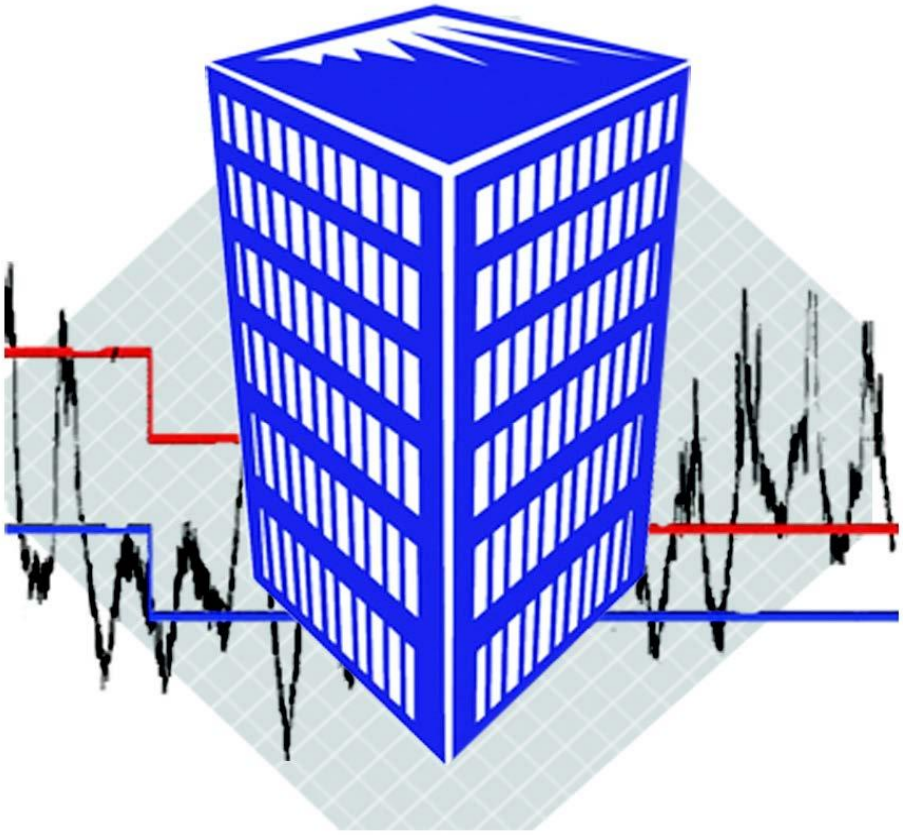

DASNY BUILDING COMMISSIONING GUIDELINES

2013

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DORMITORY AUTHORITY STATE OF NEW YORK

e-version: www.dasny.org/construc/consultants/index.php click on Building Commissioning Guidelines
intranet web page: Construction/CodeCompliance/Commissioning
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SUMMARY

The **purpose of these guidelines** is to develop a consistent method to implement Building Commissioning on Dormitory Authority projects.

The **definition of building commissioning (Cx)** is a quality assurance process that documents buildings are designed, installed, and tested to meet the owner's needs and the design intent.

The **purpose of building commissioning** is to enhance project delivery and ensure a fully functional, optimized building that is suited for its use, and can be turned over to owner operators with sufficient training and Operating & Maintenance information to provide continued building system performance.

The **intent of DASNY Building Commissioning Guidelines** is to ensure commissioning is delivered to meet the following DASNY Policy and requirements:

- DASNY Sustainability Policy, which commits to achieve the goal of LEED Silver rating for all of its applicable projects, and in turn requires commissioning

- The Green Building Tax Credit (GBTC), 6NYCRR Part 638, Section 638.8-Commissioning; and GBTC, Section 638.7(d)(1)-Indoor Air Quality Testing; and GBTC, Part 638.7(d)(2)-IAQ Management Plan During Construction. (See Chapter 2 for applicable excerpts of the Green Building Tax Credit Guidelines)

- U. S. Green Building Council's LEED™ Green Building Rating System, both prerequisite and enhanced commissioning credit

- Local Law No. 86 of the City of New York, which references commissioning requirements through the goals to achieve USGBC LEED ratings for applicable projects

- New York State Green Building Construction Act (Although enacted into law, the final language of this Act has not been adopted yet. Therefore this law is not enforceable at this time.)

The Commissioning Facilitator, Planning, Design, and Quality Assurance (PDQA), Project Management (PM), and the Design Professionals should be utilized to determine specific regulatory, policy, and client requirements with regard to commissioning applicable on a per project basis.

The commissioning process identifies that:

- The Owner's Project Requirements (OPR) are documented, updated, and achieved

- The Design Intent (DI) and Basis of Design (BOD) are developed and followed

- A Commissioning Plan is developed, updated, followed, and commissioning requirements included in the Construction Documents

- Specified equipment, components and systems have been properly installed

- Pre-functional & Functional Performance Testing has been completed and documented for proper operation through all specified modes of operation and conditions

- Training of operations and maintenance personnel has been performed

- Systems & Energy Manuals, and Operations & Maintenance Manuals are documented and completed

The commissioning process is developed and directed by the Commissioning Authority (CxA), an independent entity provided by the Owner. For the purpose of these guidelines, the CxA shall be a third-party participant, and should have no economic ties to the design professional(s) or the contractor(s). Note: Exceptions may apply (e.g. Energy Performance Contracts, LEED for Homes projects), and should be reviewed with the Commissioning Facilitator, PDQA, and PM on a per project basis.

The Commissioning Authority (CxA) leads the commissioning process and makes recommendations to the owner(s) regarding performance of the commissioned equipment and systems. In order to do so, the CxA should be an active participant throughout design, construction, and occupancy phases of a project.

Forms to complete the commissioning requirements for buildings complying with these Guidelines shall be those created by Portland Energy Conservation, Incorporated (PECI), or similar. These forms are available at http://www.peci.org/model-commissioning-plans-guide-specifications

Please refer to the following links for more information regarding the documents referenced in these guidelines:

http://new.usgbc.org/ to download a copy of the latest version of the U.S. Green Building Council's LEED® rating systems and guidelines.

http://www.dec.ny.gov/regs/4475.html to download a copy of the New York State Green Building Tax Credit and the latest version of the New York State Green Building Tax Credit Guidelines.

http://www.nyc.gov/html/dob/downloads/pdf/ll_86of2005.pdf to download a copy of the Local Laws of the City of New York for the Year 2005; No. 86.

CHAPTER 1: COMMISSIONING PROCESS

A. DETERMINING COMMISSIONING REQUIREMENTS FOR PROJECTS

The **intent** of this Section is to summarize which projects require commissioning.

The Commissioning Facilitator, PDQA and Design Professionals should be utilized to determine specific regulatory, policy, and client requirements with regard to commissioning, as applicable, on a per project basis.

Once commissioning is determined to be included in a project, commissioning delivery should be per these Guidelines and is intended to meet all commissioning requirements of DASNY Sustainability Policy, LEED certification requirements, NYC Local Law 86, and New York State Green Building Tax Credit – 6 NYCRR Part 638.8.

Does my project require commissioning?

Based on DASNY Sustainability Policy:

- DASNY Sustainability Policy, as of January 1, 2008, requires all new construction, addition, or significant renovation projects to include a goal of LEED Silver and shall be fully submitted to the U. S. Green Building Council for a rating review.
- Further, the policy also requires at a minimum that a Commissioning Authority be part of the design process at the schematic design phase.

If a project will be LEED certified per DASNY Sustainability Policy then it must be commissioned.

The intent of DASNY Sustainability Policy is to commission projects from design phase through construction phase.

Therefore, if a project will be LEED certified per DASNY Sustainability Policy, then commissioning should be delivered per these Guidelines and the intent will be to comply with both the LEED prerequisite and enhanced commissioning requirements.

Based on the U. S. Green Building Council's LEED Green Building Rating System:

- LEED certification may be part of a project based on the requirements noted above, or requested as client preference.

If a project will be LEED certified it must be commissioned.

- A LEED certified project must have commissioning per Energy and Atmosphere section, Prerequisite 1 – Fundamental Commissioning. LEED's Energy and Atmosphere section, Enhanced Commissioning Credit offers a point toward the desired LEED certification level as an option.

However, if a project will be LEED certified, then commissioning should be delivered per these Guidelines and the intent will be to comply with both the LEED prerequisite and enhanced commissioning requirements.

Based on Local Law No. 86 of the City of New York:

- All New York City-owned or City-funded buildings shall comply with Local Law 86.
- Local Law 86 states: All New York City-owned or City funded new construction or renovation projects with an estimated construction cost of two million dollars or more shall be designed and constructed in accordance with the U.S.G.B.C. LEED building rating system to achieve a LEED silver rating or higher.

Therefore, if commissioning is required per NYC, Local Law 86, then the project should be commissioned per these Guidelines and will comply with all commissioning requirements of the LEED rating system to meet both Energy and Atmosphere section, Prerequisite 1 – Fundamental Commissioning, and Energy and Atmosphere section, Credit 3 – Enhanced Commissioning.

If my project includes commissioning, what systems and equipment must be commissioned?

- A project requiring commissioning per DASNY Policy must commission all building HVAC systems, equipment, and components that affect energy use (such as controls), including air quality monitoring systems as they relate to ventilation systems, renewable and alternative energy technologies as appropriate per mechanical plant definition, waste heat recovery systems, domestic and service water heaters, and thermal storage systems and equipment (as noted in the New York State Green Building Tax Credit – 6 NYCRR Part 638.8).
- A project requiring commissioning per LEED must commission all systems and components noted in the previous bullet item, as well as lighting and day-lighting controls, and domestic hot water system components such as hot water re-circulating pumps.

However, per these Guidelines commission the systems, equipment, and components to meet the requirements of both LEED and NYS Green Building Tax Credit – 6 NYCRR Part 638.8.

Commission the following systems, equipment, and components as applicable to each specific project:

- Chillers, boilers, domestic water and service water heaters, cooling towers, pumps, unitary and split air conditioners, furnaces, fans, heat exchangers, controls for central plant and HVAC including energy management systems or portions of building automation systems that affect energy use, ducts and associated dampers, piping and associated valves, duct and pipe insulation, air quality monitoring systems as they relate to ventilation systems, duct system protection during construction as related to indoor air quality, renewable and alternative energy technologies, waste heat recovery, thermal storage equipment, automated lighting controls, and automated day-lighting controls.

The Commissioning Authority (CxA) may be requested to commission other building systems and components such as plumbing, fire protection, electrical, telecommunications, audio/video, security, Health Care and Laboratory specialty systems (such as medical gases, vacuum, reverse osmosis, de-ionized water, lab disposal, etc.), building envelope and building automation systems as needed on a per project basis.

B. SELECTING THE COMMISSIONING AUTHORITY

The **intent** of this Section is to summarize the Commissioning Authority (CxA) selection process for DASNY Design and Construction Staff.

This process of selecting a Commissioning Authority (CxA) is for specific projects only, not for use in selecting term consultants. PDQA and Construction Staff should utilize DASNY's Commissioning Facilitator (Cx Facilitator) during the Commissioning Authority (CxA) selection process.

The Commissioning Authority (CxA) leads the commissioning team and is responsible for planning, developing, organizing, coordinating, documenting, and facilitating the completion of the commissioning process on behalf of the owner to ensure that the intent of the owner is achieved.

The CxA shall be, per these guidelines, an independent entity provided by the Owner. Exceptions may apply (e.g. Energy Performance Contracts, LEED for Homes projects), and should be reviewed with the Cx Facilitator, PDQA, and Construction on a per project basis.

It is important to involve the Commissioning Authority (CxA) as early in the project as possible, preferably during the start-up of the project (for large projects >$100M) or early in the Design Phase (typically at 30% Schematic Design submission).

Commissioning Authority (CxA) selection activities for PDQA and Construction Staff:

- Assist the Cx Facilitator to determine the commissioning (Cx) budget and coordinate Cx schedule impacts.
- Ensure Cx service requirements and participation is coordinated with all Professional Services Contract(s). Design consultant contracts should include Chapter Two, Article 9 – Commissioning, and Chapter Two; Appendix 1- Professional's Documentation list should include Owner's Project Requirements (OPR), Design Intent (DI), and Basis of Design (BOD). Regardless, the Design Consultant Contract requires adherence to the Design Professional's Submission Requirements, which also requires the Design Professional to write the DI, BOD, and for LEED projects, the OPR.
- Review CxA term contract scope (see Commissioning Authority Term Contract Scope of Services, Appendix A), and have the Cx Facilitator revise the scope to be project specific if necessary.
- Review CxA Term Consultants with Cx Facilitator and select suitable Term CxA appropriate for project type and location.
- Have the Cx Facilitator send Request for Proposal (RFP) to the CxA along with revised Appendix A (Cx scope) and the Cx Proposal Breakdown Form. PDQA should ensure project specific information (such as Feasibility Study, Schematic Report, and/or Schematic Design Submission) is sent to the CxA for information and use in their compilation of the Cx services proposal.
- Receive and review the CxA's proposal with the Cx Facilitator, and assist in negotiating an acceptable CxA scope and fee for a Work Authorization. The Work Authorization structure will typically be as follows: Design phase commissioning as a Lump Sum fee; Construction phase Cx as an Actual Expense amount; The total Work Authorization will be a Not To Exceed amount.
- Ensure funding is allocated to "line 4" (for Construction Consultants) in Contract Management System for the CxA Work Authorization.

- Have the Cx Facilitator send approved proposal, CxA scope, and Work Authorization Request Form to Professional Services Contracts to write and issue the Work Authorization.

C. PHASES OF WORK

The **intent** of this Section is to outline commissioning phase activities as a systematic process with a team approach to delivering projects.

DASNY will coordinate commissioning services in a two-part delivery process: Design Phase Commissioning and Construction Phase Commissioning.

I. Design Phase:

The commissioning process begins in the design phase, as close to project inception as possible, preferably during the start-up of the project for large projects (>$100M), or early in the Design Phase (typically at 30% Schematic Design submission). This includes the review of schematic design documents where the Design Intent (DI), or Owner's Project Requirements (OPR) for a LEED project, set the basis for development of the Basis of Design (BOD). Design phase commissioning concludes with completion of contract documents.

Objectives of the commissioning process during the design phase are to:

- Identify the Project Team and discuss roles and responsibilities related to Cx.
- Develop a Design Phase Commissioning Plan (by the CxA). For large projects, a design phase commissioning kickoff meeting is recommended so the Design Phase Cx Plan can be presented and discussed.
- Document commissioning review of the Schematic Design submission and Report.
- Document commissioning review of the Owner's Project Requirements (OPR) The OPR is required for LEED projects only. The OPR should be included as a distinct section of the Schematic Design Report.
- Document commissioning review of the Design Intent (DI), and Basis of Design (BOD). The DI and BOD should be included as distinct sections of the Schematic Design Report. For LEED Projects the OPR should be substituted for the DI.
- Document commissioning review of the 60% Design Development submission.
- Develop Commissioning Specifications which will include pertinent portions of the Design Phase Commissioning Plan.
- Develop Indoor Air Quality Specifications (determined on a per project basis) that detail requirements for an Indoor Air Quality Management Plan during construction, and requirements for indoor air quality testing.
- Revise the Design Phase Commissioning Plan, incorporating appropriate portions in the contract document specifications.
- Identify potential energy efficiency measures and criteria consistent with Energy Star and/or financial incentives available from NYSERDA via their Program Opportunities Notices, NYPA, DOE, EPA, and/or any other incentives that may benefit the project, and coordinate with the Owner's Representatives to complete all necessary applications on behalf of the Owner (determined on a per project basis).
- Coordinate Testing, Adjusting, and Balancing (TAB). The Commissioning Authority's services may include provision of full TAB services (determined on a per project basis). If providing full

TAB services, the CxA shall develop the TAB Specifications and assist the Design Professional to coordinate the complete contract documents to include TAB requirements.
- Document commissioning review of the 100% Contract Document submission.
- Document commissioning review of the completed Sequence of Operations.
- Document commissioning review of training, warranty, and spare parts requirements.
- Coordinate Contract Documents that clearly describe and fulfill the Design Intent, Owner's Project Requirements, Basis of Design, Sequence of Operations and Design Phase Commissioning Plan.
- Incorporate Commissioning as part of the project schedule.
- Document Design Phase activities.

To assist the project close out process it is recommended that DASNY PDQA close out Design Phase Commissioning Services, with design phase commissioning deliverables received, prior to moving into the Construction Phase Commissioning Services.

II. Construction Phase:

During the construction phase, commissioning activities increase as equipment and systems are installed, inspected, tested, started, and put into operation.

The construction phase commissioning is delivered in two activities, Commissioning activities and Acceptance activities. Objectives of the Cx process during the construction phase Cx activities are to:

Commissioning activities:

- Have the CxA lead the Construction Project Team coordinating roles and responsibilities related to Cx. The CxA shall conduct a commissioning construction phase kick-off meeting (see Appendix for Construction Phase Commissioning Kickoff Meeting Agenda Outline), periodic commissioning progress meetings, and distribute meeting minutes.
- Review Commissioning Agent(s) (the responsible Contractor(s)) qualifications in the first commissioning submittal.
- Review submittals and shop drawings for equipment and systems requiring commissioning.
- Review and document the Cx Agent's IAQ Management Plan and prepare the IAQ Management Report, as well as oversee the IAQ management process during construction as outlined in the Green Building Tax Credit, 6NYCRR part 638.7 (d) (2). Note that this activity is not intended to replace the contractor's responsibilities of documenting indoor environmental quality requirements as related to LEED obligations.
- Develop or pre-approve Pre-functional Testing Procedures; including installation and start-up check lists and procedures.
- Revise Design Phase Commissioning Plan into the Construction Phase Commissioning Plan, and issue to Commissioning Agent(s) upon approval and completion of pre-functional testing procedures and checklists.
- Conduct periodic site inspections, and distribute inspection findings reports.
- Witness all HVAC pipe testing, flushing, and document associated procedures.
- Witness all duct testing, cleaning, and document associated procedures.
- Verify and document construction and installation of building systems and equipment (Pre-Functional Inspection Verifications).
- Review, document, and approve Pre-Functional testing including Start-up and Checkout is completed by the Commissioning Agent(s) for commissioned equipment and systems.

- Review and comment on the completeness and adequacy of the Testing, Adjusting & Balancing (TAB) Plan.
- Witness, verify, and document controls testing and calibration prior to Testing, Adjusting, and Balancing (TAB).
- Witness and verify adequate TAB, and document approved TAB Reports.
- As applicable for New York City Code based projects, coordinate with DASNY Representative(s) to receive the Testing Agent's schedule for special inspections and assess potential for performing commissioning activities congruently with Testing Agency special inspections of systems to be commissioned. Also, review and document Special Inspection Reports that pertain to commissioned systems.
- Develop Functional Performance Testing (FPT) procedures and checklists.
- Retrieve Certificate of Readiness from Commissioning Agent(s) (Contractor(s)) prior to Functional Performance Testing (FPT) stating that start-up and checkout have been successfully completed and that all equipment, systems, and controls are complete and ready for FPT, and notify Cx Team of clearance to proceed to FPT.
- Witness and document Functional Performance Testing is performed and completed.
- Develop and maintain a Master Log of deficiencies and resolutions.

Acceptance Activities:

During the acceptance activities of the construction phase, verification of functional performance test data, and other acceptance procedures will take place.

Objectives of the commissioning process during the acceptance activities are to:

- Confirm approved TAB reports and provide verification through field sampling TAB tests and observation reports.
- Address all deficiencies noted during Pre-Functional & Functional Performance Testing.
- The Commissioning Authority shall, at a minimum, review, witness portions of, and document the following regarding *IAQ Testing* (The intent is to confirm IAQ testing is performed to meet requirements of both NYS Green Building Tax Credit – 6 NYCRR Part 638.7 (d)(1) and current LEED standards.); And may be required to perform the IAQ testing itself (determined on a per project basis):
    - IAQ Testing Protocol prior to IAQ testing
    - Confirm prerequisites such as construction completion and occupancy, building flush out, and as designed HVAC operation, prior to IAQ testing
    - IAQ Testing
    - IAQ Testing Reports and confirm acceptable results
- Review O & M Manuals, comment on adequacy and completeness in accordance with the design intent and contract documents. Submit O & M review comments to the Design Professional for their review and direction to the Commissioning Agent(s).
- Prepare and document Systems & Energy Management Manuals.
- Review and comment on completeness and adequacy of the O & M training syllabus for commissioned systems.
- Oversee the training of the owner's O&M personnel, and document written verification that training of operations and maintenance personnel was conducted for all commissioned features and systems.
- Prepare and submit a draft final Commissioning Report for review.
- Perform and document off-season deferred testing and post-occupancy review.

- Provide Statement of Certification of Work by the Commissioning Authority confirming that all Commissioning Authority scope items have been completed, documented, and are reflected in the Commissioning Report.
- Perform a Post Occupancy Review
  The Commissioning Authority shall return to the site between six months and one year, prior to conclusion of the 12-month warranty period in accordance with NYS Green Building Tax Credit Part 638.8 C (14), to assess building operations as related to the contract documents and the Owner's Project Requirements.
- Upon revision and DASNY approval, submit Final Commissioning Report.

The commissioning process may also include services related to USGBC LEED certification and shall be determined on a per project basis.

D. COMMISSIONING RESPONSIBILITIES

COMMISSIONING AUTHORITY (CxA)

The **intent** of this Section is to outline commissioning responsibilities for key parties involved in the commissioning process during design and construction of a project.

The following represents key and example elements of the commissioning process. These responsibilities shall be documented in the contracts between the Owner and the Commissioning Authority.

Commissioning Authority approval is solely for the purpose of ensuring that the items below are in accordance with the commissioning requirements and must not constitute approval for any other purpose.

Commissioning Authorities (CxA) should utilize the DASNY PDQA (during design phase), Construction Unit Project Managers (during construction phase), and DASNY Commissioning Facilitator (throughout the design and construction phases) to assist in coordinating and documenting project commissioning (Cx) requirements.

I. Design Phase:

The Commissioning Authority shall:

- Lead the Commissioning Team and discuss roles and responsibilities
- Develop Design Phase Commissioning Plan. The Design Phase Cx Plan should include at a minimum:
  - The commissioning team list and contact information
  - A commissioning overview specific to the project
  - Identification of equipment and systems to be commissioned
  - Roles and responsibilities of the Cx team members during design phase
  - Communication channels and protocol
  - Description of the commissioning process activities during the design phase:
    - Design phase Cx meetings
    - Contract document design review and documentation process, including:
      - Schematic Design Report review

        - Review and maintenance of formal Design Intent, Basis of Design, and Owner's Project Requirement documents
        - 60% Design Development Document review
        - Commissioning specifications development (see Appendix C – Commissioning Specification Guidelines)
        - 100% Contract Document review including documentation of completed design for systems and equipment to be commissioned, all sequences of operations, Testing, Adjusting & Balancing requirements, and commissioning specification coordination
    - Contract document specification format and coordination for commissioning
    - Draft commissioning process form examples
    - General description of the commissioning process activities during construction phase including post occupancy and close out commissioning activities
- Review and comment on completeness and adequacy of the Owner's Project Requirements (OPR), and may be requested to assist developing the OPR. (The OPR is required for LEED projects only. The OPR should be included as distinct sections in the Schematic Design Report.).
- Review and comment on the Design Intent (DI) and Basis of Design (BOD) (The DI and BOD should be included as distinct sections of the Schematic Design Report. For LEED Projects the OPR should be substituted for the DI), confirming the BOD meets the intent of the DI and/or the OPR.
- Review and comment on Schematic Design Report and Drawings (30% submission) as applicable
- Review documents and attend design review meeting at 60% Design Development and 100% Construction Document submissions, addressing Commissioning issues, and confirming clarification of Sequence of Operation requirements, as applicable
- Develop Commissioning Specifications and assist the Design Professional to coordinate the complete contract documents to include commissioning requirements (see Appendix C – Commissioning Specification Guidelines.) Sampling strategies utilized for tests, inspections, or observations must be clearly defined in the specifications, and pre-approved by the Design Professional and Owners Representative on a per project basis. No sampling strategies should be applied to Functional Performance Testing of primary systems and equipment, or their control sequences. If sampling strategies are utilized for functional performance testing of terminal equipment, then trend logging must be employed to demonstrate functional performance of all remaining terminal equipment.
- Revise Design Phase Commissioning Plan as Contract Documents are finalized and include responsibilities of Cx team members during the construction phase. Assist with coordinating commissioning requirements throughout the contract documents.
- Document design phase activities via electronic submissions of deliverables as they are completed and submit DASNY's Building Commissioning Design Phase Documentation checklist upon design phase completion. The design phase documentation should also be archived and submitted as part of the Final Commissioning Report as noted in the CxA's Scope of Work.

The CxA may also (as determined on a per project basis during scoping):

- Identify potential energy efficient criteria consistent with Energy Star and/or financial incentives available from NYSERDA, LIPA, NYPA, DOE, EPA, or any other incentives available to benefit the project.
- Upon identifying potential financial incentives for the project, complete all necessary applications on behalf of the Owner's Representative (DASNY).

- Develop Indoor Air Quality Specifications that detail requirements for an Indoor Air Quality Management Plan during construction to meet the intent of NYS Green Building Tax Credit, 6NYCRR Part 638.7 (d) (2) and requirements for indoor air quality testing to meet the intent of GBTC, 6NYCRR Part 638.7 (d) (1). Note the CxA may be required to perform the IAQ testing itself (Determined on a per project basis. Also see Chapter 2, B – DASNY IAQ Scope Clarification & Guidelines).
- The Commissioning Authority's services may include provision of full TAB services, determined on a per project basis (TAB firm must be certified by NEBB, TABB, or AABC). If providing full TAB services, the CxA shall develop the TAB Specifications and assist the Design Professional to coordinate the complete contract documents to include TAB requirements.
- Provide the Design Professional with LEED documentation associated with the commissioning work for LEED certified projects.
- Assist with LEED checklists, provide LEED credit assessments, coordinate LEED activities, and manage the integrated LEED process as directed.

II. Construction Phase:

The Commissioning Authority shall:

- Conduct a Commissioning Team construction phase kick-off meeting, periodic progress meetings, and issue commissioning meeting minutes. The CxA should present and distribute the Construction Phase Commissioning Plan, and cover all topics noted in the Construction Phase Cx Kickoff Meeting Agenda Outline (see Appendix D) at the construction phase Cx kickoff meeting.
- Review and approve Commissioning Agent(s) qualifications in the first submittal
- Review submittals and shop drawings for equipment & systems requiring Commissioning including final Sequence of Operations
- Develop or pre-approve Pre-Functional Testing including start-up and checkout procedures and checklists
- Revise the Construction Phase Commissioning Plan upon approval of the Pre-Functional testing procedures and issue to the Commissioning Agent(s)
- Conduct periodic site inspections and distribute findings reports
- Review and document the Commissioning Agent's Indoor Air Quality Management Plan During Construction, and prepare a Construction IAQ Management Report, as well as oversee the IAQ management process during construction as outlined in the Green Building Tax Credit, 6NYCRR Part 638.7(d)(2). Note that this activity is not intended to replace the contractors responsibilities of documenting indoor environmental quality requirements as related to LEED obligations
- Review and comment on completeness and adequacy of the Testing, Adjusting & Balancing (TAB) Plan
- Develop functional performance testing (FPT) procedures and checklists

The CxA may also (as determined on a per project basis during scoping):

- Include provision of full TAB services, determined on a per project basis (TAB firm must be certified by NEBB, TABB, or AABC). If providing full TAB services, the CxA shall coordinate all TAB requirements and activities with Construction Unit Project Manager and the responsible Contractor(s)
- As applicable for NY City Code based projects, coordinate with Testing Agent's schedule for special inspections to perform commissioning inspection and testing activity concurrently with Testing Agency special inspections of systems to be commissioned. Also, review and document Special Inspection Reports that pertain to commissioned systems.

Commissioning Activities:

The Commissioning Authority shall:

- Verify and document construction and installation of systems, equipment and components prior to testing
- Verify and document pre-functional testing including start-up and checkout is completed by Commissioning Agent(s)
- Witness, document, and confirm or approve all of the following:
    - HVAC pipe flushing and testing, and associated procedures
    - Duct cleaning and testing, and associated procedures
    - Testing and calibration of the controls before TAB
    - Testing, Adjusting & Balancing (TAB) procedures and reports
- Obtain Certificate of Readiness from the Commissioning Agent (Contractor) prior to Functional Performance Testing (FPT) stating that start-up and checkout have been successfully completed and all equipment, systems and controls are ready for FPT, and notify Cx Team of clearance to proceed to FPT
- Witness, verify, and document Functional Performance Testing (FPT) is performed and successfully completed
- Maintain a Master Log of Deficiencies and resolutions

Acceptance Activities:

The Commissioning Authority shall:

- Confirm approved TAB reports and verify a minimum of 10% of the TAB field measured data by performing their own measurements
- Address all deficiencies noted during Pre-Functional & Functional Performance Testing
- Review the Operation and Maintenance (O&M) Manuals and comment on completeness and adequacy in accordance with the design intent and contract documents. Submit O & M review comments to the Design Professional for their review and direction to the Commissioning Agent.
- Review, witness portions of, and document the following regarding IAQ Testing (The intent is to meet IAQ testing requirements of both NYS Green Building Tax Credit – 6 NYCRR Part 638.7 (d)(1) and applicable LEED standards.); And may be required to perform the IAQ testing itself as determined on a per project basis:
    - IAQ Testing Protocol prior to IAQ testing
    - Confirm prerequisites such as construction completion and occupancy, building flush out, and as designed HVAC operation, prior to IAQ testing.
    - IAQ Testing Reports and confirm acceptable results
- Prepare and document Systems & Energy Management Manuals
- Review and comment on completeness and adequacy of the O&M training syllabus for commissioned systems
- Oversee the training of the owner's O&M personnel, and document written verification that training of operations and maintenance personnel was conducted for all commissioned features and systems as required
- Provide the Design Professional with LEED documentation associated with the commissioning work for LEED certified projects
- Prepare and submit a draft final Commissioning Report for review
- Perform and document off-season deferred testing and Post-Occupancy Review

- Provide Statement of Certification of Work by the Commissioning Authority confirming that all Commissioning Authority scope items have been completed, documented, and are reflected in the Commissioning Report
- Document construction phase activities by submitting DASNY's Building Commissioning Construction & Acceptance Phase Documentation checklist (see Appendix D)
- Upon revision and DASNY approval, submit Final Commissioning Report

The Commissioning Authority is responsible for the documentation of all equipment and systems during the Commissioning process. The Commissioning Authority is also responsible for obtaining and reviewing reports and documentation prepared by others that are also required by the commissioning process. This documentation shall be archived as part of the final commissioning documentation delivered to DASNY.

The CxA shall provide a final Commissioning Report for each commissioned project. Three copies of a draft report shall be sent for Owner's review and comments. The CxA shall incorporate the Owner's comments within 10 working days of receipt. Hard copy Final Report binders shall be provided with electronic format Final Report compact discs as well.

The Commissioning Authority shall produce and assemble the following items into a building profile and Final Commissioning Report that will enable a comprehensive approach to maintenance and operations. The Final Commissioning Report shall contain all requirements as detailed in the Green Building Tax Credit Part 638.8 (l), and include but not be limited to the following:

- Owner's Project Requirements, Design Intent, and Basis Of Design
- Commissioning Plan
- All commissioning design, construction, and post occupancy reviews, meeting minutes, pre-functional and functional testing verification documentation, deficiency lists, and inspection reports
- IAQ Management Plan During Construction, Construction IAQ Management Report, IAQ Testing Protocol, and IAQ Testing Reports confirming acceptable results
- Operations & Maintenance Manual Reviews and Recommendations
- Operations & Maintenance Training Syllabi and training documentation
- Systems and Energy Management Manual
- Statement of Certification of Commissioning Authority Work

PLANNING, DESIGN and QUALITY ASSURANCE UNIT (PDQA) and CONSTRUCTION UNIT (CONSTRUCTION)

The intent of this section is to outline key elements of commissioning process oversight and management activities.

PDQA should utilize the Code Compliance Department's Commissioning Facilitator (CxF) to assist in coordinating project commissioning (Cx) requirements, define Cx budget and schedule impacts, procure the Commissioning Authority (CxA) thru issue of a Term Contract Work Authorization, and for technical assistance regarding the Cx process. The CxF shall be copied all communications and deliverables pertaining to the Cx process and project Cx scope.

If at any time during the course of the project, the scope of the project changes in a way that impacts commissioning requirements, the Commissioning Unit shall be notified to determine if the CxA scope

needs to be amended. Also note that PDQA and Construction should complete and submit Commissioning Authority performance evaluations as outlined in the AEC Evaluations Procedure.

PDQA will typically manage day to day commissioning activities, maintain project files with design phase commissioning deliverables, and pay the CxA thru the design phase of the project. Construction staff having been involved in the budgeting and scheduling of the commissioning process will manage commissioning activities, maintain project files with construction phase commissioning deliverables, and pay the CxA thru the construction phase and close out of the project.

I. Pre-design and Design Phase:

PDQA shall coordinate the following activities:

- Review project scope and determine commissioning requirements based on project goals, client needs, regulations, and DASNY Sustainability Policy with the Commissioning Facilitator (CxF).
- Review the Commissioning Authority budget, Cx activity schedule impacts, and Cx Scope with the CxF
- Develop the project budget, schedule impacts, and Cx Scope with the CxF to include:
    - Design Professional involvement per Professional Services Agreement
    - Construction Manager (as applicable)
- In conjunction with the CxF select a suitable Commissioning Authority (CxA) appropriate for project from pre-qualified list of term consultants.
- Send current project documents to the selected *CxA* for information and use in their preparation of the Cx services proposal.
- In conjunction with the CxF and Construction staff review, finalize, and approve the CxA proposal.
- Participate as a Commissioning Team member, discuss roles and responsibilities, and add Commissioning Facilitator and Commissioning Authority to project distribution list.
- Review, ensure distribution to the Cx Design Team, and verify the following have been performed:
    - Design Phase Commissioning Plan
    - Cx review comments for (as applicable to the project):
        - Owner's Project Requirements (OPR) (for LEED projects only)
        - Design Intent (DI)
        - Basis of Design (BOD)
        - Schematic Report
        - 60% and 100% design submission including review of Sequence of Operations provided by Design Professional (Design submissions should include control sequence narratives in Schematic Report at 30%, detailed control sequences descriptions in specifications by 60%, and complete Sequence of Operation (SOP) including point lists and control diagrams by 100% design submission)
    - Commissioning specifications
    - Construction Phase Cx Plan including:
        - Cx Team Contact List
        - List of components, equipment, and systems to be commissioned
        - Updated description of commissioning responsibilities for the various Cx team members through construction phase
- Schedule and attend with Commissioning Authority, a minimum of two (2) design review meetings concurrent with 60% and 100% Design Submission, addressing commissioning issues (on an as needed basis determined per project)

- Ensure the Commissioning Authority submits a completed Building Commissioning Design Phase Documentation Checklist (see Appendix D) to assist close out the design phase Cx services

II. Construction Phase:

Construction staff shall coordinate the following activities with the Construction Manager, Prime Contractor(s) and Sub-contractor(s) as applicable.

- Schedule and attend Construction Phase Commissioning Kick-off Meeting. The CxA should present and distribute the Construction Phase Commissioning Plan. See Appendix D for the Construction Phase Cx Kickoff Meeting Agenda Outline.
- Schedule and attend Commissioning Team progress meetings. The CxA should also distribute minutes for all commissioning meetings.
- Review and ensure approval (along with CxA's review and approval) of the Commissioning agent(s) (responsible contractor) commissioning qualifications as the first submittal.

Construction staff shall document and confirm the following, while coordinating response and resolution to comments or deficiencies noted by the CxA:

- CxA reviews of Submittals and shop drawings for equipment & systems requiring commissioning (submittal distribution coordinated with DP and Construction Team)
- Cx Agent's (Contractor's) IAQ Management Plan and CxA's IAQ Management Report
- Construction Phase Commissioning Plan
- CxA's review of Testing, Adjusting & Balancing (TAB) Plan
- Certificate of Readiness (provided by responsible Contractor Cx Agent after successful start-up, checkout, stating that systems are ready for Functional Performance Testing)
- Functional Performance Tests procedures and checklists

Commissioning Activities:

Construction staff shall document and confirm the following, while coordinating response and resolution to comments or deficiencies noted by the CxA (the CxA shall ensure proper distribution to the Cx Team):

- The HVAC pipe flushing and testing procedures, and test results
- All duct cleaning and testing procedures, and test results
- Installation verification reports; Pre-functional test procedures and reports; Start-up & checkout procedures, checklists, and reports
- The calibration and point to point testing of the controls system (prior to TAB)
- Functional Performance Testing (FPT) procedures, checklists, and reports
- Log of deficiencies and resolutions

Acceptance Activities:

Construction staff shall coordinate, review, and/or verify that the following have been processed:

- Testing, Adjusting & Balancing (TAB) reports including CxA sample field verification report of approved TAB data
- Operation and Maintenance (O&M) Manuals (Provided by Commissioning Agent-Contractor; Must be complete prior to training)
- Systems & Energy Management Manuals (Provided by Commissioning Authority; Must be complete prior to training)

- Training Plan and Syllabus for the Owner's O & M personnel (Provided by Commissioning Agent-Contractor and approved by Commissioning Authority)
- Documentation of training for the owner's O&M personnel (Provided by Commissioning Authority)
- Commissioning Report (Provided by Commissioning Authority)
- Statement of Certification of Work (Provided by Commissioning Authority)
- Documentation of off-season deferred testing (Provided by Cx Authority)
- Documentation of Post Occupancy Review (Provided by CxA)

DESIGN PROFESSIONALS (DP)

Design Professionals (DP) should utilize the DASNY PDQA (during design phase) and Construction Unit (during construction phase) Project Managers to assist in coordinating project commissioning (Cx) requirements when applicable.

I. Pre-design and Design Phase:

Design Professionals shall perform the following:

- Ensure Professional Services Agreement includes commissioning requirements when applicable.
- Participate as a Commissioning Team member. Discuss roles and responsibilities for the commissioning process, and assist in identifying equipment and systems requiring commissioning.
- Include the following in the Schematic Design Report:
    - Owner's Project Requirements (OPR) document (for LEED projects only) in accordance with the USGBC LEED Reference Guide. The OPR should be included as a distinct section of the Schematic Design Report.
    - Design Intent (DI) document in accordance with the NY State Green Building Tax Credit, 6NYCRR Part 638.8 (e) (for LEED projects the OPR document will serve as the design intent and a separate DI document will not be required). The DI should be included as a distinct section of the Schematic Design Report.
    - Basis of Design (BOD) document in accordance with the NYS Green Building Tax Credit, 6NYCRR Part 638.8 (e). The BOD should be included as a distinct section of the Schematic Design Report.
    - Narrative of the controls strategy and general sequence of operations plan for the project. At a minimum discuss: Whether existing automated system(s) will be connected to or matched; The type and extent of automated controls; The systems to be controlled; The control criteria, measures, and system interface requirements.
- Review the Design Phase Commissioning Plans.
- During the course of the design develop project specific Sequence of Operations requirements. This should include plain language narrative sequence descriptions, control point tables, and control diagrams for every system and equipment type being controlled.
- Receive Commissioning Specifications from the Commissioning Authority and fully coordinate project commissioning requirements throughout the contract documents. For example ensure all Commissioning Agent (Contractor) requirements such as commissioning qualifications submittal, testing requirements, certificate of readiness documentation, training, and manual requirements are defined and in accordance with the New York State Green Building Tax Credit Part 638.8. (See Appendix C – Commissioning Specification Guidelines; Also see Chapter 2, B – DASNY IAQ Scope Clarification & Guidelines)

- Address Commissioning Authority review comments & attend design review meetings at each submission phase, (30, 60, 100 Percent & Bid Documents) addressing commissioning issues.

II. Construction Phase:

During the Construction Phase, the DP and/or their designee shall witness all or parts of any of the tasks as required by their contract and/or scope of work as they relate to the commissioning process.

Design Professionals shall perform the following:

- Participate as a Commissioning Team member and attend Commissioning Team construction phase kick-off meeting and periodic commissioning progress meetings.
- Review submittal process with the Commissioning Authority (CxA) as it relates to commissioning and coordinate CxA submittal review in the submittal approval process.
- Review CxA's Construction Phase Commissioning Plan.
- Distribute final approved Sequence of Operations that includes CxA's review input.
- Review and approve the IAQ Management Plan and Testing Adjusting & Balancing (TAB) Plan.
- Review functional performance testing procedures and checklists.

Commissioning Activities:

The Design Professionals shall review the documentation for the following:

- Pre-functional testing including, start-up and checkout procedures and checklists
- HVAC pipe testing and flushing procedures, and test results
- All duct testing and cleaning procedures, and test results
- Testing of the controls system before TAB
- Testing, Adjusting & Balancing (TAB)
- Certificate of Readiness from Cx Agent (contractor), prior to FPT
- Functional Performance Testing
- The Commissioning Authority's Log of deficiencies and resolutions

Acceptance Activities:

The Design Professionals shall review & approve the following:

- Operation and Maintenance (O&M) Manuals
- Systems & Energy Management Manuals
- O&M training syllabus
- The final Commissioning Report
- Documentation of off-season deferred testing
- Documentation of Post Occupancy Review

CONSTRUCTION MANAGER (CM)

Projects where the services of a Construction Manager (CM) are not required, the Contractor shall perform the activities of the CM as it relates to the commissioning process.

The following represents key and example elements of the commissioning process. These responsibilities shall be documented in the contracts between the owner and the Construction Manager.

I. Design Phase:

Throughout the design phase the Construction Manager shall review and participate in activities associated with the following (note- In the absence of a CM during design phase DASNY PDQA shall review and coordinate the commissioning activities.):

- Owner's Project Requirements
- The Design Intent and Basis of Design
- Systems and equipment requiring commissioning
- The Design Phase Commissioning Plan
- All design submission documents
- The Commissioning Authority's design submission review comments including review of Sequence of Operations
- Responses and resolution to review comments
- Commissioning Specifications detailing commissioning process requirements in all Commissioning Agent (responsible Contractor(s)) contracts
- IAQ Specifications as applicable
- Develop project schedule to include the commissioning process activities
- Attend design review meeting at each submission, (30, 60, 100 Percent) addressing commissioning issues as applicable
- Participate as a member of the Commissioning Team

II. Construction Phase:

The Construction Manager must distribute Cx documents (i.e. Cx Plan, submittals, IAQ Plan, Sequence of Operations, TAB Plan, etc.) to the Commissioning Team in an efficient and timely manner.

The Construction Manager shall coordinate all commissioning activities during the Construction Phase as required including but not limited to the following:

- Attend Commissioning Team construction kick-off meeting and periodic progress meetings
- Develop and monitor the commissioning activity schedule in project timeline
- Review the Construction Phase Commissioning Plan and coordinate the execution of the Commissioning Process
- Review and coordinate the Cx Agent (responsible Contractor(s)) qualifications submittal to the Commissioning Authority
- Coordinate the submittal distribution and review process with regard to the Commissioning Authority's submittal review requirements
- Review, document, and coordinate the Cx Agent's IAQ Management Plan During Construction, as well as the Cx Authority's IAQ Management Report
- Review final Sequence of Operations
- Review & coordinate the Testing, Adjusting & Balancing (TAB) Plan

Commissioning Activities:

The Construction Manager shall coordinate, review, and distribute the following activities and documentation:

- Review open issues reports associated with commissioning reviews and inspections, and coordinate distribution and resolutions
- HVAC pipe flushing and testing, and associated procedures
- Duct cleaning and testing, and associated procedures

- Installation verification reports, Pre-functional test procedure and reports; Start-up & checkout procedures, checklists, and reports
- Testing and calibration of the controls before TAB
- Testing, Adjusting & Balancing, TAB procedures
- Certificate of Readiness (provided by contractors) prior to Functional Performance Testing (FPT)
- As applicable for NY City Code based projects, coordinate with Testing Agent's schedule for special inspections to perform commissioning inspection and testing activity concurrently with Testing Agency special inspections of systems to be commissioned. Also, review and document Special Inspection Reports that pertain to commissioned systems.
- Functional Performance Testing (FPT) procedures, checklists, and reports
- Review the deficiency log and coordinate all deficiencies and resolutions for any system performance deficiencies

Acceptance Activities:

The Construction Manager shall coordinate, review, and/or verify the following have been processed:

- Testing, Adjusting & Balancing (TAB) reports and CxA sample field verification report of approved TAB data
- Operation and Maintenance (O&M) Manuals (provided by Commissioning Agent-contractors; must be complete prior to training)
- IAQ prerequisites, IAQ testing protocol, and IAQ testing reports
- Systems & Energy Management Manuals (provided by Commissioning Authority; must be complete prior to training)
- O&M training syllabus (provided by Commissioning Agent-contractors)
- Schedule and coordinate the training of the Owner's O&M personnel
- Documentation of training for the owner's O&M personnel (provided by Commissioning Authority)
- LEED documentation associated with commissioning work for LEED projects
- Final Commissioning Report (provided by the Commissioning Authority)
- Documentation for off-season deferred testing & schedule (provided by Cx Authority)
- Documentation for Post Occupancy Review
- Statement of Certification of Work (provided by the Commissioning Authority)

COMMISSIONING AGENT (CA) (Contractor)

For the purposes of these guidelines the Commissioning Agent (CA) is the responsible Contractor(s) and Sub-Contractor(s), and shall be responsible for the role, tasks and responsibilities of the CA as directed by the Commissioning Authority (CxA) and defined in the contract documents. In the case of multiple prime contracts, there could be multiple Commissioning Agents.

The following represents key and example elements of the commissioning process as it relates to responsibilities of the Commissioning Agent. These responsibilities shall be documented in the contract documents.

I. Design Phase:

It is assumed the Commissioning Agent, CA (Contractor) will join the project at the Construction Phase. Should the CA be involved sooner in the process, then roles and responsibilities listed in the Design Phase for all other Commissioning Team members will be modified accordingly.

II. Construction Phase:

The Commissioning Agent shall:

- Review Contract Document Commissioning Specifications and all referenced materials as they relate to the commissioning process
- Participate as a member of the Commissioning Team and attend the Construction Phase Commissioning Kick-off Meeting and periodic commissioning progress meetings
- Review the construction schedule/timeline and assist the CxA and CM (or appropriate Prime Contractor) to accurately incorporate commissioning activities into the schedule
- Submit (to Design Professional and Cx Authority) for approval - Commissioning Agent commissioning qualifications as defined in the contract documents
- Assist the Commissioning Team in coordinating the submittal distribution, review, and revision process as it relates to Commissioning Authority reviews of submittals, and provide final copies of approved submittals to the CxA for commissioned equipment and systems
- Assist with developing and/or review pre-functional testing including, start-up and checkout procedures and checklists
- Receive (from the CxA) and review the Construction Phase Commissioning Plan
- Receive (from the CxA) and review the periodic CxA site inspection findings reports and respond to open issues and/or deficiency items
- Provide the Commissioning Team with the Indoor Air Quality Management Plan during Construction, and coordinate with the CxA for their oversight of the IAQ management process during construction as well as assist the CxA in their compilation of the IAQ Management Report
- Review final approved Sequence of Operations for commissioned equipment and systems with the CxA
- Provide for approval the Testing, Adjusting & Balancing (TAB) Plan
- Assist with developing and/or review functional performance testing procedures and checklists

Commissioning Activities:

The Commissioning Agent shall document to the Commissioning Team as being completed:

- Proper installation of all systems, equipment and components
- HVAC pipe flushing and testing
- Duct cleaning and testing
- Pre-Functional Testing including start-up and checkout
- Calibration and testing of the controls system before TAB
- Testing, Adjusting & Balancing (TAB)
- Provide Certificate of Readiness prior to Functional Performance Testing (FPT) stating that start-up and checkout have been successfully completed and all equipment, systems and controls are ready for FPT, and notify Cx Team of clearance to proceed to FPT
- Functional Performance Testing

Acceptance Activities:

The Commissioning Agent shall:

- Review deficiency logs & correct all system performance deficiencies
- Provide final approved TAB Reports, and assist CxA to verify via their sample testing and observation
- Provide Operation and Maintenance (O&M) Manuals, in accordance with the NY State Green Building Tax Credit Part 638.8k and ASHRAE Guidelines 4-2008 or the latest revisions of each document, for review, and address any deficiency issues raised in the review process
- IAQ Testing:
    - Provide IAQ Testing Protocol
    - Document IAQ testing prerequisites such as construction completion and occupancy, building flush-out, and as designed HVAC operation
    - Perform IAQ Testing as applicable to the contract requirements
    - Provide IAQ Testing Reports and confirm acceptable test results
- Provide the O&M Training Syllabus, and provide and document training to Owner's personnel
- Review the Systems & Energy Manuals (provided by the CxA)
- Assist Cx Team with all LEED documentation as it relates to the construction phase Cx work
- Conduct and document off-season deferred testing
- Address items generated from Post Occupancy Review

CODE COMPLIANCE GROUP – COMMISSIONING UNIT (DASNY)

The DASNY Commissioning Unit-Commissioning Facilitator (CxF) provides administrative and technical support to facilitate and coordinate the Commissioning Process. The intent is to provide the necessary support and expertise from project set-up, procurement, and design phase, through construction, acceptance, and project closeout, to ensure a valued quality assurance process that documents owner's needs are met and the built project operates in accordance with the design intent and contract documents.

I. Pre-design and Design Phase:

The Commissioning Facilitator shall perform the following:

- Review Project Set-Up Application Forms and project scopes with Planning, Design and Quality Assurance (PDQA) and Construction Units to determine applicability and regulatory requirements for commissioning
- Review the Commissioning Authority (CxA) Term Contract Scope and revise to establish a project specific commissioning services scope to meet the project needs. If at any time during the course of the project, the scope of the project changes in a way that impacts commissioning requirements, the Commissioning Unit shall be notified to determine if the CxA scope needs to be amended.
- Establish the CxA budget and commissioning schedule impacts with PDQA and Construction
- Assist PDQA to further develop project scopes, budgets, and schedules for Commissioning to include:
    - Design Professional involvement per Professional Services Agreement
    - Construction Manager coordination requirements (as applicable)
- Review Commissioning Authority Term Consultants appropriate for the project with PDQA and select a CxA Term Consultant

- Compose and send the commissioning services RFP to the CxA along with project specific information
- In conjunction with PDQA and Construction, review, finalize, and approve the CxA proposal
- Prepare and submit the CxA Work Authorization Request to Professional Services Contracts (PSC) to write and issue the approved Work Authorization
- Participate as a Commissioning Team member, monitoring the Design Phase commissioning activities with PDQA, and assist in defining and coordinating Cx roles and responsibilities
- Attend the design kick-off meeting and/or LEED Charrette meeting(s), and subsequent design progress meetings (As required for the project. This will mainly occur on large projects.)
- In conjunction with PDQA, receive and review commissioning deliverables, and communications (see Appendix D for Building Commissioning Design Phase Documentation checklist); This includes but is not limited to the following:
    - Design Phase Commissioning Plan that includes a Design Phase Commissioning Team Contact List, and a list of systems, equipment, and components requiring commissioning
    - CxA reviews of Schematic Design Report, 60% and 100% Design Submissions
    - Commissioning meeting minutes
    - CxA reviews of Owner's Project Requirements (OPR), Design Intent (DI), and Basis of Design (BOD) as applicable
    - Commissioning Specifications
    - IAQ Specifications (as applicable)
    - TAB Specifications (as applicable)
    - Confirmation of energy efficiency incentives/grants assessment (as applicable)
    - CxA review of Sequence of Operations
    - Design Phase Commissioning Plan
- Assist in ensuring all design phase CxA open issues are addressed
- Assist PDQA in closing out CxA design phase work by ensuring all CxA design phase deliverables are submitted and approved via receipt of DASNY's Design Phase Documentation Checklist submitted by the CxA

II. Construction Phase:

The Commissioning Facilitator shall perform the following:

- Attend construction phase kick-off meeting and periodic progress meetings, and/or review commissioning meeting minutes and progress reports
- Assist Construction Staff with development of construction schedule/timeline to include commissioning activities
- Upon changes to the project scope or schedule that impacts CxA services, Construction shall notify the Commissioning Facilitator to review the current Work Authorization. If an additional Work Authorization is necessary, the CxF will proceed with tasks necessary for issuance of a new work authorization.
- In conjunction with Construction Staff, the CxF may receive and review select commissioning deliverables, and communications (see Appendix D for Building Commissioning Construction Phase Documentation checklist); This includes but is not limited to the following:
    - Construction Phase Commissioning Plan that includes a Construction Phase Commissioning Team Contact List, and a revised list of systems, equipment, and components requiring commissioning
    - CxA's review of Commissioning Agent(s) Cx qualifications submittal
    - CxA's submittal reviews for equipment and systems requiring commissioning

- CxA's submittal review of final approved Sequence of Operations for commissioned equipment and systems
- CxA's IAQ Management Report
- CxA's review of TAB Plan

Commissioning Activities:

In conjunction with Construction Staff, the CxF may receive and review select commissioning deliverables, and communications. This includes but is not limited to the following:

- Documentation of:
  - HVAC pipe flushing and testing
  - duct cleaning and testing
  - Installation verification
  - Pre-functional testing and equipment start-up
  - Testing of controls before TAB
  - Certificate of Readiness prior to FPT
  - functional performance testing procedures and checklists
  - deficiency log and resolutions

Acceptance Activities:

The Commissioning Facilitator may receive and review select commissioning deliverables (also see Appendix D for Building Commissioning Construction & Acceptance Phase Documentation checklist); This includes but is not limited to the following:

- CxA review of Operation and Maintenance (O&M) Manuals
- The CxA's Systems & Energy Management Manuals
- CxA's Final Commissioning Report
- Confirmation of completion of construction phase activities through CxA's submission of DASNY's Building Commissioning Construction & Acceptance Phase Documentation Checklist

The Commissioning Facilitator may also receive and review the following commissioning deliverables; this includes but is not limited to the following:

- CxA confirmation of approved TAB reports through field verification tests
- CxA confirmation that deficiency logs document issues are resolved or satisfactorily responded to
- IAQ Testing documentation of:
  - IAQ testing protocol
  - Confirmation of prerequisites prior to IAQ testing such as construction completion and occupancy, building flush out, and as designed HVAC operation
  - IAQ testing reports confirming acceptable results
- CxA review the O&M training syllabus
- CxA documentation of O&M training of owner's staff
- CxA's documentation of off-season deferred testing and Post-Occupancy Review
- CxA's Statement of Certification of Work

DASNY PDQA reviewing Engineers for MEP trade portions of projects that include commissioning

DASNY's Planning Design & Quality Assurance (PDQA) Group contains Architects and Engineers that perform design management during design phases and provide technical assistance and site observations during construction phases of projects. These reviewing Engineers for MEP trade portions of projects should assist in assuring commissioning requirements are defined during design phase and provide technical support to the commissioning process and activities during the construction phase of projects as needed.

I. Pre-design and Design Phase:

PDQA reviewing Engineers may perform the following:

- Participate as a member of the Commissioning Team
- May attend design meetings and LEED Charette meetings
- Assist the determination of whether commissioning will be part of the project, and assist in identifying the basis for the requirement, such as LEED goals, NYC Local Law 86, DASNY Sustainability Policy, client request, etc.
- At schematic design (30%) submission:
    - Review Schematic Report to confirm basis for commissioning requirement (or Cx not required) is noted
    - Review Owner's Project Requirements document as applicable to LEED projects
    - Review Design Intent and Basis of Design documents
    - Review the specifications Table of Contents to ensure commissioning sections are noted
    - Review plain language narrative of controls strategy and general sequence of operations plan for the project
- At design development (60%) submission:
    - Review commissioning specifications and related sections associated with commissioning requirements
    - May review the Commissioning Authority's Design Phase Commissioning Plan
    - Review CxA's review comments as they relate to design issues
    - May review CxA's analysis of potential energy efficiency incentives consistent with Energy Star, NYSERDA, etc., that may benefit the project (as applicable)
- At construction document (100%) submission:
    - Review drawing documents, commissioning specifications, and related sections to ensure commissioning requirements and responsibilities are fully defined
    - Review specifications to ensure requirements for IAQ Management Plan During Construction, IAQ Testing, and CxA's IAQ oversight and reporting are defined
    - Review CxA's review comments as they relate to design issues
    - May review CxA's energy efficiency incentive applications as applicable

II. Construction Phase:

The assigned PDQA reviewing Engineers may attend, review, or witness the following as applicable and/or requested by Construction staff:

- Commissioning Team kick-off meeting and Cx progress meetings
- CxA's submittal review comments as they relate to design issues
- Commissioning Agent's IAQ Management Plan and the Commissioning Authority's IAQ Management Report

- Cx Authority's Construction Phase Commissioning Plan
- Pre-functional Testing Procedures and checklists
- Testing, Adjusting & Balancing (TAB) Plan
- Witness or review documentation for:
    - HVAC pipe flushing and testing
    - Duct cleaning and testing
    - Testing and calibration of the control system before TAB
    - Testing, Adjusting & Balancing
- Functional Performance Testing Procedures
- CxA's Deficiency Log and responses
- Witness or review documentation for:
    - Functional Performance Testing
    - IAQ Testing

Acceptance Activities:

The assigned Planning Design & Quality Assurance Group Engineers may review documentation for the following as required:

- Operation and Maintenance (O&M) Manuals
- IAQ Testing Reports
- Systems & Energy Management Manuals
- O&M Training Syllabus
- Off-season deferred testing results and post occupancy review report
- Final Commissioning Report

Commissioning Process & Responsibility Table	DASNY								
Commissioning (Cx) Process	Owner/ Client	PDQA	Cx Facilitator	Construc-tion	PDQA Reviewer	Design Professional	Cx Authority (CxA)	Construction Manager	Cx Agent (Contractor)
	P= Primary Participant(s) for task A=Assist in the task								
I. Pre-Design and Design Phase									
Proj Setup and early Design Phase-Determine commissioning (Cx) requirements per regulations, policy, and/or client preference	A	A	P						
Coordinate Cx service participation with all consultant contracts		P	A			A		A	
Develop budget and scope for commissioning services	A	A	P	A				A	
Select Commissioning Authority (CxA)	A	A	P	A					
Send CxA Term Consultant project information and RFP		A	P						
Review/approve Cx service Proposal-and initiate Work Authorization		A	P	A					
Identify Cx Team, systems and equipment requiring Cx, and Issue Design Phase Cx Plan	A	A	A		A		P	A	
Review and Document the Owner's Project Requirements (LEED proj only)	A	A	A			A	P		
Review Schematic Design Report and Drawings, and document Cx Reviews as applicable		A	A		A		P	A	
Develop and distribute Design Intent, Basis of Design, and Sequences of Operation	A	A	A			P		A	
Review and Document Design Intent, Basis of Design, and Sequences of Operation					A		P	A	
Participate in Design Review Meetings addressing commissioning issues as applicable	A	A	A		A	A	P	A	
Develop Cx specifications (as well as IAQ and TAB specs if applicable)			A			P	P		
Review for Energy Efficient Incentives & process grants (if applicable)		A				A	P		
Perform and document Cx Design Reviews @ 30%, 60% & 100% submissions		A	A		A	A	P		
Revise Design Cx Plan incorporating Construction Phase responsibilities and issue to Cx Team							P		
Ensure all Cx issues are addressed and assist with coordinating Cx requirements prior to contract bidding		A	A		A	A	P	A	
Submit LEED documentation associated with commissioning work if applicable		A				A	P	A	
Document and close-out design phase Cx activities utilizing Des Phase Documentation Checklist		A	A				P		
II. Construction Phase									
Attend Construction Phase Cx Kickoff Meeting, periodic Cx Meetings			A	P		A	P	P	P
Manage day to day Cx activity and maintain Cx work files			A	P			P	P	A
Submit Cx Agent Qualifications submittal to DP and Cx Authority				A				A	P
Review Commissioning agent(s) qualifications			A	A		A	P		
Provide submittals for Cx'd systems and equipment for CxA to review				A				A	P
Perform commissioning reviews of submittals for Cx'd systems and equipment			A	A		A	P	A	
Develop or pre-approve Pre-functional Testing including start-up & Check out procedures				A		A	P	A	A
Revise the Design Phase Cx Plan into the Construction Phase Cx Plan and issue to Cx Team			A	A		A	P	A	A
Conduct periodic site inspections and distribute findings reports			A	A		A	P	A	
Submit the Construction IAQ Mngt Plan				A				A	P
Review and document the Cx Agent's IAQ Mngt Plan and provide an IAQ Management Report				A		A	P	A	
Submit the Testing, Adjusting & Balancing (TAB) Plan				A				A	P
Review and comment on completeness and adequacy of Testing, Adjusting & Balancing (TAB) Plan				A		P	P	A	
Develop Functional Performance Testing (FPT) procedures and issue to Cx Team				A		A	P	A	
Commissioning Activities:									
Perform and document Installation Verification of systems, equip. and components				A		A	P	A	P
Perform and document Pre-Functional Testing (PFT), including start-up and checkout				A		A	A	A	P
Verify and document Pre-Functional Testing (PFT) - start-up and checkout is completed			A	A		A	P	A	A
Perform HVAC pipe flushing and testing, duct cleaning and testing, and point to point controls testing				A				A	P
Witness, document, and confirm or approve HVAC pipe flushing and testing, and associated procedures				A		A	P	A	A
Witness, document, and confirm or approve duct cleaning and testing, and associated procedures				A		A	P	A	A
Witness, document, and confirm or approve testing and calibration of the controls system before TAB				A		A	P	A	A
Witness, document, and confirm or approve Testing, Adjusting & Balancing (TAB)				A		A	P	A	A
Obtain Certificate of Readiness from Cx Agent(s) prior to FPT				A			P	A	A
Perform Functional Performance Testing (FPT)				A			P	A	P
Witness, document, and confirm Functional Performance Testing (FPT) is adequately completed			A	A			P	A	A
Generate Inspection Reports, maintain Deficiencies Logs including deficiency resolutions			A	A			P	A	
Acceptance Activities:									
Confirm approved TAB reports and verify minimum of 10% of the TAB field measured data				A			P	A	
Review and comment on completeness and adequacy of O&M Manuals			A	A		A	P	A	
Review, witness portions of, and document IAQ Testing protocol, prerequisites, testing, and Reports			A	A		A	P	A	A
Prepare, distribute and document Systems & Energy Management Manuals							P		
Review and comment on completeness and adequacy of the Systems & Energy Management Manuals			A	A		P		A	
Provide the O&M Training Syllabus and associated O&M Training								A	P
Review and comment on completeness and adequacy of the O&M Training Syllabus				A		A	P	A	
Oversee and document the training of Owner's O&M Personnel				A		A	P	A	
Provide the DP with LEED documentation associated with construction phase Cx word if applicable				A			P	A	P
Prepare and submit final Commissioning Report for review			A	A		A	P	A	
Perform and document off-season deferred testing as applicable				A			P	A	A
Perform and document Post-Occupancy Review				A			P	A	A
Provide Statement of Certification of Work				A			P	A	A
Document and close-out construction phase Cx activities utilizing Construction Phase Documentation Checklist			A	A			P	A	

CHAPTER 2: Primary Rules and Regulations Requiring Commissioning

A. New York State Green Building Tax Credit:

i. Section 638.8 – Commissioning

Commissioned Process
Responsibilities of Primary Participants in Commissioning
Qualifications of the Commissioning Authority and Commissioning Agent
Design Intent and Basis of Design
Commissioning Plan
Commissioning Specifications
Start-up and Checkout
Functional Performance Testing
Training
Manuals
Commissioning Report

ii. Section 638.7 – IAQ Standards and Methods for Determining Compliance

Indoor Air Quality Testing
Indoor Air Quality Management Plan during Construction

B. DASNY IAQ Scope Clarification & Guidelines

C. DASNY Sustainability Policy

A. New York State Green Building Tax Credit (GBTC):

FOR REFERENCE PURPOSES THE RELEVANT COMMISSIONING REQUIREMENTS OF THE GREEN BUILDING TAX CREDIT, 6NYCRR PART 638, SECTION 638.8, HAVE BEEN REPRODUCED BELOW, PORTIONS OF WHICH HAVE BEEN AMENDED BY DASNY TO FIT THEIR OPERATIONAL NEEDS.

6NYCRR Part 638
638.8 COMMISSIONING

(b) Commissioning Process

The owner must implement the commissioning process summarized below

(1) Commissioning Steps

(i) Designate a qualified Commissioning Authority.

(ii) Ensure that the individuals or firms performing the design of the base building or tenant space(s), the commissioning agent and the commissioning authority fulfill their roles and responsibilities in accordance with Section 638.8(c) and (d).

(2) Systems to be Commissioned

(i) All base building Heating, Ventilating, and Air-Conditioning (HVAC) systems, equipment and components that affect energy use must be commissioned.

(ii) All indoor air quality systems that affect the operation of the HVAC ventilation system of the base building must be commissioned.

(iii) The following list of systems, equipment and components must be commissioned:

(a) Chillers, unitary and split-air conditioners, boilers, furnaces, and domestic hot water and service hot water heaters;

(b) Cooling towers, fans, pumps, heat exchangers;

(c) Controls for central plant and for HVAC, including, if present, the energy management system or the portion of the building automation system (BAS) that affects energy use;

(d) Ducts and associated dampers;

(e) Piping and associated valves;

(f) Duct insulation and pipe insulation;

(g) Duct system protection during construction, as related to indoor air quality;

(h) Air quality monitoring systems as they relate to ventilation systems;

(i) Renewable and alternative energy technologies, as appropriate per mechanical plant definition;

(j) Waste heat recovery; and

(k) Thermal storage.

(iv) In addition to the systems, equipment and components listed in paragraph (iii), other systems, equipment and components that are used for heating, cooling, or ventilation and that affect energy use or indoor air quality must also be commissioned.

(c) Responsibilities of Primary Participants in Commissioning

NOTE: FURTHER CLARIFICATION OF THE ROLES AND RESPONSIBILITIES CAN BE FOUND IN SECTION TITLED "COMMISSIONING RESPONSIBILITIES", IN THE DASNY COMMISSIONING GUIDELINES

THE ROLE OF THE CONSTRUCTION MANAGER (CM) HAS BEEN DESCRIBED IN THE ROLES AND RESPONSIBILITIES SECTION TITLED "COMMISSIONING RESPONSIBILITIES", IN THE DASNY COMMISSIONING GUIDELINES

(1) **Designers.** The individuals or the firms that design each system to be commissioned must prepare in writing the following: (1) Design Intent,
(2) Basis of design and
(3) Full sequences of operation for all equipment and systems, all of which must meet the requirements of this subpart and industry standards.

(2) **Commissioning Agent**. The commissioning agent must perform the functional testing of equipment, documented by the commissioning authority, using forms approved by the commissioning authority, all of which must meet the requirements of this subpart and industry standards.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES THE CONTRACTOR WILL BE REPONSIBLE FOR THE ROLE, TASKS AND REPONSIBILITIES OF THE COMMISSIONING AGENT.

(3) **Commissioning Authority**

(i) The commissioning authority must:

(a) Develop a commissioning plan, and

(b) Document performance (i.e., determines and document whether systems, equipment and components are functioning in accordance with the documented Design Intent and in accordance with the construction documents).

(c) For the purposes of this subpart, the commissioning authority (CA) cannot be responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management.

(d) Review and approve the Design Intent, basis of design, and sequence of operation. Commissioning authority approval is solely for the purpose of ensuring that sufficient information is contained therein to perform commissioning and must not constitute approval for any other purpose.

(e) Develop, or assist with developing and approve, or review and approve, the following written work products:

(1) Commissioning specifications designed;
(2) Commissioning plan;
(3) Start-up and check-out checklists and procedures;
(4) Functional performance testing procedures and checklists;
(5) Testing, adjusting, and balancing (TAB) plan;
(6) Operations and maintenance manual;
(7) Systems and energy management manual; and
(8) Commissioning Report.

Commissioning authority approval is solely for the purpose of ensuring that the above are in accordance with the commissioning requirements and must not constitute approval for any other purpose.

(4) Verify and document installation of systems, equipment and components. This activity must ensure the following:

(i) That systems, equipment and components are installed according to construction documents and manufacturer's instructions,

(ii) That other building systems or components are not compromising the efficacy of the systems or features being commissioned, and

(iii) That any required differences between the final installation and the original construction documents are documented.

(5) Verify, document, and approve that the start-up and checkout were completed and performed as required by Section 638.8(h).

(6) Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and verify that this documentation is included in operations and maintenance manuals. Notify owner of any deficiencies in results or procedures.

(7) Witness all or part of any duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and verify that this documentation is included in operations and maintenance manuals. Notify owner of any deficiencies in results or procedures.

(8) Witness sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.

(9) Verify, document, and approve that functional performance tests were performed as required by this subpart. See Section 638.8(i) for details.

(10) Maintain a master log for deficiencies and resolutions, and maintain a separate testing record. Provide to the owner written progress reports regarding issues related to the commissioning (e.g., progress being made, issues to resolve, milestones met, test results, recommended actions).

(11) Review the operations and maintenance manual for the completeness of all features components, equipment, subsystems, and systems that are commissioned in accordance with this part.

(12) Oversee and approve the training of the owner's operations and maintenance personnel. See Section 638.8(j) for details.

(13) Verify, document and approve required seasonally- deferred testing and corrections of any deficiencies. Document final testing and verify that this documentation is included in the commissioning report and in operations and maintenance manuals.

(14) Return to the site between six months and one year of building occupancy and review with facility staff the then current building operation and all outstanding issues related to the original commissioning and any seasonally deferred testing. Also interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the operations and maintenance manual and in the systems and energy management manual. Compliance with this subparagraph is required before the submission of the eligibility certificate for the second taxable year for which the green building credit is claimed.

(d) Qualifications of the Commissioning Authority and Commissioning Agent

(1) The commissioning authority's primary representative that will be fulfilling the responsibilities of the commissioning authority must have a professional engineer's license earned for mechanical engineering and must have a minimum of 5 years of experience in HVAC engineering.

(2) The commissioning authority must approve the qualifications of the commissioning agent.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES DASNY REQUIRES THE COMMISSIONING AGENT (CONTRACTOR) TO PROVIDE A COMMISSIONING AGENT QUALIFICATIONS SUBMITTAL TO THE COMMISSIONING AUTHORITY DOCUMENTING THE COMMISSIONING AGENTS PRIOR EXPERIENCE WITH COMMISSIONING AND COMMISSIONED PROJECTS. THE CX AUTHORITY SHOULD BE DEFINING THESE REQUIREMENTS IN THE COMMISSIONING SPECIFICATIONS.

(3) The commissioning agent and commissioning authority may be the same organization or person.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES DASNY DOES NOT ALLOW THE COMMISSIONING AUTHORITY AND THE COMMISSIONING AGENT TO BE THE SAME ORGANIZATION OR PERSON.

(4) A qualified member of the architecture or engineering firm or company that performs the design may act as the commissioning authority; however, such an individual must not be responsible for any aspect of the project design, or construction management or supervision for the subject building. In addition, reporting of all conditions and findings must be immediate and direct from the commissioning authority to the owner.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES DASNY GENERALLY DOES NOT ALLOW THE DESIGN PROFESSIONAL AND THE COMMISSIONING AUTHORITY TO BE THE SAME ORGANIZATION OR PERSON. THE OWNER, HOWEVER, MAY EXECUTE A SEPARATE CONTRACT WITH A QUALIFIED MEMBER OF THE DESIGN PROFFESIONAL'S FIRM TO PROVIDE THE SERVICES OF THE COMMISSIONING PROFFESIONAL, AS PROVIDED FOR BY 6NYCRR PART 638, SECTION 638.8(D)(4).

EXCEPTIONS TO THIS PRACTICE OF PROVIDING AN INDEPENDENT COMMISSIONING AUTHORITY MAY BE CONSIDERED FOR LEED FOR HOMES PROJECTS WHERE THE COMMISSIONING PROVIDER TYPICALLY SELF-CERTIFIES LEED COMMISSIONING REQUIREMENTS AS APPLICABLE. ALSO SMALLER SIZE ENERGY PERFORMANCE CONTRACT PROJECTS MAY BE CONSIDERED FOR PERFORMANCE AND/OR COMMISSIONING SELF CERTIFICATION DUE TO THE PERFORMANCE GUARANTEE ASSOCIATED WITH THOSE CONTRACTS.

(e) Design Intent and Basis of Design

A Design Intent narrative and a Basis of Design narrative must be developed.

(1) An overall **Design Intent** narrative is required for the following:

(i) Space temperature and humidity criteria;

(ii) Thermal zoning criteria;

(iii) Level of occupant control over HVAC systems (e.g., direct local control at the space level, control only at a central energy management system level)

(iv) Ventilation requirements and related indoor air quality criteria;

(v) Performance criteria related to energy efficiency;

(vi) Environmental responsiveness of the facility; and

(vii) Commissioning criteria.

(2) The **Basis of Design** must include at a minimum the following:

(i) Occupancy;

(ii) Space and process requirements;

(iii) Applicable codes, policies, and standards;

(iv) Design assumptions (e.g., heating/cooling load, and climatic);

(v) Performance standards, benchmarks or metrics;

(vi) Interaction between systems affecting intended performance; and

(vii) Control system appropriate for the skill of the operations and maintenance staff.

The Design Intent and Basis of Design must become part of the operations and maintenance manual and of the systems and energy management manual.

(f) Commissioning Plan

(1) A commissioning plan covering a given system, equipment or component is required before such system, element or component is commissioned.

(2) The commissioning plan must address the following:

(i) An overview of the tasks to be executed during commissioning;

(ii) A list of all features to be commissioned;

(iii) a list of reference documents related to commissioning, including specification references, drawing list, and submittal drawings;

(iv) a list of primary participants in the commissioning process and their responsibilities;

(v) A plan for management, communication and documentation;

(vi) An outline of the scope of the commissioning process, including submittal review, inspection, start-up, testing, training, operations and maintenance manual, systems and energy management manual;

(vii) A brief description of the checklists and tests to be performed, with reference to specific pre-start and start-up checklists;

(viii) A list of the functional performance tests to be performed to verify proper operation of all commissioned systems, including prerequisite activities and reference to specific checklists or worksheets which are necessary;

(ix) Where the commissioning authority is not the commissioning agent, a description of the process to be performed by the commissioning authority to verify that the systems are operating as indicated in the documentation provided by the commissioning agent;

(x) A brief description of the content of the training to be provided to the operations and maintenance personnel;

(xi) The expected written work products, including checklist, worksheets, and testing procedures; and

(xii) An activity schedule.

(g) Commissioning Specifications

(1) Commissioning specifications must be included in the construction documents.

(2) The commissioning specifications must include the following:

(i) Scope and details of the commissioning process;

(ii) Qualifications and skills required by the commissioning agent;

(iii) A detailed description of the responsibilities of all parties included in the commissioning process;

(iv) Systems, equipment and components to be commissioned;

(v) Requirements for pre-functional checklist and start-up;

(vi) The functional performance testing process;

(vii) Specific functional performance test requirements, including testing conditions and acceptance criteria for each piece of equipment being commissioned;

(viii) Provisions for resolving deficiencies;

(ix) Requirements for reporting and documentation for commissioning;

(x) Requirements for training;

(xi) requirements for operations and maintenance manual, and for systems and energy management manual; and

(xii) Schedule.

(h) Start-up and Checkout

Start-up and checkout must comprise the checks and tests to determine that all components, equipment, subsystems, systems, and interfaces between systems operate in accordance with construction documents. In this context, "operate" includes all modes and sequences of control operation, Interlocks and conditional control responses, and specified responses to abnormal or emergency conditions.

(1) The results of the start-up and check-out must be documented and must be performed according to:

(i) The manufacturer's written instructions for the systems and equipment being commissioned, and

(ii) The construction documents.

(2) A certificate of readiness must be prepared by the contractor **(COMMISSIONING AGENT)** and delivered to the commissioning authority stating that start-up and checkout have been successfully completed and that all equipment, systems, and controls are complete and ready for functional performance testing.

(i) The commissioning authority must verify that initial start-up and check-out were successfully completed.

(ii) The commissioning authority must verify that every point of the control system was checked and that every control point is commanding, reporting and controlling as specified in the construction documents. Verification must include a minimum sample of each type of control point. In addition, the controls that are verified must be within a minimum sample of each type of component, equipment, subsystem and system where the sensor type is installed. If any control point in the minimum sample is not commanding, reporting and controlling as specified in the construction documents, then an additional minimum sample of each type of control found not to be performing must be checked, until all control points in a minimum sample are found to be performing as specified.

(iii)The commissioning authority must verify that all sensors have been calibrated so that the value reported in the control system represents the actual local value. Verification

must include re-calibrating a minimum sample of each type of sensor. In addition, the sensors that are re-calibrated must be within a minimum sample of each type of component, equipment, subsystem and system where the sensor type is installed.

If any sensor in the minimum sample is out of calibration, then an additional minimum sample of each type of sensor found to be out of calibration must be re-calibrated, until all sensors in a minimum sample are found to be in calibration.

(iv) The commissioning authority must verify that all actuators have been adjusted to fully close and open dampers and valves, and also must verify by visual observation that the reported values in the control system are correct. Verification must include checking the operation of a minimum sample of each type of actuator, valve, and damper. In addition, the actuator, valve, and damper must be within a minimum sample of each type of component, equipment, subsystem and system where the type of actuator, valve, and damper is installed. If any actuator, valve, or damper in the minimum sample does not operate as required in the construction documents, then an additional minimum sample of each type of actuator, valve, or damper found not to be operating as required must be verified until all actuators, valves, or dampers in a minimum sample are found to be to be operating as required.

(v) The commissioning authority must verify the TAB by re-measuring a minimum sample of values reported for each type of component, equipment, subsystem, or system in the TAB reports. In addition, the values that are re-measured must be within a minimum sample of each type of subsystem and each type of system. If any re-measured value in the minimum sample deviates from the values in the TAB report or from the requirements in the construction documents by more than 10 percent, then an additional minimum sample must be re-measured for each type of component, equipment, subsystem or system for which there is a deviation, until all re-measured values in a minimum sample are within 10 percent of the values in the TAB report or of the requirements in the construction documents.

(vi) The commissioning authority must:

(a) Check that chimneys, chimney connectors and stacks are free of cracks, blockages and leaks;

(b) Ensure that proper combustion air is provided to the HVAC equipment;

(c) Ensure that all appliances are installed in accordance with applicable fire safety and local building codes; and

(d) Witness the testing of air tightness of smoking areas (if any), and document that all air leaks, if any, were sealed.

(i) Functional Performance Testing

(1) Written, repeatable test procedures must be prepared specifically for the project and must be used to functionally test equipment, components, subsystems, systems, and sequences and modes of operation. Test procedures must be documented to describe the individual test procedure, the expected system response, and acceptance criteria for each procedure.

(2) Testing documentation must identify the actual system response and must provide any pertinent observations or discussion.

(3) After initial check-out has been verified and approved by the commissioning authority, then the following must be tested:

(i) Each sequence in the sequence of operations must be tested. Additionally, other significant modes, sequences and control strategies not mentioned in the written sequences must be tested. The testing must include the following:

(a) Start-up;
(b) Shutdown;
(c) Unoccupied and manual modes;
(d) Modulation up and down the unit's range of capacity, if applicable;
(e) Staging, if applicable;
(f) Power failure/power down;
(g) Alarms;
(h) Backup upon failure; and

(i) Interlocks with other equipment.

(ii) The functional performance of each type of component, equipment, subsystem, and system must be tested using a minimum sample for each type of component, equipment, subsystem and system. If any component, equipment, subsystem or system in the minimum sample is found not to operate as required in the construction documents, then an additional minimum sample of each type found not to be operating as required must be tested until all units in a minimum sample are found to be operating as required.

(iii) Equipment must be tested to demonstrate performance under near-design conditions. To this end, tests on respective HVAC equipment and systems must be executed during both the heating and cooling season. However, overriding of control values to simulate cooling conditions during the heating season, and heating conditions during the cooling season is allowed where it would not affect the demonstrated performance required in the construction documents for the component, equipment, subsystem, system, or mode or sequence of operation being tested. Where the conditions listed above in this paragraph are not met, seasonally deferred testing must be undertaken.

(iv) The central plant (heating and cooling) must have its efficiency recorded.

(v) Functional performance testing must be done using manual methods, or control system trend logs and read-outs, or stand-alone data loggers, as deemed appropriate by the commissioning authority.

(j) Training

(1) The commissioning authority must assemble written verification that training of operations and maintenance personnel was conducted for all commissioned features and systems.

(2) The training program for operations and maintenance personnel must include instructional and demonstration portions.

(3) The owner must identify for the purpose of training the specific in-house personnel or contracted organization that will be responsible for the operations and maintenance for the building. Training must be performed within six months of the date that either the initial or subsequent statement of commissioning certification, as appropriate as determined by the commissioning authority, has been executed. Qualified personnel must perform training for a sufficient duration of time to ensure that facility staff for the building has all the information they need to properly operate, maintain and replace each feature or system that is commissioned.

(4) In addition, if operations and maintenance personnel change during the period that the tax credit provided for in this part is taken; the replacement personnel must receive the training required by these regulations. Written verification that this training was conducted must be maintained.

(5) The operations and maintenance manual, and the systems and energy management manual must be available for and used for the training.

(6) The instructional portion of the training program must cover at least the following:

(i) General purpose of each building system (i.e., Design Intent) including theory of operation, capabilities and limitations, and modes of control and sequences of operation in the subject building;

(ii) Use of the operations and maintenance manual and of the systems and energy management manual;

(iii) Review of control drawings and schematics;

(iv) Procedures for start-up, shutdown, seasonal changeover, normal operation, unoccupied operation, and manual operation;

(v) Controls set-up and programming;

(vi) Troubleshooting;

(vii) Alarms;

(viii) Interactions with other systems;

(ix) Operational monitoring and record keeping, including what should be monitored, what useful information can come from monitored data, and why that information is important to analyzing system operation;

(x) Adjustments and optimizing methods for energy conservation;

(xi) Relevant health and safety issues;

(xii) Inspection, service, and maintenance requirements for each system, including any requirements for special skills and knowledge that may best be met by specialized service contractors;

(xiii) Sources for replacement parts/equipment;

(xiv) Tenant interaction issues; and

(xv) Why certain features are environmentally responsive (i.e., save energy, improve indoor air quality (IAQ), reduce toxic materials, reduce waste).

(7) The demonstration portion of the training program must include at least the following:

(i) Operation of each system, or typical examples if there are several similar systems in the building;

(ii) Start-up and shutdown procedures, operation under all specified modes of control and sequences of operation, and the correct procedures under emergency or abnormal conditions; and

(iii) Procedures necessary for effective operational monitoring, as appropriate, but particularly for projects with direct digital control systems incorporating trending and graphing features.

(k) Manuals

(1) Operations and maintenance (O&M) manual

(i) The operations and maintenance data must be complete and must be accessible by the operations and maintenance personnel and the Owner.

(ii) The operations and maintenance manual must include for each piece of equipment and each system:

(a) The name, address and telephone number of the manufacturer or vendor and installing contractor;

(b) Submittal data; and

(c) Operations and maintenance instructions with the models and features for the subject site clearly marked.

(iii) The operations and maintenance manual must be edited to include only data for equipment that is actually installed. The data must include the following:

(a) Instructions for installation, maintenance, replacement, start-up;

(b) Special maintenance requirements and sources for replacement parts/equipment;

(c) Parts list;

(d) List of special tools required;

(e) Performance data; and

(f) Warranty information.

(iv) The manual must also include an as-built documentation package for controls that includes information related to the following:
(a) normal operation;
(b) shutdown;
(c) unoccupied operation;
(d) seasonal changeover;
(e) manual operation;
(f') controls set-up and programming;
(g) troubleshooting;
(h) alarms;
(i) control drawings and schematics; and
(j) final sequences of operation.

(2) Systems and Energy Management Manual

(i) In addition to the operations and maintenance manual and the commissioning report, a systems and energy management manual must be developed and delivered to the Owner.

(ii) The following components must be included in the systems and energy management manual even though some parts may also be found in the operations and maintenance manual:

(a) Narratives for the final Design Intent and basis of design, including brief descriptions of each system;

(b) Final sequences of operations for all equipment;

(c) Procedures for seasonal start-up and shutdown, manual and restart operation;

(d) As-built control drawings;

(e) For all energy-saving features and strategies, rationale description, operating instructions, and caveats about their function and maintenance relative to energy use;

(f) Recommendations and brief method for appropriate accounting of energy use of the whole building.

(g) Recommendations for recalibration frequency of sensors and actuators by type and use;

(h) Plans for continuous commissioning or recommended frequency for re-commissioning by equipment type, with reference to tests conducted during initial commissioning;

(i) Recommendations regarding seasonal operational issues affecting energy use;

(j) List of all user-adjustable set points and reset schedules, with a discussion of the purpose of each and the range of reasonable adjustments with energy implications;

(k) Schedule of how frequently to review the various set points and reset schedules to ensure they still are at current, relevant, and efficient values;

(l) List of time-of-day schedules and a frequency to review them for relevance and efficiency;

(m) Guidelines for establishing and tracking benchmarks for building energy use and primary plant equipment efficiencies;

(n) Guidelines for ensuring that future renovations and equipment upgrades will not result in decreased energy efficiency and will maintain the Design Intent;

(o) List of diagnostic tools, with a description of their use that will assist facility staff for the building in operating equipment more efficiently; and

(p) A copy of the commissioning report; and

(q) Index of all commissioning documents with notation as to their location.

(l) Commissioning Report

(1) After all commissioning tasks except seasonally deferred testing have been completed; a commissioning report must be delivered to the owner.

(2) The report must include:

(i) an executive summary;

(ii) list of participants and their respective roles;

(iii) a brief building description;

(iv) an overview of the scope of commissioning and testing;

(v) a general description of testing and verification methods; and

(vi) a list of each feature or system commissioned.

(3) For each piece of commissioned equipment, the report must contain the determination of the commissioning authority regarding the adequacy of the equipment, documentation and training.

(4) The commissioning report must address the following areas:

(i) Adequacy of equipment with respect to construction documents and Design Intent;

(ii) Equipment installation;

(iii) Functional performance and efficiency;

(iv) Equipment documentation;

(v) Operations and maintenance review and recommendations; and

(vi) Operator training.

(5) The functional performance and efficiency section for each piece of equipment must identify the verification method used (manual testing, trend logs of the building automation system, data loggers) and must include observations and conclusions from the testing.

(6) The report must also include a list of outstanding commissioning issues and any testing that is scheduled for a later date due to weather conditions (i.e., seasonally deferred testing).

(i) All outstanding deficiencies identified during or as a result of commissioning activities as required by this subpart must have been corrected or must be separately listed and highlighted in the commissioning report.

(ii) Each non-compliance issue must be referenced to where the deficiency is documented (e.g., the specific functional test, inspection, trend log).

(7) Appendixes must contain acquired sequence documentation, logs, meeting minutes, progress reports, deficiency lists, site visit reports, findings, unresolved issues, communications, and other relevant information. Documentation must be provided in a separate labeled binder for the following:

(i) Start-up and checkout in accordance to Section 638.8(h)

(ii) Functional performance testing (along with blank forms for the operators), and

(iii) As available, data obtained from monitoring, and analysis of those data.

(8) If components, equipment, subsystems, systems, controls, or sequences of operations as-built are different than required in the original construction documents, then the commissioning report must list these differences. In addition, the commissioning report must state that the computer models used to calculate energy use to demonstrate compliance with this Part must be revised to reflect the difference listed between the as-built conditions and original modeling assumptions and inputs and the listed deficiencies which have not been corrected. The commissioning report must also state that the revised energy models must be re-run to demonstrate that the energy performance is in compliance with the energy use provisions specified in Section 638.7(c).

(9) Once the seasonally deferred testing has been completed, the Commissioning Authority must issue an addendum to the commissioning report, or must re-issue the commissioning report, using the same criteria and methods as in the initial commissioning report.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES DASNY REQUIRES A SECTION BE INCLUDED IN THE COMMISSIONING REPORT FOR DOCUMENTING THE COMMISSIONING AUTHORITY'S REVIEWS OF THE CONTRACT DOCUMENTS AT EACH OF THE PHASES AS NOTED. THIS SECTION SHALL INCLUDE BOTH DESIGN AND CONSTRUCTION DOCUMENT REVIEW.

FOR REFERENCE PURPOSES THE RELEVANT INDOOR AIR QUALITY REQUIREMENTS PER THE NEW YORK STATE GREEN BUILDING TAX CREDIT, 6NYCRR Part 638.7 (d) (1 & 2), HAVE BEEN REPRODUCED BELOW, PORTIONS OF WHICH HAVE BEEN AMENDED BY DASNY TO FIT THEIR OPERATIONAL NEEDS:

638.7 Standards and Methods for Determining Compliance

(d) Indoor air quality. For indoor air quality with respect to levels for carbon dioxide, carbon monoxide, formaldehyde, particulate matter, radon and total volatile organic compounds.

(1) Indoor air quality testing.

(i) This applies to base building and tenant space as follows:

(a) Base building. Indoor air quality testing must be performed with respect to the whole building no later than 30 days after occupancy ~~and annually each taxable year until the taxpayer no longer has any tax credit to claim.~~ The taxpayer must show that, with respect to a base building, during a taxable year during which any part of the building is occupied, the indoor air quality met the standards established in this Part for carbon dioxide, carbon monoxide, formaldehyde, particulate matter, radon and total volatile organic compounds.

(b) Tenant space. Indoor air quality testing must be performed with respect to the tenant space no later than 30 days after occupancy ~~and annually each taxable year until the taxpayer no longer has any tax credit to claim.~~ The taxpayer must show that, with respect to the tenant space, during a taxable year during which any part of the tenant space is occupied, the indoor air quality met the standards established in this Part for carbon dioxide, carbon monoxide, formaldehyde, particulate matter, radon and total volatile organic compounds.

NOTE: FOR THE PURPOSE OF THESE GUIDELINES DASNY REQUIRES THE IAQ TESTING TO BE PERFORMED NO LATER THAN 30 DAYS AFTER OCCUPANCY, BUT NOT ANNUALLY. THE REFERENCED STANDARDS FOR IAQ TESTING COMPLIANCE ARE NOT INTENDED FOR TAX CREDIT COMPLIANCE IN THIS CONTEXT.

(ii) Standards. The IAQ testing protocol must cite the indoor air quality standards for the green building credit presented in Table 7.3 in this section.

Table 7.3 Indoor Air Quality Standards for the Green Building Tax Credit

	Test Duration (minutes)	**Criteria**	**Basis**	**Source of Standard**
Carbon Dioxide	up to 48 hours continuous, 10 minutes for mobile	700 parts per million above background (outside air)	surrogate for odors.	ASHRAE 62-1999
Carbon Monoxide	up to 24 hours for continuous, 10 minutes for mobile	Indoor levels not to exceed background (outside air). Background (outside air) and outside air at air intakes not to	primary standard set to protect public health, including the health of sensitive	Environmental Protection Agency (EPA) - National Ambient Air Quality Standards/ NYS -Air Quality Standards/ ASHRAE 62-1999

		exceed 9 ppm, 8-hour average 35 ppm, 1-hour average	populations such as asthmatics, children and the elderly.	
Formaldehyde	8 hours continuous	50 parts per billion	normative data for typical Office Buildings.	EPA's Building Assessment Survey and Evaluation (BASE) study. California Air Resources Board Indoor Air Quality Guideline, No.1,"Formaldehyde in the Home" residential Action Level
Particulates	8 hours continuous	150 micrograms per cubic meter,24-hour average (PM_{10})	protection against coarse particles associated with aggravation of respiratory conditions such as asthma	EPA - National Ambient Air Quality Standards (ASHRAE 62-1999)
Radon	48 hours minimum	4 picocuries per liter	protection against increased incidence of lung cancer.	EPA - Radon Reduction Techniques for Detached Houses, Technical Guidance (ASHRAE 62-1999)
Total volatile organic compounds	8 hours continuous	200 micrograms per cubic meter above background (outside air)	"comfort range" based mucous membrane irritation studies.	EPA Research Triangle Park research and administrative facility baseline testing, 2001.Molhave, 1990,referenced in European Collaborative Action Report No.11, Guidelines for Ventilation Requirements in Buildings
Alternative Approach to TVOCs: volatile organic	8 hours continuous	Each VOC is less than or equal to the median (50th percentile)of	normative data for typical Office Buildings	EPA's Building Assessment Survey and Evaluation (BASE) study.

compounds (VOC) scan,10 - 15 compounds		concentrations measured in EPA BASE study of Office Buildings throughout the U.S.		

(iii) Prerequisites. The required IAQ testing must be performed by a qualified professional ~~retained by the taxpayer~~. The ventilation system must be operated at the design condition of minimum outside air as specified for normal occupancy for 24 hours before and during IAQ testing. The qualified professional may elect to account for seasonal variations in meeting the prerequisite requirements by sampling on a quarterly basis where appropriate.

(a) Prior to performing the required annual IAQ testing, the following four prerequisite conditions must be met.

(1) The commissioning of the ventilation systems must be complete (with the exception of seasonally deferred testing), as documented in the commissioning report; any deficiencies related to the ventilation system must be completely corrected; and those corrections must be documented in the commissioning report.

(2) Except for residential buildings, a one week purge with air handlers operating at 100 percent outside air must be complete, on every floor prior to occupancy, according to paragraph (g)(1) of this section.

(3) The HVAC system must operate in the design condition of minimum outside air as specified in the design documents for normal occupancy.

(4) Construction or rehabilitation of at least 50 percent of the rentable square footage or occupiable space of the building which is projected to be occupied ~~in the taxable year for which the tax credit is being claimed~~ must be completed and the space used in accordance with its intended purpose. The architect or engineer of record must confirm completion of the space in compliance with design documents, including furniture, fixtures and equipment, and must confirm that use of the space is consistent with the intended occupancy of the space, prior to IAQ testing. The testing must be conducted within 30 days of the time when this percentage of building occupancy has been achieved.

(b) Prior to performing the required annual IAQ testing in multifamily residential buildings, the following two additional prerequisite conditions must be met:

(1) Ranges, ovens and unvented gas fireplaces must be coupled with fan-powered exterior exhaust.

(2) In residential buildings with combustion sources, UL-listed carbon monoxide detectors which meet Underwriters Laboratories (UL) UL Standard 2034, Single and Multiple Station Carbon Monoxide (CO) Detectors, effective June 2, 1999, must be installed (see section 638.10 of this Part).

(i) These detectors must also meet the reliability requirements of ASTM D22.05.

(ii) The number, type, selection and placement of all CO detectors or alarms must meet National Fire Protection Association (NFPA) 720, Recommended Practice for the Installation of Household Carbon Monoxide (CO) Warning Equipment, 1998 edition (see section 638.10 of this Part). Locations must include mechanical equipment rooms, attached parking garages, and adjacent occupied units.

(iv) IAQ testing protocol.

(a) Test strategy. The qualified professional must prepare an IAQ testing protocol based on a strategy which includes establishing an appropriate schedule for testing and identifying representative sampling locations in the building. The protocol must be based on: (1) a review of relevant background information on the whole building or tenant space, as applicable, and its HVAC system, including central air handling and distribution system, perimeter zone units, unitary systems, evaporative cooling systems, outdoor air intake control, and/or natural ventilation system, and (2) a site walk-through.

Preparation of the IAQ testing protocol must include:

(1) following the procedures in sub clause (2) of this clause, review the following document:

(i) updated as-built floor plans and HVAC drawings to identify the HVAC equipment serving each floor and/or major area;

(ii) the operations and maintenance records for the ventilation system; and

(iii) commissioning report, operations and maintenance manual, systems and energy management manual, and other relevant studies where available.

(2) The review required by sub clause (1) of this clause must be conducted, at a minimum, with respect to:

(i) the design intent for the mechanical plant;

(ii) location of air intakes and exhausts and pressure differentials between rooms that may account for influx of contaminants;

(iii) design for supplied outdoor air, flow and distribution of air;

(iv) position of dampers;

(v) local exhaust ventilation;

(vi) air-cleaning equipment;

(vii) HVAC operating times;

(viii) regular operational checks;

(ix) equipment cleaning and disinfecting schedules; and

(x) observed and corrected deficiencies.

(3) Interview owner, and where applicable, tenant representatives for each occupied space to ascertain whether there are indoor air quality complaints. Where such complaints exist, identify their nature and the building areas associated with them.

(4) Examine the records of indoor air quality complaints as required by section 638.9(c) (5) of this Part. Determine any patterns, their magnitude, distribution and duration.

(5) Review ventilation system operation with building engineer or designated IAQ manager. Perform a site walk-through inspection covering all relevant areas, including at a minimum:

(i) inside and outside contamination sources;

(ii) HVAC systems; and

(iii) occupied floors.

(6) Inspect for signs of water damage or microbial contamination and test for improper air pressure relationships. The qualified professional must immediately notify building management of deficiencies observed during the site walk-through.

(7) Inspect and review design and operational parameters of the HVAC system, including at a minimum the following:

(i) source and amount of outside air delivered per occupant;

(ii) adjustable or local HVAC controls;

(iii) type of humidifier/dehumidifier and how controlled;

(iv) outdoor air damper settings; and

(v) operational control sequences.

(8) Evaluate recent ~~of~~ rehabilitation or maintenance that can be a source of contaminants. The following must be evaluated where applicable:

(i) painting;

(ii) carpet installation;

(iii) air conditioning repairs;

(iv) carpet cleaning;

(v) disinfecting of HVAC system;

(vi) pesticide application; and

(vii) use of acid drain cleaners.

(9) Identify indoor contaminant sources. The following sources must be included in this inventory where applicable:

(i) office equipment;

(ii) cleaning compounds and disinfectants;

(iii) tobacco smoke;

(iv) adhesives, paints, and glues;

(v) off-gassing of construction material and building fabric;

(vi) contaminants generated by construction or rehabilitation;

(vii) appliances; and

(viii) air fresheners.

(10) Identify outdoor contaminant sources. The following must be included in this inventory where applicable:

(i) vehicle exhaust;

(ii) roofing materials;

(iii) cooling towers;

(iv) dust or other contaminants from construction activity;

(v) industrial plant exhaust or building exhaust;

(vi) gasoline vapors;

(vii) pollen;

(viii) biological contaminants; and

(ix) atmospheric pollutants.

(11) Identify areas with different occupancies or different potentials for IAQ problems. The following must be included in this inventory where applicable:

(i) high occupancy density areas, such as assembly rooms, cafeterias, physical fitness rooms;

(ii) special use areas such as elevators, restrooms, conference rooms, storage areas, janitor closets, copier rooms, hallways, graphic arts facilities, kitchens, loading docks, parking garages;

(iii) private offices, partitioned office spaces, open office spaces;

(iv) areas with different types of interior finishes on walls, partitions, ceilings and floors; and

(v) areas with different types of furnishings.

(b) Sampling locations. The qualified professional must identify representative sampling locations.

(1) If the testing is being conducted for a base building (whether a "green base building credit component" or a "green whole-building credit component," as those terms are defined in section 19 of the Tax Law, is being sought), the sampling locations must represent conditions not only in the common areas of the building, but also must represent conditions in the whole building. The building owner must notify the tenants, in advance and in writing, of the IAQ testing.

(2) If the testing is being conducted for tenant space, the testing program need only cover the tenant space.

(3) Each sampling location must cover:

(i) 20,000 square feet or less in size; or

(ii) areas in one ventilation zone.

The qualified professional is to determine whether sub clause (1) or (2) of this clause is applicable and must use the more stringent requirement.

(4) Ambient air must be tested, in addition to supply and return air.

(5) When IAQ testing is performed for radon, measurements must be made only in occupied spaces, not in supply or return or outdoor air when

IAQ testing is performed. Radon must be measured in the occupiable space on the lowest floor, particularly in those areas used regularly by building maintenance staff, such as workrooms, storage areas or mechanical rooms.

(6) Carbon monoxide testing must be conducted in the following locations:

(i) Areas containing combustion sources. Where applicable, testing must be conducted in attached parking garages; mechanical rooms with fossil fuel used to actuate boilers, furnaces, DHW heaters, chillers, desiccant dehumidifiers, heat pumps or other equipment; occupied spaces with fossil fuel- or wood-fired stoves, fireplaces, vented or unvented heaters and appliances.

(ii) Occupied spaces that share a wall, floor or ceiling slab with areas referenced in item (i) of this sub clause, including custodial rooms. Carbon monoxide testing must be coordinated with equipment tune-up and maintenance schedules required by the IAQ management plan for operations and maintenance by paragraph (c) (3) of this section.

(c) Sampling and analytical methods. The following methods and types of instrumentation, or those which provide equivalent data quality as determined by the qualified professional, must be used (see section 638.10 of this Part):

(1) Carbon dioxide: Real time non-dispersive infrared (NDIR) analyzers with output logged over time, or equivalent, with averaging times as specified in the EPA's A Standardized EPA Protocol for Characterizing Indoor Air Quality in Large Office Buildings (1994). The measurement protocol in Method IP-3A, of EPA's Compendium of Methods for the Determination of Air Pollutants in Indoor Air, Report EPA-600/4-90/010; NTIS-PB90-200288, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC (April 1990) must be used.

(2) Carbon monoxide: Real time, portable analyzers with electrochemical sensors, battery-operated, with output logged over time, or equivalent, with averaging times as specified in EPA's A Standardized EPA Protocol

for Characterizing Indoor Air Quality in Large Office Buildings (1994). CO testing equipment must provide accurate readings below 10 ppm (with a range to 200 ppm). The measurement protocol in Method IP-3A of EPA's Compendium of Methods for the Determination of Air Pollutants in Indoor Air, Report EPA-600/4-90/010; NTIS-PB90-200288, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC (April 1990) must be used.

(3) Particulate matter: At minimum, particle-size selective sampler with impactor and nozzle allowing for collection of PM_{10} particulate matter. The measurement protocol in Method IP-10A of EPA's Compendium of Methods for the Determination of Air Pollutants in Indoor Air, Report EPA-600/4- 90/010; NTIS-PB90-200288, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC (April 1990) must be used.

(4) Radon: At minimum, meet New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) Certification Manual Item 194.5 (4/15/94) using one of the following methods: Electret, alpha-track detector, charcoal canister, continuous radon monitors, or continuous working level monitors. The laboratory analyzing radon samples must have current NYSDOH ELAP certification for radon analysis. The sampling and analytical methods as specified in Indoor Radon and Radon Decay Product Measurement Device Protocols, USEPA, Office of Radiation Programs, EPA 402-R-92-004, July 1992 must be used. www.epa.gov/iaq/radon/pubs/devprot1.html

(5) Total Volatile Organic Compounds: Collection on solid sorbent with analysis by thermal desorption and gas chromatography/mass spectrometry (GC/MS), using EPA Methods TO-14A and TO-17, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second edition, EPA Center for Environmental Research Information, EPA/625/R-96/010b (January 1999). www.epa.gov/ttn/amtic/airtox.html

(6) Formaldehyde: Collection must be on 2, 4-dinitrophenylhydrazine (DNPH) - coated silica gel cartridges. The DNPH-aldehyde derivatives on

the cartridges must be eluted with acetonitrile, then analyzed by high performance liquid chromatography (HPLC) with ultraviolet (UV) detection, using EPA Method TO-11A, Determination of formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (Active Sampling Methodology), Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second edition, EPA Center for Environmental Research Information, EPA/625/R-96/010b (January 1999). www.epa.gov/ttn/amtic/airtox.html

(d) Sampling frequency and duration.

(1) At minimum, testing must be conducted no later than 30 days after occupancy and on an annual basis for each of the years for which the tax credit is being claimed.

(2) Radon measurements need not be repeated after the initial test if readings of less than 4 picocuries/liter are recorded. See Table 7.3 of this section.

(3) The sampling duration and timing for contaminants other than radon must be consistent with the methods specified in this Part. Carbon dioxide readings must include periods when concentrations are expected to peak. In settings with stable occupancies, carbon dioxide readings may be repeated in late morning and late afternoon when carbon dioxide levels in the building are closest to equilibrium, to give the best indication of effective air exchange rates.

(e) Quality assurance/quality control.

(1) The IAQ testing protocol must meet the measurement methods, monitoring regime, sample and data management requirements of (see section 638.10 of this Part):

(i) EPA's A Standardized EPA Protocol for Characterizing Indoor Air Quality in Large Office Buildings (1994), June 1994; and

(ii) EPA's Quality Assurance Overview Document for the U.S. Environmental Protection Agency's Office of Research and

Development and Office of Air and Radiation Large Building Studies (1994), prepared by EPA Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC and EPA Office of Radiation and Indoor Air, November 1994.

(v) IAQ Testing Report

(a) Report contents. Following IAQ testing the qualified professional must provide to the owner or tenant, as applicable, a report which includes:

(1) the address and location of the building or tenant space;

(2) operator and firm identification;

(3) signed approval sheet by qualified professional;

(4) general description of the building, HVAC system, and conditions recorded during the initial data-gathering phase, consisting of the document review, interviews and site walk-through;

(5) confirmation that building systems were operating in the manner specified in the IAQ testing protocol when IAQ testing was performed;

(6) description of sampling and analytical methods;

(7) field observations of how the building systems were operating; air exchange rates; inside and outside temperature and relative humidity records; wind speed and direction; weather conditions; occupant density; and occupant activities; particularly those which may affect the results;

(8) sufficient documentation of sampling procedures and locations so that test conditions could be replicated and results objectively evaluated;

(9) instrument model numbers, serial numbers, equipment calibration records, in accordance with manufacturers' instructions and method requirements;

(10) date, start times and stop times of testing;

(11) for data logged results, hourly averages for each location at each time period, based on 3-minute readings;

(12) chain-of-custody records;

(13) data interpretation; which addresses the method of sampling and analytical errors; and

(14) laboratory reports with results, minimum detection limits for each analyte and a reference to the specific analytical method used.

(b) Acceptability of results:

(1) Test results must be representative of building conditions in the base building and/or tenant space for the year for which the green building credit is being sought and must comply with the standards presented in Table 7.3 of this paragraph. If the testing is conducted only once, the test data from that period must be used in the determination. If multiple tests are conducted, the entire database must be included in the comparison and determination.

(2) Compliance with the standards set forth in this Part must be determined as follows:

(i) Data from each ventilation zone must comply with the standards presented in Table 7.3 of this section. If more than one location has been tested in one ventilation zone, the results obtained from that ventilation zone are averaged prior to the comparison. The qualified professional must certify that test results from each ventilation zone in the space for which the green building credit is being sought comply with the standards set forth in this paragraph.

(ii) For test results obtained for carbon dioxide and carbon monoxide, the data must be in the form of data logged results, with data points representing averages within the time periods specified in the IAQ testing protocol. Data will be considered to be in compliance with the standards presented in Table 7.3 of this section if the measured indoor values are less than or equal to those values, with an allowance that any accumulated period of no more than five minutes may exceed those values.

(iii) For test results obtained for particulates, radon, total volatile organic compounds, volatile organic compound scan and formaldehyde, the data must be in the form of integrated results, averaged over the time period specified in the IAQ testing protocols contained in subparagraph (2)(iii) of this subdivision. Data will be considered to be in compliance with the standards presented in Table 7.3 of this section if the values are less than or equal to those values.

(iv) For ~~each taxable year during which~~ any part of the space ~~is occupied space at any time, and for which a taxpayer claims a green building credit~~, if testing is conducted and there are exceedences ~~in any part of the space for which the green building credit is being claimed,~~ that entire space will not qualify ~~for the green building credit~~ unless:

(A) additional testing is performed and results demonstrate that during the taxable year for which the credit is being claimed the air quality meets the IAQ standards set forth in Table 7.3 of this section. Data from the additional testing must be presented in the IAQ Testing Report which explains the reasons, if identified, any exceedances and documents how the situation was remedied.

(2) IAQ Management plan during construction or rehabilitation. This Part applies to base buildings and tenant spaces.

(i) Standards. An indoor air quality management plan during construction and rehabilitation must be implemented in accordance with the following requirements of this Part for the construction or rehabilitation of any base building or tenant space.

(ii) Construction details. When constructing or rehabilitating a base building and/or tenant space, compliance with the following construction detailing provisions is required:

(a) Wherever two or more elements of the building envelope form a joint, the construction drawings must detail the continuity of the moisture protection strategy.

(b) When the joints occur in three dimensions such that three planes intersect or end dams are required, the details must be three dimensional.

(c) The level of construction detail must be as provided by Sheet Metal and Air Conditioning Contractors' National Association, Inc., Architectural Sheet Metal Manual, 5th edition, 1993 (see section 638.10 of this Part).

(iii) Indoor air quality (IAQ) management process during construction. An IAQ management process during construction which encompasses the following elements must be implemented for any base building or tenant space:

(a) Coordination.

(1) During the preconstruction phase of the project, a mechanism must be established by the owner or tenant for communication and notification between the owner or owner's representative, or tenant or tenant's representative, the architect/engineer of record, the general contractor or construction manager, plus other parties as determined by the above-listed parties, to prevent and effectively resolve problems related to construction-related air pollutant control.

(2) Specific authority must be designated by the Owner or tenant for the development, supervision, direction and enforcement of the IAQ management process during construction. This authority must include job-site inspections, with the ability to implement stop work orders or termination of services for nonconformance with the procedures for the IAQ management process during construction.

(b) Indoor air quality (IAQ) management plan during construction.

(1) Division 1 (general conditions) of the project specifications must require a written construction IAQ management plan which includes procedures meeting or exceeding the minimum requirements of the IAQ Guidelines for Occupied Buildings Under Construction published by the Sheet Metal and Air Conditioning Contractors' National Association, Inc. (see section 638.10 of this Part).

(2) The IAQ management plan during construction must include measures to protect the ventilation system components and air pathways against

contamination during construction. The plan must include cleaning procedures to be employed prior to the building being occupied, in the event that ventilation system components and air pathways are not adequately protected. The plan must include control measures, as defined in the IAQ Guidelines for Occupied Buildings Under Construction published by Sheet Metal and Air Conditioning Contractors' National Association, Inc. 2000 ~~(see section 638.10 of this Part):~~

(i) HVAC protection;

(ii) contaminant source control;

(iii) interruption of moisture/pollutant pathway;

(iv) housekeeping; and

(v) scheduling of events to protect indoor air quality by:

(A) permitting adequate airing-out of new materials;

(B) sequencing the installation of finish materials;

(C) proper curing of concrete before covering;

(D) installation during unoccupied periods; and

(E) avoidance of building occupancy while construction-related pollutants are still present.

These five requirements must be highlighted in the IAQ management plan during construction for each phase of construction. The plan must specify the location, type, amount, sequence and timing of the various control measures, including emergency procedures, and the labor, materials and time required to implement them.

(3) The project construction documents must address the following:

(i) an overview of tasks to be executed;

(ii) a list of reference documents, including specification references, drawing list, and submittal drawings;

(iii) a list of primary participants in the process and their responsibilities;

(iv) a plan for management, communication and documentation;

(v) an outline of the scope of the IAQ management process during construction, including submittal review, inspection, and enforcement;

(vi) the expected written work products, including checklists and worksheets; and

(vii) an activity schedule.

(4) The project construction documents must require the contractor responsible for constructing and/or rehabilitating the base building and/or tenant space, to:

(i) designate a representative with daily responsibility for IAQ issues;

(ii) include procedures related to the IAQ management plan during construction on the agenda during every preconstruction meeting and during every regularly scheduled meeting;

(iii) store building materials in a weather-tight, clean area protected from dust, debris and moisture damage;

(iv) keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the work. Identify the storage, disposal and housekeeping practices to be applied to building supplies and waste materials to protect building systems from contamination;

(v) submit a special construction schedule to prevent Type 2 finishes from acting as sinks for storage and subsequent release of contaminants emitted from Type 1 finishes. Specifications must identify per location whether every finish is Type 1 finish or Type 2 finish. In the schedule, the contractor must include appropriate allowances for drying or curing times of Type 1 finishes before

installation of Type 2 finishes, based on technical specifications provided by the manufacturers;

(vi) provide 100 percent outside air continuously during installation of materials and finishes, beginning after the building is substantially enclosed, according to subdivision (g) of this section. Where a supply air system is already installed, it must have filters in place before work begins;

(vii) the permanent HVAC system may be used to move both supply and return air provided the following conditions are met:

(A) replace all construction-related filtration media used on permanent HVAC equipment at substantial completion of the work;

(B) confirm that all air filters, casing, coils, fans and ducts are clean, before TAB, and air quality testing;

(C) permanent return air ducts must be inspected and/or cleaned to comply with minimum requirements of General Specifications for the Cleaning of HVAC Systems published by the National Air Duct Cleaning Association ~~(see section 638.10 of this Part)~~ www.nadca.com;

(viii) coordinate duct testing and cleaning procedures with the commissioning requirements set forth in section 638.8 of this Part to ensure that they may be witnessed and documented by the commissioning authority; and

(ix) provide the owner or tenant a building or tenant space, as applicable clean, dry and free of debris.

(c) Construction IAQ management report.

(1) To demonstrate compliance with the standards established by this section, the taxpayer (or Owner's representative – Commissioning Authority) must prepare a construction IAQ management report

documenting effective implementation of the construction IAQ management plan.

(2) The Owner (or Owner's representative – Commissioning Authority) must retain the following documentation as part of the construction IAQ management report:

(i) all meeting minutes, checklists, worksheets, notifications and deficiency or resolution logs related to construction or rehabilitation IAQ issues;

(ii) a listing of all temporary usages of building mechanical plant, cut sheets of filtration media used during construction and installed immediately prior to occupancy, and schedule of filter replacement and change outs;

(iii) progress photographs of job site sufficient to document implementation of construction or rehabilitation IAQ management measures during each phase of construction; and

(iv) documentation of duct testing and cleaning.

B. DASNY IAQ Scope Clarification & Guidelines

NOTE: FOR THE PURPOSE OF CLARIFYING DASNY's IAQ TESTING AND IAQ MANAGEMENT PLAN DURING CONSTRUCTION SCOPE REQUIREMENTS, SEE THE FOLLOWING:

1. Indoor Air Quality (IAQ) Testing

a. IAQ specification must be included in contract documents.

b. IAQ specification must include as a minimum:

i. Requirement for contractor to provide a building that passes IAQ testing protocol.

ii. Requirement for contractor to submit an IAQ management plan.

iii. Ventilation during construction.

iv. Requirement for protection of construction materials. This includes methods for protecting stored materials, and protecting materials and/or systems once they are installed but not yet turned over to the owner.

v. Requirements for construction housekeeping practices.

vi. Requirement for IAQ testing.

vii. Requirement for contractor to provide a building flush-out plan. This plan shall be reviewed by the Commissioning Authority and Design Professional for adequacy.

NOTE: IAQ TESTING IS TYPICALLY REQUIRED TO BE PERFORMED BY THE RESPONSIBLE CONTRACTOR. HOWEVER, IAQ TESTING COULD BE PART OF THE COMMISSIONING AUTHORITY'S SCOPE, AS DETERMINED ON A PER PROJECT BASIS.

c. Indoor Air Quality (IAQ) testing with respect to levels for carbon dioxide, carbon monoxide, formaldehyde, particulate matter, radon and total volatile organic compounds shall comply with LEED and The Green Building Tax Credit (GBTC), 6NYCRR Part 638, Section 638.7(d)(1).

d. IAQ testing should be performed for the whole building immediately after the building air purge and prior to turnover to the owner for occupancy, but must be performed no later than 30 days after occupancy.

e. IAQ testing protocol listed here shall be used to comply with requirements of LEED and The GBTC, 6NYCRR Part 638, Section 638.7(d)(1). Acceptance criteria listed here are the lower (more stringent) requirement of LEED and GBTC, Section 638.7.

i. Carbon Dioxide – less than 700 parts per million above background level.

ii. Carbon Monoxide – less than 2 parts per million above background, but not over 9 parts per million.

iii. Formaldehyde – less than 27 parts per billion.

iv. Particulates – less than 50 microgram/m^3 of PM10 (10 micron) material.

v. Radon – less than 4 picocuries/liter.

vi. Total Volatile Organic Compounds (TVOCs) – less than 200 micrograms/m^3.

vii. 4-Phenylcyclohexene (4-PCH) – less than 6.5 micrograms per cubic meter. This test is only required if carpet and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.

viii. Alternative Approach to TVOCs – requires DASNY approval.

f. The required IAQ testing must be performed by a qualified professional. The qualified professional must be a certified hygienist or a professional engineer.

i. Prior to performing the IAQ testing, the following prerequisite conditions must be satisfied. The requirements listed below will meet LEED and GBTC, 6NYCRR Part 638, Section 638.7 requirements for building flush-out. The commissioning of the ventilation system must be complete, except seasonally deferred testing, as documented in the commissioning report. All deficiencies must be corrected and noted in the report.

ii. Provide building flush-out prior to occupancy. Flush-out shall run for a minimum of 7 days and provide 14,000 ft^3 of outdoor air per ft^2 of floor area. Building flush shall not expose spaces to excessive or insufficient temperature or humidity.

iii. The HVAC system must operate in the design condition of minimum outside air as specified in the design documents.

iv. Construction or rehabilitation of at least 50% of the occupiable space of the building which is projected to be occupied must be completed and the space used in accordance with its intended purpose. The Architect or Engineer of record must confirm compliance with the above requirement. Testing must be conducted within 30 days of occupancy.

g. The qualified professional must establish and prepare an IAQ testing protocol, including the following:

i. Scheduling for testing.

ii. Sampling locations shall be in accordance with requirements listed in LEED 2009 for New Construction and Major Renovations – IEQ Credit 3.2 “Construction IAQ Management Plan – Before Occupancy”.

h. The qualified professional must provide the Owner a written report of the test results.

2. IAQ Management Plan During Construction

a. An Indoor Air Quality (IAQ) Management Plan During Construction shall be implemented in accordance with The Green Building Tax Credit (GBTC), 6NYCRR Part 638, Section 638.7 (d)(2).

b. An Indoor Air Quality Management process during construction must be implemented and include the following items:

   i. Coordination:

      1. During the pre-construction meeting, the Consultant must put in place a process for communication and notification between the Owner, Consultant, General and Prime Contractors, plus other parties to prevent and effectively resolve problems related to construction-related air pollutant control.

      2. The Commissioning Authority as the owner's representative shall oversee the IAQ Management Process During Construction and enforce its requirements with the assistance of DASNY Project Management.

   ii. Indoor Air Quality (IAQ) Management Plan During Construction: The Division 1 General Conditions of the Project Specifications must require a written IAQ Management Plan which includes procedures meeting or exceeding the minimum requirements of the "IAQ Guidelines for Occupied Buildings Under Construction", published by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (latest edition)

c. The IAQ Management Plan During Construction must include measures to protect the ventilation system components and air pathways against contamination during construction. The plan must include:

   i. Cleaning procedures – in the event ventilation system components and air pathways are not adequately protected.

   ii. Control measures – as defined in IAQ Guidelines for Occupied Buildings under Construction published by SMACNA all IAQ management plans shall include the following:

      1. IAQ Management Plan shall require any air handling units or systems that will be operated for any purpose (i.e. temporary heating, testing, commissioning) while building is under construction to have the specified pre and final filters installed. Filters within air handling systems utilized during construction (including building flush-out) shall be replaced with new specified filters immediately prior to occupancy.

d. The following requirements must be addressed in the IAQ Management Plan During Construction at each phase of construction:

   i. Permitting adequate airing-out of new materials.

   ii. Sequencing the installation of finish materials.

   iii. Proper curing of concrete before covering.

   iv. Installation during occupied periods.

v. Avoidance of building occupancy while construction related pollutants are present.

e. The Plan must specify the location, type, amount, sequence and timing of the various control measures, including emergency procedures and the labor, materials and time to implement them.

f. The project construction documents must address the following:

i. Overview of tasks.

ii. List of reference documents, including specification references, drawing list and submittal drawing.

iii. List of primary participants and their responsibilities.

iv. Plan for management, communication and documentation.

v. Outline of the scope of the IAQ Management process during construction – including submittal review, inspection and enforcement.

vi. Expected written work products, including checklists and worksheets.

vii. Activity schedule.

g. A construction IAQ report must be prepared by Contractor (or Commissioning Authority as determined on a per project basis) documenting the effective implementation of the Construction IAQ Management Plan and shall be reviewed by the Consultant.

NOTE: THESE ITEMS (g & h) REGARDING IAQ MANAGEMENT REPORT COULD BE PART OF THE COMMISSIONING AUTHORITY'S SCOPE, AS DETERMINED ON A PER PROJECT BASIS.

h. The IAQ Management Report must include the following documentation:

i. All meeting minutes, checklists, worksheets, notifications and deficiency or resolution logs related to the project IAQ issues.

ii. Listing of all temporary usage of building mechanical systems, cut sheet of filtration media used during construction and installed immediately prior to occupancy and schedule of filter replacement and change outs.

iii. Progress photos of job site sufficient to document implementation of IAQ management measures during each phase of construction.

iv. Documentation of duct testing and cleaning.

End

C. DASNY Sustainability Policy

Excerpt of:
Dormitory Authority – State of New York
POLICY: Sustainability
May 6, 2008

Policy

DASNY promotes and supports sustainable design approaches and construction practices. Our internal processes shall facilitate integrated design and recognition of sustainable opportunities in every project, regardless of size or complexity, using all the tools available to us. Initial programming meetings for every project shall define specific sustainable goals which will be included in all discussions, including those determining budget and scheduling.

In addition, as of January 1, 2008, all projects that are new construction, addition, or significant renovation shall include a goal of LEED Silver and shall be fully submitted to the US Green Building Council (USGBC) for a rating review. Each project will, at a minimum, include these requirements:

1) Register for LEED at the start of the project.
2) Require Energy Modeling in the schematic phase as well as the construction document phase. Schematic phase modeling shall inform design through use of "design runs" in order to explore building performance and energy use.
3) Require that a Commissioning Authority be part of the design process at the schematic design phase.
4) Track, measure, and prepare all LEED documentation. This shall be included in the design and construction process, regardless of the nature of the project.

The intent of this policy is to ensure the design and construction teams establish clear sustainable goals for the project, work toward those goals, produce the documentation confirming the goals have been achieved, and that

the project remains within the established budget and programmatic parameters that make up the project description.

APPENDIX

This section includes the following:

Appendix A:

DASNY's Commissioning Authority Term Contract Scope of Work

Appendix B:

Term Commissioning Authority-Project Proposal Breakdown Form

Appendix C:

Commissioning Specification Guide and Structure

Appendix D:

DASNY Commissioning Application Forms / Templates

- Design Phase Documentation Checklist
- Construction Phase Cx Kickoff Meeting Agenda Outline
- Construction Phase Deliverables Checklist

APPENDIX "A"

Commissioning Authority Term Contract SCOPE OF SERVICES

Objective

The Dormitory Authority of the State of New York intends to provide Commissioning Services to clients in order to comply with the relevant sections of New York State Executive Order 88, Build Smart NY, the LEED (Leadership in Energy and Environmental Design) Rating System, NYS Tax Law 19, 6 NYCRR Green Building Tax Credit Part 638, the DASNY Building Commissioning Guidelines, Article 13 of the New York State Energy Law – the Green Building Construction Act, The City of New York's Local Law No. 86, and other building commissioning related documents.

Responsibilities

For the purposes of this contract, the *Commissioning Consultant* shall provide the services of the *Commissioning Authority*, the *Contractor* shall provide the services of the *Commissioning Agent* and *the Designer* shall provide the services of the *Design Professionals* as described in Section 638.8(c) of the NYS Green Building Tax Credit as amended by the Dormitory Authority State of New York, in the DASNY *Building Commissioning Guidelines.* Note that DASNY does not allow the Commissioning Authority and the Commissioning Agent to be the same organization, nor does DASNY allow the Design Professional and the Commissioning Authority to be the same organization.

Services

The *Commissioning Authority* will be authorized to proceed with the specific tasks as required by the relevant sections of Section 638.7 (Indoor Air Quality) and 638.8 (Commissioning) as amended by DASNY, a copy of which is included in this RFP as an attachment, and other related services as listed herein. DASNY Building Commissioning Guidelines can also be found on DASNY's website at www.dasny.org.

The Commissioning Authority *Work Authorization* will be issued by the OWNER and shall include a description of the project, the scope of services to be delivered by the consultant, a schedule and a negotiated cost of services. The consultant shall provide all services described in the Work Authorization. All work shall be performed and completed in full compliance unless otherwise directed by the Owner.

The *Commissioning Authority's* services may include, but not be limited to the tasks noted below. The *Commissioning Authority* shall:

DESIGN PHASE:

- Lead the *Project Team* and discuss roles and responsibilities related to Cx.
- Identify and document systems requiring *Commissioning.*

The *Commissioning Authority* shall commission, systems, equipment, and components to meet the requirements of the following: NYS Tax Law 19, 6 NYCRR Green Building Tax Credit Part 638, LEED prerequisite and enhanced commissioning credit requirements, and Article 13 of the New York State Energy Law – the Green Building Construction Act. Commission the following systems, equipment, and components as applicable to this specific project:

Chillers, boilers, domestic water and service water heaters, cooling towers, HVAC pumps and domestic hot water circulating pumps, unitary and split air conditioners, furnaces, fans, heat exchangers, controls for central plant and HVAC including energy management systems or portions of building automation systems that affect energy use, ducts and associated dampers, HVAC piping and associated valves, HVAC duct and pipe insulation, air quality monitoring systems as they relate to ventilation systems, duct system protection during construction as related to indoor air quality, renewable and alternative energy technologies, waste heat recovery, thermal storage equipment, automated lighting controls, and automated day-lighting controls.

The *Commissioning Authority* may be requested to commission other building systems and components such as plumbing, fire protection, electrical, telecommunications, audio/video, security, Health Care and Laboratory specialty systems (such as medical gases, vacuum, reverse osmosis, de-ionized water, lab disposal, etc.), building envelope and building automation systems as needed on a per project basis.

- Develop and provide a Design Phase Commissioning Plan. The Design Phase Cx Plan should include at a minimum:
    - The commissioning team list and contact information.
    - A commissioning overview specific to the project.
    - Identification of equipment and systems to be commissioned.
    - Roles and responsibilities of the Cx team members during design phase.
    - Communication channels and protocol.
    - Description of the commissioning process activities during the design phase:
        - Design phase Cx meetings
        - Contract document design review and documentation process, including:
            - Schematic Design Report review
            - Review and maintenance of formal Design Intent, Basis of Design, and Owner's Project Requirement documents
            - 60% Design Development Document review
            - Commissioning specifications development
            - 100% Contract Document review including documentation of completed design for systems and equipment to be commissioned, all sequences of operations, Testing, Adjusting & Balancing requirements, and commissioning specification coordination.
    - Contract document specification format and coordination for commissioning.
    - Draft commissioning process form examples.
    - General description of the commissioning process activities during construction phase, including post occupancy commissioning activities.
- Review and comment on completeness and adequacy of the *Owner's Project Requirements (OPR),* and may be requested to assist developing the OPR. (The OPR is required for LEED

projects only. The OPR should be included as a distinct section of the Schematic Design Report.)

- Review and comment on *Schematic Design Report* and *Drawings.*
- Review and comment on the *Design Intent (DI)* and *Basis of Design (BOD)* (The DI and BOD should be included as distinct sections of the Schematic Design Report. For LEED Projects the OPR should be substituted for the DI).
- Review documents and attend design review meeting at 30% Schematic Design, 60% Design Development and 100% Contract Document submissions as applicable, addressing commissioning issues. Document all Design Phase Cx Meetings and distribute minutes as applicable.
- Identify potential energy efficient criteria consistent with Energy Star and/or financial incentives available from NYSERDA (www.nyserda.org/default.asp) via NYSERDA's Program Opportunity Notices, and/or LIPA (www.lipower.org), NYPA (www.nypa.gov), DOE (www.energy.gov), EPA (www.epa.gov), and/or any other incentives that may benefit the project.
- Upon identifying potential financial incentive programs for the project, coordinate with DASNY Representatives and complete all necessary applications on behalf of the owner.
- Develop *Commissioning Specifications* and assist the Design Professional to adopt and coordinate the complete contract documents to include commissioning requirements. Sampling strategies utilized for tests, inspections, or observations must be clearly defined in the specifications, and pre-approved by the design consultant and owners representative on a per project basis. No sampling strategies should be applied to Functional Performance Testing of primary systems and equipment, or their control sequences. If sampling strategies are utilized for functional performance testing of terminal equipment, then trend logging must be employed to demonstrate functional performance of all remaining terminal equipment.
- Develop *Indoor Air Quality Specifications* for the Design Professional to adopt, that detail requirements for an Indoor Air Quality Management Plan during construction to meet the intent of the Green Building Tax Credit, 6NYCRR Part 638.7 (d) (2) and requirements for indoor air quality testing to meet the intent of the GBTC, 6NYCRR Part 638.7 (d) (1). Note the CxA may be required to perform the IAQ testing itself (determined on a per project basis).
- The *Commissioning Authority's* services may include provision of full TAB services, determined on a per project basis (TAB firm must be certified by NEBB, TABB, or AABC). If providing full TAB services, the CxA shall develop the *TAB Specifications* and assist the Design Professional to coordinate the complete contract documents to include TAB requirements.
- Review and comment on the *Sequence of Operations.*
- Revise the Design Phase Cx Plan and provide a Construction Phase Commissioning Plan including responsibilities of the Cx team members during the construction phase, incorporating appropriate portions in the contract document specifications.
- Document design phase activities.

CONSTRUCTION PHASE:

- Conduct Commissioning Team Kickoff Meeting, progress meetings, and issue commissioning meeting minutes. The CxA should present and distribute the Construction Phase Cx Plan, and cover all topics noted in the Construction Phase Cx Kickoff Meeting Agenda Outline at the construction phase kickoff meeting.
- Review and approve Commissioning Agent(s) qualifications.

- Review submittals and shop drawings for equipment & systems requiring *Commissioning.*
- Review and document the Commissioning Agent's *Indoor Air Quality Management Plan During Construction,* and prepare a Construction IAQ Management Report, as well as oversee the IAQ management process during construction as outlined in GBTC, 6NYCRR Part 638.7 (d) (2). Note that this activity is not intended to replace the contractor's responsibilities of documenting indoor environmental quality requirements as related to LEED obligations.
- Upon submittals approval, develop or pre-approve *Pre-functional Testing Procedures,* including start-up and checkout, procedures and checklists.
- Upon completion of pre-functional testing procedures and checklists, revise Construction Phase Commissioning Plan and issue to Commissioning Agent(s).
- Review and comment on the completeness and adequacy of the *Testing, Adjusting & Balancing (TAB) Plan.*
- The *Commissioning Authority's* services may include provision of full TAB services, determined on a per project basis (TAB firm must be certified by NEBB, TABB, or AABC). If providing full TAB services, the CxA shall coordinate all TAB requirements and activities with Project Management and the responsible Contractor(s).
- Conduct periodic site inspections, and distribute inspection findings reports.
- Verify construction and installation of building systems, equipment and components (Pre-Functional Inspection Verifications), and document Pre-Functional Testing including start-up and checkout is completed.
- As applicable for New York City Code based projects, coordinate with DASNY Representative(s) to receive the Testing Agent's schedule for special inspections and assess potential for performing commissioning activities congruently with Testing Agency special inspections of systems to be commissioned. Also, review and document Special Inspection Reports that pertain to commissioned systems.
- The *Commissioning Authority* shall witness, document, and confirm or approve all of the following:
    - HVAC pipe flushing and testing, and associated procedures
    - Duct cleaning and testing, and associated procedures
    - Testing and calibration of the controls system before *TAB*
    - *Testing, Adjusting & Balancing (TAB)* procedures and reports, and verify a minimum of 10% of the TAB field measured data by performing their own measurements.
- Retrieve *Certificate of Readiness* from the Cx Agent (Contractor) prior to *Functional Performance Testing* stating that start-up and checkout have been successfully completed and that all equipment, systems, and controls are complete and ready for functional performance testing.
- Develop *Functional Performance Testing Procedures* and checklists.
- Maintain a master log of deficiencies and resolutions.
- Review the *Operation and Maintenance (O&M) Manual(s)* and comment on completeness and adequacy in accordance with the design intent and contract documents. Submit O & M review comments to the Design Professional for their review and direction to the Commissioning Agent.
- Witness, verify, document and approve *Functional Performance Testing* were performed and completed.
- The *Commissioning Authority* shall, at a minimum, review, witness portions of, and document the following regarding IAQ Testing (The intent is to meet applicable IAQ testing requirements

of both GBTC Section 638 and current LEED standards.); And may be required to perform the IAQ testing itself (determined on a per project basis):
    - IAQ Testing Protocol prior to IAQ testing
    - Confirm prerequisites such as construction completion and occupancy, building flush out, and as designed HVAC operation, prior to IAQ testing
    - IAQ Testing Reports and confirm acceptable results.
- Develop *Systems & Energy Management Manuals.*
- Review and comment on completeness and adequacy of the O&M training syllabus for commissioned systems.
- Oversee the training of the owner's O&M personnel, and document written verification that training of operations and maintenance personnel was conducted for all commissioned features and systems.
- Develop *Final Commissioning Report*.
- Provide *Statement of Certification of Work* by the Commissioning Authority confirming that all Commissioning Authority scope items have been completed, documented, and are reflected in the Commissioning Report.
- Verify, document and conduct off-season deferred testing.
- Verify, document and conduct *Post Occupancy Review.*

SUSTAINABILITY:

The *Commissioning Authority's* services may include, but not be limited to services related to sustainability, energy auditing, and the USGBC LEED rating system. The *Commissioning Authority* shall:

- Assist with development of LEED Checklists in design phase to achieve project LEED goals.
- Provide LEED assessments for applicable projects in Commissioning design reviews where the design should be scrutinized to confirm credit checklists are adequately reflected in the documents and LEED goals are met.
- Provide analysis of projects in design and/or construction phases with respect to LEED documentation assessments.
- Coordinate LEED activities with Owners, Design Team, and Contractors.
- Manage the integrated LEED process as directed.
- Provide energy audit services.

Final Commissioning Report:

The *Commissioning Authority* shall be required to produce a final Commissioning Report for each commissioning project containing documentation and certification of all services specified. Three (3) copies of a draft report shall be sent for Owner's review and comments, and three (3) copies of a final report that addresses these comments shall also be delivered. Hard copy Final Report binders shall be provided with electronic format Final Report compact discs as well.

The *Commissioning Authority* shall incorporate the Owner's comments within 15 working days.

The *Commissioning Authority* shall produce and or assemble the following items into a building profile and final Commissioning Report that will enable a comprehensive approach to maintenance and operations. The final Commissioning Report shall contain all requirements as detailed in the Green Building Tax Credit Part 638.8 (k), and include but not be limited to the following:

- Owner's Project Requirements, Design Intent, and Basis Of Design
- Commissioning Plan
- All commissioning design, construction, and post occupancy reviews, meeting minutes, pre-functional and functional testing verification documentation, deficiency lists, and inspection reports
- IAQ Management Plan During Construction, Construction IAQ Management Report, IAQ Testing Protocol, and IAQ Testing Reports confirming acceptable results
- Operations & Maintenance Manuals
- Operations & Maintenance Training Syllabi and training documentation
- Systems and Energy Management Manual
- Statement of Certification of Commissioning Authority Work

Term CxA Consultant Breakdown Detail

	DASNY	**Facility**
		Project Description
	Commissioning Authority Services	**Building**
		DASNY Project No.
	Term CxA Consultant Proposal Breakdown Detail	**Contract No.**

TASK	DESCRIPTION	ANTICIPATED PERSONNEL UTILIZATION								
		Class 1 Principal Hours	Class 2 Proj. Mgr Hours	Class 3 Sr. Eng Hours	Class 4 Pr. Eng Hours	Class 5 Fld. Eng Hours	Class 6 Hours	Class 7 Hours	TOTAL HOURS	TOTAL COST
	Design Phase									
1	Lead the Commissioning Team, discuss roles & responsibilities								0	$0.00
2	Develop a Pre-Design Phase Commissioning Plan									
3	Review and comment on the Owners Project Requirements									
4	Review the Schematic Design Report and drawings									
5	Identify & document systems requiring Commissioning									
6	Review and comment on Design Intent and Basis of Design									
7	Review and comment on the Sequence of Operations									
8	Develop Commissioning Specs and assist Des Prof to coordinate Cx req's									
9	Develop IAQ Specs									
10	Identify potential energy effeciency incentive grants available									
11	Complete grant applications on behalf of owner if applicable									
12	Review and comment on Contract Documents & Specs @ 60% & 100%									
13	Participate in design review meetings at 30-60-100%									
14	Revise Pre-Des Phase Cx Plan into Design Phase Commissioning Plan									
15	Document Design Phase Activities									
	Construction phase									
16	Conduct Cx Team Kickoff and Progress Meetings, and issue minutes								0	$0.00
17	Review & Approve Commissioning Agents Qualifications									
18	Review submittals & shop drawings for equipment & systems requiring Cx									
19	Review and document the Cx Agent's IAQ Mngt Plan and prep IAQ Mngt Report									
20	Revise Des Phase Cx Plan into Construction Ph Cx Plan									
21	Develop or pre-approve PFT including start-up & check out procedures									
22	Review and comment on the Testing, Adjusting & Balancing (TAB) Plan.									
23	Conduct periodic Site Inspections, testing oversight, and distribute findings reports									
24	Perform pre-functional inspection verifications and confirm completion									
25	Witness pipe & duct cleaning and testing									
26	Witness controls testing and calibration prior to TAB									
26	Review and comment on TAB procedures and reports									
27	Retrieve Certificate of Readiness prior to FPT									
28	Develop functional performance testing procedures & checklists									
29	Maintain a master log of deficiencies and resolutions									
30	Review and comment on the Operation and Maintenance (O&M) Manuals.									
31	Witness, verify, document, and approve Functional Performance Testing									
32	Review, witness, and document IAQ Testing									
33	Develop Systems & Energy Management Manual									
34	Review and comment on O & M training syllabus for commissioned systems									
35	Oversee and document the training of the owner's O & M personnel									
36	Develop final Commissioning Report									
37	Provide Statement of Certification of Work by Commissioning Authority									
38	Verify, document and conduct off-season deferred testing									
39	Verify, document and conduct Post Occupancy Review									
40	Other Scope:								0	$0.00
	Subtotal - Professional Services	0	0	0	0	0	0	0	0	$0.00

Classification	TITLE	Base Rate	Total Hours	OH&P Multiplier	Rate x Hours x Multiplier
Classification 1:	Principal-in-Charge	$0.00	0	0	$0.00
Classification 2:	Project Manager				$0.00
Classification 3:	Senior Engineer				$0.00
Classification 4:	Project Engineer				$0.00
Classification 5:	Field Engineer				$0.00
Classification 6:					$0.00
Classification 7:					$0.00
	Subtotal - Professional Services				$0.00
	Subtotal - Reimbursable Expenses*				$0.00

See attached breakdown of reimbursable expenses
N:\COMMISSIONING\DASNY Cx Templates\Cx Templates

SUMMARY PROPOSAL FEE DATA		COST
	Design Phase Subtotal Fee (Lump Sum Service)	$0.00
	Construction Phase Subtotal Fee (Actual Expense Service)	$0.00
	Reimbursable Expenses Subtotal (Actual Expense Service)	$0.00
	TOTAL FEE (Not To Exceed Amount)	$0.00

APPENDIX C

Commissioning Specification Guidelines: The following information and guidelines should be considered and implemented on a per project basis to suit commissioning needs.

1. Commissioning specifications will be edited to be project specific.
2. The Commissioning Authority's charge is to assure that the entire contract is coordinated with regards to commissioning requirements.
3. The Commissioning Authority should conduct a Cx specification coordination meeting with the Design Consultant(s) at 100% submission stage (teleconference preferred if possible). The CxA should in-turn issue minutes documenting successful completion or actions needed to achieve Cx specification coordination.
4. The CxA should devote a dedicated section to their final design review summarizing the specification coordination with regard to the Cx requirements.
5. DASNY utilizes standard "Front End" specifications consisting in part of Division 1, General Requirements. The General Requirements should include General Commissioning Requirements, Section 019113 (provided by DASNY). This section, along with other General Requirements Sections (i.e. 013100 Coordination, 013300 Submittals, 015000 Temporary Facilities, 017700 Closeout Requirements, 017823 O & M Manuals, 018113 Sustainable Requirements, etc.) should be reviewed and will be allowed limited editing (for example editing to coordinate Specification Division and Section references) to suit the project at hand. No significant add-on language is intended for the General Commissioning Requirements, Section 019113.
6. DASNY utilizes reserved Division 24 for general commissioning requirements. Typically Section 240100 (provided by the Commissioning Authority) – Commissioning Requirements will define project commissioning requirements for the project such as: Common commissioning goals; Systems, equipment, and components to be commissioned; Commissioning Plan; Commissioning process and protocols; Roles and responsibilities of the Commissioning Team, including the Commissioning Authority (CxA), the responsible Contractor called the Commissioning Agent (CA), Design Professionals, Owner's Project Management, Equipment Suppliers, etc. This Section should also contain a complete list of specification Section references for Division and Trade specific commissioning requirements.
7. Division 24 may also include additional commissioning sections devoted to Trade specific Commissioning and testing requirements at the Design Consultant's and CxA's Discretion.
8. Otherwise, Trade specific commissioning and testing requirements related to Cx shall be in the appropriate Divisions. For an example see the Division 23 – HVAC Cx spec format and content listed in the Specification Structure below. Similar specification section structure may be applied to Divisions 14-Conveying Systems, Div. 21-Fire Suppression, Div. 22-Plumbing, Div. 26-Electrical, Div. 27-Communications, Div. 28-Electronic Safety & Security, etc., as applicable to the project. (Note that Master spec Section Numbering format is used in this guide.)

Specification Structure

General Requirements – Division 1

013100 Coordination	**013300** Submittals	**015000** Temporary Facilities	**01770** Closeout	**017823** O&M Manuals	**018113** Sustainable Requirements	**019113** General Commissioning Requirements

Reserved - Division 24 utilized for Cx on DASNY Projects

240100 – Commissioning Requirements

-Systems and equipment to commission
-Common Cx Goals
-Cx Plan/Process & Protocols
-Roles/responsibilities of Cx Team
-List of spec references for Division and Trade Specific commissioning requirements

Division 24 may also include additional commissioning sections devoted to Trade specific commissioning and testing requirements at the Design Consultant's and CxA's discretion. Otherwise, Trade specific commissioning and testing requirements related to Cx shall be in the appropriate Divisions. For an example see the Division 23 – HVAC Cx spec format and content listed in the Specification Structure below.

Division 23 - HVAC

230010 **Mech-Gen Provisions** -Note/ref -General trade Cx requirements	**230593** **T.A. & Cx** -Note/ref - Section Cx requirements	**230800** **HVAC COMMISSIONING** -Note/ref Cx -Define Division Cx Agent responsibilities, expectations and acceptance criteria -Define pre-functional verification rqmts Define functional testing rqmts related to Cx	**23090** **HVAC Controls** -Note/ref Cx -Section Cx Requirements

Similar specification section structure may be applied to Divisions 14-Conveying Systems, Div 21-Fire Suppression, Div 22-Plumbing, Div 26-Electrical, Div 27-Communications, Div 28-Electronic Safety & Security, etc., as applicable to the project. (Note that Masterspec Section Numbering format is used in this guide.)

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Building Commissioning: *Design Phase Documentation*

PART I: GENERAL INFORMATION

DASNY Project Name:	**Program/Facility:**	**Date:**
Location/Address:		
Project Description:		
Design Professional (Architect):	**DASNY Project #**	**Prepared By (CxA):**
Design Professional (MEP Engineers):	**DASNY PDQA Design Project Manager:**	**Checked By (DASNY Code Compliance Cx Facilitator):**

PART II: Documentation:

(The Cx Authority shall provide the following documentation as the Design Phase Cx activities are completed).

- ☐ PRE-DESIGN PHASE COMMISSIONING PLAN
- ☐ CONTACT LIST OF DESIGN PHASE Cx TEAM (DP, MEP SUB, CM, PM, Cx Auth., Owner, DASNY Reps., etc.)
- ☐ LIST OF SYSTEMS, EQUIPMENT, AND COMPONENTS REQUIRING COMMISSIONING
- ☐ REVIEW & COMMENTS OF THE SCHEMATIC DESIGN REPORT AND DRAWINGS (30% submission)
- ☐ REVIEW & COMMENTS OF THE DRAWINGS and SPECIFICATIONS AT 60 & 100% submissions
- ☐ ALL COMMISSIONING MEETING MINUTES and/or Design Review Meeting Minutes related to commissioning
- ☐ OWNER'S PROJECT REQUIREMENTS (OPR) DOCUMENTATION & REVIEW
- ☐ DESIGN INTENT (DI) and BASIS OF DESIGN (BOD) DOCUMENTATION & REVIEW
- ☐ SEQUENCE OF OPERATIONS DOCUMENTATION & REVIEW
- ☐ COMMISSIONING SPECIFICATIONS
- ☐ INDOOR AIR QUALITY SPECIFICATIONS
- ☐ GRANT APPLICATIONS FOR ENERGY EFFICIENCY INCENTIVES (if applicable)
- ☐ DESIGN PHASE COMMISSIONING PLAN
- ☐ LEED MATRIX & SCORE CARD (as applicable)
- ☐ OTHER (as applicable)

COMMENTS:

_____
_____
_____
_____

This documentation shall be archived and submitted as part of the Final Commissioning Report as noted in the CxA's Scope of Work. However, Design Phase Commissioning services should be documented with interim electronic submissions of the listed items and this Form. The design phase commissioning services portion of the CxA's Work Authorization should be closed out upon contract bid document finalization and review and approval of both the DASNY PDQA Design Project Manager and the DASNY Code Compliance-Commissioning Facilitator

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Construction Phase Cx Kickoff Meeting Agenda Outline

PART I: GENERAL INFORMATION

DASNY Project Name:	**PROGRAM/Facility:**	**Date:**
Location/Address:		
Project Description:		
Design Professional (Architect):	**DASNY Project #:**	**Prepared by (CxA):**
Design Professional (MEP Engineers):	**DASNY PDQA Design Project Manager:**	**Checked By (DASNY):**

This meeting should review the commissioning requirements of the contract and Cx Plan. The Commissioning Construction Kick-Off Meeting should cover, but not be limited to, the following:

PART II: Documentation:

(The Cx Authority shall provide the following documentation at the end of Design Phase Cx activities).

- ☐ Overall project scope description
- ☐ Trade scope descriptions
- ☐ Highlight where in the documents that Cx, Cx definitions, and Cx responsibilities are defined
- ☐ Note that DASNY defines the term Cx Agent as the contractors, and that one of their first submittals should be Cx Agent qualifications for CxA approval
- ☐ Define the role and function of the Cx Authority, and establish that the CxA will lead, plan, schedule, and coordinate the Cx Team to implement the Cx Process
- ☐ Review systems and equipment being commissioned
- ☐ Review CxA submittal review process and schedule
- ☐ Review CxA site visits and observations at key construction progress milestones such as:
  Equipment & material deliver; "rough-in", filed installation verifications; pre-functional testing (PFT); controls point to point checks And system readiness for functional performance testing(FPT); testing, adjusting, and balancing (TAB); functional performance testing (FPT); etc
- ☐ Define regular Cx Meeting requirements
- ☐ Go through the Cx process, procedures, and schedule of Cx activities defined in the documents and Cx Plan
- ☐ Review the Cx roles, responsibilities, and expectations of each Cx Team member as defined in the Cx Plan.
- ☐ Request a distribution list and review protocols for communication, meetings, documentation, and addressing Cx deficiency Issues. At a minimum, reports should be distributed to: Design Professional, DASNY, Construction Manager (if applicable), And Contractors for their review and action.
- ☐ Q & A

COMMENTS:

This documentation shall be archived and submitted as part of the Final Commissioning Report as noted in the CxA's Scope of Work. However, Design Phase Commissioning services should be documented with interim electronic submissions of the listed items and this Form. The design phase commissioning services portion of the CxA's Work Authorization should be closed out upon contract bid document finalization, and review and approval of both the DASNY PDQA Design Project Manager and the DASNY Commissioning Facilitator.

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Building Commissioning: *Construction & Acceptance Phase Documentation*

PART I: GENERAL INFORMATION

DASNY Project Name:			**PROGRAM/Facility:**
Location/Address:			
Project Description:			
Design Professional (Architect):		**DASNY Project #**	**Prepared By (CxA):**
Design Professional (MEP Engineers):		**DASNY Construction PM:**	**Checked By (DASNY):**

PART II: Documentation:

- ☐ COMMISSIONING PROJECT MEETING MINUTES
- ☐ SUBMITTALS & SHOP DRAWINGS REVIEWS (Cx Items Only, including Cx Agent qualification submittal)
- ☐ Cx AGENT'S IAQ MANAGEMENT PLAN and Cx Authorities' IAQ MANAGEMENT REPORT
- ☐ DOCUMENTATION & VERIFICATION OF INSTALLATION and TESTING OF BLDG. SYSTEMS & EQUIPMENT
- ☐ REVISE DESIGN PHASE COMMISSIONING PLAN into CONSTRUCTION PHASE COMMISSIONING PLAN
- ☐ DOCUMENTATION & VERIFICATION OF SYSTEM STARTUP, CHECK OUT, and PREFUNCTIONAL TESTING (Forms)
- ☐ DOCUMENTATION OF Cx AUTHORITY REVIEW OF TESTING, ADJUSTING, and BALANCING PLAN
- ☐ DOCUMENTATION CONFIRMING CONTROLS TESTING AND CALIBRATION PRIOR TO TAB
- ☐ REVIEW AND COMMENTS FOR THE TAB PROCEDURES AND REPORTS
- ☐ CERTIFICATE OF READINESS (From Contractor)
- ☐ DOCUMENTATION & VERIFICATION OF FUNCTIONAL PERFORMANCE TESTING (Forms)
- ☐ DOCUMENTATION & VERIFICATION OF SATISFACTORY IAQ TESTING
- ☐ DOCUMENTATION & VERIFICATION OF TRAINING OF OPERATION & MAINTENANCE PERSONNEL
- ☐ OPERATION & MAINTENANCE MANUALS REVIEW
- ☐ SYSTEMS & ENERGY MANAGEMENT MANUALS
- ☐ FIELD INSPECTION REPORTS
- ☐ DEFICIENCY LOG
- ☐ FINAL COMMISSIONING PLAN
- ☐ PLAN FOR OFF-SEASON DEFERRED TESTING
- ☐ PLAN FOR POST-OCCUPANCY REVIEW
- ☐ FINAL COMMISSIONING REPORT (Complete Cx activities including Design Phase Activities)
- ☐ STATEMENT OF CERTIFICATION OF WORK (Cx Authority)

COMMENTS:

Document construction phase activities with electronic submissions as they are completed and also submit as part of the Final Commissioning Report as noted in the CxA's Scope of Work. The CxA's Work Authorization should be closed out upon review and approval of all deliverables and this Form by both the DASNY Construction Project Manager and the DASNY Commissioning Facilitator.

REFERENCES

This section includes the following:

A. Definitions

B. Reference Standards

DEFINITIONS

Acceptable Performance - A component or system that is able to meet the specified requirements under all ranges of actual loads.

As-built Records - Documents that accurately represent the actual installed conditions, equipment, and systems, such as drawings, computer graphics, equipment data sheets, operation manuals, maintenance manuals, and the training program and videotapes.

Basis of Design (BoD) - A document, prepared by the Design Consultant that records how the designer has met the owner's project requirements. It may include the concepts, calculations, decisions, and product selections and how applicable regulatory requirements, standards, and guidelines have been met. The document includes both narrative descriptions and lists of individual items that support the design process. The BoD narrative must include, at a minimum (per Tax Law Section 19 and 6 NYCRR Part 638.8): occupancy, space and process requirements, applicable codes, policies and standards, design assumptions (e.g. heating/cooling loads, and climatic), performance standards, benchmarks or metrics, interaction between systems affecting intended performance, and control systems appropriate for the skill of the operation and maintenance staff. The BoD must become part of the Operations and Maintenance Manual and the Systems and Energy Manual.

Building Systems - The architectural, mechanical, electrical, and control systems along with their respective subsystems, equipment, and components.

Certificate of Readiness - A document stating that all equipment, systems, and controls have been correctly installed; operated as specified, tested, adjusted, and balanced; and are verified as ready for functional performance testing and other acceptance procedures.

Commissioning (Cx) - A quality assurance process that documents specified systems and components are designed, installed, and tested to meet the owner's needs and the design intent set forth in the Project Documents; A quality control process that is to ensure that specified components and building systems have been installed and properly started-up and then functionally tested to verify and document proper operation through all specified modes of operation and conditions, all of which shall perform in conformity with the design intent. In addition, training of operations and maintenance personnel, identified by the owner, is verified, and final project operations and maintenance documents are reviewed for completeness.

Commissioning Agent (CA) – The responsible Contractor; For the purposes of commissioning the responsible Contractor shall assume the role, tasks, and responsibilities of the Commissioning Agent on DASNY projects; The entity responsible for carrying out the detailed planning and implementation of the commissioning process (as defined by the Commissioning Authority in the contract documents and the Commissioning Plan). The Commissioning Agent can be an individual, an organization, or a team with individuals from more than one organization. The Commissioning Agent and Commissioning Authority may not be the same organization or person. The Commissioning Agent shall assign a representative with expertise and authority to act on its behalf to participate in the commissioning process.

Commissioning Authority (CxA) – The Professional, appointed by the Owner, to define, direct, and coordinate the commissioning process. The commissioning authority can be an individual,

an organization, or a team with individuals from more than one organization. For the purposes of these guidelines, the Commissioning Authority should be an independent third party participant.

Commissioning Plan - The document prepared for each project that describes all aspects of the commissioning process including schedules, responsibilities, documentation requirements, and functional performance test requirements. The level of detail depends on the scope of commissioning specified. A Commissioning Plan covering a given system, equipment or component is required before such system or element is commissioned. The Commissioning Plan must address the following at a minimum: An overview of tasks to be executed during commissioning; A list of features to be commissioned; A list of reference documents related to commissioning, including specification references, drawing lists, and submittal drawings; A list of commissioning team members and primary participants in the commissioning process, and their contact information; Descriptions of commissioning responsibilities for all commissioning team members; A narrative plan and procedure for Cx management, communication and documentation; An outline of the scope of the commissioning process, including submittal review, inspection, start-up, testing, training, operations and maintenance manual, systems and energy management manual; Descriptions of checklists and tests to be performed, with reference to specific pre-start and start-up checklists; Lists of functional performance tests to be performed to verify proper operation of all commissioned systems, including prerequisite activities; A description of the process to be performed by the Commissioning Authority to verify that systems are operating as indicated in documentation provided by the Commissioning Agent(s); A description of the content of the training to be provided to the operations and maintenance personnel; The expected written work products, including checklists, worksheets, and testing procedures; An activity schedule. The Commissioning Plan is an evolving document that starts early in design with a **Design Phase Commissioning Plan** provided by the CxA defining the design phase commissioning roles, responsibilities, tasks and deliverables of the design phase Commissioning Team. The Commissioning Plan can be revised several times during the course of the project. Most notably, a **Construction Phase Commissioning Plan** shall be provided by the CxA defining the roles and responsibilities of the construction phase Commissioning Team.

Commissioning Report - The document prepared by the CxA during the acceptance phase of the commissioning process after all functional performance tests are completed. It summarizes the results of the commissioning process, including conformance to the contract documents, the design intent and the as-built system performance. It shall include the following:

Executive summary
Building description
Commissioning plan
Copy of the Design Intent document
Copy of the commissioning plan
Copy of the verified TAB report
List of deficiencies that impacts system performance
Copies of all corrective deficiencies and modification documentation
Copies of all pre-start/start-up check lists
Copies of all completed functional test check lists
Off-season functional performance test(s) documentation
Design & Construction Document Reviews
IAQ as it Relates to HVAC

Commissioning Specification - The contract document that details the objective, scope, and implementation of the construction and acceptance phases of the commissioning process as developed in the design-phase commissioning plan.

Commissioning Team - Those people and entities responsible through coordinated actions for implementing the commissioning process as deemed appropriate by the CxA and defined in the contract documents and the Commissioning Plan.

Construction Documents - Documents that contain the requirements for the construction and performance of a building and its components, equipment, systems, and subsystems. This includes, but is not limited to, construction drawings and specifications.

Construction Manager - An organization whose role is to manage the construction team and various contractors to build and test the building systems for the project. The construction manager also works with the commissioning authority to identify and correct any deficiencies.

Design Intent –A document prepared by the Design Professional that summarizes design goals, ideas and concepts considered by the owner to be important to the project, based on information gathered during the early stages of design (programming, conceptual, pre-schematic). The design intent must include at a minimum a narrative description of: the systems, what the objectives of the systems are and how the systems will meet those objectives; space temperature and humidity criteria; thermal zoning criteria; level of occupancy control over HVAC systems; ventilation requirements and related indoor air quality criteria; performance criteria related to energy efficiency; functional and environmental needs of the facility; and commissioning criteria. The design intent is developed by the design professional(s) from descriptions provided by the building owner.

Design Professionals - The architects, engineers, or other parties responsible for the design and preparation of documents for the various building systems.

Energy Efficiency Measure - Any equipment, system, or control strategy installed in a building for the purpose of reducing energy consumption and enhancing building performance. An energy efficiency measure may also be called an energy conservation measure.

Functional Performance Test (FPT) - The full range of checks and tests carried out to determine whether all components, subsystems, systems, and interfaces between systems function in accordance with the contract documents. In this context, "function" includes all modes and sequences of control operation, all interlocks, and conditional control responses and all specified responses during design day and emergency conditions.

Indoor Air Quality Management Plan – A document provided by the responsible Contractor defining the indoor air quality (IAQ) measures and procedures to be implemented during construction in accordance with The New York State Green Building Tax Credit, 6NYCRR Part 638.7 (d) (2) for construction or rehabilitation of base building or tenant space which meet or exceed the minimum requirements of the "IAQ Guidelines for Occupied Buildings Under Construction (published by SMACNA).

Operations and Maintenance - The process of sustaining the performance of a building in accordance with design requirements and intent. "Operations" refers to functional activities related to building systems. The scheduling of equipment operation and temperature control are functions of operating a building. "Maintenance" involves servicing equipment so that it will run in accordance with the manufacturer's intent for at least the duration of its expected service life.

Operations and Maintenance (O&M) Manual - The document that records the information pertinent to the operations and maintenance of the components, equipment, subsystems, and systems for the building, including all the information required by The New York State Green Building Tax Credit, 6NYCRR Part 638.8 (k) (1).

Owner's Project Requirements – A written document that details the functional requirements of a project and the expectations of how it will be used and operated. The term Project Intent is used by some owners for their commissioning process Owner's Project Requirements. For DASNY projects, and when the owner does not develop the OPR from their Project Intent document, the OPR shall be generated by the design professional, reviewed and approved by the owner, and then become the owner's document. The Owner's Project Requirements should define the criteria required for success and include the following at a minimum: Owner and user requirements; Environmental and sustainability goals; Energy efficiency goals; Indoor environmental quality requirements; Equipment and system expectations; Building occupant and O & M personnel requirements; Measurable performance criteria; Cost considerations; and other important benchmarks or project goals important to the owner.

Pre-Functional Performance Test (P-FPT) - A series of tests for specified equipment or components of systems, which determine that the systems are installed correctly, started up, and prepared for the functional performance tests. Often these tests are in a checklist format. The pre-functional test checklists may be completed as part of the normal contractor start-up test.

Re-commissioning - The periodic retesting of building systems using the original functional performance tests to ensure the equipment continues to operate as designed.

Seasonal Performance Tests - The full range of test procedures carried out to determine if all components, equipment, systems and interfaces between systems function according to design intent during heating or cooling design days. When it is not practical to perform the test during an actual design day, these conditions may be simulated.

Sequence of Operations - How the systems will react to changing conditions to achieve the proper operation of the system. The sequence must include the intended modes of operation, the steps needed to enact each mode, and the data that determines what, when, and how a step is performed.

Systems and Energy Management Manual - A composite document that expands the scope of the operation and maintenance manual by including the additional information gathered by the commissioning process (as detailed in the Green Building Tax Credit, 6 NYCRR Part 638.8(k) (2)). The following components must be included in the Systems and Energy Manual: Narratives for the final design intent and basis of design, including brief descriptions of each system; Final sequences of operation for all equipment; Procedures for seasonal start-up and shut-down, manual and restart operation; As-built control drawings; For all energy-saving features and strategies, rationale description, operating instructions, and caveats about their

function and maintenance relative to energy use; Recommendations and brief method for appropriate accounting of energy use of the whole building; Recommendations for recalibration frequency of sensors and actuators by type and use; Plans for continuous commissioning or recommended frequency for re-commissioning by equipment type, with reference to tests conducted during initial commissioning; Recommendations regarding seasonal operational issues affecting energy use; List of all user-adjustable set points and reset schedules, with a discussion of the purpose of each and the range of reasonable adjustments with energy implications; Schedule of how frequently to review the various set points and reset schedules to ensure they still are at current, relevant, and efficient values; List of time-of-day schedules and a frequency to review them for relevance and efficiency; Guidelines for establishing and tracking benchmarks for building energy use and primary plant equipment efficiencies; Guidelines for ensuring that future renovations and equipment upgrades will not result in decreased energy efficiency and will maintain the Design Intent; List of diagnostic tools, with a description of their use, that will assist facility staff for the building in operating equipment more efficiently; A copy of the commissioning report; and an index of all commissioning documents with notation as to their location.

System Commissioning - In a narrower sense, the act of statically and dynamically testing the operation of equipment and building systems to ensure they operate as designed and can satisfactorily meet the needs of the building throughout the entire range of operating conditions.

Statement of Certification of Work – A written statement issued by the Commissioning Authority certifying that all work has been completed, tested and verified and that all equipment and systems are functional and operational in accordance with the complete contract documents, including, but not limited to, design intent documents, shop drawings, submittals, commissioning plan, commissioning specifications, all systems manuals, operation and maintenance manuals, TAB reports, functional performance testing, and final commissioning report.

Testing, Adjusting, and Balancing (TAB) - The process of checking and adjusting all the heating, cooling and ventilating systems to meet the requirements of the construction documents and design intent. This process includes the following: (1) balancing air and water distribution systems; (2) adjusting the total system to provide design quantities; (3) electrical measurement; (4) establishing quantitative performance of equipment; (5) verifying automatic controls; and, as applicable, (6) sound and vibration measurement.

Verification - The full range of checks and tests carried out to determine if all components, subsystems, systems, and interfaces between systems operate in accordance with the contract documents. In this context, "operate" includes all modes and sequences of control operation, interlocks, conditional control responses, and specified responses to abnormal or emergency conditions.

Volatile Organic Compound (VOC) - (1) A chemical with high vapor pressure at ordinary room temperature conditions; Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air. An example is formaldehyde, with a boiling point of -19 degrees Centigrade (-2 degrees Fahrenheit), slowly exiting paint and getting into the air. (2) any organic compound that participates in atmospheric photochemical reactions. They include both human-made and naturally occurring chemical compounds. Some VOCs are dangerous to human health or cause harm to the environment. Anthropogenic VOCs are

regulated by law, especially indoors, where concentrations are the highest. Harmful VOCs are typically not acutely toxic, but instead have compounding long-term health effects.

REFERENCE STANDARDS

ASHRAE The Commissioning Process, ASHRAE Guideline 0-2005
ASHRAE Publications Dept., 1791 Tullie Circle, NE, Atlanta, GA 30329.

ASHRAE HVAC Commissioning Process, ASHRAE Guideline 1.1-2007. ASHRAE Publications Dept., 1791 Tullie Circle, NE, Atlanta, GA 30329. (404) 636-8400
ASHREA Guideline 1-1996 "The HVAC Commissioning Process"

SMACNA HVAC Systems Commissioning Manual, Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), 2000. SMACNA, 4201 Lafayette Center Dr., Chantilly, VA 22021. (703) 803-2980

NYSGBTC New York State Green Building Tax Credit
6 NYCRR Part 638
Statutory Authority: Tax Law Section 19

ECCCNYS Energy Conservation Construction Code of New York State

USGBC LEED Reference Guide
United States Green Building Council
Leadership in Energy & Environmental Design
Green Building Design and Construction
2009 Edition

PECI Portland Energy Conservation, Inc
Model Commissioning Plan & Guide Specifications
Version 2.05

NY City Local Law 86
Green Building Standards for certain New York City capital projects
2005; taking effect on January 1, 2007

New York State Green Building Construction Act
Green Building Standards for certain New York State capital projects
2007; *The final language for this Act has not been adopted yet.*