

Training Commissioning Technicians

Jim Magee

Facility Commissioning Group

Associated Air Balance Council Commissioning Group (ACG)

Synopsis

With the advancement of commissioning services throughout the construction industry, provider firms have increasingly utilized technicians and testing specialists to execute commissioning processes, particularly on larger, more complicated projects. Individuals qualified to perform specialty testing in various purviews require an understanding of commissioning methodology to augment their technical field of expertise relative to the mission of incorporating data and information within the context of a commissioning plan. Whereas ever more abundant educational and training resources are available for owners, designers and commissioning authorities, relatively few avenues exist for technicians to receive training and certification in the commissioning process.

This paper explores the needs and resources available and under development for obtaining and training technical personnel to support commissioning activities. The construction industry offers a diverse variety of specially trained personnel qualified to handle most commissioning assignments; however, commissioning services providers recognize that an additional level of familiarization with commissioning practices is beneficial for those individuals to incorporate their work into the commissioning documentation stream. We will explore the various organizations that provide certified skills such as HVAC technicians, test and balance engineers and technicians, electrical testing specialists, fire alarm and fire protection experts, security system technicians, low voltage experts, building envelope professionals, and many others. We will examine in detail what additional tools are needed to integrate these skills into the delivery of commissioning services that minimizes the need for duplicative documentation and methodology.

As building owners increasingly require commissioning on projects, commissioning services providers experience a significant challenge in finding capable commissioning technicians. Our program will provide active audience engagement to capture the experiences and requirements of conference attendees regarding commissioning technician training programs. This information could be useful to the NCBC's mission of providing future relevant programs.

An efficient means of certifying understanding of the commissioning process commensurate with the technical specialties available would enable commissioning firms to select and apply experts more efficiently, thereby streamlining services and passing on value to building owners. Increased utilization of technicians will deliver greater value for more modest fees without diluting the professional quality of the commissioning process. Combining commissioning

professionals with certified commissioning technicians offers an efficient, confident, quality process for owners, designers and commissioning services providers.

About the Author

Jim Magee is president of Facility Commissioning Group, a third party independent commissioning services provider from Nicholasville, Kentucky. Jim earned a Bachelor of Science degree from the University of Kentucky in Mechanical Engineering. Jim is president of the Associated Air Balance Council Commissioning Group (ACG). He has 21 years of HVAC Test and Balance experience and is an AABC certified Test and Balance Engineer (TBE). Jim is a co-author of the *ACG Commissioning Guideline for Building Owners, Design Professionals, and Commissioning Service Providers*, and he is a charter Certified Commissioning Agent (CxA). Jim is a member of the Building Commissioning Association (BCA), and a board member of the SERBCA chapter. He is a member of ASHRAE, ISPE and the USGBC. Jim specializes in HVAC troubleshooting and laboratory fume hood systems, and practices third party independent commissioning implementation with programs and clients in Kentucky, Indiana, and elsewhere.

Training Commissioning Technicians

Based on responses from members to assessment surveys, ACG (Associated Air Balance Council Commissioning Group) is developing a Commissioning Technician (CxT) certification program for release in 2007. The objective of this program will be to serve our ACG Certified Commissioning Authority (CxA) members, as well as our associate members composed of owners, designers, vendors, and advocates, with a means to provide qualification for individuals who will work under the direction and direct supervision of CxA's in implementing commissioning process on construction projects. PECCI and BCA have recently and in the past conducted surveys to determine commissioning provider firm needs with regard to training opportunities. The need for technician support for Commissioning Authorities is well known in the industry, and a frequent topic among commissioning provider firm representatives during meetings and networking opportunities.

With the advancement of commissioning services throughout the construction industry, provider firms have increasingly utilized technicians and testing specialists to execute commissioning processes, particularly on larger, more complicated projects. Individuals qualified to perform specialty testing in various purviews require an understanding of commissioning methodology to augment their technical field of expertise relative to the mission of incorporating data and information within the context of a commissioning plan. Whereas ever more abundant educational and training resources are available for owners, designers and commissioning authorities, relatively few avenues exist for technicians to receive training and certification in the commissioning process.

Commissioning provider firms, owners, designers, vendors, and contractors determine the skills and knowledge levels of the individuals they hire to support commissioning activities. The purpose of a commissioning technician certification program is to teach and test comprehension of the commissioning process and the details of implementing this process in a construction environment. Technical skills are acquired by CxT candidates through existing industry sources as the basis of knowledge for commissioning specific system types. This core technical skill set is augmented by learning the commissioning process, commissioning roles and responsibilities, and practical construction site commissioning protocols. Technician certification will test for both the commissioning process knowledge and a firm grasp of how these concepts are implemented through field activities. Communication and accountability team building attributes form the foundation of commissioning execution. Technician training stresses the importance of following carefully crafted information and distribution protocols tailored for each construction project.

Defining CxT

Commissioning Technician (CxT) certification should identify and test for the skills and characteristics required by field personnel to successfully implement instructions from a certified Commissioning Authority (CxA). Both demonstrated technical trade/purview accomplishment and direct CxA supervision are prerequisite to CxT training. Commissioning proposals and

commissioning plans must clearly define technician roles for specific projects. The general philosophy adopted by ACG to date is that CxT's serves as "eyes and ears" for the CxA at the job site. CxT's can perform many routine activities more efficiently. For instance, weekly construction meetings can be routinely attended by a qualified CxT who reports site progress and quality control to the CxA through daily reports including digital photography. The CxA will be active in critical meetings as required, while delivering to the owner/client value added services at reasonable cost. Table 1 contains a working template for assigning roles and responsibilities for CxT and CxA commissioning service providers.

Table 1: CxA/CxT Responsibilities Matrix

Phase of Project	CxA Responsibility	CxA/CxT Shared Responsibility	CxT Responsibility
PRE-DESIGN	Develop Cx Scope Review DID/OPR Prepare Cx Outline Attend Meetings		
DESIGN	Identify Systems to Cx Design Reviews Review Cx Specifications Design Phase Cx Plan Design Phase Cx Kick-Off Meeting Draft SVC's Draft FPT's Attend Meetings Attend Pre-Bid Meeting	Design Phase Cx Kick-Off Meeting Draft SVC's Draft FPT's	Design Phase Cx Kick-Off Meeting Draft SVC's Draft FPT's
CONSTRUCTION	Attend Pre-Construction Meeting Construction Cx Plan Cx Schedule Integration Pre-TAB Report Review Submittals Review Update SVC's Approve SVC's Distribute SVC's Update FPT's Approve FPT's Distribute FPT's Site Observations SPQC Reports Approve SPQC Reports Distribute SPQC Reports	Attend Pre-Construction Meeting Update SVC's Distribute SVC's Update FPT's Distribute FPT's Site Observations SPQC Reports Distribute SPQC Reports	Attend Pre-Construction Meeting Update SVC's Distribute SVC's Update FPT's Distribute FPT's Site Observations SPQC Reports Distribute SPQC Reports

Table 1: CxA/CxT Responsibilities Matrix (continued)

Phase of Project	CxA Responsibility	CxA/CxT Shared Responsibility	CxT Responsibility
CONSTRUCTION	RTF's Approve RTF's Distribute RTF's	RTF's Distribute RTF's	RTF's Distribute RTF's Coordination Meetings Progress Meetings Attend Meetings
	Attend Meetings Supervise/Direct CxT	Attend Meetings	Attend Meetings Facilitate SVC Initials Witness Install Tests
	Monitor Controls Install Monitor TAB Execution Facilitate Start-Up of Commissioned Systems	Monitor Controls Install Monitor TAB Execution Facilitate Start-Up of Commissioned Systems	Monitor Controls Install Monitor TAB Execution Monitor TAB Execution Facilitate Start-Up of Commissioned Systems Collect Manuf. Checklists
	Cx Schedule Updates Review O&M Documents Review "As-Built" Record Facilitate O&M Training Track RFI's/CO's/SI's Monitor Field Reports	Review O&M Documents Review "As-Built" Record Facilitate O&M Training Track RFI's/CO's/SI's Monitor Field Reports	Review O&M Documents Review "As-Built" Record Review "As-Built" Record Facilitate O&M Training Track RFI's/CO's/SI's Monitor Field Reports
ACCEPTANCE	Controls P to P Review Control Program Review Control SOP Review TAB Verification Direct FPT's Implement FPT's Write FPT Summaries Approve FPT Summaries Distribute FPT Summary Direct Re-Testing Implement Re-Testing Facilitate O&M Training Review "As-Built" Record Track RFI's/CO's/SI's	Controls P to P Review Control Program Review Control SOP Review TAB Verification Implement FPT's Write FPT Summaries Distribute FPT Summary Implement Re-Testing Facilitate O&M Training Review "As-Built" Record Track RFI's/CO's/SI's	Controls P to P Review Control Program Review Control SOP Review TAB Verification Implement FPT's Write FPT Summaries Distribute FPT Summary Implement Re-Testing Facilitate O&M Training Review "As-Built" Record Track RFI's/CO's/SI's Digitally Record Training Monitor Field Reports
	Monitor Field Reports Acceptance Cx Report	Monitor Field Reports	Monitor Field Reports
POST-ACCEPTANCE	Direct Off-Season FPT's Implement FPT's Direct Re-Testing Implement Re-Testing Direct Warranty Issues	Implement FPT's Implement Re-Testing	Implement FPT's Implement Re-Testing

Table 1: CxA/CxT Responsibilities Matrix (continued)

Phase of Project	CxA Responsibility	CxA/CxT Shared Responsibility	CxT Responsibility
POST-ACCEPTANCE	Warranty Issues Work Direct 11 th Month Review Attend 11 th Month Review Cx Report/Addendums	Warranty Issues Work Attend 11 th Month Review	Warranty Issues Work Attend 11 th Month Review

List of Acronyms and Abbreviations

- CO – Change Order
- Cx - Commissioning
- FPT – Functional Performance Test
- Install – Installation
- Manuf. – Manufacturer’s
- P to P – Point-to-Point
- RFI – Request for Information
- RTF – Resolution Tracking Form
- SI – Supplemental Instruction
- SOP – Sequence of Operation
- SPQC – Site Progress/Quality Control
- SVC – System Verification Checklist
- TAB – Test and Balance –or- Testing, Adjusting, and Balancing

CxT Prerequisites

Knowledge and experience required of Commissioning Technicians, in addition to a thorough understanding of the Commissioning Process includes the proper use of forms and templates, communication with contractors and field inspectors, technical understanding experience of systems being commissioned, functional performance testing techniques, resolution tracking procedures, and the protocols for CxA and CxT activities. CxT’s must have a hands-on comprehension of design and construction processes. In order to affectively interface with field personnel the CxT has to know with whom, how, and when to communicate and coordinate with the various project team entities.

First, and foremost, CxT candidates must work under the direct employment of an ACG member firm and be supervised by a CxA for a minimum period of 6 months. The candidate must possess a minimum of two years of field experience involving verification and testing of the building systems of specialty. CxT applicants will be required to complete an application form, submit an up-to-date resume, and a letter of recommendation from a CxA attesting to the

technicians understanding of the commissioning process and proven communication skills. It is absolutely vital that a CxT possess a command of both verbal and written language. The CxT must have a record of successful computer skills to enable word processing, email management, and Internet proficiency. Many projects operate with web based project management software. The ability to use resources such as spreadsheets, graphics software, and digital photograph management are essential for a successful CxT.

CxT Exam and Training Materials

Some of the most common systems commissioned on commercial building projects today include:

- HVAC
- HVAC Controls
- Building Automation Systems
- Electrical Power Distribution
- Lighting
- Lighting and Dimming Controls
- Emergency Power/Generators/Transfer Switches
- UPS Systems
- Electrical Circuitry
- Electrical Switchgear
- Electrical Transformers
- Plumbing Systems
- Domestic Hot Water
- Elevators
- Fire Alarm
- Fire Protection
- Building Envelope
- Security (Cameras/Card Readers/ Alarms)
- IT Installations

Considering that the above list of potential building systems to commission makes it evident that a single commissioning technician will be restricted to those systems for which that technician is qualified. In fact, for many projects encompassing multi-venue scopes of commissioning, multiple CxT's might be employed by a variety of CxA's operating under a commissioning provider group manager known as the lead CxA or Project CxA. Commissioning Provider firms configure themselves through partnering, teaming, and sub-consulting arrangements. To protect clients and provider firms from issues that might arise with personnel several tiers into the commissioning configuration on large projects, certification through examination of commissioning technicians can prove invaluable. This is even more important in light of the aggressive schedules many projects operate under, where removal and rehiring of unacceptable personnel can compromise the commissioning process by virtue of lost opportunities to execute commissioning process in the correct time frame. Employing certified commissioning

technicians assures both a level of purview-specific competence and a demonstrated understanding of the commissioning process and its implementation.

To this end the CxT examination seeks to combine test questions derived specifically from the *ACG Commissioning Guideline* with scenarios that depict decisions required of CxT's during the implementation and execution of commissioning process. The general concept that commissioning personnel do not direct contractors must be understood, as well as the principle that commissioning personnel do not perform design authority functions. Technical aptitude must be combined with clear communication and document distribution protocols in order to achieve commissioning goals. ACG will offer web-based training opportunities to interactively teach these important skills.

Some of the technical references relative to qualifying and taking the CxT exam include:

- ASHRAE Guideline 0 – 2005: *The Commissioning Process*
- ASHRAE Guideline 1-1996: *The HVAC Commissioning Process*
- ACG Commissioning Guideline - 2005
- NECA 90-2004: *Recommended Practices for Commissioning Building Electrical Systems*
- BICSI: *Telecommunications Distribution Methods Manual*, 11th Edition - 2006
- NFPA-2002: *National Fire Alarm Code*
- AABC National Standards for Total System Balance – 2002
- International Building Code 2006
- The BOCA National Building Code 1999
- NFPA-70: *National Electric Code (NEC) 2005*
- International Mechanical Code 2006
- Uniform Mechanical Code 2006
- International Plumbing Code 2006
- Uniform Plumbing Code 2006
- International Electrical Testing Association, Inc.: *2003 NETA Acceptance Testing Specifications*

The above list of technical references is very incomplete. A plethora of ASHRAE, ANSI, ASTM, ISO, ARI, ACCA, UL, ASME, NFPA, SMACNA, and numerous other standards, codes, and guidelines may apply to various commissioning projects. For this reason, among others, ACG qualifies CxT candidates technically as prerequisite to certification examining. Exam delivery will be offered at testing centers using the same system developed for the CxA exam.

Needs Assessment Survey

A brief assessment survey similar to the following was distributed to ACG members for input into the technician certification program. Additional member input will be sought as the program progresses. The major goal of technician certification is to support actual field

implementation needs of our members and their clients. It is therefore critical to keep members informed of the development of this program. Association meetings, newsletters and email messages will be used as opportunities to keep members connected with technician certification program development along with needs surveys.

1. Would your company participate in this program by getting one or more technicians certified?

Yes No

2. If yes, how many of your technicians would you like to see certified in 2007-2008?

1 2 3 4 or more

3. Do you have any additional comments on any aspect of the proposed CxT program?

4. Are you seeing requirements for commissioning certification on specifications and/or in RFPs?

Yes No

5. Have you seen specifications that call for ACG certification?

Yes No

Comments:

Name

Company

Conclusion

As building owners increasingly require commissioning on projects, commissioning services providers experience a significant challenge in finding capable commissioning technicians.

An efficient means of certifying understanding of the commissioning process commensurate with the technical specialties available would enable commissioning firms to select and apply experts more efficiently, thereby streamlining services and passing on value to building owners. Increased utilization of technicians will deliver greater value for more modest fees without diluting the professional quality of the commissioning process. Combining commissioning professionals with certified commissioning technicians offers an efficient, confident, quality process for owners, designers and commissioning services providers.

Additionally, owners, contractors, vendors, and commissioning sub-consultants employ numerous technicians to support commissioning efforts. Commissioning technician education and certification provides new training opportunities for these individuals. Office and clerical skills from administration associates alone will not guarantee successful commissioning documentation. Technical understanding is often required in support of the Commissioning Authority, where producing documents and protocols consistent with design intent and owner's project requirements means more than simply checking grammar and formatting issues. Without specific knowledge and demonstrated understanding of commissioning process execution, parties supporting the CxA may not capture significant technical issues. A commissioning technician certification program will strengthen the value-added attributes of sound commissioning procedures.