**NOTES TO ARCHITECT/ENGINEER (A/E) & DAS/CS PROJECT MANAGER:**

This version of the Division 01 General Requirements is for **ALL** CT Department of Administrative Services (DAS) Construction Services (CS) **Design-Bid-Build (DBB) AND Construction Manager at Risk (CMR) Capital Construction Projects.**

IMPORTANT NOTE: Section 01 91 00 Commissioning includes requirements for commissioning of facilities and facility systems to verify compliance with design, including optimum energy efficient operations. This Section includes requirements for commissioning activities and documentation in compliance with the green building rating system used. Edit paragraphs carefully to reflect specific project requirements, or delete them if they do not apply.

**EDITING:** To Show the Editing Notes in this MS Word document the show/hide symbol (¶) button must be must turned on in the MS Word Toolbar. To print this document show/hide symbol (¶) must be turned off in the MS Word Toolbar, this will enable the document to indicate the correct number of total pages.

**TEXT:** The below **blue text** are project specific information that must be completed by the A/E as applicable to the specific project. When complete change **blue text** to **black text.** The ***bold and italicized text*** is for example purposes only and must be modified and edited by the A/E to make it project specific. For **text boxes**, left click on **Insert** and then insert project specific information over the word **Insert** in the underlined space.

**TABLES:** To view the Table Grid in this MS Word document, click inside any table, then go to the **Table Tools > Layout** tab, **Table** group, and click **View Gridlines.**

**HEADERS: The header** for each page of the Project Manual shall match the format, font (Arial), size (9 pt), font style (BOLD & CAPITALIZED) and line borders, of the header shown herein. The header of each page shall contain the Section Number, the Section Title, and the page number & number of pages as shown herein.

**FOOTERS: The footer** for each page of the Project Manual shall match the format, font (Arial), size (9 pt), font style (BOLD & CAPITALIZED) and line borders, of the footer shown herein. The footer shall contain the project number in the right hand side as shown herein. The revision date in the left side of the footer is to remain as it is for Department informational purposes only and should not be altered by the Architect/Engineer.

**SECTIONS AND PARAGRAPHS:** If a **Section** is not part of the project scope, **do not use** the Section in the General Requirements. Check “**NOT USED**” in the Table of Contents. **DO NOT delete** the Section title from the Table of Contents.

If a **Paragraph** is not applicable to the project, **delete the contents** of the Paragraph and renumber the subsequent Paragraphs. Edit **Paragraphs** carefully to reflect specific project requirements. DO NOT include Paragraphs or parts of Paragraphs in the project manual, which have no applicability to the specific project. KEEP IN NUMERICAL SEQUENCE and re-number as necessary.

**GENERAL CONDITIONS:** Please review the General Conditions carefully and coordinate the requirements of those Articles including the Definitions.

**DIVISION 01 SECTIONS** are the organizational key of the Project Manual. All revisions to this Division are the responsibility of the A/E. Division 01 must be closely coordinated with Division 00, Divisions 02 through 49, Division 50 (Project-Specific Available Information), the Drawings, and the Department’s Consultant Bid Data Statement (Form 6005, to be filled out by the A/E for bidding).

**IMPORTANT NOTE REGARDING “HIDDEN TEXT”:**

Each document contains Editing Notes in the form of “hidden text”. The Editing Notes assist the Architect in modifying and editing the document to make it project-specific. In order to show the “hidden text”, click the **Home** tab, and in the **Paragraph** group, click the **Show/Hide** symbol (¶). **Turn off** the Show/Hide symbol (¶) **before printing the document** in order to indicate the correct number of pages. **DELETE THIS NOTE.**

**IMPORTANT NOTE REGARDING FORMATTING:**

Insert a blank page at the end of all *odd numbered* specification sections that states “THIS PAGE INTENTIONALLY LEFT BLANK”. **DELETE THIS NOTE.**

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

#### **A.** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

## 1.2 SUMMARY

### **A.** This Section includes equipment and system commissioning, including the following:

#### **1.** Completion of commissioning procedures on specific equipment and systems as indicated under "Related Sections" below.

#### **2.** Verification of operational and functional performance of specific equipment and systems for compliance with the “Design Intent” as described in the "Related Sections" indicated below.

### **B. Related Sections**: The following Sections contain requirements that relate to this Section:

**1.** Section 01 31 00 “Project Management And Coordination” specifies procedures for coordinating the Commissioning Process.

#### **2.** Division 01 Section 01 33 00 "Submittal Procedures" specifies procedures for submittal of Product Data and Quality Assurance Submittals.

#### **3.** Division 01 Section 01 77 00 "Closeout Procedures" specifies general closeout requirements.

#### **4.** Division 21 Section 21 08 00 "Commissioning of Fire Suppression" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **5.** Division 22 Section 22 08 00 "Commissioning of Plumbing" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **6.** Division 23 Section 23 08 00 "Commissioning of HVAC" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **7.** Division 23 Section 23 08 00 "Commissioning of HVAC" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **8.** Division 25 Section 25 08 00 "Commissioning of Integrated Automation” specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **9.** Division 26 Section 26 08 00 "Commissioning of Electrical Systems" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

#### **10.** Division 27 Section 27 08 00 "Commissioning of Communications" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

## 1.3 DEFINITIONS

### **Basis of Design (BOD):** A document that records the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

### **Commissioning Agent (CxA):** An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process.

**C. Commissioning (Cx) Plan:** A plan that includes a list of all equipment to be commissioned, delineation of roles for each of the primary commissioning participants, and details on the scope, timeline, and deliverables throughout the commissioning process.”

### **Deficiencies and Resolutions List:** List of noted deficiencies discovered as result of commissioning process.

### **Final Commissioning Report:** Overall final commissioning document (see 1.6, I(2) below), prepared by the Commissioning Agent, which details the actual commissioning procedures performed, inspection and testing results, and the final version of the deficiencies and resolutions list indicating that all issues discovered through the commissioning process have been verified as resolved.

### **Functional Completion:** Functional Completion is when all remaining TAB (Testing, Adjusting, Balancing) and commissioning responsibilities of the Contractor and their subcontractor’s (except for Seasonal Testing or Approved Deferred Functional Testing and controls training), have been functionally certified as complete by the Owner’s Commissioning Agent (CxA) and the Certificate of Functional Completion has been issued.

### **Functional Testing Process:** Documented testing of system parameters, under actual or simulated operating conditions. Functional Testing is the dynamic testing of systems (rather than just components).

### **Pre-Commissioning Checklists:** Installation and start-up items to be completed by the appropriate party prior to operational verification through Functional Testing.

### **Physical Inspection Process:** On-site inspection and review of related system components for conformance to the specifications.

### **Seasonal Tests:** Functional Tests that are deferred until the system(s) will experience conditions closer to their intended design conditions.

### **Trending:** Monitoring using the building control system.

**1.4 COORDINATION**

**A. Commissioning Team:** The members of the commissioning team consist of the Commissioning Agent (CxA), the DAS/CS Project Manager (PM), the Construction Administrator (CA), the Contractor, the Architect and Design engineers (particularly the mechanical engineer), the Mechanical Subcontractor, the Electrical Subcontractor, the TAB representative, the Controls Subcontractor, any other installing subcontractors or suppliers of equipment. If known, the Agency’s building or plant operator/engineer is also a member of the Commissioning team.

**B. Management:** The CxA is hired by the Owner. The CxA directs and coordinates the commissioning activities and the reports to the CA. All members of the Commissioning Team work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to Section 01 91 00 Part 1.6 and 1.7 for additional management details.

**C. Scheduling.** The CxA will work with the CA and Contractor according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CA and Contractor for scheduling commissioning activities. The Contractor will integrate all commissioning activities into their master CPM schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

**1.** The CxA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan—Construction Phase provides a format for this schedule. As construction progresses more detailed schedules are developed by the CxA. The Commissioning Plan also provides a format for detailed schedules.

## DESCRIPTION OF CONSTRUCTION PHASE COMMISSIONING PROCESS

### As soon as practicable after the "Contract Start Date", the Commissioning Agent (CxA) will conduct a pre-installation commissioning "kick-off" meeting with the Subcontractors. Parties directly affected by the commissioning work will be required to attend. The CxA will explain the commissioning process in detail, and identify specific commissioning related responsibilities of the various parties.

### Commissioning status meetings will be scheduled to occur during construction to monitor progress and to help facilitate the commissioning process. Contractor representatives will be required to attend these meetings.

### Once Subcontractors have provided the CxA with written verification indicating completion of installation and startup procedures, the CxA will conduct an on-site physical inspection of the specific systems and equipment.

### Upon confirmation of system readiness, the CxA will schedule the Subcontractors to perform Functional Testing in accordance with the project specifications and drawings. The CxA will oversee the process and will provide the format and documentation for these tests.

### Deficiencies noted during these tests will be documented on the Deficiencies and Resolutions list. When corrected, issues will be resolved at the time of discovery. The responsible Contractor will resolve all other issues at a later date. All deficiencies will be noted by the CxA as either resolved or pending resolution.

### The construction commissioning process will be complete when all noted deficiencies have been corrected, proved to be in compliance with the project specifications and drawings, or otherwise resolved to the satisfaction of the Owner and when the CxA has issued the Certificate of Functional Completion.

## COMMISSIONING AGENT’S (CxA’s) DUTIES AND RESPONSIBILITIES

### Meet and communicate with the Owner’s representatives, **[Contractor] [Construction Administrator]**, Subcontractors, equipment manufacturers’ representatives, Architect, Engineer **[and others]** as needed, to facilitate the commissioning process.

### Review commissioning related specifications, submittals and construction documents. Communicate noted deficiencies and concerns to the Owner, Architect and Engineer.

### Develop detailed and specific Functional Testing procedures for equipment and systems to be commissioned.

### Develop testing, adjusting and balancing (TAB) specifications. Oversee the TAB process.

### Perform site inspections and verify Contractor’s Subcontractor readiness for the Functional Testing process. Document deficiencies for future resolution.

### Witness Contractor-performed Functional Testing process as appropriate to verify Contractor compliance with the functional testing procedures. Document deficiencies for future resolution.

### Provide the Owner, **[Contractor] [Construction Administrator]***,* Architect, and Engineer with a Final Commissioning Report to document the commissioning process and to verify that the commissioning process is complete.

### Verify that the Contractor O&M documentation is complete.

### **Commissioning Record in O&M Manuals.**

**1.** The CxA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the Contractor, to be included with the O&M manuals. Three copies of the manuals will be provided. The format of the manuals shall be:

**1.1** **Tab I-1:** Commissioning Plan;

**1.2 Tab I-2:** Final Commissioning Report (see (2) below)

**1.3 Tab 01*:*** System Type 1 (chiller system, packaged unit, boiler system, etc.);

**1.3.1 Sub-Tab A:** Design narrative and criteria, sequences, approvals for equipment in System Type 1;

**1.3.2 Sub-Tab B:** Startup plan and report, approvals, corrections, blank Precommissioning Checklists;

**.1 Colored Separator Sheets**—for each equipment type (fans, pumps, chiller, etc.);

* + 1. **Sub-Tab C:** Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended recommissioning schedule.
	1. **Tab 02:** System Type 2......repeat as per above requirements for System 1.

**2. Final Commissioning Report Details.** The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:

**2.1** Equipment meeting the equipment specifications;

**2.2** Equipment installation,

**2.3** Functional performance and efficiency;

**2.4** Equipment documentation and design intent; and

**2.5** Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

**2.6 Pre-Occupancy Commissioning (Cx) Report:**

A Pre-occupancy Commissioning (Cx) Report shall be prepared by the Commissioning Agent (CxA**)** that demonstrates that the project has met all of the requirements spelled out in the following Table:

|  |
| --- |
| **Twelve (12) Mandatory Requirements [16a-38k-3] Summary Table:** |
|  | **Regulation** | **Summary Description** |
| **1.** | 16a-38k-3(a) | Building Commissioning:  |
| **2.** | 16a-38 -3(b)  | Integrated Design Process:  |
| **3.** | 16a-38k-3(d) | ENERGY STAR Products:  |
| **4.** | 16a-38k-3(c)  | Energy Performance:  |
| **5.** | 16a-38k-3(e) | Indoor Air Quality Management Plan:  |
| **6.** | 16a-38k-3(f) | Water Usage:  |
| **7.** | 16a-38k-3(g) | Recycling of Materials:  |
| **8.** | 16a-38k-3(h) | Erosion and Sedimentation Control:  |
| **9.** | 16a-38k-3(i) | No Smoking Policy:  |
| **10.** | 16a-38k-3(j) | Integrated Pest Management Plan:  |
| **11.** | 16a-38k-3(k) | Chlorofluorocarbon (CFC)-Based Refrigerants:  |
| **12.** | 16a-38k-3(l) | Minimum Ventilation Requirement:  |

* 1. **Post-Occupancy Commissioning (Cx) Report:**

A Post-Occupancy Commissioning (Cx) Report shall be prepared by the Commissioning Agent (CxA) and submitted to the DAS/CS PM for review and approval. The approved Report shall be submitted by the State Agency that is responsible for the ongoing care, operation, and maintenance of the building to the CT OPM Secretary and the DAS Commissioner within one hundred eighty (180) days after one year of Occupancy Date of DAS/CS Acceptance of the Work. The Report shall include results of any post-occupancy survey of building occupants, a description of any adjustments made to equipment or building operation and the reasons for which the changes were made, and one year of all energy usage by source and water usage.

**3.** Other documentation will be retained by the CxA.

## DUTIES AND RESPONSIBILITIES OF OTHERS FOR COMMISSIONING

### The commissioning process will require the active participation of persons qualified to represent the Owner, Mechanical Engineer, Electrical Engineer, Construction Manager, Equipment Manufacturers’ Representatives, Mechanical Subcontractor, HVAC Subcontractor, Controls Subcontractor, TAB Subcontractor, Electrical Subcontractor, and other specific subcontractors, as deemed appropriate. The CxA will witness the final functional performance commissioning process. Participants shall include in their contracts all costs necessary to participate in and complete the commissioning process.

### The Contractor will assure the participation and co-operation of the Subcontractors, as required to complete the commissioning process.

### The Owner will assure the participation of their chosen representatives as required to complete the commissioning process.

### The Architect will assure the participation of necessary representatives from the Design Team as required to complete the commissioning process. Design team members will provide prompt replies to requests for information issued during the commissioning process.

### It is the Contractor’s specific responsibility to complete their respective start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase. The CxA shall request written confirmation of system readiness for performance testing, from the appropriate Contractor or Subcontractor. Once the CxA is provided with confirmation of all related systems completion, the actual date and times for the functional performance testing process will be confirmed. Contractor and Subcontractors shall provide sufficient time, and qualified representatives, to complete this process at no additional cost to the State.

### After a second failure of a system to successfully meet the criteria as set forth in the functional performance testing process, the Contractor shall reimburse the Owner for all costs associated with any additional re-testing efforts made necessary due to remaining Contractor related system deficiencies previously reported by the Contractor as corrected. These costs shall also include the costs (where applicable) for the CxA.

### **G.** Training on related systems and equipment operation and maintenance shall only be scheduled to commence after final performance commissioning is satisfactorily completed, and systems are verified to be 100 percent complete and functional.

## 1.8 SUBMITTALS

### Refer to Section 01 33 00 Submittal Procedures.

### **Pre-Commissioning Checklist Forms:** Submit **[two (2)]** signed copies of the checklist forms to the CxA upon completion of all listed items.

### **Equipment Manufacturer’s Startup Forms:** Submit **[two (2)]** completed copies of the installation and startup checklists provided by the equipment manufacturers to the CxA.

### **Test Reports:** Submit **[two (2)]** copies of test reports for equipment and systems to the CxA.

### **Control Schematics:** Submit **[two (2)]** copies of the control schematics for equipment, systems, and subsystems to the CxA.

### **Inspection Records:** Submit **[two (2)]** copies of the records of inspections for code compliance, and approved permits and licenses to operate the equipment and systems to the CxA.

### **Operating Data:** Submit **[two (2)]** copies of equipment and system operating data including all necessary instructions to facilitate operation to specified performance standards to the Owner.

### **Maintenance Data:** Submit **[two (2)]** copies of equipment and system maintenance data including all necessary information required to maintain the equipment and systems in continuous operation, such as the testing, balancing and adjusting report and the as-built drawings.

**1.9 TRAINING OF OWNER PERSONNEL**

**A.** The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

**B.** The CxA shall be responsible for overseeing and approving the content and adequacy of the training of Agency’s personnel for commissioned equipment.

**1.** The CxA shall interview the Agency’s facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Construction Administrator, Agency’s facility manager, and CxA shall decide how rigorous the training should be for each piece of commissioned equipment. The CxA shall communicate the results to the Contractor of Subcontractors and vendors who have training responsibilities.

**2.** In addition to these general requirements, the specific training requirements of Owner personnel by Subcontractor and vendors are specified in Divisions 21, 22, 23, 25, 26, and 27.

**3.** The Contractor shall require each Subcontractor and vendor responsible for training to submit a written training plan to the CxA for review and approval prior to training. The plan will cover the following elements:

**3.1** Equipment (included in training);

**3.2** Intended audience;

**3.3** Location of training;

**3.4** Objectives;

**3.5** Subjects covered (description, duration of discussion, special methods, etc.);

**3.6** Duration of training on each subject;

**3.7** Instructor for each subject;

**3.8** Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.);

**3.9** Instructor and qualifications.

**4.** For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

**5.** The CxA shall develop an overall training plan and coordinate and schedule, with the CA, Agency Representative, and Contractor, the overall training for the commissioned systems. The CxA shall develop criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA shall recommend approval of the training to the CA using a standard form for submittal to the Contractor. The CA also shall sign the approval form.

**6.** At one of the training sessions, the CxA shall present a **one (1)** hour presentation discussing the use of the blank functional test forms for re-commissioning equipment.

**7.** Video recording of the training sessions shall be provided by Contractor. The Contractor shall provide the CA, with video disks cataloged by Contractor, and added to the O&M manuals.

**8.** The HVAC design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be **two (2)** hours in length and include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, condenser water or heat rejection systems, heating systems, fuel oil and gas supply systems, supply air systems, exhaust system and outside air strategies.

**1.10 DEFERRED TESTING**

**A. Unforeseen Deferred Functional Testing.** If the Contractor determines that any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and Functional Testing may be delayed upon approval of the DAS/CS PM. These tests will be conducted in the same manner as the Seasonal Tests as soon as possible. Services of necessary parties will be negotiated.

**B. Seasonal Testing.** During the warranty period, Seasonal Testing (tests delayed until weather conditions are closer to the system’s design intent) as specified in Division 23 shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subcontractors, with the Agency facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-built drawings due to the testing will be made.

# PART 2 - PRODUCTS (Not Applicable)

# PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 91 00