



International Accreditation Service, Inc.
3060 Saturn Street, Suite 100
Brea, CA 92821-1732 USA
tel: 562.364.8201
tel: 866.427.4422
fax: 562.699.8031
www.iasonline.org

ACCREDITATION CRITERIA FOR ORGANIZATIONS PROVIDING TRAINING AND/OR CERTIFICATION OF COMMISSIONING PERSONNEL

AC476

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PREFACE

The attached accreditation criteria has been issued to provide all interested parties with guidelines on implementing performance features of the applicable standards referenced herein. The criteria was developed and adopted following public hearings conducted by the International Accreditation Service, Inc. (IAS), Accreditation Committee and is effective on the date shown above. All accreditations issued or reissued on or after the effective date must comply with this criteria. If the criteria is an updated version from a previous edition, solid vertical lines (|) in the outer margin within the criteria indicate a technical change or addition from the previous edition. Deletion indicators (→) are provided in the outer margins where a paragraph or item has been deleted if the deletion resulted from a technical change. This criteria may be further revised as the need dictates.

IAS may consider alternate criteria provided the proponent submits substantiating data demonstrating that the alternate criteria are at least equivalent to the attached criteria and otherwise meet applicable accreditation requirements.

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ACCREDITATION CRITERIA FOR ORGANIZATIONS PROVIDING TRAINING AND/OR CERTIFICATION OF COMMISSIONING PERSONNEL

PART I: GENERAL PROVISIONS

1.1 PURPOSE: The purpose of the criteria is to develop an accreditation protocol for organizations providing training and/or certification of commissioning personnel. Personnel involved in commissioning may include Commissioning Providers or Commissioning Specialists. Accreditation to these criteria will assist the Authority Having Jurisdiction (AHJ) in ensuring competency of Commissioning Providers.

Note: Throughout this document, the term "Commissioning Provider" is used. Other commonly used terms include, but are not limited to, Commissioning Authority, Professional, or Agent. Another term used in this document is "Commissioning Specialist." Both terms are defined in Section 1.4.

1.2 SCOPE: This criteria sets forth requirements for obtaining and maintaining International Accreditation Service, Inc. (IAS), accreditation for Training and/or Certification of Commissioning Providers and Commissioning Specialists. The following specialties are covered in this document for training and/or certification of Commissioning Specialists:

1.2.1 Heating Ventilation and Air Conditioning (HVAC) Systems

1.2.2 Lighting Systems

1.2.3 Plumbing Systems

1.2.4 Energy Systems

1.2.5 Irrigation Systems

1.2.6 Indoor Environmental Quality

1.2.7 Building Enclosure (Architectural Building Design)

1.2.8 Fire Protection Systems

1.2.9 Fire Alarm Systems

1.2.10 Vertical Conveyance Systems

1.2.11 Site Development and Land Use

1.2.12 Construction and Demolition Waste Management

1.3 REFERENCE: ICC G4-2012 Guideline for Commissioning.

1.4 DEFINITIONS

1.4.1 Authority Having Jurisdiction or Building Official: The officer or other designated authority charged with the administration and enforcement of state or local building codes, or a duly authorized representative.

1.4.2 Building Enclosure: The building enclosure systems separating one defined environment from another, including walls, fenestration, roofing and roof openings, floors and ceilings, below-grade perimeter walls, crawl spaces and attics, slabs on grade and below grade,

perimeter walls and interior walls and floor/ceiling assemblies separating interior zones with differing performance criteria.

1.4.3 Building Science: The collection of scientific knowledge that focuses on the analysis and control of the physical phenomena affecting buildings.

1.4.4 Codes: Construction codes published by a national promulgation organization, and adopted by the Authority Having Jurisdiction.

1.4.5 Commissioning (Cx): See Commissioning Process.

1.4.6 Commissioning Agent: See Commissioning Provider.

1.4.7 Commissioning Authority (CxA): See Commissioning Provider.

1.4.8 Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements, and project construction documents.

1.4.9 Commissioning Provider: An individual or agency identified by the Owner that is responsible for the overall building commissioning and who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process. Other commonly used terms for this individual or agency include, but are not limited to, Commissioning Agent or Commissioning Authority.

Note: "An agency may be considered a certified Commissioning Provider if they employ and maintain at least one person who has been certified as a Commissioning Provider and the Commissioning Provider is actively involved in the project being commissioned."

1.4.10 Commissioning Specialist: A certified party who works on a specific project to conduct commissioning of a specific technical area.

1.4.11 Commissioning Team: The individuals and agencies who, through coordinated actions, are responsible for implementing the commissioning process.

1.4.12 Guideline: A document developed to facilitate interpretation, understanding and application of processes, technologies, systems, assemblies, including applicable codes and standards.

1.4.13 HVAC Software Applications: The software systems and sequences that apply to the construction operation and maintenance of HVAC systems.

1.4.14 Owner: An individual, organization, corporation, etc., that has a legal right to make decisions on a real property.

1.4.15 Personnel Certification Bodies: A body that issues certification of persons as evidence of demonstrated professional and technical competency.

1.4.16 Standard: A document that defines properties, processes, dimensions, materials, relationships, concepts, nomenclature, or test methods for rating purposes.

1.4.17 Training Agencies: A training agency is defined as having all of the following elements: (1) dedicated funding, (2) staffing, (3) oversight by a dedicated agency, (4) a procedure to determine professional development expectations, (5) training content, (6) quality assurance, (7) identified and measured outcomes, (8) ongoing activities, (9) structure for delivery, and (10) work-place applicability.

1.4.18 Training Plan: A written document that details the expectations, schedule, duration and deliverables of commissioning process activities applicable to training of project operating and maintenance personnel, users, and occupants.

1.4.19 Working Knowledge: The ability to demonstrate a basic understanding of the scope of the commissioning processes as required by this accreditation criteria and the Authority Having Jurisdiction.

1.5 MANAGEMENT SYSTEM REQUIREMENTS

1.5.1 For training agencies seeking accreditation to these criteria, compliance with IAS Accreditation Criteria AC371 is required.

1.5.2 Personnel certification bodies seeking accreditation to these criteria must operate a management system complying with International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) Standard 17024.

1.5.3 Training agencies and personnel certification bodies shall provide a method for building owners and the Authority Having Jurisdiction to verify the qualifications of commissioning personnel. Certification bodies shall provide proof of certification for certified personnel, which may include photo identification card, listing on public domains, pocket license, etc. The method of verification shall be readily and publicly available.

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PART II: MINIMUM QUALIFICATIONS FOR CERTIFICATION OF COMMISSIONING PROVIDERS

2.1 PURPOSE: The purpose of Part II is to establish minimum qualification requirements for certification of Commissioning Providers.

2.2 KNOWLEDGE OF THE COMMISSIONING PROCESS

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2.2.1 Commissioning Process: Commissioning Providers must understand that the commissioning scope will depend upon how the project will be designed, built, and operated. Commissioning will be performed based on the extent of commissioning effort defined and procured by the owner and adopted codes. The process outlined in this section is written for a generic project and must be adapted to each project. This section describes the commissioning process and can be supplemented by companion technical documents and guidelines to describe the specific details and to properly implement the commissioning process relative to a specific facility, system, or assembly. This process can be applied to both new and renovation projects.

2.2.2 Commissioning Process Management: Commissioning Providers must understand that the commissioning process is applicable on many levels. It can be applied to one or a number of systems and assemblies in the project as defined in the owner's project requirements and commissioning plan. If more than one system and more than one person or entity is involved in the commissioning process, there must be a designated manager of the entire commissioning process to coordinate the process and the documentation. That person is called the Commissioning Provider and he/she must be certified for that responsibility. Certification under this criteria does not certify individuals to conduct technical performance tests. Technical performance tests shall be performed by qualified personnel as determined by state and local laws.

2.2.3 Knowledge, Skills & Abilities (KSAs): The persons being certified as a Commissioning Provider shall demonstrate the knowledge, skills and abilities outlined in Appendix 1.

2.3 EDUCATION AND EXPERIENCE REQUIREMENT FOR CERTIFICATION OF COMMISSIONING PROVIDER: The person being certified as a Commissioning Provider must have the education and experience qualifications as detailed in Table 1 on page 5:

Table 1 – Education and Experience Requirements

Option	Educational Requirements	Work Experience	Project Experience	Examination
Option A	Four-year undergraduate degree or higher in a building science field from an accredited institution	Minimum 3 years as Cx Provider	1. Cx Provider must have a minimum of 3 qualifying projects ¹ from design phase thru completion of construction and 2. The projects ¹ must total a minimum of 150,000 SF	Pass an exam on commissioning and applicable fundamentals, demonstrating knowledge of the Cx process, design, construction, operations and maintenance fundamentals After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry
Option B	Four-year undergraduate degree or higher in a non-building science field from an accredited institution, or Two-year undergraduate degree in a building science field from an accredited institution, or Degree from an accredited and recognized Technical School or Completed apprentice program from a nationally recognized and accredited program in an applicable technical field	Minimum 3 years as Cx Provider and Minimum 5 years applicable technical experience	1. The Cx Provider must have a minimum of 3 qualifying projects ¹ from design phase thru completion of construction 2. The projects ¹ must total a minimum of 150,000 SF	Pass an exam on commissioning and applicable fundamentals, demonstrating knowledge of the Cx process, design, construction, operations and maintenance fundamentals After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry
Option C	Two-year undergraduate degree in a non- building science field from an accredited institution, or High school diploma or GED	Minimum 3 years as Cx provider and Minimum 7 years applicable technical experience	1. The Cx Provider must have a minimum of 3 qualifying projects ¹ from design phase thru completion of construction and 2. The projects ¹ must total a minimum of 150,000 SF	Pass an exam on commissioning and applicable fundamentals, demonstrating knowledge of the Cx process, design, construction, operations and maintenance fundamentals After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry

¹ A qualifying project is defined as a commissioning project where the applicant may provide evidence of having participated in the Cx process from design phase to project completion. Completion of an accredited* Cx training program may reduce the number of qualifying projects by a maximum of one and the SF from 150,000 to 100,000.

*Accredited by an International Accreditation Forum signatory or other nationally recognized accrediting body.

2.4 TECHNICAL KNOWLEDGE: The person being certified as a Commissioning Provider must be familiar with methods of measurements and verification of the systems and assemblies of HVAC, lighting, energy, plumbing, irrigation and building enclosure as outlined below. Familiarity in these areas may be tested simultaneously.

2.4.1 HVAC Systems

2.4.1.1 Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall have a basic knowledge of the following documents and procedures:

2.4.1.1.1 Applicable national mechanical, plumbing, electrical, energy, and sustainability codes utilized in design, construction and operation of HVAC systems;

2.4.1.1.2 Standards and guidelines utilized in design, construction and operation of HVAC systems

2.4.1.1.3 Design criteria of mechanical and related electrical and plumbing systems

2.4.1.1.4 Facility sustainability and energy requirements

2.4.1.1.5 Facility design conditions (climatic conditions, room conditions, temperature humidity levels, pressure requirements, etc.)

2.4.1.1.6 HVAC software applications

2.4.1.1.7 Facility schematic, design development, construction phase documents

2.4.1.1.8 Electrical power distribution, motor control centers, power monitoring, etc.

2.4.1.1.9 Commissioned systems and equipment specifications

2.4.1.1.10 Operations and maintenance (O&M) documentation and requirements

2.4.1.1.11 Mechanical/electrical equipment and system operation as applicable to HVAC system

2.4.1.1.12 Building Automated System (BAS) control diagrams, points, sequences and configuration

2.4.1.1.13 Testing and balancing (TAB) process and procedures; system manual components and assembly

2.4.1.1.14 Commissioning report assembly and organization for HVAC

2.4.1.2 Verification of Performance: Person being certified as a commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

2.4.1.2.1 Instrumentation and control for HVAC

2.4.1.2.2 Unitary HVAC equipment

2.4.1.2.3 Humidity control equipment

2.4.1.2.4 Convection heating and cooling units

2.4.1.2.5 Radiant heating units

2.4.1.2.6 Central heating equipment – breechings, chimneys and stacks

2.4.1.2.7 Fuel-fired heaters

2.4.1.2.8 Furnaces

2.4.1.2.9 Heat exchangers

2.4.1.2.10 Heating boiler feed water equipment

2.4.1.2.11 Heating boilers

2.4.1.2.12 Solar energy heating equipment

2.4.1.2.13 Central cooling equipment

2.4.1.2.14 Cooling towers

2.4.1.2.15 Packaged water chillers

2.4.1.2.16 Thermal storage

2.4.1.2.17 Air outlets and inlets

2.4.1.2.18 Air terminal units

2.4.1.2.19 Induction air distribution

2.4.1.2.20 Underfloor air distribution

2.4.1.2.21 Building pressurization

2.4.1.2.22 Electronic air cleaners

2.4.1.2.23 Gas-phase air filtration

2.4.1.2.24 HVAC air cleaning devices – particulate air filtration

2.4.1.2.25 HVAC air distribution

2.4.1.2.26 Special exhaust systems

2.4.1.2.27 Ventilation hoods

2.4.1.2.28 HVAC piping and pumps; hydronic piping and pumps

2.4.1.2.29 HVAC water treatment

2.4.1.2.30 Refrigerant piping

2.4.1.2.31 Steam and condensate piping and pumps

2.4.2 Lighting

2.4.2.1 Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall have a basic knowledge of the following documents, and procedures:

2.4.2.1.1 Applicable national codes, standards, and guidelines

2.4.2.1.2 Lighting systems design, installation and operation principles

2.4.2.1.3 Arc flash safety requirements

2.4.2.1.4 Lockout tag-out procedures and medium-voltage power distribution equipment and controls

2.4.2.1.5 Illumination level requirements

2.4.2.1.6 Minimum lighting levels

2.4.2.1.7 Lighting controls and lighting control systems

2.4.2.2 Verification of Performance: Person being certified as a Commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

2.4.2.2.1 Lighting fixtures and lamps

2.4.2.2.2 Lighting control systems

2.4.3 Energy

2.4.3.1 Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall have a basic knowledge of the following documents, and procedures:

2.4.3.1.1 Applicable national codes, standards, and guidelines

2.4.3.1.2 Facility sustainability programs energy requirements

2.4.3.1.3 Facility energy system design and construction requirements

2.4.3.1.4 Measuring, tracking, evaluating and communicating energy use and performance results

2.4.3.1.5 Minimum ASHRAE Level II energy audits

2.4.3.1.6 Inspection, survey and analysis of energy flows for energy conservation

2.4.3.1.7 Energy modeling for buildings and the evaluation of Building Energy Analysis Computer programs

2.4.3.1.8 Instrumentation for testing and monitoring

2.4.3.1.9 Building automation and control systems

2.4.3.1.10 Energy modeling software

2.4.3.1.11 Electrical metering and sub-metering systems

2.4.3.1.12 Lighting systems and controls

2.4.3.1.13 Natural gas and other fuel systems metering, sub-metering and control

2.4.3.2 Verification of Performance: Person being certified as a Commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components.

2.4.3.3 Monitoring and controls:

2.4.3.3.1 Workstation graphic displays

2.4.3.3.2 Public display systems

2.4.3.3.3 Energy management systems and central processing/monitoring hardware and software for energy using systems

2.4.3.3.4 Network communications and alarm function systems

2.4.3.3.5 User interface with emergency services

2.4.3.3.6 Monitoring systems required for facility operations

2.4.3.3.7 Local control panels and individual monitoring points

2.4.3.3.8 Whole-building energy analysis calibration (if required)

2.4.3.3.9 Controls for lighting systems

2.4.3.3.10 Controls for thermal systems

2.4.3.4 Instrumentation for HVAC Systems:

2.4.3.4.1 Actuators and operators

2.4.3.4.2 Sensors and transmitters

2.4.3.4.3 Control valves

2.4.3.4.4 Control dampers

2.4.3.4.5 Flow meters

2.4.3.5 Plumbing Energy Systems:

2.4.3.5.1 Domestic water heating systems

2.4.3.5.2 Fuel system (gas, oil) metering systems

2.4.3.6 Electrical Systems:

2.4.3.6.1 Power meters

2.4.3.6.2 Kilowatt (kW) transducers

2.4.3.6.3 Current sensors

2.4.3.6.4 Battery monitors

2.4.3.6.5 Lighting control systems

2.4.3.6.6 UPS monitors

2.4.3.6.7 Lockout tag-out procedures and medium-voltage power distribution equipment and controls

2.4.3.7 Renewable Energy Systems:

2.4.3.7.1 Solar photovoltaic systems

2.4.3.7.2 Wind generation systems

2.4.3.7.3 Geothermal systems

2.4.3.7.4 Alternative fuel

2.4.3.8 Emergency Power:

2.4.3.8.1 Power distribution

2.4.3.8.2 Access control

2.4.3.8.3 Intrusion detection

2.4.3.8.4 Closed Circuit television systems

2.4.4 Plumbing

2.4.4.1 Applicable Water Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall have a basic knowledge of the following documents, and procedures:

2.4.4.1.1 Applicable national codes, standards, and guidelines

2.4.4.1.2 Labeling of non-potable and potable water piping

2.4.4.1.3 Design and installation of “Gray Water Systems” and applicable equipment

2.4.4.1.4 Design and installation of “Rainwater Collection Systems” and applicable equipment

2.4.4.1.5 Metering for on-site non-potable water source

2.4.4.1.6 Design and installation of “Reclaim Water Systems” and applicable equipment

2.4.4.1.7 Hot water circulating systems and heat sources

2.4.4.1.8 Disinfection of water systems

2.4.4.1.9 Water supply distribution testing requirements

2.4.4.1.10 Plans and construction documents

2.4.4.1.11 Hot water and tempered water insulation requirements and applicable equipment

2.4.4.1.12 Lift station and sump pumping design and safety requirements

2.4.4.1.13 Sewage treatment requirements

2.4.4.2 Verification of Performance: Person being certified as a Commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies and components:

2.4.4.2.1 Water distribution systems (potable and non-potable) plumbing fixtures and fittings

2.4.4.2.2 Pumping and piping systems (water)

2.4.4.2.3 Water treatment devices and equipment

2.4.4.2.4 Water efficiency of plumbing fixtures

2.4.4.2.5 Non-potable plumbing systems

2.4.4.2.6 Water storage tanks

2.4.4.2.7 Backflow prevention assemblies

2.4.4.2.8 Swimming pool and decorative fountain circulating systems

2.4.4.2.9 Water heating and recirculation

2.4.4.2.10 Drainage, waste and vent piping systems (gravity and pressure)

2.4.5 Irrigation

2.4.5.1 Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall have a basic knowledge of the following documents, and procedures:

2.4.5.1.1 Applicable national codes, standards and guidelines

2.4.5.1.2 Cross-connection control programs

2.4.5.1.3 Inspection and testing criteria of backflow prevention assemblies

2.4.5.1.4 Landscape irrigation emission devices

2.4.5.1.5 O&M manual preparation

2.4.5.1.6 Use of native or adaptive plants that are not invasive

2.4.5.1.7 Use of non-potable water sources and required identification of piping and outlets

2.4.5.1.8 Sprinkler head layout

2.4.5.2 Verification of Performance: Person being certified as a Commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

2.4.5.2.1 Landscape irrigation systems

2.4.5.2.2 Static pressure devices

2.4.5.2.3 Backflow preventers

2.4.5.2.4 Flow meters

2.4.5.2.5 Weather-based or soil moisture-based controllers and timers

2.4.5.2.6 Sprinklers

2.4.5.2.7 Rainfall sensors

2.4.5.2.8 Soil moisture sensors

2.4.5.2.9 The use of drip/micro-irrigation

2.4.5.2.10 Hydro-zoning

2.4.6 Building Enclosure

2.4.6.1 Applicable Building Enclosure Codes, Standards, and Guidelines: Person being certified as a Commissioning Provider shall, at a minimum, have a basic knowledge of ASTM E 2813 and the following:

2.4.6.1.1 Heat transfer via conduction, convection, radiation, and air infiltration/exfiltration

2.4.6.1.2 Moisture storage and transport via gravity, diffusion, convection, capillary action, absorbed flow, and osmosis

2.4.6.1.3 Characteristics and behavior of enclosure-related materials, components, systems, and assemblies when specified for a given application, geographic region, exposure, or climate

2.4.6.1.4 Influence of enclosure-related design, construction, and integration on total building performance, including mechanical system performance and consideration of the following:

- Energy
- Environment
- Security
- Durability
- Sustainability
- Operation and maintenance
- Air and vapor transmissions

2.4.6.1.5 Importance of material compatibility and continuity of primary heat, air, and moisture control layers at the exterior building enclosure on total building performance

2.4.6.1.6 Pre-construction laboratory and field-applied test standards and methodology referenced in this standard and their intended use and application in evaluating the durability, performance, constructability, and anticipated service-life of enclosure-related materials, components, systems, and assemblies

2.4.6.2 Verification of Performance: Person being certified as a Commissioning Provider shall have a basic knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems equipment, assemblies, and components:

2.4.6.2.1 Acoustic performance

2.4.6.2.2 Air infiltration

- Air pressurization and depressurization
- Continuous air barrier application

2.4.6.2.3 Thermal performance and condensation resistance

2.4.6.2.4 Water penetration

2.4.6.2.5 Durability and appearance

2.4.6.2.6 Structural performance

2.4.6.2.7 Rain screen pressure equalization

2.4.6.2.8 Solar optical performance

2.4.6.2.9 Moisture control

2.4.6.2.10 Security

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**PART III: MINIMUM QUALIFICATIONS FOR
CERTIFICATION OF COMMISSIONING
SPECIALIST**

3.1 PURPOSE: The purpose of Part III is to set the minimum qualification requirements for certification of a Commissioning Specialist.

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3.2 KNOWLEDGE OF THE COMMISSIONING PROCESS

3.2.1 Commissioning Process: Commissioning Specialists must understand that the commissioning scope will depend upon how the system will be designed, built, and operated. Commissioning will be performed based on the extent of commissioning effort defined and procured by the owner and adopted codes. The process outlined in this section is written for a generic project and must be adapted to each project. This outline describes the commissioning process and can be supplemented by companion technical documents and guidelines to describe the specific details and to properly implement the commissioning process relative to a specific facility, system, or assembly. This process can be applied to both new and renovation projects. Certification under this criteria does not certify Commissioning Specialists to conduct technical performance tests. Technical performance tests shall be performed by qualified personnel as determined by state and local laws.

3.2.2 Commissioning Process Management: Commissioning Specialists must understand that the commissioning process is applicable on many levels. It can be applied to one or a number of systems and assemblies in the project as defined in the owner's project requirements and commissioning plan.

3.3 EDUCATION AND EXPERIENCE REQUIREMENTS FOR CERTIFICATION OF COMMISSIONING SPECIALISTS: The person being certified as a Commissioning Specialist must have the minimum qualifications as detailed in Table 2 below:

Table 2 – Minimum Qualifications of Commissioning Specialist – All Technical Areas

Option	Educational Requirements	Experience and Certification Requirements	Cx Experience in Technical Specialty being Certified	Successful Examination
Option A	Four-year undergraduate degree or higher in a building science field from an accredited institution	Minimum 3 years performing commissioning in the designated technical area	The Cx Specialist must have a minimum of 3 qualifying projects ¹ from design phase thru completion of construction	<p>Pass an exam on Cx and applicable fundamentals, demonstrating knowledge of the Cx process, and specific technical area design, construction, operations and maintenance fundamentals</p> <p>After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry</p>
Option B	<p>Four-year undergraduate degree or higher in a non-building science field from an accredited institution,</p> <p>or</p> <p>Two-year undergraduate degree in a building science field from an accredited institution,</p> <p>or</p> <p>Degree from an accredited and recognized Technical School</p> <p>or</p> <p>Completed apprentice program from a nationally recognized and accredited program in a technical applicable field</p>	<p>Minimum 3 years performing commissioning</p> <p>and</p> <p>Minimum 5 years technical applicable experience</p>	The Cx Specialist must have a minimum of 4 qualifying projects ¹ from design phase thru completion of construction	<p>Pass an exam on Cx and applicable fundamentals, demonstrating knowledge of the Cx process, and technical area design, construction, operations and maintenance fundamentals</p> <p>After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry</p>
Option C	<p>Two-year undergraduate degree in a non- building science field from an accredited institution,</p> <p>or</p> <p>High school diploma or GED</p>	<p>Minimum 3 years performing commissioning</p> <p>and</p> <p>Minimum 7 years technical applicable experience</p>	The Cx Specialist must have a minimum of 5 qualifying projects ¹ from design phase thru completion of construction	<p>Pass an exam on Cx and applicable fundamentals, demonstrating knowledge of the Cx process, and technical area design, construction, operations and maintenance fundamentals</p> <p>After passing exam, maintain good standing in the Cx industry and undertake continuing education in the Cx, design, construction and operations industry</p>

¹ A qualifying project is defined as a commissioning project where the applicant may provide evidence of having participated in the Cx process from design phase to project completion. Completion of an accredited* Cx training program may reduce the number of qualifying projects by a maximum of one and the SF from 150,000 to 100,000.

* Accredited by an International Accreditation Forum signatory or other nationally recognized accrediting body.

3.4 COMMISSIONING SPECIALIST IN HVAC

3.4.1 Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in HVAC systems shall have a working knowledge of the following documents, and procedures:

3.4.1.1 Applicable mechanical, plumbing, electrical, energy, sustainability and applicable codes utilized in design, construction and operation of HVAC systems

3.4.1.2 Standards and guidelines utilized in design, construction and operation of HVAC systems

3.4.1.3 Design of mechanical, related electrical and related plumbing systems

3.4.1.4 Facility sustainability and energy requirements

3.4.1.5 Facility design conditions (climatic conditions, room conditions, temperature humidity levels, and pressure requirements, etc.)

3.4.1.6 HVAC software applications

3.4.1.7 Facility schematic, design development, construction phase documents

3.4.1.8. Electrical power distribution, motor control centers, power monitoring, etc.

3.4.1.9 Commissioned systems and equipment specifications

3.4.1.10 Operations and maintenance (O&M) documentation and requirements

3.4.1.11 Mechanical/electrical equipment and system operation as applicable to HVAC system

3.4.1.12 Building Automated System (BAS) control diagrams, points, sequences and configuration

3.4.1.13 Testing and balancing (TAB) process and procedures, system manual components and assembly

3.4.1.14 Commissioning report assembly and organization for HVAC

3.4.2 Verification of Performance: Person being certified as a Commissioning Specialist in HVAC systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.4.2.1 Instrumentation and control for HVAC

3.4.2.2 Unitary HVAC equipment

3.4.2.3 Humidity control equipment

3.4.2.4 Convection heating and cooling units

3.4.2.5 Radiant heating units

3.4.2.6 Central heating equipment — breechings, chimneys and stacks

3.4.2.7 Fuel-fired heaters

3.4.2.8 Furnaces

3.4.2.9 Heat exchangers

3.4.2.10 Heating boiler feed water equipment

3.4.2.11 Heating boilers

3.4.2.12 Solar energy heating equipment

3.4.2.13 Central cooling equipment

3.4.2.14 Cooling towers

3.4.2.15 Packaged water chillers

3.4.2.16 Thermal storage

3.4.2.17 Air outlets and inlets

3.4.2.18 Air terminal units

3.4.2.19 Induction air distribution

3.4.2.20 Underfloor air distribution

3.4.2.21 Building pressurization

3.4.2.22 Electronic air cleaners

3.4.2.23 Gas-phase air filtration

3.4.2.24 HVAC air cleaning devices — particulate air filtration

3.4.2.25 HVAC air distribution

3.4.2.26 Special exhaust systems

3.4.2.27 Ventilation hoods

3.4.2.28 HVAC piping and pumps; hydronic piping and pumps

3.4.2.29 HVAC water treatment

3.4.2.30 Refrigerant piping

3.4.2.31 Steam and condensate piping and pumps

3.5 COMMISSIONING SPECIALIST IN LIGHTING SYSTEMS

3.5.1 Knowledge of Applicable Lighting Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in lighting systems shall have a working knowledge of the following documents and procedures:

3.5.1.1 Applicable national codes, standards, and guidelines

3.5.1.2 Lighting systems design, installation and operation principles

3.5.1.3 Arc flash safety requirements

3.5.1.4 Illumination level requirements

3.5.1.5 Minimum lighting levels

3.5.1.6 Lighting controls and lighting control systems

3.5.2 Verification of Performance: Person being certified as a Commissioning Specialist in lighting systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.5.2.1 Lighting fixtures and lamps

3.5.2.2 Lighting control systems

3.6 COMMISSIONING SPECIALIST IN PLUMBING SYSTEMS

3.6.1 Knowledge of Applicable Water Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in water systems shall have a working knowledge of the following documents and procedures:

3.6.1.1 Applicable national codes, standards, and guidelines

3.6.1.2 Labeling of non-potable and potable water piping

3.6.1.3 Design and installation of “Gray Water Systems” and applicable equipment

3.6.1.4 Design and installation of “Rainwater Collection Systems” and applicable equipment

3.6.1.5 Metering for onsite non-potable water source

3.6.1.6 Design and installation of “Reclaim Water Systems” and applicable equipment

3.6.1.7 Hot water circulating systems and heat sources

3.6.1.8 Disinfection of water systems

3.6.1.9 Water supply distribution testing requirements

3.6.1.10 Plans and construction documents

3.6.1.11 Hot water and tempered water insulation requirements and applicable equipment

3.6.1.12 Lift station and sump pumping design and safety requirements

3.6.1.13 Sewage treatment requirements

3.6.2 Verification of Performance: Person being certified as a Commissioning Specialist in water systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.6.2.1 Water distribution systems (potable and non-potable), plumbing fixtures and fittings

3.6.2.2 Pumping and piping systems (water)

3.6.2.3 Water treatment devices and equipment

3.6.2.4 Water efficiency of plumbing fixtures

3.6.2.5 Non-potable plumbing systems

3.6.2.6 Water storage tanks

3.6.2.7 Backflow prevention assemblies

3.6.2.8 Swimming pool and decorative fountain circulating systems

3.6.2.9 Water heating and recirculation

3.6.2.10 Drainage, waste and vent piping systems (gravity and pressure)

3.7 COMMISSIONING SPECIALIST IN ENERGY SYSTEMS

3.7.1 Knowledge of Applicable Commissioning, Standards, and Guidelines: Person being certified as a Commissioning Specialist in energy systems shall have a working knowledge of the following documents and procedures:

3.7.1.1 Applicable national codes, standards, and guidelines

3.7.1.2 Facility sustainability programs energy requirements

3.7.1.3 Facility energy system design and construction requirements

3.7.1.4 Measuring, tracking, evaluating and communicating energy use and performance results

3.7.1.5 Minimum ASHRAE Level II energy audits

3.7.1.6 Inspection, survey and analysis of energy flows for energy conservation

3.7.1.7 Energy modeling for buildings and the evaluation of Building Energy Analysis computer programs

3.7.1.8 Instrumentation for testing and monitoring

3.7.1.9 Building automation and control systems

3.7.1.10 Energy modeling software

3.7.1.11 Electrical metering and sub-metering systems

3.7.1.12 Lighting systems and controls

3.7.1.13 Natural gas and other fuel systems metering, sub-metering and control

3.7.2 Verification of Performance: Person being certified as a Commissioning Specialist in energy systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.7.2.1 Monitoring and Controls:

3.7.2.1.1 Workstation graphic displays

3.7.2.1.2 Public display systems

3.7.2.1.3 Energy management systems and central processing/monitoring hardware and software for energy using systems

3.7.2.1.4 Network communications and alarm function systems

3.7.2.1.5 User interface with emergency services

3.7.2.1.6 Monitoring systems required for facility operations

3.7.2.1.7 Local control panels and individual monitoring points

3.7.2.1.8 Whole-building energy analysis calibration (if required)

3.7.2.1.9 Controls for lighting systems

3.7.2.1.10 Controls for thermal systems

3.7.2.2 Instrumentation for HVAC Systems:

3.7.2.2.1 Actuators and operators

3.7.2.2.2 Sensors and transmitters

3.7.2.2.3 Control valves

3.7.2.2.4 Control dampers

3.7.2.2.5 Flow meters

3.7.2.3 Plumbing Energy Systems:

3.7.2.3.1 Domestic water heating systems

3.7.2.3.2 Fuel system (gas, oil) metering systems

3.7.2.4 Electrical Systems:

3.7.2.4.1 Power meters

3.7.2.4.2 Kilowatt (kW) transducers

3.7.2.4.3 Current sensors

3.7.2.4.4 Battery monitors

3.7.2.4.5 Lighting control systems

3.7.2.4.6 UPS monitors

3.7.2.4.7 Lockout tag-out procedures and medium-voltage power distribution equipment and controls

3.7.2.5 Renewable Energy Systems:

3.7.2.5.1 Solar photovoltaic systems

3.7.2.5.2 Wind generation systems

3.7.2.5.3 Geothermal systems

3.7.2.5.4 Alternative fuel

3.8 COMMISSIONING SPECIALIST IN IRRIGATION SYSTEMS

3.8.1 Knowledge of Applicable Landscape Irrigation Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in landscape irrigation systems shall have a working knowledge of the following documents and procedures:

3.8.1.1 Applicable national codes, standards and guidelines

3.8.1.2 Cross-connection control programs

3.8.1.3 Inspection and testing criteria of backflow prevention assemblies

3.8.1.4 Landscape irrigation emission devices

3.8.1.5 O&M manual preparation

3.8.1.6 Use of native or adaptive plants that are not invasive

3.8.1.7 Use of non-potable water sources and required identification of piping and outlets

3.8.1.8 Sprinkler head layout

3.8.2 Verification of Performance: Person being certified as a Commissioning Specialist in landscape irrigation systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.8.2.1 Landscape irrigation systems

3.8.2.2 Static pressure devices

3.8.2.3 Backflow preventers

3.8.2.4 Flow meters

3.8.2.5 Weather-based or soil moisture-based controllers and timers

3.8.2.6 Sprinklers systems

3.8.2.7 Rainfall sensors

3.8.2.8 Soil moisture sensors

3.8.2.9 Use of drip/micro-irrigation

3.8.2.10 Hydro-zoning

3.9 COMMISSIONING SPECIALIST IN INDOOR ENVIRONMENTAL QUALITY

3.9.1 Knowledge of Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in indoor environmental quality shall have a working knowledge of the following documents, and procedures:

3.9.1.1 Applicable national codes, standards and guidelines

3.9.1.2 Ventilation for acceptable indoor air quality

3.9.1.3 Thermal environmental conditions for human occupancy

3.9.1.4 Method of testing general ventilation air-cleaning devices for removal efficiency by particle size

3.9.1.5 Safety standard for refrigeration systems

3.9.1.6 Sustainability requirements for applicable programs designated for the project

3.9.1.7 Facility design conditions (climatic conditions, room conditions, lighting, temperature humidity levels, and pressure requirements, etc.)

3.9.1.8 Sampling and testing of conditions and contaminants

3.9.2 Verification of Performance: Person being certified as a Commissioning Specialist in indoor environmental quality shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.9.2.1 Outside air systems and controls

3.9.2.2 Refrigerant safety and exhaust systems

3.9.2.3 Air filtration

3.9.2.4 Construction phase indoor air quality (IAQ) programs and application

3.9.2.5 Post construction flushing and/or contaminant testing

3.10 COMMISSIONING SPECIALIST IN BUILDING ENCLOSURE SYSTEMS

3.10.1 Knowledge of Applicable Building Enclosure Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in building enclosure systems shall, at a minimum, have a working knowledge of ASTM E 2813 Standard Practice for Building Enclosure Commissioning and the following:

3.10.1.1 Heat transfer via conduction, convection, radiation, and air infiltration/exfiltration

3.10.1.2 Moisture storage and transport via gravity, diffusion, convection, capillary action, absorbed flow, and osmosis

3.10.1.3 Characteristics and behavior of enclosure-related materials, components, systems, and assemblies when specified for a given application, geographic region, exposure, or climate

3.10.1.4 Influence of enclosure-related design, construction, and integration on total building performance, including, mechanical system performance and consideration of the following:

3.10.1.4.1 Energy

3.10.1.4.2 Environment

3.10.1.4.3 Security

3.10.1.4.4 Durability

3.10.1.4.5 Sustainability

3.10.1.4.6 Operation and maintenance

3.10.1.5 Air and vapor transmissions

3.10.1.6 Importance of material compatibility and continuity of primary heat, air, and moisture control layers at the exterior building enclosure on total building performance

3.10.1.7 Pre-construction laboratory and field-applied test standards and methodology referenced in this standard and their intended use and application in evaluating the durability, performance, constructability, and anticipated service-life of enclosure-related materials, components, systems, and assemblies

3.10.2 Verification of Performance: Person being certified as a Commissioning Specialist in indoor environmental quality shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.10.2.1 Acoustic performance

3.10.2.2 Air infiltration

3.10.2.2.1 Air pressurization and depressurization

3.10.2.2.2 Continuous air barrier application

3.10.2.3 Thermal performance and condensation resistance

3.10.2.4 Water penetration

3.10.2.5 Durability and appearance

3.10.2.6 Structural performance

3.10.2.7 Rain screen pressure equalization

3.10.2.8 Solar optical performance

3.10.2.9 Moisture control

3.10.2.10 Security

3.11 COMMISSIONING SPECIALIST IN FIRE PROTECTION SYSTEMS

3.11.1 Knowledge of Applicable Fire Protection Codes, Standards, Guidelines, and Monitoring Systems: Person being certified as a Commissioning Specialist in fire protection systems shall have a working knowledge of the following documents, and procedures:

3.11.1.1 Applicable national codes, standards and guidelines

3.11.1.2 Installation of sprinkler systems in non-residential occupancies

3.11.1.3 Installation of sprinkler systems in residential occupancies

3.11.1.4 Installation of standpipe and hose systems

3.11.1.5 Inspection, testing, and maintenance of water-based fire protection systems

3.11.1.6 Pressure and flow testing

3.11.1.7 Installation of stationary pumps for fire protection

3.11.1.8 Water tanks for private fire protection

3.11.1.9 Installation of private fire service mains and their appurtenances

3.11.1.10 Instrumentation for testing and monitoring

3.11.1.11 Installation of hood suppression systems

3.11.1.12 Installation of foam systems

3.11.1.13 Installation of wet and dry chemical systems

3.11.1.14 Installation of clean agent fire extinguishing systems

3.11.1.15 Installation carbon dioxide systems

3.11.2 Verification of Performance: Person being certified as a Commissioning Specialist in fire protection systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.11.2.1 Overhead piping

3.11.2.2 Underground piping

3.11.2.3 Standpipe systems

3.11.2.4 Fire pump systems

3.11.2.5 Water storage tank

3.11.2.6 Pre-action automatic sprinkler systems

3.11.2.7 Deluge sprinkler systems

3.11.2.8 Dry pipe automatic sprinkler systems

3.11.2.9 Instrumentation for testing and monitoring

3.12 COMMISSIONING SPECIALIST IN FIRE ALARM SYSTEMS

3.12.1 Knowledge of Applicable Fire Alarm Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in fire alarm systems shall have a working knowledge of the following documents and procedures:

3.12.1.1 Applicable national codes, standards, and guidelines

3.12.1.2 Interface with building automation and control systems

3.12.1.3 Americans with Disabilities Act

3.12.1.4 Integrated systems testing

3.12.2 Verification of Performance: Person being certified as a Commissioning Specialist in fire protection systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.12.2.1 Testing of fire alarm devices and appliances

3.12.2.2 The use of sound level meters used to ensure the systems provide the code required audibility

3.12.2.3 Intelligibility meters used to ensure the systems provide the code required intelligibility

3.12.2.4 Door controls, HVAC, elevator control, smoke control, and suppression systems and how they should operate in conjunction with the operation of the fire alarm system

3.13 COMMISSIONING SPECIALIST IN VERTICAL CONVEYANCE SYSTEMS

3.13.1 Knowledge of Applicable Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in vertical conveyance systems shall have a working knowledge of the following documents, and procedures:

3.13.1.1 Safety code for elevators and escalators

3.13.1.2 Guide for inspection of elevators, escalators, and moving walks

3.13.1.3 Safety code for existing elevators and escalators

3.13.2 Verification of Performance: Person being certified as a Commissioning Specialist in vertical conveyance systems shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.13.2.1 Elevator controls and systems

3.13.2.2 Escalators external systems and components

3.13.2.3 Escalators internal components and systems

3.14 COMMISSIONING SPECIALIST IN SITE DEVELOPMENT AND LAND USE

3.14.1 Knowledge of Applicable Site Development and Land Use Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in site development and land use systems shall have a working knowledge of the following documents, and procedures:

3.14.1.1 Applicable national codes, standards, and guidelines

3.14.1.2 Landscape irrigation systems layout

3.14.1.3 Plans and construction documents

3.14.1.4 Lift station and sump pumping design and safety requirements

3.14.1.5 Outdoor lighting systems design, installation, and operation principles

3.14.1.6 Stormwater pollution prevention

3.14.2 Verification of Performance: Person being certified as a Commissioning Specialist in site development and land use shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.14.2.1 Landscape irrigation systems

3.14.2.2 Outdoor fountains and water features

3.14.2.3 Natural resources and base line conditions of building site

3.14.2.4 Topsoil and vegetation protection measures, setbacks from protected areas

3.14.2.5 Imported soils, soil restoration and reuse

3.14.2.6 Storm water management system

3.14.2.7 Erosion and sediment control

3.14.2.8 Hardscape and shading provided by structures and vegetation

3.14.2.9 Vegetative roofs

3.14.2.10 Water management; on-site storm water management

3.14.2.11 Topography and site grading

3.14.2.12 Heat island mitigation

3.14.2.13 Outdoor and site lighting

3.14.2.14 Environmental Protection Agency's (EPA) 1995 Brownfield Program

3.15 COMMISSIONING SPECIALIST IN CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

3.15.1 Knowledge of Applicable Construction and Demolition Waste Management Codes, Standards, and Guidelines: Person being certified as a Commissioning Specialist in construction and demolition waste management shall have a working knowledge of the following documents, and procedures:

3.15.1.1 Applicable nationally recognized codes, standards, and guidelines

3.15.1.2 Federal and state regulatory requirements

3.15.1.3 Integrated waste management plans

3.15.1.4 Non-hazardous construction waste recycling, salvaging, and disposal

3.15.1.5 Materials cost pertaining to their adaptive use

3.15.1.6 Requirements for health and safety for Construction and Demolition (C&D) material handling and management

3.15.1.7 Bulk comingling, source separation and diversion

3.15.1.8 C&D information reporting and records management

3.15.1.9 Disposal of land clearing debris

3.15.1.10 Project documents, schedule, critical path, and scope of work for C&D Waste Management (WM)

3.15.1.11 Project staging and coordination

3.15.1.12 Hazardous waste identification, storage, and disposal

3.15.2 Verification of Performance: Person being certified as a Commissioning Specialist in construction and demolition waste management shall have knowledge of and ability to coordinate, document and evaluate performance tests of appropriate discipline-specific systems, equipment, assemblies, and components:

3.15.2.1 External documentation and reporting

3.15.2.2 Internal information management process reporting and records

3.15.2.3 Progress and events; proper documentation of meetings and other communications

3.15.2.4 Integrated waste management plan documented to a qualified and approved waste hauler

3.15.2.5 Proper handling and transfer of hazardous C&D materials on site to an approved waste hauler

3.15.2.6 Project material consumption

3.15.2.7 Recycled and salvaged material intended for project reuse meets all material design requirements, codes, standards and project documents

3.15.2.8 Material cost savings and diversion as they relate to recycled and salvaged materials

3.15.2.9 Amount of source site separation and diversion, for each material identified

3.15.2.10 Amount of bulk comingling and diversion, for all materials with an estimate for each type of material used on project

3.15.2.11 Workers are approved and meet all necessary federal, state and local regulatory requirements for handling hazardous materials

3.15.2.12 Project closeout; all documentation required for the project, up-to-date, and reported as required by the AHJ and contract documents

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**PART IV: MINIMUM QUALIFICATIONS FOR
TRAINING OF COMMISSIONING PROVIDERS
AND SPECIALISTS**

4.1 PURPOSE: The purpose of Part IV is to set the minimum requirements for training of Commissioning Providers and Commissioning Specialists.

4.2 TRAINING OF COMMISSIONING PROVIDERS: Training agencies must provide training that satisfies the requirements of Section 2.2 and 2.4 contained within Part II of this document.

4.3 TRAINING OF COMMISSIONING SPECIALISTS: Training agencies must provide training that satisfies Section 3.2 and 3.4 through 3.15, as applicable, to their desired scope of accredited training courses, contained within Part III of this document. ■

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Appendix 1

Duties, Tasks and KSAs of Commissioning Provider

Duties		Tasks	Knowledge, Skills & Abilities
A	Develop Design Phase Cx Plan	A.1 Determine Cx scope A.2 Outline the design phase Cx process A.3 Define roles and responsibilities of Cx team A.4 Determine schedule of Cx activities A.5 Document Cx communication channels A.6 Document Cx team and contact information A.7 Write Design Cx Plan	Knowledge of: <ul style="list-style-type: none"> Design & construction phase commissioning process Construction communication protocol Skills to: <ul style="list-style-type: none"> Writing Plans Ability to: <ul style="list-style-type: none"> Review and comment on Cx plan
B	Develop/Review Owner's Project Requirements (OPR)	B.1 Verify OPR meets owner's goals & objectives B.2 Verify OPR is specific to project B.3 Verify OPR meets minimum requirements B.4 Verify OPR provides design & construction team sufficient direction B.5 Develop comments	Knowledge of: <ul style="list-style-type: none"> Facility requirements Sustainability and energy requirements Facility design and construction Minimum requirements of owner project (OPR) Skills to: <ul style="list-style-type: none"> Write OPR Ability to: <ul style="list-style-type: none"> Review and Comment on OPR
C	Review Basis of Design (BOD)	C.1 Verify BOD complies with OPR C.2 Verify documentation of design conditions C.3 Review documentation of applicable codes C.4 Evaluate application of selected systems C.5 Develop comments related to BOD review C.6 Verify comments are addressed & BOD is updated regularly	Knowledge of: <ul style="list-style-type: none"> Design conditions (climatic conditions, room conditions, temperature humidity levels, and pressure requirements, etc.) Design methods, techniques, and software applications National, state & local building codes, standards, & guidelines Application of commissioned systems and assemblies Skilled to: <ul style="list-style-type: none"> Review and Comment on BOD
D	Review Design Documents (Drawings and Specifications)	D.1 Ascertain completeness of documents at each phase D.2 Verify documents comply with OPR & BOD D.3 Verify equipment & systems meet energy and sustainability goals D.4 Verify equipment & system integration details are sufficient D.5 Verify building envelope complies with OPR & BOD D.6 Examine BAS system diagrams, point lists, & control sequences D.7 Review documents for O&M considerations & clearances D.8 Develop comments related to documents review D.9 Verify comments were addressed	Knowledge of: <ul style="list-style-type: none"> Schematic, design development, construction phase documents Design procedures for commissioned systems Skilled in: <ul style="list-style-type: none"> Detailed design review of documents Writing design review comments for review by design team Ability to: <ul style="list-style-type: none"> Determine completeness of documents at current phase

Duties		Tasks	Knowledge, Skills & Abilities
E	Develop Commissioning Specification	E.1 Determine format of Cx specification E.2 Identify commissioned systems and equipment E.3 Determine Cx team roles & responsibilities E.4 Outline testing requirements E.5 Determine technical commissioning requirements E.6 Modify Cx template specification language to suit project	Knowledge of: <ul style="list-style-type: none"> • Specification formats • General commissioning specification requirements • Technical commissioning specification requirements Skilled in: <ul style="list-style-type: none"> • Writing specifications
F	Develop Construction Phase Cx Plan	F.1 Determine/update Cx scope F.2 Outline construction phase Cx process F.3 Define roles and responsibilities of Cx team members F.4 List commissioned equipment & systems F.5 Determine schedule of Cx activities F.6 Document Cx communication channels F.7 Identify Cx team and contact information	Knowledge of: <ul style="list-style-type: none"> • Construction phase commissioning processes • Commissioned systems and equipment Skilled in: <ul style="list-style-type: none"> • Writing construction phase commissioning plan
G	Review Equipment Submittals	G.1 Determine submittals to be reviewed G.2 Verify submittals meet BOD & OPR requirements G.3 Review submittals for technical accuracy G.4 Verify submittals are coordinated with drawings G.5 Develop comments related to submittal review G.6 Verify comments are addressed	Knowledge of: <ul style="list-style-type: none"> • Construction submittals • Installation requirements equipment and systems • Operation and maintenance requirements Skilled in: <ul style="list-style-type: none"> • Writing submittal comments for review by design team Ability to: <ul style="list-style-type: none"> • Review submittals • Review submittals for acceptability
H	Develop Construction Checklists	H.1 Develop project-specific checklist H.2 Create checklist as required to suit project requirements H.3 Present draft construction checklist for review H.4 Revise checklists incorporating review comments H.5 Develop the start-up plan	Knowledge of: <ul style="list-style-type: none"> • Installation requirements of commissioned systems • Manufacturer's installation requirements Skilled in: <ul style="list-style-type: none"> • Revising developed checklist for specific projects • Creating checklists per project requirements
I	Observe Jobsite System Installation (Installation of Equipment and Systems)	I.1 Verify installation is consistent with construction documents I.2 Verify installation adheres to manufacturer & industry standards I.3 Evaluate installation for operation repair & maintenance considerations I.4 Compare installation with (full or partial) construction checklists I.5 Document deficiencies I.6 Perform installation evaluation	Knowledge of: <ul style="list-style-type: none"> • Installation methods and procedures • Equipment maintenance and operation requirements Ability to: <ul style="list-style-type: none"> • Verify installation complies with construction documents and manufacturer's installation instructions
J	Witness Equipment Start-up	J.1 Review construction checklists for completeness J.2 Review start-up procedures with contractors J.3 Observe start-up of equipment & systems J.4 Evaluate start-up activities J.5 Document deficient issues	Knowledge of: <ul style="list-style-type: none"> • Equipment manufacturer's start-up procedures Skilled in: <ul style="list-style-type: none"> • Documenting start-up procedures

Duties		Tasks	Knowledge, Skills & Abilities
K	Track Issues (Throughout Project)	K.1 Identify issues K.2 Document issues K.3 Document and communicate issues to appropriate party K.4 Verify resolution of issues K.5 Document changes to resolve issues	Skilled in: <ul style="list-style-type: none"> Identifying installation and operational deficiencies Verifying resolution of deficiencies
L	Write Performance Test (PT) Procedures	L.1 Develop/update PT list L.2 Examine drawings, diagrams, & specifications L.3 Examine control system diagrams, point lists, & control sequences for test scenarios L.4 Write draft PT procedures L.5 Present draft PT for review L.6 Revise PT incorporating review comments L.7 Perform integration testing	Knowledge of: <ul style="list-style-type: none"> Equipment and system operation BAS control diagrams, points, sequences and configuration TAB process and procedures Skilled in: <ul style="list-style-type: none"> Writing detailed step-by-step procedures Ability to: <ul style="list-style-type: none"> Determine testing requirements of specific systems and equipment
M	Conduct Performance Testing	M.1 Coordinate PT schedule M.2 Facilitate PT process M.3 Document execution of tests M.4 Evaluate, document and communicate results of PT	Skilled in: <ul style="list-style-type: none"> Recording test data & results Trending and trend analysis Ability to: <ul style="list-style-type: none"> Facilitate the PT process Evaluate test results
N	Review O&M Documents	N.1 Review record drawings usability and compliance with specifications N.2 Evaluate O&M materials for usability N.3 Develop comments related to O&M documents N.4 Verify comments are addressed	Knowledge of: <ul style="list-style-type: none"> O&M documentation Ability to: <ul style="list-style-type: none"> Determine accuracy of record documents
O	Develop Systems Manual	O.1 Identify required documents for compliance with specs, submittals, and specific project O.2 Assemble system manual documents O.3 Write specific documents as required O.4 Write executive summary O.5 Write facility guide	Knowledge of: <ul style="list-style-type: none"> System manual components Skilled in: <ul style="list-style-type: none"> Writing executive summaries Organizing documents
P	Verify Training of O&M Staff	P.1 Develop and/or review training agenda P.2 Evaluate instructor qualifications P.3 Document training sessions per specifications P.4 Evaluate, document and communicate training issues	Knowledge of: <ul style="list-style-type: none"> O&M staff training requirements Delivery of training
Q	Review Facility Performance Prior to End of Warranty	Q.1 Prepare for site visit Q.2 Discuss issues with owner, O&M staff & occupants Q.3 Review equipment and system performance Q.4 Document issues Q.5 Develop a plan for resolving issues Q.6 Comfort performance evaluation	Skilled in: <ul style="list-style-type: none"> Documenting deficiencies Developing plans
R	Develop Cx Report	R.1 Document Cx results R.2 Write executive summary R.3 Compile contents of commissioning report as required	Knowledge of: <ul style="list-style-type: none"> Cx report components Skilled in: <ul style="list-style-type: none"> Writing executive summaries