

Candidate Handbook  
Associate Commissioning Professional (ACP) Program



Building Commissioning Certification Board  
1600 NW Compton Drive, Suite 200  
Beaverton, OR 97006

Phone: 1-877-666-BCXA (2292)

E-mail: [certification@bcxa.org](mailto:certification@bcxa.org)

Website: [www.bccbonline.org](http://www.bccbonline.org)

# Table of Contents

History and Background .....	3
The Building Commissioning Certification Board.....	3
ACP Program Development .....	3
ACP Program Purpose .....	4
Program and Technical Specialty.....	4
ACP Benefits.....	4
ACP Process and Eligibility .....	5
ACP Cost .....	5
ACP Eligibility.....	5
Application Information .....	6
Confidentiality .....	6
Application Information Changes.....	6
Application Review and Approval by BCCB.....	6
Examination Information .....	7
Exam Site and Date Selection.....	7
Examination Format.....	7
Study References .....	7
Examination Preparation.....	7
Special Testing Arrangements .....	7
Examination Scoring .....	8
Examination Failure .....	8
Active ACP Guidelines.....	9
ACP Designation Use Guidelines.....	9
ACP Recertification .....	9
ACP Revocation.....	9
Appendix A: Examination Content .....	10
Appendix B: Sample Questions .....	16

## **History and Background**

### **The Building Commissioning Certification Board**

The Building Commissioning Certification Board (BCCB) was formed in 2004 for the purpose of recognizing building commissioning professionals who meet the standards of the Building Commissioning Association (BCA). The BCCB offers the Associate Commissioning Professional (ACP) designation to individuals who pass a national examination. Successful candidates are awarded a certificate and have the right to use the Associate Commissioning Professional (ACP) designation. The BCCB also recertifies certificants who demonstrate evidence of continued professional competence.

The BCCB also manages the Certified Commissioning Professional (CCP) certification, created in 2004. The CCP is recognized as a rigorous commissioning certification process for professional commissioning practitioners. Substantial commissioning experience is required to be considered for the CCP certification. For this reason, not every commissioning professional can satisfy the requirements to begin the application process for the CCP, although they may be on the path to do so and will achieve the required experience in the future. ACP holders are encouraged to apply for the CCP when eligible.

### **ACP Program Development**

The eligibility requirements and examination materials for the ACP certification program were developed based on a study of the current state of knowledge and practice in building commissioning. A survey of expert building commissioning professionals was conducted to define the body of knowledge used in the building commissioning process and the job responsibilities and tasks carried out by building commissioning professionals. A representative panel of building commissioning experts reviewed the results of the survey. The data from the survey were used to determine the body of knowledge and the content areas appropriate for the examination. The content of the examination is based on this body of knowledge. Additionally, a member survey was conducted and a national consensus process was followed in the developing the program.

The examination questions are written by practicing building commissioning professionals and are reviewed by a panel of experts prior to being selected for the examination. After the examination, the questions are analyzed statistically to identify any hidden flaws. Questions that appear to be flawed are discussed by the BCCB Examination Committee to determine if they should be deleted from scoring entirely or if credit should be given for more than one answer. After these issues are resolved, the examination is scored.

The examination question pool for the ACP certification program will be updated on a regular basis to reflect current practice in building commissioning. Individual questions that have been shown by statistical analysis to be unclear or unfair will be revised or deleted from the pool.

The ACP examination has been designed to meet testing industry standards for validity and reliability. Validity refers to the degree to which the content of the examination reflects the knowledge required to competently perform the responsibilities of a building commissioning professional. Reliability refers to the accuracy of the examination scores, i.e., the degree to which the examination scores are free from measurement error.

## ACP Program Purpose

The purposes of the ACP program are to:

- Establish nationally recognized standards of knowledge and experience for building commissioning practitioners
- Assess the level of knowledge and skills demonstrated by building commissioning practitioners in a valid and reliable manner
- Encourage professional development in the field of building commissioning
- Recognize formally individuals who meet the requirements set by the BCCB and
- Serve building owners and the public by encouraging high quality building commissioning services

The BCCB, with the assistance and advice of many practitioners in building commissioning, has attempted to develop a designation that will recognize expertise in the profession with the goal of improving professional standards in building commissioning. However, no certification program can guarantee professional competence. Moreover, given the constant changes in the field of building commissioning, the BCCB cannot warrant that the examination materials will at all times reflect the most current state of the art, despite the diligent effort undertaken to keep the examination up to date. The BCCB welcomes constructive comments and suggestions from building owners, the public and the profession.

## Program and Technical Specialty

Building commissioning professionals who are eligible for the ACP program may have achieved technical expertise in one or more types of building systems. However, the examination focuses on the process of building commissioning and the management of building commissioning projects. Therefore, the ACP designation is appropriate for all qualified practitioners, no matter their area of specialization: mechanical/HVAC, electrical, building envelope, fire and safety, etc.

## ACP Benefits

Building commissioning practitioners who achieve the ACP designation can experience one or more of the following benefits:

- Verification of their expertise by an independent organization—a way to prove that they have the knowledge and skills needed for the job
- Professional growth and development
- Enhanced professional credibility
- Greater project and employment opportunities

The potential benefits of ACP designation for employers of building commissioning professionals include:

- Increased productivity
- Less training time needed to bring new employees up to speed
- Increased client referrals from satisfied building owners and managers
- A competitive advantage in promoting services to clients
- An assurance of a level of qualification for new job applicants

Finally, the potential benefits of the ACP program for building owners and managers include:

- Greater ease in identifying a qualified building commissioning professional or firm
- More confidence in the quality of building commissioning services provided
- Consistency for comparing service providers

## ACP Process and Eligibility

The ACP program is a three-step process:

1. You must submit a completed ACP application, request the required supporting documents and pay the required application fee.
2. The BCCB must approve your application and advance you to candidacy in the ACP program.
3. If advanced to candidacy, you must pass the ACP examination. You will find out more about each of these steps in the next section of this Candidate Handbook.

### ACP Cost

- Application Fee for BCA Members: \$350
- Application Fee for non-BCA Members: \$550
- Examination Fee: \$150 (Refunded if applicant does not qualify to sit for the exam.)

Payment must be made by credit card, banker's check, money order, or check made payable to the BCCB. **NO OTHER FORM OF PAYMENT—INCLUDING CASH—WILL BE ACCEPTED.** Failure to submit the full fee in one of the acceptable formats will result in the rejection of your application.

The application fee is non-refundable and is incurred upon receipt of your application by the BCCB. However, your application will be returned to you and your fee refunded, less a \$50.00 nonrefundable processing fee, if you fail to meet the basic eligibility requirements at the time of application.

### ACP Eligibility

Below are the minimum qualifications that must be met for a candidate to be eligible to sit for the ACP examination based on level of education achieved. To be eligible for the ACP program you must demonstrate the following:

Highest Degree Attained	Building-Related Experience Needed <sup>(1)</sup>
Four-year undergraduate or graduate degree in a building sciences field <sup>2</sup>	1 full year
Four-year undergraduate degree or graduate degree in a non-building sciences field <sup>2</sup> <b>or</b> Two-year undergraduate degree in a building sciences field <sup>2</sup> <b>or</b> Technical school degree (building-related) <sup>2</sup> <b>or</b> Completion of apprenticeship program (building-related) <sup>2</sup>	3 full years
Two-year undergraduate degree in a non-building sciences field <sup>2</sup>	5 full years
High school diploma or GED	10 full years

- 1 Building-related experience includes your experience as a commissioning provider as well as other related experience, such as serving as a project engineer, building operations supervisor, contractor, etc.
- 2 Acceptable fields of study in building science include mechanical engineering, electrical engineering, construction science, construction management, architecture, and other majors/fields of study designed to train people for careers in the building industry.

## Application Information

The ACP application can be downloaded from the BCA website, [www.bccbonline.org](http://www.bccbonline.org). Please read the application instructions carefully to be sure that you have complied with all application requirements. Completed applications can be emailed or mailed as noted below:

Email (preferred method)	<a href="mailto:Certification@bcxa.org">Certification@bcxa.org</a>
Mail	Building Commissioning Certification Board 1600 NW Compton Drive, Suite 200 Beaverton, OR 97006

The BCCB must also receive your fee and transcript for the application to be considered complete.

### Confidentiality

Your application data and examination score will be held in strictest confidence and will not be released to anyone without your express written consent. However, the BCCB reserves the right to use certain data from your application to prepare summary statistical analyses, some of which may be published. In these cases, your data will be consolidated with data from other applicants. Your individual data will never be made public.

### Application Information Changes

If the name, mailing address, e-mail address, and/or telephone number that you entered on your application changes while your application is pending, you must notify the BCCB in writing immediately, and not later than six (6) days after such change of information. If you neglect to report the changes to the BCCB, you may miss important notices, which may result in your not being able to sit for the examination. Also, you must notify the BCCB in writing, if you want your new name to appear on your certificate. Please note that the name on the identification documents you present at the test site must match the name on file at the BCCB.

### Application Review and Approval by BCCB

When all materials have been received and the minimum qualifications have been met, your application is deemed complete and is passed to 2 members of the BCCB for review. The BCCB members will perform a detailed review the work experience, and documentation to determine if the applicant is eligible to sit for the examination. At this time the BCCB may contact the candidate directly to ask for clarification or additional information.

If the BCCB approves the application the candidate will be notified and sent information on how to register for the examination. If the BCCB denies the application the candidate will be given details about the reason for denial and have the opportunity to submit additional information within 24 months without resubmitting an application in its entirety.

## Examination Information

### Exam Site and Date Selection

The ACP examination is offered electronically through our testing partner, ISO-Quality Testing, at over 200 testing sites in the United States and abroad. Test location information is available at the ISO-Quality Testing website, <http://www.isoqualitytesting.com/locations.aspx>.

The application approval notification will include a username and password to be used on the ISO-Quality Testing website to register for a testing date. Candidates have a six month window in which to take the exam.

### Examination Format

You will take the computer-based examination in a single, two-hour session. The examination consists of 125 multiple-choice questions. Each question contains four options or choices, only one of which is the correct or best answer. You will be asked to select the correct or best answer from these options. The examination will include some commissioning scenarios on which a set of two or more questions is based. Sample questions can be found in Appendix A.

### Study References

The following is a list of references that may be helpful in reviewing for the examination. This list is intended for use as a study aid only. The BCCB does not intend the list to imply endorsement of these specific references, nor are the examination questions necessarily taken from these sources.

Organizations:

- BCA
- ASHRAE
- US Green Building Council
- Portland Energy Conservation Inc.

Suggested Reading:

- Building Commissioning Handbook, 2nd Edition
- BCA Best Practices and Essential Attributes, available from the BCA website
- ASHRAE Guideline 0
- US Green Building Council Manual –LEED, Version 3.0

### Examination Preparation

The BCCB offers the following suggestions in preparing for the examination:

1. Review the test content outline in Appendix A and, for each content area, consider your understanding of that area, your regular practice of that skill, and the percentage of questions that will be devoted to that area. Scale your study efforts accordingly to ensure that those areas you use or know less and have a major representation on the test are given in-depth attention.
2. Decide which resources will best help you to prepare for the examination. The references listed above may be helpful when you are reviewing the content areas included in the examination. (Again: The reference list is provided for possible use as a study aid only. The BCCB does not intend the list to imply endorsement of specific documents.)
3. Answer the sample questions in Appendix B to familiarize yourself with the type and format of questions in the examination.

### Special Testing Arrangements

The BCCB will make a reasonable effort to accommodate candidates who provide evidence of a need for special arrangements as long as the accommodations do not fundamentally alter the measurement of the knowledge and skills that the examination is intended to test. If you believe that you will require special testing arrangements, you should inform the BCCB of your specific needs in writing. This will be handled on a case-by-case basis.

## **Examination Scoring**

Your performance on the examination will be measured against a predetermined standard of knowledge and skills. This standard is the level of knowledge and skills that can reasonably be expected of building commissioning professionals serving in a lead project role. You will NOT be measured against the performance of the other individuals taking the examination. This means that if everyone who takes the examination meets the standard, everyone will pass.

All questions on the examination carry the same weight toward your final score. There is no penalty for a wrong answer, so it is to your advantage to answer every question, even if you have to guess.

The passing score for the ACP examination is set by a national panel of experts representative of the field of building commissioning. These experts reviewed each examination question, evaluated the difficulty of the question, and made a judgment as to how a professional having the defined standard of competence would perform on the question. These judgments were analyzed statistically to determine the passing score.

The examination is designed only to distinguish those who have the minimum requisite knowledge and skills from those who do not. There is no evidence that someone who receives a very high score on the examination will be a noticeably better practitioner than someone whose score falls exactly at the passing point. Therefore, if you pass the examination, you will be informed only that you have successfully completed the ACP process. You will NOT be notified of your actual numeric score. Notification of a pass or fail will be indicated by the testing system upon completion of the exam.

### Nondiscrimination Policy

Your score will be based solely on your performance on the ACP examination. The BCCB does not discriminate against any person on the basis of age, gender, sexual orientation, race, ethnicity, religion, national origin, medical condition, physical or learning disability, or marital status.

## **Examination Failure**

If you fail the examination, you will be notified of your performance in each major content area. This information is provided to assist you in deciding whether to retake the examination and how to plan your study efforts for future examinations.

If you do not pass the ACP examination, you are eligible to re-take the examination within two (2) years of your original application date. You may retake the exam as often as you like within this period, however, each time you take the test an exam fee of \$150 will apply. If you are reapplying for an examination date that is beyond the 24-month period, you must submit a new complete application, including project documentation, all required references, and the application fee.

### Appeals and Complaints

There shall be no right to appeal a failing examination score; however, you may request that your examination be rescored by hand. Requests for hand scoring must be submitted in writing and accompanied by a payment of \$50.00 made payable to the BCCB. Requests for hand scoring can be honored only up to six months from your testing date.

A candidate with questions about the reliability, validity, and/or fairness of a test and its questions may submit a complaint in writing to BCCB no later than fourteen (14) days after taking the examination. BCCB will NOT consider late challenges or complaints, or challenges or complaints not submitted in writing. Any complaints and challenges should be addressed to the BCA Executive Director. All challenges and complaints shall receive BCCB's full attention. BCCB will investigate each challenge or complaint and acknowledge it in writing to the complaining candidate. All comments will be kept in BCCB's records.

Appeal: A candidate may appeal a decision to the BCA Board of Directors. However, the Board of directors will only reconsider the decision if the candidate provides a rationale for why the original disposition was arbitrary or capricious. Any such appeal shall be limited to written briefs. The decision of the BCA Board of Directors shall be final.

# Active ACP Guidelines

## ACP Designation Use Guidelines

Candidates who pass the examination will receive a certificate suitable for framing and will have the right to refer to themselves as a Associate Commissioning Professional (ACP) as long as they maintain valid applicable renewal with BCCB. The “ACP” and “Associate Commissioning Professional” marks are owned by BCA, and BCA and BCCB have the sole rights to control the use of these designations. BCA and BCCB, however, grant a worldwide, non-exclusive license to all individuals holding ACP designation from BCCB to use the marks in the following manner:

- Displaying the certificate issued by BCCB granting ACP status
- Stating that the individual is a “Associate Commissioning Professional” or a “ACP”
- Using the marks on business cards and/or stationery
- Using the marks in a directory or advertisements for services as a building commissioning professional
- Using the marks on other promotional materials, provided that such materials are reviewed and approved in advance by BCCB

If you have any questions regarding the proper use of the “ACP” and “Associate Commissioning Professional” marks, submit a sample of the proposed use to BCCB for review. BCCB reserves the right to control the quality of all promotional materials on which these marks are used. These marks may not be used in any manner that implies that you have any relationship with BCCB or BCA other than as a designated ACP or in any other manner that is in conflict with BCCB philosophy or principles. The BCCB may ask you to provide a sample of stationery, business cards, or other promotional materials to ensure compliance. If you fail to comply with the permitted use of BCCB’s marks, or if you fail to maintain valid ACP renewal with BCCB, you will no longer have the right to use these marks in any manner and may not distribute any materials containing the marks. BCCB shall be the final judge as to whether any use of its marks is consistent with BCCB’s standards, policies, and procedures.

BCA and BCCB also grant your employer an non-exclusive, worldwide license to use the “ACP” and “Associate Commissioning Professional” marks to advertise your services as an Associate Commissioning Professional, provided you maintain continued ACP renewal with BCCB and that such advertisements are truthful and not misleading.

BCA and BCCB reserve the right to take legal action against you and/or your employer for any use of the “ACP” or “Associate Commissioning Professional” marks that are in violation with the terms of this license.

## ACP Recertification

Your initial ACP designation will be valid for a period of three (3) years from the date printed on your certificate. You must renew every three (3) years. Renewal involves completing an application and being approved by the BCCB. To be renewed, you will have to show evidence of continued competence, as demonstrated by your additional work experience and other related professional activities. Toward the end of your initial designated ACP period, the BCCB will send you a reminder of the need to renew.

## ACP Revocation

The ACP designation will be revoked if you fail to renew. Otherwise, if you continue to work as a professional in good standing within the field of building commissioning, it is very unlikely that your ACP standing will be revoked. However, the BCCB has the right to revoke your ACP standing if it is substantiated that you:

- Falsified information on your application
- Misappropriated examination questions or materials
- Cheated on the ACP examination or assisted another candidate with cheating
- Misused or misrepresented the ACP designation
- Were found guilty of violating the law with respect to your professional responsibilities by a court, licensing agency, or registration agency
- Engaged in any other behavior that is in violation of the BCCB disciplinary policy

# Appendix A: Examination Content

## Test Content Outline

The following pages include a detailed outline of the major content areas and commissioning tasks and skills evaluated in the examination, with an indication of the approximate number and percentage of examination questions devoted to each of the five major content areas.

Please note that questions from the various content areas will be mixed throughout the examination. The questions will NOT be presented in content area order on the examination.

### *Pre-Design*

*5 Questions, 4% of Exam*

#### 1. Participate in the development of the Design Intent Document

1.a. Participate in drafting the Design Intent Document (DID).

1.b. Interview the owner, design team, operation and maintenance staff, and end users to gather information from each group about the requirements, desired options, and concerns related to building use.

1.c. Facilitate group exercise with the owner, design team, operation and maintenance staff, and end users to gather information from each group about the requirements, desired options, and concerns related to building use.

1.d. Review the Design Intent Document to verify content and provide comments to design team.

#### 2. Develop a preliminary commissioning plan

2.a. Collate the design narrative and basis of design.

2.b. Identify the team members and the roles and responsibilities of team members and contractor as they relate to the commissioning effort.

2.c. Identify the testing and verification methodology, including the sampling method.

2.d. Identify the systems that will be commissioned and the acceptance criteria for systems and equipment.

- Acquire the review and approval of the commissioning plan from the design team and owner's representative.
- Review program documents

3.a. Review the program documents for quality and the capability to meet the Design Intent Document, commissionability, constructability, and maintainability issues and provide comments to the owner and/or design team.

### *Design*

*23 Questions, 18% of Exam*

#### 4. Review design development documents

4.a. Review the designer's specifications and drawings to ensure that the design development documents follow the owner's wishes and good design practices and provide comments to the owner and/or design team.

#### 5. Develop commissioning specifications

5.a. Develop commissioning-related specifications sections and narrative, in formal written format, based on the preliminary commissioning plan and the project documents.

5.b. Clearly define the roles and responsibilities of the commissioning team, including the design team, owner, and commissioning provider.

5.c. Define the commissioning process and contractor's roles and responsibilities.

5.d. Identify the scope and expected outcomes of the commissioning process.

5.e. Define the lines of communication.

5.f. Define the requisite conditions for the project completion/acceptance.

5.g. Meet with the maintenance staff to determine the level of training needed by the staff.

5.h. Include training requirements that are sufficient to prepare the staff to maintain, operate, and troubleshoot equipment and systems.

5.i. Submit commissioning specifications to the design team for review.

#### 6. Review final construction documents

6.a. Review the final project documents to verify that all commissioning-related issues have been included and meet the design intent.

6.b. Conduct the final review to verify that the document is clear and the commissioning specifications are referenced correctly.

6.c. Verify the testing/acceptance criteria.

6.d. Prepare a document review letter to the design team and owner's representative.

#### 7. Pre-bid meeting

7.a. Attend the pre-bid meeting to present information on the commissioning process, answer any questions regarding the process, and explain the unique contribution of the commissioning process.

#### 8. Develop contractor checklist

8.a. Create a construction checklist to verify equipment delivery, storage, equipment and systems installation, start-up, and readiness for functional testing.

8.b. Include equipment information from design documents (including unit number, location, rating, capacity, etc.)

8.c. Include spaces to document verification that associated ducting, wiring, and piping has been included and tested.

8.d. Include spaces to document verification of accessibility and maintainability of equipment.

8.e . Include spaces to document verification that the installation is per project documents and manufacturer's requirements.

8.f . Include spaces to document verification of completion of the construction checklists by the contractor.

*Construction*

*66 Questions, 53% of Exam*

#### 9. Review submittals

9.a. Once the project is bid and the successful contractors have been identified, acquire and review the submittals on all commissioned systems for consistency with owner requirements.

9.b. Verify that information needed for the installation and start-up is included.

9.c . Identify and quantify issues or conflicts discovered in a written report to the contractor, design team, and owner's representative.

#### 10. Create a master list of commissioned equipment and systems that were defined in the statement of work

10.a . Create a master list of equipment by part number, and location.

10.b . List all systems to be commissioned (i.e., HVAC, electrical, fire/life safety, lighting controls, etc.) based on the final design, addendum, and submittal information.

10.c . List equipment parameters and associated equipment (i.e., cfm, gpm, amps, volts for AHU; lumens, volts, watts for light system; attenuation, NEXT, resistance for data cables; etc.).

10.d . Review control dependencies (i.e., sequence of operations information, etc.) and, if discrepancies are noted, bring them to the attention of the design team for resolution.

10.e . Identify all modes of operation and any integrated system relationships.

10.f . Integrate these lists into the final commissioning plan.

#### 11. Create final commissioning plan

11.a . Create the final commissioning plan that outlines the entire commissioning process including the roles and responsibilities as outlined in the specifications.

11.b . Update and adjust the commissioning plan to support the DID.

#### 12. Conduct initial on-site commissioning coordination meeting

12.a. Develop preliminary documents and agenda.

12.b. Conduct the commissioning coordination meeting.

12.c. Introduce the commissioning process to those who are unfamiliar.

12.d. "Sell" commissioning and work for buy-in by all involved.

12.e. Review the commissioning plan and process.

12.f. Identify the commissioning team members and their roles and responsibilities.

12.g. Present the schedule and deliverables.

12.h. Clarify the issues raised by contractor.

12.i. Identify the modes of communication and reporting structure to be used in the commissioning process.

#### 13. Develop functional performance documents

13.a. Review specifications and manufacturer's documentation: and submittal information.

13.b. Add blanks or check boxes to enter actual measured /witnessed information.

13.c. Compare information to the design and submittal data and to the design team's acceptance criteria.

13.d. Develop functional test criteria that take the systems through all operational modes and failure modes.

13.f. Prepare and submit a binder of all functional test procedures for review and comment to the owner.

#### 14. Monitor contractor start-up and test

14.a. Review contractor-conducted start-up test results to confirm that the contractor has completed all pre-test activities.

14.b. Compare the contractor's data and observations to the manufacturers startup and installation information and to the acceptance criteria and knowledge of proper equipment and system operation.

14.c. Analyze data with respect to associated equipment.

14.d. Review the start-up documentation to determine the level of system readiness for continuation of the commissioning process.

14.e . Witness contractor startup procedures.

14.f. Prepare and submit report to owner.

#### 15. Conduct ongoing commissioning coordination meetings

15.a. Conduct regularly scheduled on-site commissioning meetings once construction begins.

15.b. Prepare meeting agenda and invite participants.

15.c. Conduct more frequent meetings as the project approaches completion.

15.d. Keep meeting minutes and distribute them to the participants.

15.e. Schedule and coordinate start-ups, observations, testing, and other commissioning process activities.

15.f. Coordinate the commissioning process across all systems.

#### 16. Conduct installation verification

16.a. Perform site walks to verify all equipment installations.

16.b. Using the construction checklist, verify the information recorded and the contractor's progress. Verify that equipment, systems, and assemblies are properly installed and ready for functional testing where applicable.

16.c. Record commissioning issues on a commissioning issues list and their resolution status.

16.d. Periodically prepare and submit a commissioning issues report to the owner.

#### 17. Review balancing report

17.a. Review the TAB report to include conformance to project document requirements and standard practices.

17.b. Review the balancing data and evaluate for completion.

17.c. Prepare and submit a report to the owner.

#### 18. Verify balancing report

18.a. Verify that previous issues, if any, were resolved.

18.b. Verify that measured data are within design tolerances.

18.c. Test or witness testing of a sample of TAB readings and compare data with the balancing report.

#### 19. Conduct functional performance tests

19.a. Complete a review of all construction checklists, start-up, and installation verification forms prior to functional testing.

19.b. Conduct or witness the functional tests performed in accordance with approved test procedures.

19.c. Test or witness tests of interrelationships between equipment and systems, such as "comfort in space" testing that includes more than one system.

19.d. Conduct tests to simulate as many potential modes of operation as will fit within the commissioning scope of work for active systems such as HVAC, controls, generators, etc.

19.e. Conduct performance-based tests for passive systems and assemblies such as roofs, walls, acoustical ceilings, etc.

19.f. Conduct some tests using observation and random verification.

19.g. Record issues on the commissioning issues list.

#### 20. Re-testing and issue resolution

20.a. Verify that issues have been resolved through visual observations, physical measurements, or certificates of completion from the contractor.

20.b. Verify that functional testing failures have been resolved, either through retesting or witnessing a successful repeat of the functional test.

20.c. Work with the members of the design team to develop and implement appropriate design changes where needed.

20.d. Prepare and submit a revised commissioning issues list to the owner, showing issues resolved, actions taken by whom, and dates resolved.

20.e. Propose solutions to the owner when issues have not been resolved.

20.f. Address lessons learned with the contractors at next commissioning coordination meeting.

#### 21. Review contractor record documents and operation and maintenance manuals

21.a. Review documents in parallel with the design team.

21.b. Conduct ongoing reviews of documentation as documents become available.

21.c. Review record drawings.

21.d. Review that documentation is complete and adequate for use by the staff charged with the operation and maintenance of the facility (including parts, service, routine maintenance, and emergency procedures).

#### 22. Organize and coordinate training of the operation staff

22.a. Verify the level of training needed by staff and make sure that training requirements are sufficient to prepare staff to maintain, operate, and troubleshoot equipment and systems.

- 22.b. Using the operation and maintenance manuals as guides, evaluate the training plan and syllabus.
- 22.c. Approve the plan and syllabus or recommend improvements.
- 22.d. Attend training sessions to verify that training is given in sufficient detail and clarity to be understood and remembered by staff.
- 22.e. Gather training evaluations and recommend to the owner if further training is required.
- 22.f . Provide training for operation and maintenance staff.

23. Develop maintenance, operation, and/or energy management manuals

- 23.a. Develop maintenance, operation and/or energy management manuals (technical systems manuals) to assist the owner, and be used by the operation and maintenance staff, in operating and maintaining the facility in an effective, safe, and efficient manner into the future.
- 23.b. List equipment information (i.e., nameplate information, filter and belt sizes).
- 23.c. List the manufacturer's recommended maintenance procedures and frequency and the manufacturer's recommended replacement frequency.
- 23.d . List supplier's name, address, and warranty dates.
- 23.e . Develop an occupant system use manual.

24. Re-commissioning management manual

- 24.a. Develop a document that outlines the process and procedures that will be used to re-commission the facility in the future.

*Occupancy and Operations*

*16 Questions, 13% of Exam*

25. Final report

- 25.a. Prepare a final report at the close of the project based on the commissioning plan that includes (1) all previously generated commissioning documentation (including, but not limited to, all official correspondence, site visit reports, functional testing reports), and (2) a project summary that identifies any unresolved issues and makes further recommendations.
- 25.b. Develop and include an executive summary describing the systems as built and installed, a menu /table of contents, and index.
- 25.c. Store the final report electronically on CD for ease of reference and duplication.

26. Seasonal testing

- 26.a. Perform functional testing or witness testing to prove functionality during alternate seasonal peak load conditions to verify that the system will both heat and cool sufficiently.
- 26.b. Prepare a summary of seasonal testing for addition to the final report.

27. Near warranty-end testing

- 27.a. Verify that equipment is still functioning properly several months after installation.
- 27.b. Conduct testing near warranty end (typically 10 months past the start of the warranty period).
- 27.c. Conduct a subset of the original test plan to identify potential issues prior to the expiration of the warranty period.
- 27.d. Interview maintenance staff and occupants to get input regarding any issues or quirks.
- 27.e. Identify any issues that should be resolved prior to warranty end and report to the owner for submittal as a warranty item to the contractor.
- 27.f. Prepare summary of near warranty-end issues for addition to the final report.

28. Post-occupancy review

- 28.a. Review the facility operation in light of actual facility use.
- 28.b. Work with maintenance staff to resolve issues and develop solutions.

28.c. Conduct an occupant survey or interview, including a "lessons-learned" session.

28.d. Prepare summary of "lessons learned" for addition to the final report.

*Additional Commissioning Related Content*      *15 Questions, 12% of Exam*

29. USGBC LEED Certification As it relates to Fundamental and Additional Commissioning only.

30. BCA Essential Attributes

30. BCA Essential Attributes

31. Construction document process (protocol, RFI, submission, shop drawings, etc.)

32. ASHRAE Guidelines

## Appendix B: Sample Questions

Please note that the difficulty of these sample questions may not be representative of the overall difficulty of the examination.

1. What document is most helpful for identifying the acceptance criteria needed when writing functional test procedures?
  - A. Architect's program
  - B. Basis of design
  - C. Commissioning plan
  - D. Design intent
2. The commissioning authority has been given a complete set of project drawings and specifications. While reviewing submittals, they discover a technical error. One of the commissioning authority's first actions should be to
  - A. ask the mechanical contractor to correct error
  - B. ask the supplier to make changes
  - C. document the error and inform the commissioning team
  - D. reject the submittal with comments on errors
3. What documents should be used to develop functional performance tests?
  - A. Owner's design intent, project specifications, industry guidelines, and approved submittals
  - B. Manufacturer's listing of inspections and testing used on factory testing and acceptance
  - C. Test procedures used on the previous project for similar equipment
  - D. The commissioning plan on the last project completed for this client
4. A test and balance report has been submitted without documentation of domestic hot water recirculation readings. What action should the CA take to address this omission?
  - A. Reject the report for being incomplete.
  - B. Review the specification to determine if domestic water systems are included in the test and balance scope.
  - C. Return the report to the contractor with a request to complete the domestic hot water recirculation balance.
  - D. Request that the mechanical contractor submit a test report for the domestic hot water recirculation system.
5. Functional performance testing of the specified components has been successfully completed. What is the next step in the commissioning process?
  - A. Submit the final commissioning report.
  - B. Perform owner training.
  - C. Test inter-relationships between systems and subsystems.
  - D. Recommend beneficial occupancy.

Answer Key: 1-D, 2-C, 3-A, 4-B, 5-C