such evidence or "sampling" of data, such as in collecting evidence from a crime scene and what constitutes a breach of that procedure or process if not followed accordingly and in proper order. Where so called "forensic engineering" is concerned, that testing and gathering of crucial data may be compromised by not following such a procedure. Similarly, the wild card of "tampering" with evidence or possible "sabogtage" of systems may enter the equation and thus cause tainted test results bringing false conclusions. This may also allow a subject to skip over steps in the process and thus compromise the test results or circumvent the issues. 7) Knowledge of what true "Third Party Independent Verification" means when related to the Cx process and other related processes, such as Testing and Balancing, Leakage Testing, and other technically intensive testing as it pertains to a given

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project. This means specific tests conducted by an Independent Verifier, an apropriate entity who has no vested interest in the outcome of the project and who has proper qualifications in the specialized areas of testing as required. Unqualified individuals making proffered suggestions and executive decisions on Cx projects is a prominent issue that detracts from the Cx process and ultimate achievement of goals.

- 1. There is a difference between Functional Testing & Performance Testing. 2. Measurement and Verification are more important to a Cx effort than modeling which is more of a design activity expressed in the Basis of Design review Cx activity. 3. The Cx Process is the gateway to Sustainable Occupancy. Focus only on Project outcomes, e.g. budgets, compromises the effectiveness of operations. Projects are focused on Design and Construction but Sustainable Occupancy depends on input from and participation of the Operations and Maintenance interests. 4. Knowledge of Compliance issues e.g. building codes, other regulatory requirements, corporate and internal policy, and voluntary goals need to be considered when reviewing acceptance criteria, elements of training, and planning ongoing or retro commissioning activities.
- Ability to review the drawings. I am finding as a CxA that the drawings are the best place to ward off many of the errors that end up on the projects. We have just recently worked on a project that we didn't do the design review and it is truly a nightmare. Because of this, our company will no longer take on a project that we haven't been allowed to review the drawings.
- Building Enclosure Condition Assessment Building Enclosure Coordination Process
- Building systems and mechanical, electrical and plumbing design experience.
- Certification training, or just certifications by: 1) State (PE or other) 2) NIBS, NEBB, ASHRAE or other
- CFR - Current Facilities Report
- Communication/leadership skills to run meetings and facilitate getting the team members to cooperate and produce results.
- Communication Skills
- Communication Skills
- Communication skills. Small group and individual communications skills are necessary.
- Communications skills
- Conflict Management Contract Claims
- Construction specifications
- Contractor team typically determines and keeps the schedule
- Contractual issues related to Cx. The Owners Project Requirements (OPR) apply only to the design team; the contractors are not required to meet the OPR and typically don't even see the OPR. The owner needs to understand that for most CxAs and ASHRAE Guideline Zero and Std 202, that energy modeling does not exist and that few CxAs take responsibility for meeting the OPR energy goals. Owners need to understand that the USGBC or most utility DSM EDA programs have no QA reviews of energy models, which are typically performed by the design team, who are more concerned with LEED points than good design. 3rd party verification of energy modeling (maybe by the CxA) is key to buildings meeting their energy goals.
- Control logic versus sequence of operations
- Cx and knowledge of Renewable energy systems Cx of Life safety systems Knowledge of various MEP systems Knowledge of codes: IBC, IgCC, IMC, IPC, NFPA, IECC, ASHRAE 90.1, 62.1, 55, etc.
- Data Visualization. This goes along with reporting, but is a unique knowledge set unto itself.
- Electrical Safety Procedures, General Safety, Lock out procedures

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- Engineering Design Cx meets the definition engineering in all state laws and statutes and therefore a Cx authority in charge of a Cx project should be a licensed, experienced engineer.
- General knowledge of the use of tools and how to properly use, store and maintain them.
- HVAC Engineering experience HVAC Design experience Electrical systems design and testing experience
- HVAC theory and design techniques
- I believe all CxAs should have to pass a technical exam, similar to the NEBB requirements. NEBB requires the same written exam as a NEBB TAB Certified Professional. There are too many CxAs administering a process without understanding the technical aspects behind the process.
- I think you needed more detailed breakdown of "construction document review"; to many people this is incorrectly thought of as a peer review. It should be described as a commissioning review and the questions should have broken out the items in that review: conformance to OPR, best practices, "commissionability", maintenance requirements, etc.
- Identification of when sampling activities are acceptable/not acceptable; potential adverse results that can be experienced by the owner when sampling activities are integrated into new building, existing building and on-going commissioning programs.
- Interview techniques Basic people skills
- Is that the applicant is currently commissioning or TAB certified by one of the three body's TAB firm Certified by one of the following: (AABC, NEBB, & TABB) Cx firm Certified by one of the following: (ACG, NEBB, & TABB) As a supervisor, test and balance engineer or commissioning authority and have documented experience in trade performing TAB and/or Cx activities.
- Knowledge about renewable energy technologies and systems such as photovoltaic, eolic, geothermal and fuel cells. Each with specific commissioning procedures along with performance verification in accordance to design documents and manufacturer procedures. In addition, knowledge about building envelope air barrier testing and ductwork air pressurization testing general procedural standards.
- Load calculation and equipment sizing understanding. Understanding design sizing criteria (duct sizing, pipe sizing). Regarding the above 2, it's very common that a duct or pipe section is not sized correctly in the first place (in design drawings). Ultimately, if not caught during design, it often creates performance issues which the CxA would be expected to find and subsequently be involved in troubleshooting. The CxA needs to understand load calculation fundamentals then and be able to identify appropriate system (duct, pipe, equipment) sizes needed to produce and convey the energy flows associated with the loads.
- maybe
- Methods and/or techniques for motivating contractors to perform pre-start checkouts
- More on team building and communication.
- New Construction a Commissioning Agent works directly for the owner, to measure and verify to the owner, the owner has received a building that meets the minimum requirement of the Owners Project Requirement (OPR)... What does that mean? The survey had numerous questions that are overlapping with the responsibility of the AOR and EOR which is dangerous. The commissioning professional can and should be influential during the basis of design but once the design has been delivered by the EOR to the AOR/owner and the project has been awarded to a General Contractor the Commissioning Agent become an "inspector" for the owner. Their are several tasks that this may take we perform system fabrication and installation inspections on biweekly intervals to report when a site condition will negatively impact the OPR. The CM is then to take the corrective action necessary to resolve the reported issue. When the General Contractor has issued Substantial Completion the Commissioning Agent will conduct the

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Functional Performance Test (FPT) to determine if the OPR has been achieved. We are ALWAYS involved with system/component troubleshooting to correct for the minor system deficiency that are inherent with all construction projects, no fault of the GC team, to achieve the OPR. Remember the owner also holds contract with the following: Architect of Record (AOR) is contracted to write the OPR, typically the AOR will subcontract an Engineer of Record (EOR) to create the Construction Documents (Specification and drawings set) to identify the work needed to be completed to deliver the minimum requirement of the OPR. The AOR may also hire a Commissioning Agent to conduct the Current Facility Requirements as part of the preparation of the OPR. This is done because the AOR holds the design contract with the owner and to protect the AOR they need to be responsible for the existing building conditions that will effect the basis of design. General Contractor is hired to subcontract the construction trades (Mechanical, Electrical, Plumbing (MEP) as specified in Bid Documents created by AOR/EOR. Construction Manager (CM) may be hired by the owner to manage the General Contractor and the logistics of the project, normally based on the size of the project the larger the project the need for a CM otherwise the responsibility for the logistics is carried by the General Contractor

- One of the most important things we do is to test the building control system. Some of the survey questions ask about the required knowledge of building controls however I did not see any questions related to the required knowledge of electrical control systems and control system hardware installation review and point testing.
- Other building systems i.e. Fire Alarm, Fire Protection, Electrical, Building Envelope, Critical vs non-critical commissioning...the questions seemed to all be directed towards mechanical system commissioning, but commissioning involves much more than just mechanical systems.
- Owner expectation management and communication Experience with current industry best practices Working within an owners budget/maximizing return on commissioning project costs Engaging the contractors/other involved parties in the process
- People skills
- people skills, diplomacy, persuasion communication skills - oral and written troubleshooting skills - you may have touched on that, can't remember
- Possibly the knowledge of how to generate an OPR through facilitation of a group event / workshop. This is core to the success of a project and potential value that the commissioning process brings to a project (unfortunately it is rarely accomplished as it is intended).
- Presentation skills/knowledge Interpersonal skills/knowledge Knowledge in LEED and other building quality/environmental impact programs
- Regulatory knowledge
- Should at minimum have a Test and Balance Certification from either AABC or NEBB in addition to BSC
- Should have asked in what depth of commissioning is being requested on most projects. A lot of projects are just requesting pre-functional and functional testing of HVAC systems. The customer doesn't want to pay for anything else
- Skill level required for tasks stated.
- Software Programs used in the commission's activities. Auto desk applications. Specific progs.
- Specific knowledge relative to the individual MEP systems and Building Enclosure assemblies
- Technical, HANDS ON experience. As identified above, too many people claiming to be CxA's don't have the field experience to provide value to overseeing TAB or Cx tests. For example, how can a CxA accept a TAB report, if they themselves do not know the proper TAB procedures? As far as commissioning goes, the testing criteria NEEDs to contain actual questions regarding HVAC, controls, lighting, domestic water, TAB systems and processes that they are allegedly

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experts in. Too many of the current "Commissioning Certifications" only test on the Cx process. Knowing what an OPR is doesn't necessarily provide the owner value over the technical commissioning person who can identify that an airflow measuring station is installed incorrectly, leading to inaccurate readings, and a control loop that is subsequently hunting.

- Terrence Rollins, MBA, CEM, CDSM, CSDP RHC Global Energy Solutions trollins@earthlink.net AEE Regional Energy Professional of the Year 2013 Another question: Have you commissioned any projects as a owner of the facilities, not using a 3rd party professional, and have you developed and implemented annual or retro-commissioning programs?
- The retro-commissioning process is very different from the commissioning process and I feel this survey did not adequately address the differences.
- Thermography
- This survey seems much more focused on New Building Commissioning. Although Existing Building Commissioning is included and addressed to some extent, the process is notably different. It should be more clear to the market as well as Providers that New Construction Commissioning Services and Existing Building Commissioning services should not be discussed as one and the same. Existing Building Commissioning most notably has a different meeting structure, timeline and is frequently constrained (in full form) by budget and document/drawing, or controls limitations.
- Use of documentation software, i.e. ftp sites, autocad, revit, and adobe.
- Use of software tools, email, report writing skills
- Whether or not a commissioner should be certified, licensed, etc.

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