AGREEMENT FOR COMMISSIONING SERVICES

PROJECT: **Williamson County Expo Center AV Upgrade** ("Project")

COMMISSIONING PROVIDER: **NV5 Consultants, Inc.** ("CxP")
Sean Weida, Director of Operations
1501 Reedsdale St., Suite 300
Pittsburgh, PA 15233

COUNTY'S DESIGNATED REPRESENTATIVE: **Williamson County Facilities Department**
Director of Facilities
3101 SE Inner Loop
Georgetown, Texas 78626

THIS AGREEMENT FOR COMMISSIONING SERVICES ("Agreement") is made and entered into effective as of the latest date of the signatories indicated at the conclusion of this document (the "Effective Date"), by and between **Williamson County, Texas** a body corporate and politic under the laws of the State of Texas ("County") and CxP.

R E C I T A L S

WHEREAS, **V.T.C.A., Government Code §2254.002(2)(A)(vii) under Subchapter A** entitled "Professional Services Procurement Act" provides for the procurement by counties of services of professional commissioning providers; and

WHEREAS, County intends to **have Commissioning provider evaluate the performance, design, and operation of the Williamson County Expo Center AV Upgrades**; and

WHEREAS, County desires that CxP perform certain professional services in connection with the Project; and

WHEREAS, CxP represents that it is qualified and desires to perform such services;

NOW, THEREFORE, County and CxP, in consideration of the mutual covenants and agreements herein contained, do mutually agree as follows:

ARTICLE 1
SCOPE OF AGREEMENT

CxP agrees to perform professional services in connection with the Project as stated herein, and for having rendered such services, County agrees to pay to CxP compensation as stated in the articles to follow.

ARTICLE 2
CONTRACT DOCUMENTS AND APPLICABLE PROJECT DOCUMENTS

2.1 Contract Documents.

Contract Documents consist of this Agreement, any exhibits attached hereto (which exhibits are hereby incorporated into and made a part of this Agreement), and all fully executed Supplemental Agreements which are subsequently issued. These form the entire Agreement, and all are as fully a part of this Agreement as if attached to this Agreement or repeated herein.

2.2 Existing Information.

County shall provide CxP with all existing plans, maps, studies, reports, field notes, statistics, computations, and other data in its possession relative to existing facilities and to this particular Project at no cost to CxP; however, any and all such information shall remain the property of County and shall be returned, if County so instructs CxP.

2.3 Project Documents.

In addition to any other pertinent and necessary Project documents, the following documents shall be used in the development of the Project:

2.3.1
Owner's Project Requirements (OPR)

2.3.2
Basis of Design (BOD)

2.3.3
Design Review Comments

2.3.4
Commissioning (Cx) Plan

2.3.5
Test Procedures & Reports

2.3.6
Deficiency Log

2.3.7
Inspection Reports

2.3.8
Commissioning Report

2.3.9
Operation & Maintenance (O&M) and System Manuals

2.3.10
Training Plans and Reports

2.3.11
Warranties and Guarantees

2.3.12
As-Built Drawings

2.3.13
Williamson County Building Commissioning Guideline, Volume 1.1, July 21, 2023 edition as updated

ARTICLE 3
NON-COLLUSION; DEBARMENT; AND FINANCIAL INTEREST PROHIBITED

3.1 Non-collusion.
CxP warrants that it has not employed or retained any company or persons, other than a bona fide employee working solely for CxP, to solicit or secure this Agreement, and that it has not paid or agreed to pay any company or subconsultant any fee, commission, percentage, brokerage fee, gifts, or any other consideration, contingent upon or resulting from the award or making of this Agreement. For breach or violation of this warranty, County reserves and shall have the right to annul this Agreement without liability or, in its discretion and at its sole election, to deduct from the Agreement price or compensation, or to otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift or contingent fee.

3.2 Debarment Certification.
CxP must sign the Debarment Certification enclosed herewith as **Exhibit E**.

3.3 Financial Interest Prohibited.
CxP covenants and represents that CxP, its officers, employees, agents, consultants, and subcontractors will have no financial interest, direct or indirect, in the purchase or sale of any product, materials, or equipment that will be recommended or required for the construction of the Project.

ARTICLE 4
CHARACTER AND SCOPE OF SERVICES

4.1
In consideration of the compensation herein provided, CxP shall review professional design and engineering plans for the Project, which are acceptable to County, based on standard architectural and engineering practices and the scope of work described on the Exhibits attached to this Agreement. CxP shall also serve as County's professional commissioning provider in those phases of the Project to which this Agreement applies and will consult with and give advice to County during the performance of CxP's services.

4.2
CxP shall perform the following Basic Scope of Services (sometimes referred to herein as the “Basic Scope of Services”, “Basic Services” or the “Scope of Services”):

4.2.1
The Basic Scope of Services shall generally consist of all elements of work, meetings, materials, and equipment required for the development of the Project in accordance with the requirements, policies, and general practices of Williamson County.

4.2.2
As part of the Basic Services, CxP shall submit its work products to County for review as requested by County.

4.2.3
The detailed Basic Services for the Project is set forth herein as **Exhibit A** to this Agreement, which is expressly incorporated and made a part hereof.

ARTICLE 5
TIME FOR PERFORMANCE

5.1 Commencement.
CxP shall not commence work until CxP has been thoroughly briefed on the scope of the Project and has been notified in writing to proceed, as evidenced by a Notice to Proceed.

5.2 Duration.
CxP agrees to complete the Basic Services within the time period set forth in **Exhibit C**. The time limits set out therein may, for good cause, be extended, in writing, by County as the Project proceeds.

ARTICLE 6
COMPENSATION AND EXPENSES

6.1 Basic Fee.
For and in consideration of the Basic Services rendered by CxP, County shall pay to CxP up to **Forty-Five Thousand Seven Hundred Fifty and No/100 Dollars ($ 45,750.00)** hereinafter called the "Basic Fee".

The Basic Fee is based upon all estimated labor costs required in the performance of all items and phases of the Basic Services set forth in **Exhibit A**. Compensation for Basic Services will be paid by County by monthly invoices of percentage completion of fees by phase of the Basic Fee as set forth in **Exhibit B**. County will only be obligated to pay CxP for the performance of items and phases of the Basic Services actually rendered and incurred, which may be less than the above stated Basic Fee.

6.2 Expenses.
CxP shall be reimbursed for actual non-labor and subcontract expenses incurred in the performance of the services under this Agreement in accordance with the Williamson County Vendor Reimbursement Policy set forth under **Exhibit D**. Invoices requesting reimbursement for costs and expenditures related to the Project (reimbursables) must be accompanied by copies of the provider's invoice and **must strictly comply with the Williamson County Vendor Reimbursement Policy**. The copies of the provider's invoice must evidence the actual costs

billed to CxP without markup. Reimbursable Expenses are in addition to compensation for Basic and Additional Services and must not exceed **Four Hundred Fifty-Eight and No/100 Dollars ($ 458.00)**.

ARTICLE 7
ADDITIONAL SERVICES AND CHARGES

For the performance of services not specifically described as Basic Services under **Article 4** above (sometimes referred to herein as "Additional Services"), County shall pay and CxP shall receive, under a negotiated, written Supplemental Agreement, Additional Services compensation based upon invoices of percentage completion.

CxP shall not, however, be compensated for work made necessary by CxP's negligent errors or omissions. In the event of any dispute over the classification of CxP's services as Basic or Additional Services under this Agreement, the decision of County shall be final and binding on CxP.

It is expressly understood and agreed that CxP shall not furnish any Additional Services without the prior written authorization of County by a negotiated Supplemental Agreement. County shall have no obligation to pay for such Additional Services which have been rendered without prior written authorization of County as hereinabove required.

ARTICLE 8
TIME OF PAYMENT; PAYMENT AND INTEREST; AND RIGHT TO AUDIT

8.1 Time of Payment.

During the performance of the services provided for in this Agreement, monthly payments shall be made based upon that portion of the services which has been completed.

On or about the last day of each calendar month during the performance of the Basic Services to be provided under this Agreement, CxP shall submit to County working documents in any stage of completion to demonstrate incremental progress of Basic Services and the compensation which is due for percentage completion of Basic Services.

On or about the last day of each calendar month during the performance of the Additional Services to be provided under **Article 7**, CxP shall submit to County working documents in any stage of completion to demonstrate incremental progress of Additional Services under an applicable Supplemental Agreement related thereto, and the compensation which is due for percentage completion of particular Additional Services.

County shall review the documentation and shall pay each statement as set forth in this **Article 8**, however, the approval or payment of any statement shall not be considered evidence of performance by CxP to the point indicated by such statement or of receipt or acceptance by County of the services covered by such statement. Final payment does not relieve CxP of the responsibility of correcting any errors or omissions resulting from CxP's negligence.

Upon submittal of the initial invoice, CxP shall provide the County Auditor with an Internal Revenue Form W-9, Request for Taxpayer Identification Number and Certification that is complete in compliance with the Internal Revenue Code, its rules and regulations.

8.2 Prompt Payment Policy.

In accordance with **Chapter 2251, V.T.C.A., Texas Government Code**, payment to CxP will be made within **thirty (30) days** of the day on which the performance of services was complete, or within **thirty (30) days** of the day on which the County Auditor receives a correct invoice for services, whichever is later. CxP may charge a late fee (fee shall not be greater than that which is permitted by Texas law) for payments not made in accordance with this prompt payment policy; however, this policy does not apply in the event:

8.2.1
There is a bona fide dispute between County and CxP concerning the supplies, materials, or equipment delivered or the services performed that causes the payment to be late; or

8.2.2
There is a bona fide dispute between CxP and a subcontractor/ subconsultant or between a subcontractor/ subconsultant and its supplier concerning supplies, materials, or equipment delivered or the Basic Services performed which causes the payment to be late; or

8.2.3
The invoice is not submitted to Williamson County in strict accordance with instructions, if any, on the purchase order, or this Agreement or other such contractual agreement.

The County Auditor shall document to CxP the issues related to disputed invoices within **ten (10) calendar days** of receipt of such invoice. Any non-disputed invoices shall be considered correct and payable per the terms of **Texas Government Code, Chapter 2251, V.T.C.A**.

ARTICLE 9
PROJECT TEAM

County's Designated Representative for purposes of this Agreement is as follows:

Williamson County Facilities Department
Attn: Director of Facilities
3101 SE Inner Loop
Georgetown, Texas 78626

County shall have the right, from time to time, to change the County's Designated Representative by giving CxP written notice thereof. With respect to any action, decision, or determination which is to be taken or made by County under this Agreement, the County's Designated Representative may take such action or make such decision or determination or shall notify CxP in writing of an individual responsible for, and capable of, taking such action, decision, or determination, and shall forward any communications and documentation to such individual for response or action. Actions, decisions or determinations by County's Designated Representative on behalf of County shall be done in his or her reasonable business judgment unless express standards or parameters therefor are included in this Agreement, in which case, actions taken by County's Designated

Representative shall be in accordance with such express standards or parameters. Any consent, approval, decision, or determination hereunder by County's Designated Representative shall be binding on County; *provided, however,* County's Designated Representative shall not have any right to modify, amend, or terminate this Agreement or executed Supplemental Agreement. County's Designated Representative shall not have any authority to execute a Supplemental Agreement unless otherwise granted such authority by the Williamson County Commissioners Court.

CxP's Designated Representative for purposes of this Agreement is as follows:

NV5 Consultants, Inc.
Sean Weida, Director of Operations
1501 Reedsdale St., Suite 300
Pittsburgh, PA 15233

CxP shall have the right, from time to time, to change CxP's Designated Representative by giving County written notice thereof. With respect to any action, decision, or determination which is to be taken or made by CxP under this Agreement, CxP's Designated Representative may take such action or make such decision or determination, or shall notify County in writing of an individual responsible for and capable of taking such action, decision, or determination and shall forward any communications and documentation to such individual for response or action. Actions, decisions, or determinations by CxP's Designated Representative on behalf of CxP shall be done in his or her reasonable business judgment unless express standards or parameters therefor are included in this Agreement, in which case, actions taken by CxP's Designated Representative shall be in accordance with such express standards or parameters. Any consent, approval, decision, or determination hereunder by CxP's Designated Representative shall be binding on CxP. CxP's Designated Representative shall have the right to modify, amend, and execute Supplemental Agreements on behalf of CxP.

ARTICLE 10
NOTICE

Any notice required to be given under the provisions of this Agreement shall be in writing and shall be duly served when it shall have been deposited, enclosed in a wrapper with the proper postage prepaid thereon, and duly registered or certified, return receipt requested, in a United States Post Office, addressed to County or CxP at the following addresses. If mailed, any notice or communication shall be deemed to be received **three (3) days** after the date of deposit in the United States Mail. Unless otherwise provided in this Agreement, all notices shall be delivered to the following addresses:

County: Williamson County Judge
710 Main Street, Suite 101
Georgetown, Texas 78626

With copy to: Williamson County Facilities Department
Attn: Director of Facilities
3101 SE Inner Loop
Georgetown, Texas 78626

and to: Office of General Counsel

Williamson County Commissioners Court
401 W. 6th Street
Georgetown, Texas 78626

CxP: NV5 Consultants, Inc.
1501 Redsdale St., Suite 300
Pittsburgh, PA 15233

Attention: Sean Weida
Director of Operations

Either party may designate a different address by giving the other party ten (10) days written notice.

ARTICLE 11
PROGRESS EVALUATION

CxP shall, from time to time during the progress of the Basic Services and, when applicable, progress of Additional Services, confer with County at County's election. CxP shall prepare and present such information as may be pertinent and necessary, or as may be reasonably requested by County, in order for County to evaluate features of the Basic Services and any applicable Additional Services. At the request of County or CxP, conferences shall be provided at CxP's office, the offices of County, or at other locations designated by County. When requested by County, such conferences shall also include evaluation of the Basic Services and any applicable Additional Services. County may, from time to time, require CxP to appear and provide information to the Williamson County Commissioners Court.

Should County determine that the progress in Basic Services or any applicable Additional Services does not satisfy the terms of this Agreement, then County shall review same with CxP to determine corrective action required.

CxP shall promptly advise County in writing of events which have or may have a significant impact upon the progress of the Basic Services and any applicable Additional Services, including but not limited to the following:

11.1
Problems, delays, adverse conditions which may materially affect the ability to meet the objectives of this Agreement or preclude the attainment of Project Basic Services and any applicable Additional Services by established time periods; and such disclosure shall be accompanied by statement of actions taken or contemplated, and County assistance needed to resolve the situation, if any; and

11.2
Favorable developments or events which enable meeting goals sooner than anticipated in relation to this Agreement or any applicable Supplemental Agreement.

ARTICLE 12
CHANGES IN COMPLETED BASIC SERVICES

If County deems it necessary to request changes to previously satisfactorily completed Basic Services or parts thereof which involve changes to the original Basic Services or character of Basic Services under this Agreement, then CxP shall make such revisions as requested and as directed by County. Such revisions shall be considered as Additional Services and paid for as specified under **Article 7** and **Article 8**. CxP shall make revisions to Basic Services authorized hereunder as are necessary to correct errors appearing therein, when required to do so by County. No additional compensation shall be due for such Basic Services.

ARTICLE 13
REVIEW PROCESS AND REVISIONS TO CxP WORK PRODUCT

13.1 Review Process.

CxP's Work Product will be reviewed by County under its applicable technical requirements and procedures, as follows:

13.1.1 Submittal.
Reports, plans, surveys, field notes, original drawings, computer tapes, graphic files, tracings, calculations, analyses, reports, specifications, data, sketches and/or schematics prepared by CxP and supporting documents (collectively referred to hereinabove and hereinafter as the "CxP Work Product(s)"), shall be submitted by CxP on or before the dates specified for completion, as set out in the Production Schedule set forth in **Exhibit C**.

13.1.2 Completion.
Reports, plans, specifications, and supporting documents shall be submitted by CxP on or before the dates specified in **Exhibit C**. Upon receipt of same, the submission shall be checked for completion. "Completion" or “Complete” shall be defined as all of the required items, as set out in **Exhibit A**, have been included in compliance with the requirements of this Agreement. The completeness of any Basic Services submitted to County shall be determined by County within thirty (30) days of such submittal and County shall notify CxP in writing within such thirty (30) day period if such Basic Services have been found to be incomplete. If the submission is Complete, County will notify CxP and County’s technical review process will begin.

If the submission is not Complete, County will notify CxP, who shall perform such professional services as are required to complete the Basic Services and resubmit it to County. This process shall be repeated until a submission is Complete.

13.1.3 Acceptance.
County will review the completed Basic Services in each commissioning phase for compliance with this Agreement and general conformance with the Building Commissioning Guideline, Volume 1.1. "Acceptance" or “Accepted” shall mean that in County’s reasonable opinion, substantial compliance with the requirements of this Agreement has been achieved.

If a lack of coordination between subconsultant documents is discovered in the CxP work product, which is not specifically called-out by CxP as a pending coordination item, the work product will be returned to CxP along with written email notification which may describe preliminary deficiencies discovered and may reference the terms of **Paragraph 13.1.3** of this Agreement. CxP shall perform any required corrections to Basic Services and resubmit to County.

Should this process need to be repeated for the same or subsequent deficiencies related to the initial deficiencies, County will issue a marked-up work product to CxP indicating specific deficiencies for correction. County will also issue a notice for CxP to deduct **One Thousand Dollars ($ 1,000)** from the CxP 's Basic Fee on the next invoice for each occurrence until the Basic Services are Accepted.

13.1.4 Final Approval.
After Acceptance, CxP shall perform any required modifications, changes, alterations, corrections, and additional work necessary to receive Final Approval by County. "Final Approval" in this sense shall mean formal recognition that the Basic Services have been fully carried out.

13.2 Revision to CxP Work Product.

CxP shall make, without expense to County, such revisions to CxP Work Product as may be required to correct negligent errors or omissions so CxP Work Product meets the needs of County, but after the approval of CxP Work Product any revisions, additions, or other modifications made at County's request which involve extra services and expenses to CxP shall entitle CxP to additional compensation for such extra services and expenses; provided, however, CxP hereby agrees to perform any necessary corrections to CxP Work Products which are found to be in negligent error or omission as a result of CxP's development of CxP Work Product, at any time, without additional compensation. If it is necessary, due to such error or omission by CxP, to revise any CxP Work Product in order to make the Project constructible, CxP shall do so without additional compensation. In the event of any dispute over the classification of CxP's Work Products as Complete, Accepted, or Approved under this Agreement, the decision of County shall be final and binding on CxP, subject to any civil remedy or determination otherwise available to the parties and deemed appropriate by the parties.

13.3 Days.

All references to a "day" in this Agreement shall mean a calendar day unless otherwise specified.

13.4 County's Reliance on CxP.

CxP's duties as set forth herein shall at no time be in any way diminished by reason of any review, evaluation, or approval by County nor shall CxP be released from any liability by reason of such review, evaluation or approval by County, it being understood that County, at all times, is ultimately relying upon CxP's skill, ability, and knowledge in performing the Basic Services required hereunder.

ARTICLE 14
SUSPENSION

Should County desire to suspend the Basic Services, but not to terminate this Agreement, then such suspension may be effected by County giving CxP **thirty (30) calendar days'** verbal

notification followed by written confirmation to that effect. Such **thirty (30)-day** notice may be waived in writing by agreement and signature of both parties. The Basic Services may be reinstated and resumed in full force and effect within **sixty (60) days** of receipt of written notice from County to resume the Basic Services. Such **sixty (60)-day** notice may be waived in writing by agreement and signature of both parties. If this Agreement is suspended for more than **thirty (30) days**, CxP shall have the option of terminating this Agreement and, in the event, CxP shall be compensated for all Basic Services performed and reimbursable expenses incurred, provided such Basic Services and reimbursable expenses have been previously authorized and approved by County, to the effective date of suspension.

County assumes no liability for Basic Services performed or costs incurred prior to the date authorized by County for CxP to begin Basic Services, and/or during periods when Basic Services are suspended, and/or subsequent to the completion date.

ARTICLE 15
VIOLATION OF CONTRACT TERMS/ BREACH OF CONTRACT

Violation of contract terms or breach of contract by CxP shall be grounds for termination of this Agreement, and any increased costs arising from CxP's default, breach of contract, or violation of contract terms shall be paid by CxP.

ARTICLE 16
TERMINATION

This Agreement may be terminated as set forth below.

16.1
By mutual agreement and consent, in writing, of both parties.

16.2
By County, by notice in writing to CxP, as a consequence of failure by CxP to perform the Basic Services set forth herein in a satisfactory manner.

16.3
By either party, upon the failure of the other party to fulfill its obligations as set forth herein.

16.4
By County, for reasons of its own and not subject to the mutual consent of CxP, upon not less than **thirty (30) days** written notice to CxP.

16.5
By satisfactory completion of all Basic Services and obligations described herein.

Should County terminate this Agreement as herein provided, no fees other than fees due and payable at the time of termination plus reimbursable expenses incurred shall thereafter be paid to CxP. In determining the value of the Basic Services performed by CxP prior to termination, County shall be the sole judge. Compensation for Basic Services at termination will be based on a percentage of the Basic Services completed at that time. Should County terminate this

Agreement under **Section 16.4** above, then the amount charged during the **thirty (30)-day** notice period shall not exceed the amount charged during the preceding **thirty (30) days**.

If CxP defaults in the performance of this Agreement or if County terminates this Agreement for fault on the part of CxP, then County shall give consideration to the actual costs incurred by CxP in performing the Basic Services to the date of default, the amount of Basic Services required which was satisfactorily completed to date of default, the value of the Basic Services which are usable to County, the cost to County of employing another firm to complete the Basic Services required and the time required to do so, and other factors which affect the value to County of the Basic Services performed at the time of default.

The termination of this Agreement and payment of an amount in settlement as prescribed above shall extinguish all rights, duties, and obligations of County under this Agreement. If the termination of this Agreement is due to the failure of CxP to fulfill its contractual obligations, then County may take over the Project and prosecute the Basic Services to completion. In such case, CxP shall be liable to County for any additional and reasonable costs incurred by County.

CxP shall be responsible for the settlement of all contractual and administrative issues arising out of any procurements made by CxP in support of the Basic Services under this Agreement.

ARTICLE 17
USE OF DOCUMENTS

All documents, including but not limited to drawings, specifications, and data or programs stored electronically, (hereinafter referred to as “CxP Work Products”) prepared by CxP and its subcontractors/ subconsultants are related exclusively to the services described in this Agreement and are intended to be used with respect to this Project. However, it is expressly understood and agreed by and between the parties hereto that all of CxP’s documents under this Agreement (including but not limited to commissioning plans and reports, test procedures and reports, specifications, investigations, studies and other documents, completed or partially completed), shall be the property of County to be thereafter used in any lawful manner as County elects. Any such subsequent use made of documents by County shall be at County’s sole risk and without liability to CxP.

By execution of this Agreement and in confirmation of the fee for services to be paid under this Agreement, CxP hereby conveys, transfers, and assigns to County all rights under the Federal Copyright Act of 1976 (or any successor copyright statute), as amended, all common law copyrights and all other intellectual property rights acknowledged by law in the Work Product developed under this Agreement. Copies may be retained by CxP. CxP shall be liable to County for any loss or damage to any such documents while they are in the possession of or while being worked upon by CxP or anyone connected with CxP, including agents, employees, Engineers or subcontractors/ subconsultants. All documents so lost or damaged shall be replaced or restored by CxP without cost to County.

Upon execution of this Agreement, CxP grants to County permission to reproduce CxP’s work and documents for purposes of constructing, using, and maintaining the Project, provided that County will comply with its obligations, including prompt payment of all sums when due, under this Agreement. CxP shall obtain similar permission from CxP’s subcontractors/ subconsultants consistent with this Agreement. If and upon the date CxP is adjudged in default of this Agreement, County is permitted to authorize other similarly credentialed commissioning professionals to

reproduce and, where permitted by law, to make changes, corrections, or additions to the work and documents for the purposes of completing, using, and maintaining the Project.

County shall not assign, delegate, sublicense, pledge, or otherwise transfer any permission granted herein to another party without the prior written consent of CxP. However, County shall be permitted to authorize the contractor, subcontractors, and material or equipment suppliers to reproduce applicable portions of CxP Work Products appropriate to and for use in the execution of the Work. Submission or distribution of CxP Work Products to meet official regulatory requirements or for similar purposes in connection with the Project is permitted. Any unauthorized use of CxP Work Products shall be at County's sole risk and without liability to CxP and its subconsultants.

Prior to CxP providing to County any CxP Work Products in electronic form or County providing to CxP any electronic data for incorporation into CxP Work Products, County and CxP shall, by separate written agreement, set forth the specific conditions governing the format of such CxP Work Products or electronic data, including any special limitations not otherwise provided in this Agreement. Any electronic files are provided by CxP for the convenience of County and use of them is at County's sole risk. In the case of any defects in electronic files or any discrepancies between them and any hardcopy of the same documents prepared by CxP, the electronic copy shall prevail. Only printed copies of documents conveyed by CxP shall be relied upon.

CxP shall have no liability for changes made to the drawings by other consultants subsequent to the completion of the Project.

ARTICLE 18
PERSONNEL, EQUIPMENT, AND MATERIAL

CxP shall furnish and maintain, at its own expense, quarters for the performance of all Basic Services, and adequate and sufficient personnel and equipment to perform the Basic Services as required. All employees of CxP shall have such knowledge and experience as will enable them to perform the duties assigned to them. Any employee of CxP who, in the reasonable opinion of County, is incompetent or whose conduct becomes detrimental to the Basic Services shall immediately be removed from association with the Project when so instructed by County. CxP certifies that it presently has adequate qualified personnel in its employment for performance of the Basic Services required under this Agreement, or will obtain such personnel from sources other than County. CxP may not change the Project Manager without prior written consent of County.

ARTICLE 19
SUBCONTRACTING

CxP shall not assign, subcontract, or transfer any portion of the Basic Services under this Agreement without prior written approval from County. All subcontracts shall include the provisions required in this Agreement. No subcontract shall relieve CxP of any responsibilities under this Agreement.

ARTICLE 20
MODIFICATIONS

This instrument contains the entire Agreement between the parties relating to the right herein granted and obligations herein assumed. Any oral or written representations or modifications concerning this instrument shall be of no force and effect excepting a subsequent written modification signed by both parties hereto.

ARTICLE 21
COMPLIANCE WITH LAWS

21.1 Compliance.

CxP shall render the services hereunder in accordance with generally accepted standards applicable thereto and shall use that degree of care and skill commensurate with the architecture and engineering professions, and in recognition of such standards, CxP shall comply with all applicable federal, state, and local laws, statutes, codes, ordinances, rules and regulations, and the orders and decrees of any court, or administrative bodies or tribunals in any manner affecting the performance of this Agreement, including, without limitation, minimum/ maximum salary and wage statutes and regulations, and licensing laws and regulations. CxP shall furnish County with satisfactory proof of its compliance.

CxP shall further obtain all permits and licenses required in the performance of the Basic Services contracted for herein.

21.2 Taxes.

CxP shall pay all taxes, if any, required by law arising by virtue of the Basic Services performed hereunder. County is qualified for exemption pursuant to the provisions of **Section 151.309 of the Texas Limited Sales, Excise, and Use Tax Act**.

ARTICLE 22
INDEMNIFICATION

CXP AGREES, TO THE FULLEST EXTENT PERMITTED BY LAW, TO INDEMNIFY AND HOLD COUNTY HARMLESS FROM AND AGAINST ANY AND ALL LIABILITIES, LOSSES, PENALTIES, JUDGMENTS, CLAIMS, LAWSUITS, DAMAGES, COSTS AND EXPENSES, INCLUDING, BUT NOT LIMITED TO, REASONABLE ATTORNEYS' FEES, ("LOSSES") TO THE EXTENT SUCH LOSSES ARE CAUSED BY OR RESULTS FROM A NEGLIGENT ACT OR OMISSION, NEGLIGENCE, OR INTENTIONAL TORT COMMITTED BY CXP, CXP'S EMPLOYEES, AGENTS, OR ANY OTHER PERSON OR ENTITY UNDER CONTRACT WITH CXP INCLUDING, WITHOUT LIMITATION, CXP'S SUBCONSULTANTS, OR ANY OTHER ENTITY OVER WHICH CXP EXERCISES CONTROL.

CXP FURTHER AGREES, TO THE FULLEST EXTENT PERMITTED BY LAW, TO INDEMNIFY AND HOLD COUNTY HARMLESS FROM ANY AND ALL LIABILITIES, LOSSES, PENALTIES, JUDGMENTS, CLAIMS, LAWSUITS, DAMAGES, COSTS AND EXPENSES, INCLUDING, BUT NOT LIMITED TO, REASONABLE ATTORNEYS' FEES, ("LOSSES") TO THE EXTENT SUCH LOSSES ARE CAUSED BY OR RESULTS FROM CXP'S FAILURE TO PAY CXP'S EMPLOYEES, SUBCONTRACTORS, SUBCONSULTANTS, OR SUPPLIERS, IN CONNECTION WITH ANY OF THE WORK PERFORMED OR TO BE PERFORMED UNDER THIS AGREEMENT BY CXP.

CxP FURTHER AGREES TO INDEMNIFY AND HOLD COUNTY HARMLESS FROM ANY AND ALL LIABILITIES, LOSSES, PENALTIES, CLAIMS, LAWSUITS, DAMAGES, COSTS AND EXPENSES, INCLUDING, BUT NOT LIMITED TO, REASONABLE ATTORNEYS' FEES, ("LOSSES") TO THE EXTENT SUCH LOSSES ARE CAUSED BY OR RESULTS FROM THE INFRINGEMENT OF ANY INTELLECTUAL PROPERTY ARISING OUT OF THE USE OF ANY PLANS, REPORTS, LOGS, O&M OR SYSTEM MANUALS OR SPECIFICATIONS FURNISHED BY CxP IN THE PERFORMANCE OF THIS AGREEMENT.

THE LIMITS OF INSURANCE REQUIRED IN THIS AGREEMENT AND/OR THE CONTRACT DOCUMENTS SHALL NOT LIMIT CxP'S OBLIGATIONS UNDER THIS **ARTICLE 22**. THE TERMS AND CONDITIONS CONTAINED IN THIS **ARTICLE 22** SHALL SURVIVE THE TERMINATION OF THIS AGREEMENT AND/OR CONTRACT DOCUMENTS OR THE SUSPENSION OF THE WORK HEREUNDER. TO THE EXTENT THAT ANY LIABILITIES, PENALTIES, DEMANDS, CLAIMS, LAWSUITS, LOSSES, DAMAGES, COSTS AND EXPENSES ARE CAUSED IN PART BY THE ACTS OF COUNTY OR THIRD PARTIES FOR WHOM CxP IS NOT LEGALLY LIABLE, CxP'S OBLIGATIONS SHALL BE IN PROPORTION TO CxP'S FAULT. THE OBLIGATIONS HEREIN SHALL ALSO EXTEND TO ANY ACTIONS BY COUNTY TO ENFORCE THIS INDEMNITY OBLIGATION.

IN THE EVENT THAT CONTRACTORS INITIATE LITIGATION AGAINST COUNTY IN WHICH CONTRACTOR ALLEGES DAMAGES AS A RESULT OF ANY ACTS, ERRORS OR OMISSIONS OF CxP OR ANY OF ITS EMPLOYEES OR ANY PERSON, FIRM OR CORPORATION DIRECTLY OR INDIRECTLY EMPLOYED BY CxP, INCLUDING, BUT NOT LIMITED TO, DEFECTS, ERRORS, OR OMISSIONS IN THE CONSTRUCTION DOCUMENTS OR IN THE ADMINISTRATION OF THIS AGREEMENT BY CxP OR ANY OF ITS EMPLOYEES OR ANY PERSON, FIRM OR CORPORATION DIRECTLY OR INDIRECTLY EMPLOYED BY CxP, AND/OR INADEQUATE SERVICES PURSUANT TO THE CONSTRUCTION PHASE-ADMINISTRATION OF THE CONSTRUCTION CONTRACT AS DEFINED AND REQUIRED BY THIS AGREEMENT, AGREEMENT EXHIBITS AND THE CONSTRUCTION CONTRACT DOCUMENTS, THEN COUNTY SHALL HAVE THE RIGHT TO JOIN CxP AT COUNTY'S COST. CxP SHALL ALSO HOLD COUNTY HARMLESS AND INDEMNIFY COUNTY TO THE EXTENT THAT CxP, ANY OF ITS EMPLOYEES, AGENTS, SUBCONTRACTORS, SUBCONSULTANTS, OR SUPPLIERS, OR OTHER ENTITIES OVER WHICH CxP EXERCISES CONTROL, CAUSED SUCH DAMAGES TO CONTRACTOR, INCLUDING ANY AND ALL COSTS AND ATTORNEYS' FEES INCURRED BY COUNTY IN CONNECTION WITH THE DEFENSE OF ANY CLAIMS WHERE CxP, ITS EMPLOYEES, AGENTS, SUBCONTRACTORS, SUBCONSULTANTS, OR SUPPLIERS, OR OTHER ENTITIES OVER WHICH CxP EXERCISES CONTROL, ARE ADJUDICATED AT FAULT.

ARTICLE 23
PROFESSIONAL'S RESPONSIBILITIES

CxP shall be responsible for the accuracy of its Professional Services and shall promptly make necessary revisions or corrections to its Work Product resulting from errors, omissions, or negligent acts, and same shall be done without compensation. County shall determine CxP's responsibilities for all questions arising from errors and/or omissions, subject to the dispute resolution provisions of **Article 31**. CxP shall not be relieved of responsibility for subsequent correction of any such errors or omissions in its work product, or for clarification of any ambiguities until after the construction phase of the Project has been completed.

ARTICLE 24
NOT USED

ARTICLE 25
INSURANCE

CxP must comply with the following insurance requirements at all times during this Agreement:

25.1 Coverage Limits.
CxP, at CxP's sole cost, shall purchase and maintain during the entire term while this Agreement is in effect the following insurance:

25.1.1
Worker's Compensation in accordance with statutory requirements.

25.1.2
Commercial General Liability Insurance with a combined minimum Bodily Injury and Property Damage limits of $1,000,000.00 per occurrence and $2,000,000.00 in the aggregate.

25.1.3
Business Automobile Liability Insurance for all owned, non-owned, and hired vehicles with combined minimum limits for Bodily Injury and Property Damage of $1,000,000.00 each accident.

25.1.4
Professional Liability Insurance in the amount of $2,000,000.00 per claim and annual aggregate.

25.2 Additional Insureds; Waiver of Subrogation.
"Williamson County, its directors, officers and employees" shall be added as additional insureds under policies listed under (2) and (3) above, and on those policies where "Williamson County, its directors, officers and employees" are additional insureds, such insurance shall be primary; and, any insurance maintained by County shall be excess and not contribute with it. Such policies shall also include waivers of subrogation in favor of County.

25.3 Premiums and Deductible.
CxP shall be responsible for payment of premiums for all insurance coverages required under this **Article 25**. CxP further agrees that for each claim, suit, or action made against insurance provided hereunder, with respect to all matters for which CxP is responsible hereunder, CxP shall be solely responsible for all deductibles and self-insured retentions. Any deductibles or self-insured retentions over **$50,000** in CxP's insurance must be declared and approved in writing by County in advance.

25.4 Commencement of Work.
CxP shall not commence any work under this Agreement until it has obtained all required insurance and such insurance has been approved by County. As further set out below, CxP shall not allow any subcontractor/ subconsultant(s) to commence work to be performed in connection

with this Agreement until all required insurance has been obtained and approved; and, such approval shall not be unreasonably withheld. Approval of the insurance by County shall not relieve or decrease the liability of CxP hereunder.

25.5 Insurance Company Rating.

Required insurance must be written by a company approved to do business in the State or Texas with a financial standing of at least an A-rating, as reflected in Best's insurance ratings or by a similar rating system recognized within the insurance industry at the time the policy is issued.

25.6 Certification of Coverage.

Prior to the performance of any services, CxP shall furnish County with a Certificate of Insurance issued by the insurer evidencing the required coverages and terms under this article. The initial Certificate of Insurance is evidenced as **Exhibit F** herein entitled "Certificates of Insurance." As further set out below, CxP shall not allow any subcontractor/subconsultant(s) to commence work to be performed in connection with this Contract until all required insurance has been obtained and approved and such approval shall not be unreasonably withheld. Approval of the insurance by County shall not relieve or decrease the liability of CxP hereunder.

25.7 Certificate Holder.

The name of the Certificate Holder in the Certificate of Insurance issued by the insurer shall be as follows:

Williamson County, Texas
C/O: Williamson County Risk Management
301 SE Inner Loop
Georgetown, TX. 78626
Email: coi.submission@wilco.org

25.8 No Arbitration.

It is the intention of County and agreed to and hereby acknowledged by CxP, that no provision of this Agreement shall be construed to require County to submit to mandatory arbitration in the settlement of any claim, cause of action or dispute, except as specifically required in direct connection with an insurance claim or threat of claim under an insurance policy required hereunder or as may be required by law or a court of law with jurisdiction over the provisions of this Agreement.

25.9 Subcontractor/ Subconsultant's Insurance.

Without limiting any of the other obligations or liabilities of CxP, CxP shall require each subcontractor/ subconsultant performing work under this Agreement (to the extent a subcontractor/ subconsultant is allowed by County) to maintain during the term of this Agreement, at the subcontractor/ subconsultant's own expense, the same stipulated minimum insurance required in this **Article 25** above, including the required provisions and additional policy conditions as shown below in this **Article 25**.

CxP shall obtain and monitor the certificates of insurance from each subcontractor/ subconsultant in order to assure compliance with the insurance requirements. CxP must retain the certificates of insurance for the duration of this Agreement and shall have the responsibility of enforcing these insurance requirements among its subcontractor/ subconsultants. County shall be entitled, upon request and without expense, to receive copies of these certificates of insurance.

25.10 Insurance Policy Endorsements.

Each insurance policy shall include the following conditions by endorsement to the policy:

25.10.1
County shall be notified **ten (10) days** prior to the expiration, cancellation, nonrenewal or any material change in coverage, and such notice thereof shall be given to County by certified mail to:

Williamson County, Texas
C/O: Williamson County Risk Management
301 SE Inner Loop
Georgetown, TX. 78626
Email: coi.submission@wilco.org

25.10.2
The policy clause "Other Insurance" shall not apply to any insurance coverage currently held by County, to any such future coverage, or to County's Self-Insured Retentions of whatever nature.

25.11 Notices by CxP.

CxP shall not cause any insurance to be canceled nor permit any insurance to lapse. In addition to any other notification requirements set forth hereunder, CxP shall also notify County, within twenty-four (24) hours of receipt of any notices of expiration, cancellation, non-renewal, or material change in coverage it receives from its insurer.

25.12 Cost of Insurance.

The cost of all insurance required herein to be secured and maintained by CxP shall be borne solely by CxP, with certificates of insurance evidencing such minimum coverage in force to be filed with County. Such certificates of insurance are evidenced as **Exhibit F**.

ARTICLE 26
SUCCESSORS AND ASSIGNS

This Agreement shall be binding upon and inure to the benefit of the parties hereto, their successors, lawful assigns, and legal representatives. CxP may not assign, sublet, or transfer any interest in this Agreement, in whole or in part, by operation of law or otherwise, without obtaining the prior written consent of County.

ARTICLE 27
SEVERABILITY

In the event any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, then such invalidity, illegality or unenforceability shall not affect any other provision thereof and this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

ARTICLE 28
PRIOR AGREEMENTS SUPERSEDED

This Agreement constitutes the sole agreement of the parties hereto and supersedes any prior understandings or written or oral agreements between the parties respecting the subject matter defined herein. This Agreement may only be amended or supplemented by mutual agreement of the parties hereto in writing.

ARTICLE 29
CxP'S ACCOUNTING RECORDS

CxP agrees to maintain, for a period of **three (3) years** after final payment under this Agreement, detailed records, books, documents, and papers which are directly pertinent to the services to be performed under this Agreement and records of reimbursable costs and expenses of other providers and provide such other details as may be requested by the County Auditor for the purposes of making audits, examinations, excerpts and transcriptions. CxP agrees that County or its duly authorized representatives shall, until the expiration of **three (3) years** after final payment under this Agreement, have access to and the right to examine and photocopy any and all detailed records, books, documents, and papers which are directly pertinent to the services to be performed under this Agreement and records of reimbursable costs and expenses of other providers for the purposes of making audits, examinations, excerpts, and transcriptions. CxP further agrees that County shall have access during normal working hours to all necessary CxP facilities and shall be provided adequate and appropriate workspace in order to conduct audits in compliance with the provisions of this **Article 29**. County shall give CxP reasonable advance notice of intended audits.

ARTICLE 30
GENERAL PROVISIONS

30.1 Time is of the Essence.
CxP understands and agrees that time is of the essence and that any failure of CxP to complete the Basic Services within the agreed Production Schedule set out in **Exhibit C** may constitute a material breach of this Agreement. CxP shall be fully responsible for its delays or for failures to use its reasonable efforts in accordance with the terms of this Agreement and CxP's standard of performance as defined herein. Where damage is caused to County due to CxP's negligent failure to perform, County may accordingly withhold, to the extent of such damage, CxP's payments hereunder without waiver of any of County's additional legal rights or remedies.

30.2 Force Majeure.
Neither County nor CxP shall be deemed in violation of this Agreement if prevented from performing any of their obligations hereunder by reasons for which they are not responsible or circumstances beyond their control. However, notice of such impediment or delay in performance must be timely given, and all reasonable efforts undertaken to mitigate its effects.

30.3 Enforcement and Venue.
This Agreement shall be enforceable in Georgetown, Williamson County, Texas, and if legal action is necessary by either party with respect to the enforcement of any or all of the terms or conditions herein, exclusive venue for same shall lie in Williamson County, Texas. This

Agreement shall be governed by and construed in accordance with the laws and court decisions of the State of Texas excluding, however, its choice of law rules.

30.4 Standard of Performance.
The standard of care for all professional services performed or furnished by CxP and its employees under this Agreement will be the care and skill ordinarily used by members of CxP's profession, practicing under the same or similar circumstances at the same time and in the same locality.

30.5 Opinion of Probable Cost.
Any reviews of opinions of probable Project cost or probable construction cost provided by CxP are made on the basis of information available to CxP and on the basis of CxP's experience and qualifications and represents its judgment as an experienced and qualified professional. However, since CxP has no control over the cost of labor, materials, equipment, or services furnished by others, or over the contractor(s') methods of determining prices, or over competitive bidding or market conditions, CxP does not guarantee that proposals, bids or actual Project or construction cost will not vary from opinions of probable cost CxP prepares.

30.6 Opinions and Determinations.
Where the terms of this Agreement provide for action to be based upon opinion, judgment, approval, review, or determination of either party hereto, such terms are not intended to be and shall never be construed as permitting such opinion, judgment, approval, review, or determination to be arbitrary, capricious, or unreasonable.

30.7 Reports of Accidents.
Within **twenty-four (24) hours** after CxP becomes aware of the occurrence of any accident or other event which results in, or might result in, injury to the person or property of any third person (other than an employee of CxP), whether or not it results from, or involves, any action or failure to act by CxP or any employee or agent of CxP and which arises in any manner from the performance of this Agreement, CxP shall send a written report of such accident or other event to County, setting forth a full and concise statement of the facts pertaining thereto. CxP shall also immediately send to County a copy of any summons, subpoena, notice, or other documents served upon CxP, its agents, employees, or representatives, or received by it or them, in connection with any matter before any court arising in any manner from CxP's performance of work under this Agreement.

30.8 Gender, Number, and Headings.
Words of any gender used in this Agreement shall be held and construed to include any other gender, and words in the singular number shall be held to include the plural, unless the context otherwise requires. The headings and section numbers are for convenience only and shall not be considered in interpreting or construing this Agreement.

30.9 Construction.
Each party hereto acknowledges that it and its counsel have reviewed this Agreement and that the normal rules of construction are not applicable and there will be no presumption that any ambiguities will be resolved against the drafting party in the interpretation of this Agreement.

30.10 Independent Contractor Relationship.
Both parties hereto, in the performance of this Agreement, shall act in an individual capacity and not as agents, employees, partners, joint ventures or associates of one another. The employees

or agents of one party shall not be deemed or construed to be the employees or agents of the other party for any purposes whatsoever.

30.11 No Waiver of Immunities.

Nothing in this Agreement shall be deemed to waive, modify, or amend any legal defense available at law or in equity to County, its past or present officers, employees, or agents, nor to create any legal rights or claim on behalf of any third party. County does not waive, modify, or alter, to any extent whatsoever, the availability of the defense of governmental immunity under the laws of the State of Texas and of the United States.

30.12 Texas Public Information Act.

To the extent, if any, that any provision in this Agreement is in conflict with **Texas Government Code 552.001** et seq., as amended (the "Public Information Act"), the same shall be of no force or effect. Furthermore, it is expressly understood and agreed that County, its officers and employees may request advice, decisions and opinions of the Attorney General of the State of Texas in regard to the application of the Public Information Act to any items or data furnished to County as to whether or not the same are available to the public. It is further understood that County's officers and employees shall have the right to rely on the advice, decisions and opinions of the Attorney General, and that County, its officers and employees shall have no liability or obligation to any party hereto for the disclosure to the public, or to any person or persons, of any items or data furnished to County by a party hereto, in reliance of any advice, decision or opinion of the Attorney General of the State of Texas.

30.13 Governing Terms and Conditions.

If there is an irreconcilable conflict between the terms and conditions set forth in this Agreement or any Supplemental Agreement and the terms and conditions set forth in any Exhibit, Appendix to this Agreement, the terms and conditions set forth in this Agreement or any Supplemental Agreement shall control over the terms and conditions set forth in any Exhibit, Appendix to this Agreement.

30.14 Appropriation of Funds by County.

County believes it has sufficient funds currently available and authorized for expenditure to finance the costs of this Agreement. CxP understands and agrees that County's payment of amounts under this Agreement is contingent on the County receiving appropriations or other expenditure authority sufficient to allow the County, in the exercise of reasonable administrative discretion, to continue to make payments under this Agreement. It is further understood and agreed by CxP that County shall have the right to terminate this Agreement at the end of any County fiscal year if the governing body of County does not appropriate sufficient funds as determined by County's budget for the fiscal year in question. County may affect such termination by giving written notice of termination to CxP.

ARTICLE 31
DISPUTE RESOLUTION

Except as otherwise specifically set forth herein, County and CxP shall work together in good faith to resolve any controversy, dispute, or claim between them which arises out of or relates to this Agreement, whether stated in tort, contract, statute, claim for benefits, bad faith, professional liability or otherwise ("Claim"). If the parties are unable to resolve the Claim within **thirty (30) days** following the date in which one party sent written notice of the Claim to the other party, and

if a party wishes to pursue the Claim, such Claim shall be addressed through non-binding mediation. A single mediator engaged in the practice of law, who is knowledgeable about subject matter of this Agreement, shall be selected by agreement of the parties and serve as the mediator. Any mediation under this Agreement shall be conducted in Williamson County, Texas. The mediator's fees shall be borne equally between the parties. Such non-binding mediation is a condition precedent to seeking redress in a court of competent jurisdiction, but this provision shall not preclude either party from filing a lawsuit in a court of competent jurisdiction prior to completing a mediation, if necessary to preserve the statute of limitations, in which case such lawsuit shall be stayed pending completion of the mediation process contemplated herein. This provision shall survive the termination of this Agreement.

ARTICLE 32
EQUAL OPPORTUNITY IN EMPLOYMENT

The parties to this Agreement agree that during the performance of the services under this Agreement they will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The parties to this Agreement will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; termination; rates of pay or other forms of compensation, and selection for training, including apprenticeship.

ARTICLE 33
MERGER

The Parties agree that this Agreement contains all of the terms and conditions of the understanding of the parties relating to the subject matter hereof. All prior negotiations, discussions, correspondence and preliminary understandings between the parties and others relating hereto are superseded by this Agreement.

ARTICLE 34
PUBLIC CONTACT

Contact with the news media, citizens of Williamson County or governmental agencies shall be the responsibility of County. Under no circumstances shall CxP release any material or information developed in the performance of its services hereunder without the express written permission of County.

ARTICLE 35
CxP's REPRESENTATIONS

CxP represents that it is financially solvent, able to pay its debts as they become due, and possesses sufficient working capital to complete the services and perform its obligation under this Agreement and under the Contract Documents. CxP further represents and acknowledges that: (a) it is a sophisticated business entity that possesses the required level of experience and

expertise in business administration, construction, and contract administration of projects of similar or like size, complexity, and nature as the Project and (b) the fee stated in this Agreement is adequate compensation for the timely completion of the Basic Services.

ARTICLE 36
CONFIDENTIALITY

CxP hereby acknowledges the services to be performed hereunder pertain to a secured correctional facility (Williamson County Jail) and that CxP must ensure that information relating all areas of the Williamson County Jail must not be disclosed to third parties. CxP expressly agrees that its employees, agents, or any other person or entity under contract with CxP including, without limitation, CxP's subconsultants, or any other entity over which CxP exercises control will not use any information relating to the Williamson County Jail that may be obtained while providing services hereunder for any purpose other than for what is necessary to perform the required services. CxP agrees to use the same degree of care as it uses to protect the confidentiality of its own confidential information, but no less than reasonable precautions to maintain confidentiality with respect to the Williamson County Jail, and to prevent disclosure thereof to persons other than its employees, agents, any other person or entity under contract with CxP including, without limitation, CxP's subconsultants, or any other entity over which CxP exercises control who need access to information regarding the Williamson County Jail to carry out their obligations under this Agreement. CxP agrees that CxP and its employees, agents, any other person or entity under contract with CxP including, without limitation, CxP's subconsultants, or any other entity over which CxP exercises control will not enter any unauthorized areas of the Wiliamson County Jail and will not disclose any information to unauthorized third parties and will take care to guard the security of the information at all times. CxP agrees that all of its employees, agents, any other person or entity under contract with CxP including, without limitation, CxP's subconsultants, or any other entity over which CxP exercises control shall be subject to background checks and that the Williamson County Sheriff or his agent will perform checks. County shall retain the right to deny right of entry to the Williamson County Jail to anyone.

ARTICLE 37
SIGNATORY WARRANTY

The undersigned signatory for CxP hereby represents and warrants that the signatory is an officer of the organization for which he/she has executed this Agreement and that he/she has full and complete authority to enter into this Agreement on behalf of the firm. The above-stated representations and warranties are made for the purpose of inducing County to enter into this Agreement.

IN WITNESS WHEREOF, County has caused this Agreement to be signed in its name by its duly authorized County Judge, or presiding officer of the Williamson County Commissioners Court in the absence of the County Judge, thereby binding the parties hereto, their successors, assigns and representatives for the faithful and full performance of the terms and provisions hereof. NO OFFICIAL, EMPLOYEE, AGENT, OR REPRESENTATIVE OF THE COUNTY HAS ANY AUTHORITY, EITHER EXPRESS OR IMPLIED, TO AMEND, TERMINATE OR MODIFY THIS AGREEMENT, EXCEPT PURSUANT TO SUCH EXPRESS AUTHORITY AS MAY BE GRANTED BY THE WILLIAMSON COUNTY COMMISSIONERS COURT.

CxP:
NV5 Consultants, Inc.

By: Sean Weida Digitally signed by Sean Weida DN: C=US, E=Sean.Weida@NV5.com, O=NV5, CN=Sean Weida Date: 2025.10.13 11:44:34-04'00'
Signature

Sean Weida
Printed Name

Director of Operations
Title

Date Signed: October 13, 2025

COUNTY:
Williamson County, Texas

By: _____
Signature

_____
Printed Name

_____
Title

Date Signed: _____

EXHIBIT A

SCOPE OF BASIC SERVICES

THE FOLLOWING SCOPE OF SERVICES IS INTENDED TO BE CONSISTENT WITH THE AGREEMENT. TO THE EXTENT THIS SCOPE OF SERVICES IS INCONSISTENT WITH THE AGREEMENT, THE AGREEMENT WILL SUPERSEDE THE SCOPE OF SERVICES AND WILL BE CONTROLLING.

In consideration of the Basic Fee provided in the Agreement, CxP shall perform the following Basic Services, based on standard commissioning practices:

These services may include, but are not limited to developing commissioning plans, reviewing design documents, inspecting and testing systems, verifying performance, training staff, and documenting results as agreed to by County and CxP.

GENERAL REQUIREMENTS

Commissioning Criteria. CxP shall prepare all work in accordance with the latest version of applicable County's Building Commissioning Guideline, procedures, specifications, manuals, guidelines, and standard specifications.

Right-of-Entry and Coordination. CxP shall notify County and secure permission to enter private property to perform any surveying, environmental, engineering or geotechnical activities needed off County property. In pursuance of County's policy with the general public, CxP shall not commit acts which would result in damages to private property, and CxP shall make every effort to comply with the wishes and address the concerns of affected private property owners. CxP shall contact each property owner prior to any entry onto the owner's property and shall request concurrence from County prior to each entry.

CxP shall notify County and coordinate on all controls at project interfaces.

CxP shall review each exhibit necessary for approval by each utility, and other governmental or regulatory agency in compliance with the applicable format and guidelines required by each entity and as approved by County. CxP shall notify County in writing prior to beginning any services on any outside agency's exhibit.

Progress Reporting. CxP shall submit monthly (at a minimum) a progress status e-mail to County Architect Office (CxA) regardless of whether CxP is invoicing for that month.

CxP shall review the design and estimated construction schedule and provide findings in a format reasonably acceptable to County during project phases prior to the Construction Administration Phase. CxP shall schedule milestone submittals per **Exhibit C – Production Schedule**. Contractor shall prepare and maintain a construction schedule in Gantt chart format during the project Construction Administration Phase through the Close-out Phase.

Within **thirty (30) days** of completion of construction of the project, CxP shall review all electronic

closeout files provided by Contractor and A/E in formats reasonably acceptable to County. Within **three hundred (300) days** of completion of construction of the project, CxP shall provide a list of problems or concerns, suggested improvements, and ongoing commissioning plan in formats reasonably acceptable to County.

Final payment is contingent upon County's receipt and confirmation by CxA that the electronic files function and are formatted in accordance with the Agreement and all review comments are addressed.

CxP shall prepare a letter of transmittal to accompany each document submittal to County. At a minimum, the letter of transmittal must include County's project name, Agreement and Work Authorization numbers, as well as facility name and address.

Coordination. CxP shall coordinate issues through County's AO. County will communicate, in writing, resolution of issues and provide CxP direction through County's AO.

Level of Effort. CxP shall base the level of effort at each phase on the prior work developed in earlier phases without unnecessary repetition or re-study.

Quality Assurance (QA) and Quality Control (QC). CxP shall provide peer review at all levels. For each deliverable, CxP shall maintain evidence of CxP's internal review and mark-up of that deliverable as preparation for submittal. When internal mark-ups are requested by County in advance, County, at its sole discretion, may reject the deliverable should CxP fail to provide the evidence of internal mark-ups. CxP shall clearly label each document submitted for quality assurance as an internal mark-up document.

CxP shall perform QA and QC on all consultant products (when applicable to the project) prior to delivery to County. If, during the course of reviewing a submittal, it becomes apparent to County that the submittal contains unreasonable errors, omissions, or inconsistencies, County may cease its review and immediately return the submittal for appropriate action by CxP.

A submittal returned to CxP for this reason is not a submittal for purposes of the submission schedule. Rejected submittals shall neither impact the overall deadline of the Project nor the review period allotted to County officials. CxP shall provide an updated schedule showing interim submission date changes to make-up for any lost time. CxP shall not submit an invoice until County accepts the submittal as reasonably complete.

Naming of Electronic Project Files and Organization of Commissioning Project Folders. CxP shall use succinct and understandable file names including project name, document content, and date created (i.e. "*Project_DOCUMENT_yyyy.mm.dd*"). CxP shall maintain files in an organized folder structure that is readily understandable to outside users to facilitate communication and minimize complications in project close-out.

Referenced Documents. County standardized procedure documents are provided for public reference at the following web address:

https://www.wilcotx.gov/376/Facilities-Management

SCOPE OF WORK:

Williamson County Expo Center
5350 Bill Picket Trail, Taylor, TX 76574
Parks
P648

CxP shall provide a comprehensive commissioning services for the AV system upgrades at the Williamson County Expo Center to ensure all AV systems are designed, installed, and function in accordance with the County's Project Requirements (CPR), and the facility staff are equipped for long-term operation and maintenance.

Areas Covered:

- Expo Hall A
- Expo Hall B
- Pre-function and associated meeting room and conference room
- Concession 1 and Concession 2
- Additional AV tie-in locations

AV Systems to be Commissioned:

- Audio Systems: Amplifiers, microphones, speakers, mixers etc.
- Visual Systems: Projectors, displays, video walls.
- Control Systems: AV automation, touch panels, remote interfaces.
- Networking Infrastructure: AV-over-IP, switches, cabling.
- Power Systems: UPS, surge protection.
- Integration Points: Coordination with lighting, HVAC, and building automation systems
- Infrastructure

Design Phase

1. Review AV design documents and specifications for alignment with CPR.
2. Participate in coordination meeting.
3. Develop the Commissioning Plan and system-specific checklists.

4. Provide feedback to the design team to enhance system performance and maintainability.

Construction Phase

1. Review contractor submittals and AV installation documentation for compliance with design and commissioning requirements.
2. Conduct site inspections and verify installation quality.
3. Witness pre-functional testing performed by the contractor and verify checklist completion.
4. Maintain issue logs and coordinate resolution with contractors and vendors.

Startup and Testing

1. Perform Functional Performance Testing (FPT) for all AV systems to validate operation.
2. Verify system interoperability and responsiveness across AV components.
3. Document deficiencies and track corrective actions until resolution.
4. Review final system configurations and settings for completeness and accuracy.

Acceptance

1. Facilitate training sessions for operations and maintenance staff, ensuring understanding of AV systems.
2. Verify completeness of O&M manuals, system guides, and as-built documentation.
3. Ensure staff readiness for system operation, troubleshooting, and basic maintenance.

Warranty Phase

1. Conduct seasonal testing and performance reviews to assess long-term reliability.
2. Address post-occupancy issues and support system optimization.
3. Assist with warranty claims and coordinate system adjustments as needed.

Roles & Responsibilities

1. CxP: Lead all commissioning activities independently, report directly to County, and ensure transparency and accountability.
2. County: Provide access, project requirements, and receive final deliverables.
3. Design Team: Collaborate during design review and respond to commissioning feedback.
4. Contractors: Execute installation and testing per commissioning requirements.

Deliverables

1. Commissioning Plan
2. Functional Performance Test Reports
3. Issue Logs and Resolution Tracking
4. Training Materials and Attendance Records
5. Final Commissioning Report

Commissioning services shall be conducted in phases as outlined herein. Phases may be combined to expedite commissioning process when defined in **Exhibit C – Production Schedule**. Individual phases or groups of phases shall be authorized herein or by fully executed Supplemental Agreement.

Phase I - PROJECT REQUIREMENTS

Upon receipt of written Notice to Proceed, CxP shall accomplish the following:

A. Investigate site/facility and verify known or existing conditions in occupied and existing buildings.

B. Clearly define Owner's Performance Requirements (OPR).

C. Develop and provide a comprehensive commissioning plan outlining the procedures, timelines, and responsibilities for each phase of the process.

D. Review International Building Code (IBC), ASHRAE 90.1, ASHRAE 62.1, International Mechanical Code (IMC), National Electric Code (NEC), International Energy Conservation Code (IECC), and any other applicable codes and ordinances.

E. Advise County of any changes, additions, or corrections to the preliminary program, plans, specifications, and budget.

F. Provide reports in accordance with County's Commissioning Guide.

Phase II - DESIGN PHASE COMMISSIONING

Upon County acceptance of previous phase, CxP shall proceed with the following:

A. Review project requirements and preliminary design documents, including modification of specifications regarding commissioning.

B. Review plans and specifications, which indicate materials, construction methods and buildings systems. These building systems may include (but are not limited to) structural, mechanical, plumbing, and electrical.

C. Review design documents at 30%, 60%, and 90%. Verify that the construction meets the design specifications and the commissioning plan.

D. Review complete plans, specifications and engineering calculations setting forth in detail the work required for the architectural, structural, civil, mechanical, plumbing, electrical, landscaping and irrigation, and site work.

E. Provide deliverables in accordance with County's Commissioning Gude.

Phase III - CONSTRUCTION PHASE COMMISSIONING

Upon County acceptance of previous phase, CxP shall proceed with the following:

A. Review submittals with County, including site observations and witnessing installation of critical systems.

B. Develop checklists for equipment and functional testing requirements based on approved submittals.

C. Review RFI and change order logs and submittals. Report deficiencies to County.

D. Consult freely with County concerning the principal phases of the work and immediately advise County of any unusual requirements or features not apparent during execution of the design phases.

E. Verify pre-functional checklists are completed to identify potential issues or discrepancies.

F. Provide deliverables in accordance with County's Commissioning Guide.

Phase IV – STARTUP AND TESTING

Upon County acceptance of previous phase, CxP shall proceed with the following:

A. Perform functional tests to ensure system operating as designed, including test and balance verification. Static inspection (field verification) of components and systems

B. Collaborate with County, design team and contractor to address any systems not performing as designed.

C. Provide deliverables in accordance with County's Commissioning Guide.

Phase V – ACCEPTANCE

Upon County acceptance of previous phase, CxP shall proceed with the following:

A. Review with County initial functional performance testing, integrated functional performance testing (performance verification), deficiency resolution tracking. Review as-built drawings for completeness.

B. Prepare comprehensive report documenting the entire processing, including test

results, findings, and recommendations.

C. Maintain thorough documentation throughout the process, including checklists, reports, and training materials.

D. Review O&M manuals and systems manuals

E. Deliver commissioning report

F. Review warranties and plan for seasonal testing:

a. Review outstanding issues

b. Review building optimization needs

c. Determine required deferred testing

d. Develop lessons learned presentation/ report

G. Accompany County on Substantial Completion Inspection with appropriate staff and affiliates. Prepare a punch list of items needing correction. After Contractor has performed the required corrections, notify County in writing that the contract has been performed in general conformance with the plans and specifications and is ready for Final Inspection.

H. Provide deliverables in accordance with County's Commissioning Guide.

Phase VI – WARRANTY PHASE

Upon County acceptance of previous phase, CxP shall perform the following services:

A. Conduct site visits with personnel technically qualified by education and experience to competently observe relevant aspects of construction. Make necessary observations to determine if workmanship and quality of materials generally conform to the plans and specifications, and that provisions of the contract are complied with.

B. Collaborate with County, design team and contractor to ensure the equipment, material, and workmanship meets the specifications.

C. Review warranties, guarantees, bonds, equipment operating instructions, and similar deliverables to verify receipt, and general conformance to requirements of the OPR.

D. Perform opposite season testing events. Opposite season testing to be determined.

E. Accompany County on Warranty Inspection to determine if project is meeting County's original County's Performance Requirements (OPR) and that all supplier and manufacturer warranties remain in force.

F. Provide deliverables in accordance with County's Commissioning Guide.

EXHIBIT B
FEE SCHEDULE

This schedule indicates fees by Phase of the Basic Fee:

		$	**45,750**	100%
100%	**NV5**	**$**	**45,750**	
Phase I - PROJECT REQUIREMENTS		**$**	**-**	0%
	NV5	$	-	
Phase II - DESIGN PHASE COMMISSIONING		**$**	**12,860**	28%
	NV5	$	12,860	
Phase III - CONSTRUCTION PHASE COMMISSIONING		**$**	**11,400**	25%
	NV5	$	11,400	
Phase IV - STARTUP AND TESTING		**$**	**11,050**	24%
	NV5	$	11,050	
Phase V - ACCEPTANCE		**$**	**4,700**	10%
	NV5	$	4,700	
Phase VI - WARRANTY PHASE		**$**	**5,740**	13%
	NV5	$	5,740	

EXHIBIT C

PRODUCTION SCHEDULE

CxP agrees to complete the professional design services called for in **Exhibit A** of this Agreement within **Six Hundred Forty (640) calendar days** from the date of this Agreement.

The above time limits may, for good cause, be extended, in writing, by County as the Project proceeds.

The schedule below indicates various project milestones and target dates. Standard end-of-phase review periods for County shall be (21) calendar days.

Agreement Execution Date	**10/21/25**

Phase I - PROJECT REQUIREMENTS

Provide OPR (County's Performance Requirements)	11/20/25
Provide comprehensive commissioning plan	12/04/25
County written authorization to proceed to next phase	12/18/25

Phase II - DESIGN PHASE COMMISSIONING

Develop pre-functional checklists for equipment/testing requirements	01/05/26
Review project requirements and preliminary design documents	01/12/26
Review 100% design documents	01/19/26
County written authorization to proceed to next phase	01/26/26

Phase III - CONSTRUCTION PHASE COMMISSIONING

Start of submittal reviews	01/05/26
Verify pre-functional checkslists are completed	02/11/26
County written authorization to proceed to next phase	02/25/26

Phase IV -STARTUP AND TESTING

Perform functional testing, including test and balance verification	03/27/26
Review the completed Testing Reports	04/03/26
County written authorization to proceed to next phase	04/10/26

Phase V - ACCEPTANCE

Review performance testing and as-built drawings	04/17/26
Review O&M manuals and system manuals	05/01/26
Provide comprehensive report	05/15/26
Conduct Substantial Completion inspection	05/29/26
Conduct Final Completion inspection	06/26/26

Phase VI - WARRANTY PHASE

Review documents for conformance to the OPR.	04/25/27
Complete opposite season testing events.	05/28/27
Conduct One-year Warranty inspection.	06/25/27

Update the Final Cx Report to incorporate findings/activities

All services shall be complete on, or before: **07/23/27**

EXHIBIT D

Williamson County
Vendor Reimbursement Policy

The purpose of this Williamson County Vendor Reimbursement Policy ("Policy") is to provide clear guidelines to vendors on Williamson County's expectations and requirements regarding allowable reimbursable expenditures and required backup. The Policy will also minimize conflicts related to invoice payments and define non-reimbursable items. This Policy is considered a guideline and is not a contract.

This Policy may be altered, deleted or amended, at any time and without prior notice to vendors, by action of the Williamson County Commissioners Court. Unenforceable provisions of this Policy, as imposed by applicable law, regulations, or judicial decisions, shall be deemed to be deleted. Any revisions to this Policy will be distributed to all current vendors doing business with the County.

1. Invoices and Affidavits

1.1 Invoices must adequately describe the goods or services provided to County and include all required backup (i.e. reimbursable expenses, mileage log, timesheets, receipts detailing expenses incurred etc.) that is in a form acceptable to the Williamson County Auditor. Invoices that do not adequately describe the goods or services provided to County or contain backup that is satisfactory to the Williamson County Auditor will be returned to vendor for revisions and the provision above relating to invoice errors resolved in favor of the County shall control as to the required actions of vendor and when such invoice must be paid by the County.

1.2 In the event an invoice includes charges based upon hourly billing rates for services or any other rates based upon the amount of time worked by an individual or individuals in performing services, whether the charges are being billed directly to the County or whether they are the basis of invoices from subcontractors for which the vendor seeks reimbursement from the County, the charges shall be accompanied by an affidavit signed by an officer or principal of the vendor certifying that the work was performed, it was authorized by the County and that all information contained in the invoice that is being submitted is true and correct.

1.3 Upon County's request, vendor must submit all bills paid affidavits wherein vendor must swear and affirm that vendor has paid each of its subcontractors, laborers, suppliers and material in full for all labor and materials provided to vendor for or in connection with services and work performed for County and, further, vendor must swear and affirm that vendor is not aware of any unpaid bills, claims, demands, or causes of action by any of its subcontractors, laborers, suppliers, or material for or in connection with the furnishing of labor or materials, or both, for services and work performed for County.

2. Travel Reimbursement

2.1 The County will only cover costs associated with travel for vendors outside a 45-mile radius from the Williamson County Courthouse, 710 Main Street, Georgetown, Texas 78626.

2.2 The County will only cover costs associated with travel as documented work for County. If a vendor is also doing business for another client, the travel costs must be split in proportion to the amount of work actually performed for the County and the other client. The only allowable travel expense will be for the specific days worked for Williamson County.

2.3 No advance payments will be made to vendor for travel expenditures. The travel expenditure may only be reimbursed after the expenditure/trip has already occurred and vendor has provided the Williamson County Auditor with all necessary and required backup.

2.4 Vendors must submit all travel reimbursement requests on each employee in full. Specifically, a travel reimbursement request must include all related travel reimbursement expenses relating to a particular trip for which vendor seeks reimbursement. Partial travel reimbursement requests will not be accepted (i.e. vendor should not submit hotel and mileage one month then the next month submit rental car and airfare). If the travel reimbursement appears incomplete, the invoice will be sent back to the vendor to be submitted when all information is ready to submit in full.

2.5 Reimbursement for transportation costs will be at the most reasonable means of transportation (i.e.: airline costs will be reimbursed for coach rate, rental car costs will only be reimbursed if rental car travel was most reasonable means of travel as compared to travel by air).

2.6 The County will not be responsible for, nor will the County reimburse additional charges due to personal preference or personal convenience of individual traveling.

2.7 The County will not reimburse airfare costs if airfare costs were higher than costs of mileage reimbursement.

2.8 Additional expenses associated with travel that is extended to save costs (i.e. Saturday night stay) may be reimbursed if costs of airfare would be less than the cost of additional expenses (lodging, meals, car rental, mileage) if the trip had not been extended. Documentation satisfactory to the Williamson County Auditor will be required to justify expenditure.

2.9 County will only reimburse travel expense to necessary personnel of the vendor (i.e. no spouse, friends or family members).

2.10 Except as otherwise set forth herein, a vendor must provide a paid receipt for all expenses. If a receipt cannot be obtained, a written sworn statement of the expense from the vendor may be substituted for the receipt.

2.11 Sales tax for meals and hotel stays are the only sales taxes that will be reimbursed. Sales tax on goods purchased will not be reimbursed. A sales tax exemption form is available from the Williamson County Auditor's Office upon request.

2.12 The County will not pay for any late charges on reimbursable items. It is the responsibility of the vendor to pay the invoice first and seek reimbursement from the County.

3. Meals

3.1 Meal reimbursements are limited to a maximum of $59.00 per day on overnight travel. On day travel (travel that does not require an overnight stay), meal reimbursements are limited to a maximum of $25.00 per day. The travel must be outside the Williamson County Courthouse, 710 Main Street, Georgetown, Texas 78626 by a 45-mile radius.

3.2 Receipts are required on meal reimbursement amounts up to the maximum per day amount stated for overnight or day travel. If receipts are not presented, the vendor can request per diem (per diem limits refer to 3.2). However, a vendor cannot combine per diem and meal receipts. Only one method shall be allowed.

3.3 Meals are reimbursable only to vendors who do not have necessary personnel located within a 45-mile radius of the Williamson County Courthouse, 710 Main Street, Georgetown, Texas 78626, who are capable of carrying the vendor's obligations to the County. Meals will not be reimbursed to vendors who are located within a 45-mile radius of the Williamson County Courthouse.

3.4 County will not reimburse for alcoholic beverages.

3.5 Tips are reimbursable but must be reasonable to limitation of meal allowance

3.6 No meals purchased for entertainment purposes will be allowed.

3.7 Meal reimbursement must be substantiated with a hotel receipt.

4. Lodging

4.1 Hotel accommodations require an itemized hotel folio as a receipt. The lodging receipt should include name of the motel/hotel, number of occupant(s), goods or services for each individual charge (room rental, food, tax, etc.) and the name of the occupant(s). Credit card receipts or any other form of receipt are not acceptable.

4.2 Vendors will be reimbursed for a single room rate charge plus any applicable tax. If a single room is not available, the vendor must provide documentation to prove that a single room was not available in order to justify the expense over and above the single room rate. A vendor may also be required to provide additional documentation if a particular room rate appears to be excessive.

4.3 Personal telephone charges, whether local or long distance, will not be reimbursed.

5. Airfare

5.1 The County will only reimburse up to a coach price fare for air travel.

5.2 The County will exclude any additional charges due to personal preference or personal convenience of the individual traveling (i.e. seat preference charges, airline upgrades, etc. will not be an allowable reimbursement)

5.3 Air travel expenses must be supported with receipt copy of an airline ticket or an itinerary with actual ticket price paid. If tickets are purchased through a website, vendor must submit a copy of the webpage showing the ticket price if no paper ticket was issued.

5.4 Cancellation and/or change flight fees may be reimbursed by the County but vendor must provide the Williamson County Auditor with documentation in writing from a County department head providing authorization for the change.

5.5 The County will not reimburse vendor for tickets purchased with frequent flyer miles.

6. Car Rental

6.1 Vendors that must travel may rent a car at their destination when it is less expensive than other transportation such as taxis, airport shuttles or public transportation such as buses or subways.

6.2 Cars rented must be economy or mid-size. Luxury vehicle rentals will not be reimbursed. Any rental costs over and above the cost of a mid-size rental will be adjusted.

6.3 Vendors will be reimbursed for rental cars if the rental car cost would have been less than the mileage reimbursement cost (based on the distance from vendor's point of origin to Williamson County, Texas) had the vendor driven vendor's car.

6.4 Vendors must return a car rental with appropriate fuel levels as required by rental agreement to avoid the car rental company from adding fuel charges.

6.5 Rental agreement and credit card receipt must be provided to County as back up for the request for reimbursement.

6.6 Insurance purchased when renting vehicle may also be reimbursed.

6.7 Car Rental optional extras such as GPS, roadside assistance, and administrative fees on Tolls will not be reimbursed.

7. Personal Car Usage

7.1 Personal vehicle usage will be reimbursed in an amount equal to the standard mileage rate allowed by the IRS.

7.2 Per code of Federal Regulations, Title 26, Subtitle A, Chapter 1, Subchapter B, Part IX, Section 274(d), all expense reimbursement requests must include the following:

7.2.1.1 Date

7.2.1.2 Destination

7.2.1.3 Purpose

7.2.1.4 Name of traveler(s)
7.2.1.5 Correspondence that verifies business purpose of the expense

7.3 The mileage for a personal vehicle must document the date, location of travel to/from, number of miles traveled and purpose of trip.

7.4 Mileage will be reimbursed on the basis of the most commonly used route.

7.5 Reimbursement for mileage shall not exceed the cost of a round trip coach airfare.

7.6 Reimbursement for mileage shall be prohibited between place of residence and usual place of work.

7.7 Mileage should be calculated from employee's regular place of work or their residence, whichever is the shorter distance when traveling to a meeting or traveling to Williamson County, Texas for vendors who are located outside of the Williamson County Courthouse, 710 Main Street, Georgetown, Texas 78626 by at least a 45-mile radius.

7.8 When more than one person travels in same vehicle, only one person may claim mileage reimbursement.

7.9 Tolls, if reasonable, are reimbursable. Receipts are required for reimbursement. If a receipt is not obtainable, then written documentation of expense must be submitted for reimbursement (administrative fees on Tolls will not be reimbursed).

7.10 Parking fees, if reasonable are reimbursable for meetings and hotel stays. For vendors who contract with a third party for visitor parking at vendor's place of business, Williamson County will not reimburse a vendor based on a percentage of its contracted visitor parking fees. Rather, Williamson County will reimburse Vendor for visitor parking on an individual basis for each time a visitor uses Vendor's visitor parking. Receipts are required for reimbursement. If a receipt is not obtainable, then written documentation of expense must be submitted for reimbursement.

7.11 Operating and maintenance expenses as well as other personal expenses, such as parking tickets, traffic violations, and car repairs and collision damage are not reimbursable.

8. Other Expenses

8.1 Taxi fare, bus tickets, conference registrations, parking, etc. must have a proper original receipt.

9. Repayment of Non-reimbursable Expense.

Vendors must, upon demand, immediately repay County for all inappropriately reimbursed expenses whenever an audit or subsequent review of any expense reimbursement documentation finds that such expense was reimbursed contrary to these guidelines and this Policy. Williamson County reserves the right to retain any amounts that are due or that become due to a vendor in order to collect any inappropriately reimbursed expenses that a vendor was paid.

10. Non-Reimbursable Expenses

In addition to the non-reimbursable items set forth above in this Policy, the following is a non-exhaustive list of expenses that will not be reimbursed by Williamson County:

10.1 Alcoholic beverages/tobacco products
10.2 Personal phone calls
10.3 Laundry service
10.4 Valet service (excludes hotel valet)
10.5 Movie rentals
10.6 Damage to personal items
10.7 Flowers/plants

10.8 Greeting cards
10.9 Fines and/or penalties
10.10 Entertainment, personal clothing, personal sundries and services
10.11 Transportation/mileage to places of entertainment or similar personal activities
10.12 Upgrades to airfare, hotel and/or car rental
10.13 Airport parking above the most affordable rate available
10.14 Excessive weight baggage fees or cost associated with more than two airline bags
10.15 Auto repairs
10.16 Babysitter fees, kennel costs, pet or house-sitting fees
10.17 Saunas, massages or exercise facilities
10.18 Credit card delinquency fees or service fees
10.19 Doctor bills, prescription and other medical services
10.20 Hand tools
10.21 Safety Equipment (hard hats, safety vests, etc.)
10.22 Office Supplies
10.23 Lifetime memberships to any association
10.24 Donations to other entities
10.25 Any items that could be construed as campaigning
10.26 Technology Fees
10.27 Sales tax on goods purchased
10.28 Any other expenses which Williamson County deems, in its sole discretion, to be inappropriate or unnecessary expenditures.

EXHIBIT E
DEBARMENT CERTIFICATION

STATE OF TEXAS §
§
COUNTY OF WILLIAMSON §

1. I, the undersigned, being duly sworn or under penalty of perjury under the laws of the United States and the State of Texas, certifies that A/E and its principals:

    a. Are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from covered transactions by any federal department or agency:

    b. Have not, within a three-year period preceding this proposal, been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public* transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

    c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity* with commission of any of the offenses enumerated in **Paragraph 1(b)** of this certification;

    d. Have not, within a three-year period preceding this application/proposal, had one or more public transactions* terminated for cause or default; and

    e. Have not been disciplined or issued a formal reprimand by any State agency for professional accreditation within the past three years.

NV5 Consultants, Inc.

Sean Weida Digitally signed by Sean Weida DN: C=US, E=Sean.Weida@NV5.com, O=NV5, CN=Sean Weida Date: 2025.10.13 11:47:21-04'00'

Signature of Certifying Official

Sean Weida

Printed Name of Certifying Official

Director of Operations

Title of Certifying Official

October 13, 2025

Date

2. Where the PROVIDER is unable to certify to any of the statements in this certification, such PROVIDER shall attach an explanation to this certification.

* federal, state, or local

SUBSCRIBED and sworn to before me, the undersigned authority, by _____
Signatory Name

the _____ of _____, on behalf of said firm.
Signatory Title Entity Name

_____
Notary Public in and for the
State of Texas

My commission expires: _____

EXHIBIT F

CERTIFICATES OF INSURANCE

CxP and Subconsultant Certificates of Insurance attached:

Building Commissioning Guideline, Volume 1.1
July 21, 2023

Wilco Facilities Commissioning Guideline Final Version

FOREWORD

The commissioning process is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems and assemblies meets defined objectives and criteria. The commissioning process begins at project inception and continues for the life of the facility through the occupancy and operational phases. Because this guideline details a process, it can be applied to both new and renovation projects.

The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the Owner's Performance Requirements (OPR). This guideline in concert with our Division 1, 15 and 16 commissioning specifications as well as our Building Closeout and Transition Program describes the overall commissioning process in order to provide a uniform, integrated, and consistent approach for delivering and operating facilities that meet Facilities' ongoing requirements.

This edition of the Recommended Guidelines for Facilities Building Commissioning is intended to assist Facilities project managers during the development and implementation of the commissioning process. It is anticipated that, once the principles stated herein have been tested, updates to the guidelines will be necessary. Comments or suggestions on how to improve this document and the quality of facilities at Williamson County Facilities would be greatly appreciated. Please send all comments to the Commissioning Program Manager at the Facilities in Georgetown, Texas.

TABLE OF CONTENTS

Table of Contents

EXECUTIVE SUMMARY

Commissioning is a planned, collaborative, and systematic process of review, testing and documentation collection conducted to confirm that a structure and its subsystems perform as designed and as expected by the building occupant. In most cases, this procedure takes place during the entire project, from planning through final acceptance of the building. Commissioning has been shown to improve building quality in thousands of major projects nationwide. Commissioning (more specifically the commissioning authority) should not be confused with project management or construction management (project manager (PM) and/or construction management (CM)). A project manager is the person assigned responsibility and accountability for the project. This person is responsible for delivering the project in the agreed schedule, to the correct technical specifications, i.e. defined to meet user requirements, and within the approved budget and other specified criteria, e.g. key performance indicators[1].

Construction management is a professional service that applies management techniques to the planning, design and construction of a project from inception to completion for the purpose of controlling time, cost and quality. PM's and CM's share a commonality which focuses resources on time, cost and schedule. Commissioning, in contrast, focuses on the overall quality, operability and completion of the project using the KPI and Owner's project requirements as a basis for the success criteria.

Facilities has opted for three methodologies in the delivery of commissioning services all of which are based on the implementation of the Facilities Cx Guideline and program:

1 Internal staff resources provide all commissioning necessary for small to mid size projects and retrofits.
2 Independent commissioning authorities contracted by Facilities for large or mission critical projects where Facilities internal resources cannot commit or fulfill the necessary time requirements for the successful completion of commissioning task.
3 Collaborative approach in which Facilities internal staff will act as the CxA project manager and coordinate a team of individual contract designees or internal staff to fulfill the commissioning program requirements.

Regardless of the methodology, the CxA (Commissioning Authority) should be chosen based on experience and in a manner similar to consulting engineers and architects where experience, resources, skills and the required amount of availability and flexibility are appropriately addressed.

[1]The Key Performance Indicators (KPI) determined at the beginning of the project, reflect directly on the key objectives (goals) of the project and provide the basis for project management trade-off decisions during the course of the project. At the completion of the project these KPI's will be the most relevant measures to confirm the acceptability of the project and its product by the project's stakeholders as being successful. The KPI's will also be documented in a Williamson County Facilities Management Central database to continually evaluate building metrics, value and lifecycle cost benefits (Location TBD).

Facilities Factors Supporting the Need for Building Commissioning
■ Unclear Owner's Performance Requirement (OPR) ■ Complex building systems ■ Increased specialization without integration ■ Unclear standards and criteria for gauging system performance ■ Lack of functional performance testing ■ Conflicts between specifications and applicable codes ■ Conflicts between program management and long term operability ■ Inadequate system documentation ■ Current maintainability and accessibility problems ■ Inadequate provision for maintenance, O&M manuals and training ■ Numerous change orders and cost overruns ■ Unfinished systems at project completion ■ Poor quality of design and installation ■ Lack of records including change order authorization and agreements to reduce scope ■ Current reality of significant unbudgeted time for follow-up to remedy errors and omissions using operating budgets ■ Facilities PMs overworked ■ Potential lack of OEM at project turnover ■ Typically no construction manager on the job ■ Lack of appropriate resources to develop, implement and perform necessary quality assurance programs.
Sources: U.S. General Services Administration Building Commissioning Guide, July 2003, Facilities Initial Project Evaluation October 5, 2006

It is anticipated that the Facilities commissioning program will be available for all projects as a resource and management tool. The Facilities Commissioning Program team will/can provide all materials and resources necessary for the announcement, review and selection of an outside third party commissioning firm. The Facilities Commissioning Program team can also manage the commissioning process by providing actual commissioning services or by ensuring that contracted independent commissioning firms are fulfilling their contractual obligations. Facilities PMs should look for a staff that includes both professional engineers and experienced technicians when awarding projects to CxA firms until such time as the release of this program. One should also expect commissioning

service providers to participate in the national commissioning community through conferences, continuing education, and as participants in national peer organizations.

All building programs at Facilities will require commissioning for at least the mechanical, life safety, and electrical portions of the project. As Key Performance Indicators are evaluated, commissioning may expand to a total building function. The determination of whether to use an independent or internal staff commissioning provider should be evaluated using this simple criteria:

Use of an independent third party commissioning provider is considered standard procedure for all new building projects.

Use of the collaborative program should be considered when the complexity of the project or the time commitments couldn't be completely fulfilled by Facilities' internal staff or in situations in which multiple remodel projects are being assigned to one Facilities internal staff to manage the commissioning aspects.

Program managers should anticipate a budget between .75 percent to 3.0 percent of the new building construction for total building commissioning. If only select systems are to be commissioned, then the recommendation is to budget an average of 3.0 percent of the system component cost for commissioning of that system. These fees are exclusive of travel, videotaping, testing-adjusting and balancing (TAB) work, and extra certifications beyond occupancy. If 3.0 percent of the new building construction is less than $3.5k and the project will require third party commissioning, it is recommended to use the estimate of $3.5K amount due to a minimum amount of time needed to perform the commissioning process.

While the cost of commissioning constitutes only a very small part of the cost of the initial construction process, it has been shown to be a significant, positive contributor to the economical construction and maintenance of the facility for years to come. In a recent study conducted for the U.S. Department of Energy, the cost of commissioning was actually determined to be a negative number for the Owner. The expected first cost increase for these services actually lowered the entire first cost of the project. Metrics below do not reflect the additional long-term operational savings

COMMISSIONING METRICS (These Numbers need to be revised)
U.S. DOE
Cross Section of Building Types (Administrative, Data Center, Production, Research)

Project Types	Average Total Cost of Construction (millions)	Average Square Feet (thousands)	Average # of Deficiencies Discovered	Average Commissioning Cost	Net Cost Cx Cost-Cost of corrections prior to turn over.
Project "A" Type	$14	36	622	$155,000	-$128,960
Project "B" Type	$48.6	360	528	$265,000	-$162,925
Project "C" Type	$10	55	650	$168,000	-$396,875
Project "D" Type	$10.1	52	473	$123,000	-$202,527

SECTION 1 - WHAT IS COMMISSIONING?

Simply stated, commissioning is the process of making sure a building works as intended. A more complete definition is:

> **"Systematic process of assuring by verification and documentation, from the design phase to minimum of one year after construction, that all facility systems perform interactively in accordance with the design documentation and intent, and in accordance with the Owner's requirements, including preparation of operation personnel"** [2]

Let us take a closer look at this definition:

Commissioning is *systematic*. Benefits from commissioning can be achieved no matter when the process starts. The earlier one begins the process of commissioning, the greater the potential benefits are. The maximum benefit will be achieved when commissioning is a part of the project from the very start. Furthermore, commissioning must be *integrated* into the project, meaning that commissioning is made integral to every stage of the project: design, construction, acceptance, and post occupancy (warranty).

The factors of *planning* and *integration* are two key points that set commissioning apart from traditional construction quality assurance processes. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[3], a leader in HVAC issues, offers several resources that are helpful for becoming acquainted with commissioning for mechanical systems. Another important resource for learning about commissioning is the Facilities Online Commissioning resource tool (www.Facilitiesxxx.Facilities.com) that provides a self-paced course on Facilities commissioning standards, resources and programs.

Historically, the term "commissioning" has referred to the process by which the heating, ventilation and air conditioning (HVAC) systems of a building were tested and balanced according to established standards prior to acceptance by the building Owner. Facilities, however, recognizes that the use of commissioning is key for the integrated nature of all building systems performance that impact our sustainability, workplace productivity and security. Because all building systems are integrated, a deficiency in one or more components can result in sub-optimal operation and performance among other components. Remedying these deficiencies can result in a variety of benefits including:

[2] GSA Guideline "Building Commissioning"

[3] ASHRAE can be contacted in Atlanta, GA at 404-636-8400 or e-mailed at edu@ashrae.org. The ASHRAE web site can be accessed at www.ASHRAE.org.

- Lower utility bills through energy savings
- Improved environmental/health conditions and occupant comfort
- Improved system and equipment function
- Improved building operation and maintenance
- Better building documentation
- Shortened occupancy transition
- Significant extension of equipment/system life cycle
- Reduced construction cost
- Increased reliability of building systems
- Improved building occupant productivity
- INCREASED BOTTOM LINE PROFITIABILITY

This highly integrated approach has been adopted by the National Institute of Building Sciences (NIBS), General Services Administration (GSA), Department of Energy (DOE), Department of the Navy, and many other federal, public and private entities. According to the GSA,[4] the largest owner and operator of buildings in the United States, commissioning will become business as usual due to the tremendous benefits it bestows upon the projects. Furthermore, total building commissioning is the Public Buildings Service process for quality assurance in new construction and facility modernization. "It is the process for achieving, validating and documenting that the performance of the total building and its systems meet the design needs and requirements of the Owner."

1.1 Planned and Integrated Commissioning is Crucial

Using the Facilities commissioning process during the design phase does not significantly change the way the design firms do business or the way we should manage our projects. It provides the design firm with additional information they need to do their job, requires that they document all assumptions, and that they submit quality design products. In essence, it requires them to fulfill their contract obligations to us!

Each design option developed by the design team must be linked back to the OPR (Owner's Performance Requirement) document. When a specific OPR cannot be met, that situation should be identified and the reason given as to why it cannot be met. The project team then evaluates the design options on their ability to meet the OPR as a whole. Tradeoffs are made based on cost, risk, schedule or other considerations, and the OPR is updated to reflect the decisions made.

[4] GSA publication "*GSA Guide to Building Commissioning"*

The process of selecting each design option is critical in that the designers are working as part of the project team to hone the shape, size, and type of facility and components to meet the OPR. Sufficient time must be spent during this step to ensure that all questions and concerns have been addressed and agreed to by the project team. Mistakes that are not caught during this step have repercussions throughout the life of the facility.

The implementation of commissioning during design is important because of several key services and benefits that the process provides to us including:

Commissioning Benefits During Design Phase
■ Early introduction to the commissioning plan avoids exposing team members to unexpected reviews and service requirements during the course of the project. ■ The CxA should confirm that the Owner's Performance Requirement (OPR) is complete during design phase. If not complete, the CxA should develop the initial OPR document that will be turned over to the A/E team so that the Basis of Design (BoD) can be developed. The OPR document is described in more detail later in this paper. ■ The CxA contributes to the documentation of the Basis of Design (BoD) in several ways. Once the designers begin submitting their BoD information, the CxA must review the information to verify that it is a quality effort and to help reduce the occurrence of omissions. Next, as a part of the design review, the CxA must also compare the BoD information supplied by the designers with the OPR, to verify that the design does not violate the Owner's requirements. ■ The CxA should check the construction plans and specifications during the pre-bid phase to confirm that the documents include provisions for commissioning, including systems testing and sequence of operation verification. ■ The CxA should provide the requirements for commissioning in the specifications so that the general contractor is aware of their responsibilities prior to submitting a bid. ■ The CxA's presence at pre-bid and preconstruction conferences should further acquaint construction personnel with the commissioning process and draw the constructor(s) into the project team. ■ The CxA should document any changes that are made to the BoD, and identify them to other members of the design team so that the design team can insure the coordination of the drawings and specifications. ■ The CxA can aid the designers by supplying a consistent format for guidance, which is likely to be very valuable to designers new to the BoD and the commissioning process.

1.2 Commissioning is Collaborative, Systematic, and Documented

Commissioning is *collaborative*. It is a team process from the very beginning. *One of the most important responsibilities of the CxA is team formation and the development of an accepted and standardized communications protocol.* The experienced commissioning professional verifies that quality is included in the project from start to finish by creating a heightened respect for quality within the team. To be sure, there is a certain amount of error identification, both in design and construction; but mainly, quality is built in, not inspected in!

Commissioning is *systematic*. Commissioning includes testing all items in all modes of operation. Equipment is first inspected in a static condition to assure it is installed correctly **(Field Verification)**. Moving equipment is then started up and electrical equipment energized for the first time under controlled conditions **(Functional Verification)**. After equipment is started up, systems of equipment are tested running together to prove that the system as a whole will operate as required **(Performance Verification)**.

Systematic refers to the commissioning building blocks of review, inspection, startup, and testing. It also refers to the "systems" nature of modern buildings. The commissioning process is organized by system components, including air handling units, pumps, boilers, chillers, water treatment, fire alarms, smoke evacuation, door locks, roofs, and walls. Grouping the building into subsystems makes it easier to understand how the building works and provides a framework for commissioning.

Commissioning is *documented.* The value of commissioning remains long after the building is accepted and turned over to the O&M staff. In the course of commissioning, key parameters of the systems are documented, organized, and preserved in the commissioning report. Not the least of these items is the OPR. The commissioning report records the intended use of the building and its various spaces so that if operation and maintenance personnel change, O&M staff will be able to understand why things work the way they do.

The review and approval of the O&M manual and the organization of the training program are also assigned to the CxA. This further insures that the tools required for future correct building operation are provided for Facilities' operational staff by the time of the completion of the project.

SECTION 2 - WHY COMMISSION?

There are two main benefits of commissioning:

- Facilities can have assurance of a correctly operating building at completion.
- Facilities can have a basis for confidence in continued correct operation due to documentation and staff training.

Recent studies conducted by Department of Energy indicate that on average the operating costs of a commissioned building range from 8% to 20% below that of a non–commissioned building. Certain available commissioning implementation tools, such as energy modeling and verification, may even result in a negative capital investment cost. Facilities' goal in adopting building commissioning is:

- To safeguard our building interest, by implementing solutions that best represent and meet the long term efficiency and functionality of all buildings and meet the expectations of our customers
- To improve facility operations
- To optimize the value received for each construction dollar spent
- To improve Indoor Air Quality (IAQ) and decrease liability due to IAQ problems
- To reduce unnecessary energy consumption
- To increase the productivity of our employees

To better understand these benefits, consider the increase in the complexity of building components over the past three decades. A greater increase in the complexity of building components has come about in the last thirty years than in the 200 years before. Thirty years ago, buildings operated by microprocessors were a novelty. Now nearly all buildings are operated by a Building Automation System (BAS) and large research facilities may have hundreds of microprocessors controlling everything from lights and comfort to the safety and security needs of the occupants. The same is true regarding automatic valves, actuators, solid-state sensors, occupancy sensors, CO_2 sensors, variable frequency drives, pure water systems, fume hoods, biological hoods, and other modern appurtenances.

Consider the increasing use of technology to meet the demands of safety and efficiency. The energy crisis of the 1970s brought about a huge increase in America's energy consciousness. This is reflected today in building codes as well as design standards. Buildings must operate at a higher level of efficiency than they did thirty years ago. They attain this level of efficiency largely by using the sophisticated components described above, coupled with complex computerized building operating strategies.

Benefits of Commissioning for Facilities

- Reduce change orders
- Reduce project delays
- Enforce start-up requirements
- Shorten building turnover period
- Reduce post-occupancy corrective work
- Minimize effects of design defects
- Improve indoor environment and employee productivity
- Increase building maintainability and reliability
- Reduce energy and operating costs
- Increase value through better quality construction
- Enhance move in experience of our customers
- Reduce overall cost of new building delivery
- Provide market awareness of sustainable efforts at Facilities

Consider also the increase in the use of new materials over the past two decades. New materials have been incorporated into wall finishes, insulation, carpet, ceiling tiles, window coverings, office equipment, furniture, paper, books, cleaning agents, and almost every other item to be found in the modern workplace. All these items either cost less or provide better service. Some do both. Unfortunately, many of them contain untested chemicals that deteriorate the building air quality and cause allergic reactions for some workers unless a building's HVAC systems are operating correctly.

Top Deficiencies Discovered in Facilities' New and Existing Buildings

- Incorrect scheduling of HVAC and day lighting systems
- Incorrect heating and cooling sequence of operations
- Incorrect calibration of sensors and instrumentation
- Lack of control strategies for optimum comfort and efficient operation
- Malfunctioning air- and water-side economizers
- Under-utilized computer-based control systems
- Short-cycling of HVAC equipment leading to premature failure
- Lack of design intent and building documentation
- Lack of training for building operators or service contractors
- Missing specified and paid-for equipment
- Lack of uniform building deficiency tracking
- Occupancy determined by schedule not functionality
- Lack of turnover standards and documentation
- No warranty documentation
- No design intent determined for buildings
- No measurable KPI's
- Meeting OPR can take years
- Lack warranty troubleshooting procedures and standards
- Lack standards of review for controls and points prior to acceptance
- Lack of acceptance program
- No energy consumption tracking or verification program
- Lack of consistent O&M training program
- Lack of clearly defined roles of all parties and their responsibilities

2.1 Commissioning for Maintenance

In the same way that engineering fees have remained relatively fixed, funding for maintenance and operations has stayed about the same on a unitary (per square foot) basis for a great number of years. Maintenance funding fails to reflect the increased complexity of buildings, as well as the need and cost for education and ongoing re-training of the O&M staff.

An ever-widening gap has developed between what a constructor installs and what O&M staff members are ready to accept. System components can be correctly sized, specified,

and supplied, but not installed, adjusted, and integrated to work optimally on the job. The consequence is that the noncommissioned building does not work correctly when it is built and the O&M staff does not have the time to figure out why. In fact, the O&M staff may be unaware that the building is operating incorrectly until the occupants complain.

Unfortunately, by this time, the building occupants' productivity has been reduced and they have come to expect no better than the poor building environment given them. Already, this new building is in an operations death spiral in which the building staff spends all their time attacking the symptoms of installation and design problems but have no training or time to attack the root causes. Evidence of such a situation may be seen in the bypassing and disconnecting of automatic controls, whether because of a lack of operational and maintenance training or because of equipment that has not been tested and adjusted to work smoothly as part of the overall installation. The result is steadily deteriorating environmental quality in the workspace, reduced energy efficiency, and building performance that falls short of the Owner's expectations.

The cost of these consequences is huge and can easily add up to many times the cost of commissioning.

Commissioning is the quality management process applied to building construction. It builds quality into the project and confirms correct operation through testing.

SECTION 3 - WHEN TO COMMISSION?

Facilities' Commissioning process should be performed on all new buildings and on any building remodel projects costing approximately $50,000 or more. On projects smaller than this, Facilities should execute its Commissioning Lite process. Projects that involve the installation of Electrical and/or HVAC equipment that has to be integrated into existing systems. Commission should be done on projects that change occupancy and/or intent of area of the building.

3.1 Budgeting for Commissioning

When considering budget criteria for commissioning, project managers should consider the following factors: What is the cost to Facilities if the building is energy inefficient? Environmentally wasteful? Inflexible? Seismically unsafe? Inaccessible? Unresponsive to client needs and Costly to Operate?

No set standards can be applied to determine the proper cost of commissioning for every building. The extent of desired commissioning services will affect the budget requirements. Factors such as building complexity, systems to be commissioned, critical operations inside the building, level of testing required, operation and maintenance goals, training requirements, project duration, and travel requirements all need to be considered in the budgeting process.

- Total building commissioning cost ranges from 0.75% to 3.0% of construction cost.

Cost Savings from Building Commissioning
■ Energy savings of 20 to 50 percent ■ Maintenance savings of 15 to 35 percent ■ Reduction of claims of 2 to 10 percent ■ Reduction of in-house overtime costs ■ Reduction of trouble-shooting costs
Source: Building Owners and Managers Association (BOMA) cost data for office buildings

Testing of sophisticated electrical systems such as emergency generators, uninterruptible power supply (UPS) systems, automatic transfer gear, etc, when included in the CxA contract will increase the cost of the electrical system commissioning.

Section 3 – When to Commission?

Various surveys on the cost of commissioning have been conducted throughout the U.S. and Canada. These surveys provide a starting point for budgeting. The data collected to date, indicate the cost of commissioning appears to range from 1.5% to 4.5% of the cost of the systems to be commissioned. For a building of average complexity and construction schedule, the cost of commissioning should be about 3.0% of the construction cost for the systems being commissioned. An average cost for basic commissioning of mechanical and electrical systems appears to be 3.0% and 1.5% respectively. For commissioning of sophisticated buildings such as research facilities and laboratories, this range can rise to 3.5% to 4.0%. For commissioning of simple fan-coil systems, the cost will be below these values. In the event that total building commissioning is desired, we recommend using 1% to 3.0% of the total construction cost in the project budget.

SECTION 4 - COMMISSIONING DELIVERY METHODS

The "How To" process of commissioning begins with the decision-making requirement of "Which delivery method?" As important as it is to implement a commissioning process, the method selected is crucial to the success of a project. Relationships and trust established at the onset of the project are the significant drivers for success. Many factors and variables (procurement, purchasing, resources, budget, schedule) greatly influence which delivery method is chosen. Facilities has adopted three primary commissioning delivery methods, which are outlined below.

4.1 Commissioning Delivery Methods

The combination of variables in the commissioning delivery selection process has led to the development of primary commissioning delivery methods adopted at Facilities:

- Engagement of independent commissioning provider
- Sole Facilities internal staff resource performs commissioning services
- Collaborative approach where Facilities internally manages a team of contracted providers

Which method is employed is driven primarily by project cost and complexity together with resource availability. While we may assume that it is always better to use internal Facilities resources from an operations support team, our experience suggests that time allocation, conflicting priorities and lack of excess capacity have degraded our ability to provide this service. Thus, for most projects our standard procedure would be the engagement of an independent CxA provider who would fulfill the obligations as outlined in our commissioning program.

Facilities has purchasing and procurement regulations and procedures in place to support this process. Therefore, the details of these processes are not enumerated here. Instead, the focus is on explanation of the delivery methods. In subsequent sections, development of the Scope of Work, Scope of Services, and other project specific aspects are covered.

4.2 Understanding and Evaluating the Options—Pros and Cons

Pros and cons stated herein are given for extreme effect to illustrate the stereotypical point. As further illustrative examples, imaginary quotes are listed in "role playing" fashion to demonstrate possible scenarios. We believe that in real life, the teams, players, and examples given may well be more moderate than the examples given here.

At the same time that the project delivery method is chosen and the decision is made to include commissioning, the commissioning delivery method should also be determined.

4.2.1 Option 1: Engagement of Independent Commissioning

In this option, an independent, separate entity assumes responsibility for administering and implementing the Facilities commissioning program under contract directly to Facilities.

Again, whenever Facilities selects this choice, the CxA should be separated from the design element or construction management unit in order to provide Facilities with the independence required for the commissioning process to be successful and to avoid any conflicts of interest.

The CxA should have a separate professional services contract in place with Facilities. (It is envisioned that a separate Facilities business partner (DBP) may manage this program for Facilities. If so, a project manager would contact the DBP, and they would arrange for all commissioning services) The CxA should be independent of the other stakeholders (Owner's project manager, A/E, construction managers, and construction contractors). It is important that the CxA has design, construction, and operations experience for the type of systems and assemblies included in the project. Expertise and experience in successfully implementing the Facilities commissioning process should take priority over knowledge of all systems and assemblies. The CxA should have internal technical resources for each specific system and assembly. Contracting for commissioning process services through a separate, independent professional enables the CxA to focus on the commissioning process and to avoid potential conflicts of interest. This separate relationship allows the CxA to act independently as director of commissioning process activities and to focus on the functionality of systems and assemblies relative to the OPR. For this reason, the CxA must be able to communicate directly with the Facilities project manager. Additionally, for the commissioning process to be successful there must be a cooperative atmosphere among all parties to avoid adversarial relationships. To achieve this, all parties should be represented on the commissioning team.

The CxA will implement the detailed Facilities commissioning program requirements, which verify the OPR, and subsequent deliverable task as outlined in the Facilities Commissioning Specification. While Facilities maintains standard commissioning specifications and design guidelines, the CxA will review the Facilities Standard Commissioning Specifications and Design Guidelines and suggest any modifications that are necessary with the Facilities project manager. Therefore, regardless of the selection of a CxA and the use of design guidelines the CxA is a contributor to the project specifications (construction contract documents).

Pros

- Classical independent consultant can provide impartiality without a link to profitability or reverse incentives.
- Data is provided directly to Facilities (saves time, translation).
- The fox is not guarding the hen house.

- Since they are not responsible for the design, the independent CxA is more likely to ask questions, acting as the Facilities' advocate to identify failure scenarios.
- They may bring field testing experience to the design phase.

Cons

- The third party role can result in "reporting" without resolution. Because the independent authority is not responsible for design or construction.
- Who takes the lead to resolve issues or effect change and action where needed?
- If not brought on board early enough, or brought without buy-in to the team and the design or construction process to date, the independent firm can lack the "can do" attitude earned by the rest of the team. It may introduce rework and potential conflict with A/E and or the general contractor.

4.2.2 Option 2: Owner-Led Commissioning

In this method, Facilities implements the Facilities Commissioning Program via in-house staff. No external third party authority, constructor or designer is retained. Facilities must have an experienced field commissioning and management team on staff trained in the use and implementation of the Facilities Commissioning Program and tools. This would also include the capability to provide all necessary commissioning disciplines (mechanical, electrical, etc.) in a timely and effective manner. While the CxA can be an employee of Facilities, they should not be part of the project design team. Whenever this choice is made by Facilities, the CxA should be separated from the design element in order to provide Facilities with the independence required for the commissioning process to be successful and to avoid any conflicts of interest.

Pros

- Facilities retains control and decision-making ability over all other parties.
- Quick, single-point action is possible.
- No information translation loss from CxA team to Facilities.
- Facilities' team retains all the lessons learned during the commissioning process.
- Provides Facilities with another opportunity for designer and constructor performance evaluation.

Cons

- Facilities may not have enough staff or staff with enough detailed technical knowledge.
- Facilities may not be able to maintain impartial control and decision-making ability.
- Owner may not have a sufficiently assertive manager to run the commissioning process well and resolve conflicts in a timely manner. For example, the case may

arise in which a difference of opinion exists between a headstrong design engineer and an unyielding mechanical trade subcontractor about some system requirement, which needs to be resolved decisively and quickly.

- Facilities' CxA leader may not be empowered to make decisions, take risks, or resolve gray issues given that the same project managers who may have been affected by commissioning may judge their employment advancement.
- True completion of a commissioned facility may be less likely without the benefit of state-of-the-industry professionals.
- True total cost, including callbacks, problems, and downtime may greatly exceed the apparent initial savings of not having an external CxA.

4.2.3 Collective Commissioning Program

In this option, Facilities internal staff will lead the commissioning process in concert with industry professionals and/or tradesmen. The use of this delivery approach has been designed to augment as necessary the labor or expertise short fall that can be found within facilities and engineering. The use of this delivery model is ideal for quick turnaround projects, retrofits and renovations. As in the other delivery methods, the Facilities Commissioning Program will be implemented completely however, the Facilities Commissioning project manager will assign segmented tasks to his team for execution.

Pros

- Reduce the need for additional full time facilities staff
- Enable the Facilities Commissioning Program for aggressive small projects with short turnaround times
- Emulates success criteria found in larger Facilities project experience

Cons

- Who takes the lead to resolve issues or effect change and action where needed?
- Potential for fox guarding the hen house (conflict of interest)
- Potential for drive by reporting

SECTION 5 - IMPLEMENTING THE COMMISSIONING DELIVERY PROCESS

Commissioning will now be implemented on all Facilities projects. In order to begin the program several questions in regards to project programming may be helpful to review.

5.1 Q: As a Facilities Project Manager, which delivery method should I use?

A: As soon as the project begins programming and/or preliminary design, the Facilities PM should decide the Cx delivery method that will be used for the project. Generally, the appropriate choice of delivery method is determined by a combination of items, including the following:

- The level of sophistication of the building
- The level of sophistication and availability of Facilities' in-house resources
- The budget that is available for the commissioning effort
- The skill sets of the parties that will be involved in the construction project (low bid, versus CM, versus negotiated, geographic region etc.)
- The experience of contractors and their subs with the commissioning process
- The skill sets of the commissioning service providers who will be sent a CWA
- If the DCP is approved, consultations with the program director for commissioning will aid in this effort.
- As discussed earlier, while Facilities would prefer to use internal resources, for most projects involving new facility construction, data centers, manufacturing or extensive renovation, the use of an independent provider pre-approved by Facilities would be the logical choice.

5.2 Q: When should I select the commissioning delivery method?

A: The commissioning process should be started early in the programming or pre-design phase. If that is not possible, the CxA should be selected early enough for them to contribute as a member of the design team. As defined previously, commissioning is a systematic process beginning in the design phase. At this point, the design team can begin working with the CxA to (1) develop the commissioning-focused quality assurance procedures for the design; (2) develop the building product that meets the Owner's performance requirements; and (3) develop the drawings and specifications that will facilitate commissioning during the construction phase.

5.3 Q: What level of commissioning is appropriate?

A: Williamson County Facilities Management, expects that all projects will fulfill the intent and requirements of the Facilities Commissioning Program. The depth and amount of resources are a function of the complexity and the critical nature of the building systems. Obviously, a mission critical process has greater needs than a spec office complex. The Facilities customer, PM, and the design/engineering team should work together to determine the needs. A***s a minimum, all mechanical, electrical, plumbing, security, and critical systems will be commissioned. This would include the following typical deliverables:***

- Predesign/Planning development of OPR
  a. Development of initial commissioning plan
  b. Training for project team on Facilities' CxA
- The Design Stage
  a. Maintain master issue log in Facilities' (Database TBD)
  b. Schematic review
  c. Design document review at 50% & 100%
  d. Construction Document review at 50%, 75% & 95%
  e. Review and modification of specifications regarding commissioning
  f. Development of checklist for equipment
  g. Development of functional testing requirements
- The Bidding Stage-Respond to questions concerning commissioning requirements
- Construction
  a. Submittal reviews concurrent with Facilities
  b. Development of commissioning schedule
  c. Site observation
  d. Witnessing of critical systems
  e. Review RFI & change order logs and submittals
  f. Deficiency tracking (Database TBD)
  g. Reporting
  h. Asset data collection
  i. Test and balance verification
  j. Review of O&M drafts
  k. Review of training program
  l. Static inspection (field verification) of components and systems
  m. Startup (functional verification)
- Acceptance
  a. Initial functional performance testing
  b. Integrated functional performance testing (performance verification)
  c. Deficiency resolution tracking
  d. Review of as-built drawings and completeness
  e. Acceptance of O&M manuals and systems manuals (soft & hard)

f. Delivery of commissioning report

- O&M staff training and documentation
- Warranty review and seasonal testing
  a. Review of outstanding issues
  b. Review of building optimization needs
  c. Deferred testing
  d. Lessons learned presentation.

5.4 Q: When do we implement the commissioning process?

A: In most cases, the earlier in the project that commissioning activities can begin; the greater the effect they can have on the performance and outcome of the design, construction, and commissioning process. Various reasons for this advantage include the following:

- The CxA needs to develop a relationship of trust with the design team and with Facilities' staff. When CxAs are brought in late in the design phase, the designers have a tendency to view them as adversaries and not members of the team.
- The CxA needs to have a full understanding of the OPR. Such an understanding can be communicated more effectively in face-to-face meetings with all parties involved, rather than in written form only.
- Ideally, the team members selected to perform commissioning will have extensive experience with startup and troubleshooting of buildings. They may identify design issues that will be much less costly to correct on the drawings than after the systems are constructed.
- It is important that the constructor have a clear understanding of the constructor's role in the commissioning process. The CxA should list those requirements clearly in the specifications, especially when using a CM to help with the construction budgeting process.
- The CxA will help to ensure that sufficient balancing devices, measuring devices, and control items are included in the bid documents, which is more cost effective than adding these devices to the project through the "change-order" process.

5.5 Q: What are the benefits of early commissioning?

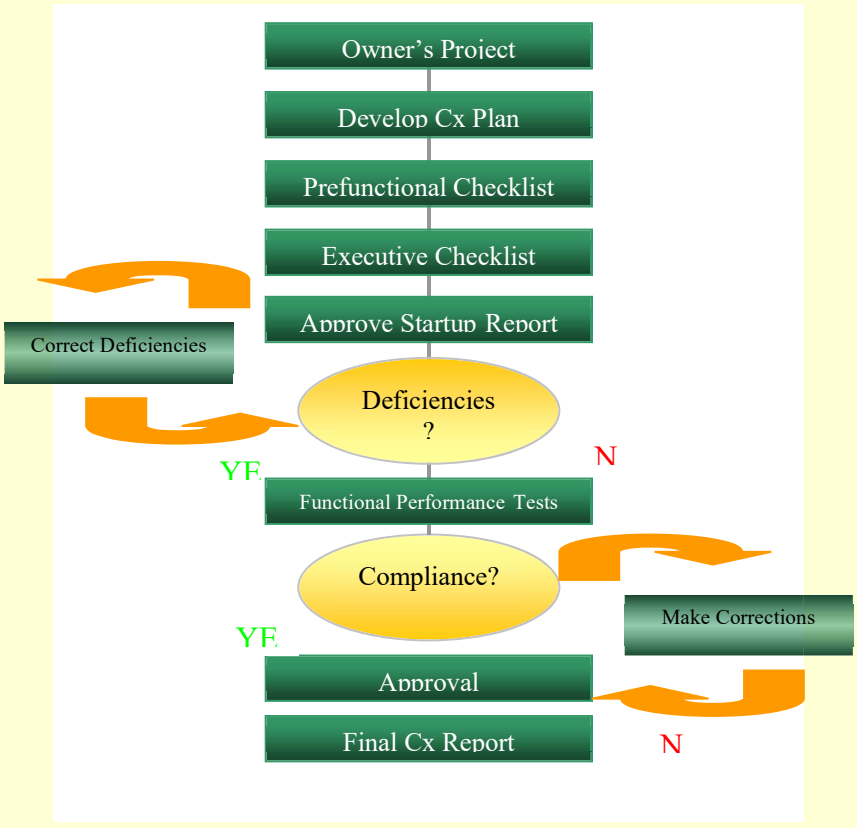
A: In almost every case, the earlier in the project that the commissioning activities can begin, the greater the benefit they can bring to the performance and outcome of the design and construction processes, and the commissioning process itself. Why is this true? Because these processes all profit from collective experience, feedback loops, and lessons learned and shared. If the commissioning

entity is able to influence or create the design intent document, they can bring their knowledge from the field of "what works" to the design stage, resulting in a building that, by design, will have a better chance of working as intended.

SECTION 6 - THE COMMISSIONING PROCESS—STEP-BY-STEP

A comprehensive view of the integrated commissioning process can be considered to have nine distinct phases in the following order:

- Predesign/Planning
- The Design Stage
- The Bidding Stage
- Early Construction
- Static Inspection (Field Verification)
- Startup (Functional Verification)
- Shakedown (Performance Verification)
- O&M Staff Training and Documentation
- Warranty Review and Seasonal Testing



Commissioning Process

6.1 The Commissioning Process—Predesign/Planning

A sample Owner's Performance Requirement is included in Appendix G of the Facilities Commissioning Plan.

The most important components of this early phase of the project are the Owner's Performance Requirement (OPR) and the Basis of Design (BoD) documents.

The OPR is Facilities' *intention and expectation* of the *design and operations* of the building. It is the Owner's requirements for a successful building. It is a written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting documentation. In order for the project to be successful, the project team must achieve these requirements and document the achievement.

Regardless of what the document includes, it is architectural in origin: having been developed in association with the project design team. The document is performance-based and concentrates on what the occupants *need* instead of focusing on how the design team will provide it.

This does not mean that architectural considerations are foremost in the document. If only mechanical and electrical systems are being commissioned, then a sufficient OPR may be 90% those disciplines and 10% architectural issues (such as building code requirements, occupancy, etc.). The OPR, once complete, is then turned over to the A/E design team. They have the responsibility to develop the BoD, the primary document that translates the Owner's needs into building components such as occupancy type, room size, population, air quality, etc. The design team will produce design documents based on the BoD.

The job of the CxA is to assure that components have been supplied and installed correctly according to the bid documents, and to assure that the occupant's needs are met as described in the OPR. Therefore, the CxA needs both the OPR, based on the architect's knowledge of the occupants' needs and the design itself, showing the specified solution.

The OPR should be referred to frequently in the construction process. At the pre-bid conference, the design team should present it and solicit ideas from the constructor. It is true that the constructor will build according to the plans and will expect change orders for any work not shown on the plans. It is also true that some constructors will count on making money from such change orders and so will tend not to suggest improvements prior to bidding. However, some constructors may make such suggestions prior to bidding if they are given a chance to see the actual intent of the structure. If they are given only the design, and not the intent, they cannot be expected to help improve the project without change orders.

The document should be presented again at the pre-construction conference. The presentation of the OPR document at the pre-bid and preconstruction conferences should

be used as a team-building tool in defining a common goal. This is where the communication and team-building skills of the CxA are very important.

When the OPR is presented to the constructor team, the Basis of Design should accompany it. The Basis of Design explains how the design team chose certain systems and space arrangements to meet the needs of the occupants.

The most basic inclusion in the OPR is the general description of the building type (for example, data center, fulfillment center, support facility, office building, etc.). Beyond the building type, details are stated such as the occupant's age group, particular needs with regard to air quality, outside air volume, occupant load, and pattern of occupancy.

For instance, the OPR might describe a testing area that is to hold one hundred persons for two hours, be empty for an hour after that, all the while providing comfort and operating at maximum energy efficiency. The Basis of Design could specify a variable air volume system integrated with occupancy sensors and special programming, while the actual design in the bid documents could specify components, air volumes, and the required control sequence. Commissioning would assure that the equipment has been supplied and installed correctly, the air volumes and control sequence are correct, and the overall system "works" at each occupancy level.

6.2 The Commissioning Process—The Design Stage

The CxA can enhance quality during the design stage after a competent review of the design documents. The CxA should coordinate this review with any design review Facilities may perform. Generally, reviews performed by Facilities engineering review group are limited to programmatic and code compliance and constructability issues. The review performed by the CxA should determine, at a minimum, that the documents:

- Are consistent with the OPR
- Specify commissionable systems
- Include inspection and testing details
- Include equipment parameters that can be verified
- Incorporate a layout that allows testing and maintenance
- Fully describe the commissioning process for the bidders

The CxA should review the contract documents during development and should offer comments and recommendations.

The review process does not transfer responsibility for the design, nor is it intended that the CxA “check” or “warrant” the design. Responsibility for design rests fully with the design professional. However, the review process should be used to provide an additional quality control feature to augment the design process.

The Facilities PM should monitor this process and make certain that procedures are in place within the team so that issues the CxA raises are reviewed and the team comes to a consensus about them. If a consensus cannot be reached on an issue, the process should document the issue and Facilities should provide a decision and direction in consultation with the appropriate design professional.

The CxA will also review the contract documents to confirm that each piece of equipment or system is capable of being tested and has objective performance parameters that can be confirmed. For example, the CxA will confirm that pumps and other hydronic devices have test ports specified to allow flow measurement and maintenance access at air handling units or at straight duct lengths where airflow measurements must be taken.

6.3 The Commissioning Process - Writing the Specifications

Sample commissioning specifications are included in the Appendices.

The CxA should review the Facilities Commissioning Specifications and Construction Guideline and modify as required (with approval from the Facilities project manager). Any modification to the specifications should follow the appropriate division as determined by the Construction Specification Institute's (CSI) *MasterFormat*™ classification of construction systems.

Section No.	Document/Section	List of Contents	Scope of Contents
01100	SUMMARY OF WORK	Work covered by contract documents Identification of separate prime contractors	Describe commissioning process activities as part of the project. Alert the contractor that FACILITIES has contracted for commissioning process services with a separate CxA. Delineate contractor's scope of work relative to the commissioning process.
01200	PRICE AND PAYMENT PROCEDURES		No special commissioning requirements
01310	PROJECT MANAGEMENT AND COORDINATION	Provisions about coordination of commissioning process activities among contractors and subcontractors; project meetings	Coordination of meetings and conferences

Section No.	Document/Section	List of Contents	Scope of Contents
01300	SUBMITTALS	Procedures for submittals	Submittal requirements for commissioning process activity reports and schedules should be specified in Sections 01811 to 01819 Add requirements here for additional copies from contractor to CxA and for approved submittals to be distributed to CxA
01400	QUALITY ASSURANCE		No special commissioning process requirements
01500	TEMPORARY FACILITIES AND CONTROLS		No special commissioning process requirements
01600	PRODUCT REQUIREMENTS		No special commissioning Process requirements
01700	EXECUTION REQUIREMENTS		General requirements for construction checklists in terms of format and submittal requirements.
01731	CUTTING AND PATCHING		No special commissioning process requirements
01770	CLOSEOUT PROCEDURES		Include requirements for CxA to review and approve O&M documentation
01810	COMMISSIONING PROCESS		General administrative and procedural requirements without regard to specific systems and assemblies.

Section No.	Document/Section	List of Contents	Scope of Contents
01811	BUILDING ASSEMBLIES COMMISSIONING REQUIREMENTS	Substructure Superstructure Building shell Exterior wall assemblies Roof assemblies Building interior Separations Paths of egress	Construction checklists Assembly description Performance requirements Prerequisites to Testing System or Assembly Test requirements Test Reports
01812	CONVEYING SYSTEMS COMMISSIONING PROCESS REQUIREMENTS	Elevators and lifts Escalators and moving walks	Construction checklists Assembly description Performance requirements Perquisites to testing system or assembly test requirements Test Reports
01813	PROTECTIVE SYSTEMS COMMISSIONING PROCESS REQUIREMENTS	Fire suppression (including pumps, sprinkler and standpipe piping and terminal devices) detection and alarms (including fire, smoke, gas and leak) Lighting protection Cathodic protection	Construction checklists Assembly description Performance requirements Prerequisites to testing system or assembly test requirements Test reports
01814	PLUMBING SYSTEMS COMMISSIONING PROCESS REQUIREMENTS`	Water distribution Sanitary waste Storm drainage Other plumbing systems	Construction checklists Assembly description Performance requirements Prerequisites to testing system or assembly test requirements Test reports
01815	HVAC SYSTEMS COMMISSIONING PROCESS REQUIREMENTS	Heat generation (including central equipment, distribution systems, and terminal devices) Refrigeration (including central equipment, distribution systems and terminal devices) Ventilation (including central equipment, distribution systems and terminal devices) HVAC control systems (including central equipment, distribution systems, and terminal devices)	Construction checklists Assembly description Performance Requirements Prerequisites to testing system or assembly test requirements Test reports

Section No.	Document/Section	List of Contents	Scope of Contents
01816	ELECTRICAL SYSTEMS COMMISSIONING PROCESS REQUIREMENTS	Power distribution (including central equipment, distribution circuits, and terminal devices) Lighting (including fixtures and controls)	Construction checklists Systems description Performance requirements Prerequisites to testing System or assembly test requirements Test reports
01817	COMMUNICATIONS SYSTEMS COMMISSIONING PROCESS REQUIREMENTS	Voice and data Sound and video	Construction checklists Systems description Performance requirements Prerequisites to testing System or assembly test requirements Test reports
01820	DEMONSTRATION		Coordination requirements with CxA
01830	OPERATING AND MAINTENANCE DOCUMENTATION		Coordination with CxA
	INDIVIDUAL SECTIONS IN DIVISION 2 THROUGH 16	Field quality control tests Adjusting and balancing Cleaning Demonstration	A statement requiring commissioning process Activities to be accomplished for system, subsystem, or equipment components as a part of its parent system. A statement that requires contractor to complete construction checklists and perform tests.

6.4 The Commissioning Process - The Preliminary Commissioning Plan[5]

Even though standard specifications for commissioning have been developed, the CxA will review and modify if necessary and develop procedure and specification into a preliminary commissioning plan. This plan extends Facilities' original system-by-system commissioning procedure into a scope of work that names actual components and systems

[5] See Sample Commissioning Plan in Appendix "X"

in the design documents. The CxA should develop procedures for each of the systems to be commissioned. This interim plan should be incorporated into the specifications to give the constructor the best possible idea of his part in the process. After the bid is awarded and submittals are approved, the CxA writes the formal commissioning plan that completely describes the commissioning work.

6.5 The Commissioning Process—The Constructor Selection Stage

The selection of the constructor is a brief but important time in the commissioning process. This is the first opportunity to bring the constructor(s) into the process, and it is vital that the constructor cooperate in the commissioning process if the team is to reach the goal of a quality building. Constructor personnel perform the inspection and testing required by the CxA. It takes constructor time, and it costs the constructor money. It also saves the constructor time and money through reduced callbacks and the early and fair resolution of problems. Overall, the constructor and subcontractors will save more than they spend on commissioning, although they may not believe this at first.

As the bidders/proposers prepare their bids/proposals, there will be questions about their roles in commissioning. The CxA should answer these questions, either at a pre-bid/pre-proposal conference, in writing, or both. Although commissioning is still a new and developing practice for Facilities, it has been found that most constructors readily accept commissioning once they understand it. Furthermore, they accept the process much more readily if the CxA exhibits a positive, helpful, cooperative approach right from the start. This is a key aspect of independent third party commissioning. The CxA team leader should have excellent leadership and team building skills.

In addition to answering constructor questions, the CxA may need to answer questions for the design team. This is especially true if the project bids/proposals come in over the cost estimate. The CxA may be called upon to evaluate the savings in commissioning costs that should result from cutting portions of the project out to make the required budget. Indeed, the CxA may be required to help defend the commissioning process itself from elimination in view of a budget problem.

When the pre-bid/pre-proposal conference is organized, the CxA should be placed on the agenda to present a brief overview of the commissioning process and answer specific questions posed by the constructors. The questions and answers that come out of this conference, including those related to commissioning, should be recorded in the minutes and issued in writing to all bidders/proposers as an addendum. The CxA should provide answers to commissioning questions to the Owner’s project manager.

Subsequent addenda will answer questions posed to Facilities and the design team after the pre-bid/pre-proposal conference; however, they may or may not include commissioning questions. All commissioning questions posed by the constructor should be routed through the Facilities PM and then to the CxA to assure that each response is sent in an identical form to all constructors and all members of the design team. The CxA should review any

addendum to confirm that revised drawings and specifications do not reduce the commissioning requirements or capabilities. The CxA should stay alert to any changes in construction time as related to addenda. If there are significant changes in the project that will affect the time for CxA services, make sure adequate time is added to the constructor's construction time in the addenda to allow for commissioning.

Proposals to cut commissioning because of cost should be met with resistance. Facilities expects that all projects will be commissioned to ensure our assets have been designed, built and capable of being operated as intended. It is wrong to compromise quality to address minor budget concerns. The cost of correcting our facilities after project turnover is considerably more than the fees for commissioning. The cost of unplanned facility shutdown due to a systems failure is unacceptable.

6.6 The Commissioning Process—Early Construction

The beginning of the construction process includes the following commissioning-related activities:

- Preconstruction meeting
- Development of the construction schedule and schedule of values
- Submittal of equipment and materials
- Completion of the final commissioning plan

During the early stages of construction, the CxA will continue to answer questions for the constructor and verify that commissioning is being integrated into the construction process. The best venue for this is the preconstruction meeting.

The first item of discussion is the schedule. Developing the schedule is actually two tasks: 1) getting commissioning milestones placed on the construction schedule, and 2) including contractor commissioning activities in the schedule of values. The construction schedule and schedule of values are key documents that allow Facilities to track the construction process. Having commissioning included in these is a good way to confirm that the constructor is an active part of the commissioning team.

The CxA works with the constructor and, if necessary, the subcontractors to discuss phasing and timing of commissioning. This schedule gives the constructor an idea about what commissioning information must be included in the constructor's overall schedule. The constructor is required to integrate the information into the overall schedule of the project. In this way, all subcontractors are given additional notice about the requirement for commissioning.

When the schedules are submitted, copies are routed to the CxA for review with regard to commissioning milestones. The commissioning milestones shown on the tentative schedule of commissioning activities should be integrated into the overall schedule by the time the schedule is submitted for approval. Although it is true that this schedule may be

revised many times before the bulk of the commissioning activities are accomplished, these activities should be a part of the schedule from the start. As other milestones are revised, the commissioning schedule should be revised accordingly.

As the constructor makes equipment submittals to the design engineer, the Facilities PM should route copies of the approved submittals to the CxA for information only. The CxA does not approve submittals (that is the engineer's job), but the CxA does comment to the Facilities PM if there is anything in the submittals that appears seriously wrong. The CxA should make sure that any submittal requirements for items key to commissioning are not left off constructor submittals.

Commissioning procedures include static inspection, startup, and functional test descriptions. The CxA writes and assembles these procedures as part of the commissioning plan as equipment information is available from submittals. As the documents are completed, they should be submitted to the PM and the designer for approval, and then to the constructor for scheduling. Meetings between the CxA and the constructor serve to further clarify the intent of the process and keep the constructor involved.

The final draft of the commissioning plan is completed during the early stages of construction after all equipment submittals have been approved and before equipment has arrived on the site. It starts with the requirements on a system-by-system basis and provides more detail based on the actual design and the equipment ordered. The commissioning plan developed at this point should have detailed information on the support required from constructor personnel. Specifically, each inspection and test should be annotated to show the responsible subcontractor.

6.7 The Commissioning Process—Static Inspection (Field Verification)

As the commissioning plan is completed, equipment is ordered, and the building foundation and framing is beginning, the static inspection phase of commissioning begins. The static inspection phase lays the foundation for equipment startup by confirming that equipment is installed in such a manner that it can function in a safe and effective manner. In general, this includes verifying items in the list below, among other things.

- Equipment location: Are unit locations according to plans and practical requirements? For example, is air handling units positioned to allow full access door openings for maintenance?
- Installation of instrumentation: Are installations performed according to manufacturers' requirements (such as laminar flow for flow sensing devices) and according to engineering requirements (such as duct pressure sensors located 3/4 of the distance to the furthest point in a VAV duct system)?
- Drain piping: Are drains sloped as specified and have pipes been pressure tested?
- Sheaves: Are all sheaves aligned properly?

- Connection to power and other utilities: Have utility connections been verified?

- Pipe and duct support: Are these items properly suspended for safety and function?

The CxA provides checklists[6] to construction personnel to carry out these inspections. These checklists incorporate manufacturers' requirements and other basic steps that typically would be done even without the commissioning process and, therefore, should not take a great deal more time to process than would the normal checkout procedure. As the constructor submits completed checklists, the CxA spot-checks the forms. If the checklists have not been completed accurately, shortcomings will become known as the group attempts to begin Functional Performance Tests (FPTs). If FPTs are cancelled and rescheduled, the constructor is responsible for the cost of repeat testing (an important notice to be included in the specifications).

Examples of inspection activities are as follows:

6.7.1 Piping and HVAC Ductwork

- During construction, piping and ductwork should be inspected for correct installation and should be pressure tested.
- Items affecting maintenance, such as valve locations, damper access panels, plumbing cleanout access, and sloped piping for drainage, etc., should be checked during construction inspections.
- Domestic water and sanitary sewer piping testing is a contractor quality assurance requirement—as well as a code requirement—and should be witnessed by Facilities' representative, the architect, or the CxA.
- Low-pressure (less than 3 inches static pressure water gauge) ductwork need not be pressure tested. However, all ductwork should be inspected visually before insulation for correct joining and supports.
- Testing, adjusting, and balancing (TAB) of air and water systems should have been preliminarily performed and ready for startup of the HVAC equipment. CxA to verify.

6.7.2 Air Handling Units and Other Major HVAC Equipment

- Air handling units (AHUs), make-up air units, rooftop heating and cooling units, and similar equipment should be inspected for mechanical items such as properly functioning case drains, filter seals, maintenance access, general air tightness, and vibration isolator supports.

[6] See Sample Checklist in Appendix "A"

- Control devices, such as sensors and actuators, should be verified as complete according to the Building Automation System (BAS) points list and control diagrams. These devices should be correctly located and completely and soundly installed.
- All electrical wiring is to be confirmed as installed properly, in conduit, terminated, grounded, and tested to confirm power and correct polarity (for motor rotation).
- HVAC piping should be inspected for air handling units, including coil connections, control valve locations, balance valves and test ports, bypasses, drain pans and traps, and maintenance isolation valves.
- Lubrication points for fan and motor bearings, as well as all movable supports, should be checked and mounting fasteners confirmed.

6.7.3 Building Automation System (BAS) Controls

- The controls contractor should perform a complete point-to-point checkout of all control devices throughout the building. Checkout is used to confirm that the engineer's point list is installed as designed. CxA to validate.
- For laboratories or other critical environments as defined by Facilities, all input and output devices in the critical zones should be calibrated to NIST (National Institute of Standards and Technology) traceable standard at the job site. Critical devices are defined in the contract documents in the I/O summaries or I/O list. Factory calibrations are not acceptable. The CxA must certify that this activity has taken place prior to Functional Performance Testing.

6.7.4 Electrical Systems

- During construction, power feeder cables are to be tested for proper insulation and dryness. Owner representative or CxA should monitor tests.
- Switchgear, panelboards, etc., are to be inspected for proper connections and grounding.
- Authorized testing companies should certify building electrical grounding and lightning protection systems.

6.7.5 Fire Protection and Life Safety Systems

- Fire service water line piping is to be flushed and tested; NFPA (National Fire Protection Association) certificate is required.
- Aboveground fire protection piping is to be flushed and tested (preferably per floor). Witness is normally by local fire officials. NFPA certificate is required.

- Smoke and heat detection sensors at air moving equipment are to be checked and verified for proper installation.

6.8 The Commissioning Process—Startup (Functional Verification)

Equipment is to be started up for the first time with required factory representatives in attendance. The equipment should be tested at all required speeds and preliminary programming should be completed as required to allow subsequent safe and easy starting. On most projects historically, the main issues that arise during equipment startup are related to control software for the temperature control system.

6.9 The Commissioning Process—Shakedown (Performance Verification)

After equipment has been proved at startup, Functional Performance Tests (FPTs) are to be conducted to confirm that the pieces work together. Tests must confirm that smoke causes air handling units (AHUs) to shut down and dampers to go into smoke-control modes. Other tests must assure that valves open on calls for heating and cooling and close when the set-point is satisfied. Tests should further assure that AHU economizer cycles respond to outdoor air temperatures and indoor calls for cooling, and that freeze protection actually shuts down the required equipment. AHU discharge temperature control should be checked at the unit and at the central energy management and control station.

Dampers should be cycled and checked for leakage, especially face and bypass dampers on steam coils. All actuators should be stroked full-open and full-closed to check for binding, calibration, and correct Building Automation System (BAS) addressing.

Functional tests include checking BAS parameters, such as programmed addresses, sensor calibration factors, occupied/unoccupied programming, and trend logging. Programming charts, sequences of operation, block wiring diagrams, and wiring termination diagrams should be included in the report. All BAS tuning variables, such as response times, damping variables, delays, and interlocks, should be included in the report.

Critical facilities, as defined by Facilities, will have the control input and output points loop calibrated. Inputs will be simulated with signal generators (4-20mA, 0-10vDC, etc.) and values reported on the central station console to be checked against published loop calibration tolerances of the manufacturer. Outputs will be loop calibrated so that when the system calls for an output device to be at the 50% open position, the device is physically checked to be in that position. 10% open and 90% open are also checked in addition to full open and full closed. Variable speed drives will also be checked in this manner.

A sample of items included in the subcontractor's Testing, Adjusting, and Balancing (TAB) report should be checked for accuracy. If a substantial failure rate is encountered, all failures should be corrected and a different sample chosen for a repeat test at the constructor's expense. Check all TAB parameters on AHUs and associated return/exhaust

fans. On critical facilities such as laboratories, clean rooms and data centers, Facilities may want to check 100% of the TAB readings

The Functional Performance Tests are the heart of the commissioning process, but they are also the most difficult and time consuming. This is when the team-building skills of the CxA pay off. If the CxA has succeeded in gaining the trust of the constructors by this time, the chances of completing the FPTs in a timely manner will be markedly increased. The best method of earning and keeping a good working relationship with constructors is constant communication. As the FPTs proceed, the CxA should constantly keep the constructors informed as to upcoming testing.

As inspection and testing proceed, the CxA may find a number of items that do not appear to work as intended. In some instances, the intended operation will be unclear and, in such cases, the CxA should submit a Request for Information (RFI) to the Facilities PM in the same manner that a constructor would submit an RFI. After confirming the intended mode of operation, the CxA can proceed with testing.

If equipment or systems are found to be malfunctioning, these problems should be listed on a deficiency form or listing. This form should indicate the test and item involved; it also tracks the status of the problem as it is corrected. The CxA will need to perform a varying amount of retesting because of system and equipment failures during the initial testing. The amount of retesting that is paid for by Facilities and the amount that is passed back to the constructor should be very clearly spelled out in the construction contract.

6.10 The Commissioning Process—O&M Staff Training and Documentation

A properly designed and constructed building cannot function properly without an adequately trained Operations & Maintenance (O&M) staff. Unfortunately, inadequate O&M training is a traditional shortcoming on most construction projects. Problems with O&M training include unqualified trainers, insufficient training time, and incomplete O&M manuals and record drawings. Training is often conducted before systems are fully functional (before the completion of performance verification testing), or is focused on *discrete* systems while failing to address the *interoperability* of modern building systems. Building users also tend to send the wrong personnel to training sessions, or miss scheduled training sessions entirely. The result of errors such as these will be an ill-prepared, overwhelmed O&M staff, and building problems from the start.

A qualified commissioning authority's requisite in-depth knowledge of the design intent and building systems makes them an ideal candidate to assist in O&M training. The following is a list of items that need to be prepared for an orderly transition of the building from construction to occupancy. The CxA is an ideal resource to help implement the following:

- **Review preventative maintenance plan.**
  This task is directly tied to the development of the O&M staffing. The commissioning authority can assist in a facility preventative maintenance plan that makes best use of O&M staffing to ensure that systems are properly maintained and running at peak efficiency.
- **Review facility record drawings.**
  The accuracy of facility records can be verified during functional and performance verification testing.
- **Prepare framed instructions showing the sequence of operations and interoperability for major systems and components.**
  Framed instructions displayed beside major equipment items (chillers, boilers, air handling units, HV units, emergency generators, etc.) can be a major aid for training, routine preventative maintenance, and equipment troubleshooting.
- **Review asset lists and Computerized Maintenance Management System (CMMS) input forms.**
- **Document warranty coverage and warranty claims procedures (both standard warranties and any extended manufacturer's warranties).** Most standard warranties provide one-year of coverage for major equipment items from the date of installation. This warranty date may be weeks or months before building turnover to the customer. In some instances, manufacturers will offer equipment warranties beyond the standard one-year period, while others may include limited services during the warranty period. This type of information is usually found either in the equipment documentation or in the O&M manuals. The CxA should research the appropriate documentation and prepare a consolidated warranty list for the customer.
- **Prepare a recommended list of spare parts, bench stock, overbuy, and special tools/equipment required for the first year of building operation.**
- **Review O&M manuals.**
  O&M training should never be performed without the benefit of completed O&M manuals. Regrettably, O&M manuals are often incomplete, or they are completed *after* the scheduled O&M training. The CxA can provide quality assurance by reviewing the O&M manuals for completeness, accuracy, and timeliness.
- **Coordinate and supervise constructor and subcontractor O&M training (using the system's O&M manuals and framed instructions).**
  Usually, the constructor should schedule all O&M training, but the commissioning authority can coordinate and supervise O&M training to ensure that it meets users' needs.

O&M training is not a traditional task for commissioning authorities, but it is one for which they are well suited. The constructor (with oversight by customer) traditionally provides the services shown above, or else the customer performs these tasks themselves. Unfortunately, many customers are not staffed to manage these activities. Customers

desiring the commissioning authority's assistance with O&M training should include specific O&M training tasks in their commissioning RFP.

6.11 The *Commissioning* Process - Final Report

By the completion of training or shortly thereafter, the CxA should have completed the commissioning final report. This report is a collection of all that has gone on before. As such, it contains copies of the following:

- OPR
- Basis of design
- Pre-functional checklists complete
- Functional checklists complete
- TAB reports
- System schematics
- Control strategies and set points
- Deficiency log
- Guidelines for energy accounting

The commissioning final report, the TAB report, the O&M manuals, and the record drawings and specifications form the bulk of the documentation that will be left with the O&M staff at the new building. Additional information on building controls that includes block wiring diagrams, as-built control diagrams and sequences of operation will also be included in either the commissioning final report or the O&M manual.

6.12 The Commissioning Process—Warranty Review and Seasonal Testing

- **The First Year of Building Operation**

  At the completion of training and all other work required by the contract documents, the building will be occupied. There should be a specific notice in the specifications indicating to the constructor that the successful completion of commissioning is a requirement for the issuance of the architect's final certificate.

  Issues may arise during the one-year warranty period, but if the CxA process has been followed, the issues should be minor and readily handled by the O&M staff armed with documentation and training. Overall, the commissioned building should provide the working environment required for the occupants and the O&M staff can concentrate on establishing an effective preventative maintenance program that should work for the life of the building.

- **Seasonal Testing**

  It is likely that certain parts of the building mechanical system cannot be adequately tested due to the season of the completion. For instance, testing of a boiler system might be difficult in the summer and testing of a chiller and cooling tower might be difficult in the winter. Checking an outside air percentage is much easier when there is a substantial difference in temperature between the outside air and the return air.

  For this reason, commissioning plans should include off-season testing to allow testing certain equipment under the most appropriate test conditions. This requirement must be clearly spelled out in the specifications because it will require some constructor personnel to return to the site after the project is completed. It is also necessary to withhold money for this activity in addition to that usually withheld for warranty items.

  It is also recommended to have the systems tested during the shoulder seasons (spring/fall). Items to look for include proper dehumidification sequences and partial load performance of mechanical systems.

- **Building Automation System (BAS) Trend-Logging**

  During the completion of Functional Performance Testing, the CxA is also asked to assist in the programming of the BAS to include the trend logging of a selected group of key performance indicators. These indicators usually include temperatures and pressures for boiler and chiller operations, duct pressures, outside airflows, and some typical variable air volume (VAV) boxes operating parameters, and unitary equipment performance parameters.

  Trend-logging is a valuable part of the training program and allows the staff to get started on the right foot, thus ensuring that the established building performance is maintained for the life of the building. Some specification writers may ask that temporary flow monitoring equipment be installed to verify system operation. The agency's designer should consider making the flow monitoring equipment permanent and include it as part of the project so that the operations and maintenance staff can continue to use the instrumentation.

Section 7 – Transition Program

7.1 Project Closeout

The process of project closeout is not a sole responsibility of the Facilities Commissioning Program. In fact, the closeout process will engage all of the project stakeholders in a systematic approval process that will aid in the transition of the project from a state of construction to occupancy. The CxA will have specific tasks within the process and will also perform the role in administering and documenting the completion of this program. Facilities Building Management (DFBM) has developed the Building Acceptance - Occupancy Approval Process & Checklist for use with all of our construction projects. The process & checklist is a management tool for assuring the successful completion and satisfactory occupancy for our projects. It provides a summary of actions and goals to be performed by and information to be produced by the project designers, contractors and Facilities personnel.

To assist the project designers, contractors, and Facilities FM personnel during the construction phase of each project, the checklist identifies multiple series of related actions, tasks, milestones and information submittals that should be considered for each project. The checklist is not comprehensive; it must be modified for the specific requirements for each project, which will require the coordination of the CxA with the entire project team - deleting items that are not applicable and adding items as appropriate.

The Facilities Building FM Management Team, including personnel from Corporate Planning (CP), Project Management & Construction (PMC), Facility Operations (FOps) and Resource Planning (RP) is responsible for making sure that each checklist item and any other project specific issue is identified and incorporated into the custom checklist for each project.

In the following text, each checklist item is defined. These definitions provide a brief explanation of the actions or items and describe why these actions are beneficial to the successful completion of the construction project. Some of the definitions also include the purpose or use to which these actions will be put.

A PROJECT START

Successful project management depends on developing a plan & schedule for getting to the end of the project - a road map. For each new project, the Facilities Project Management Team will meet with the designer and contractor to create the project plan and schedule. In addition to identifying the specific items required by the project, the time frames shown in the checklist should be adjusted to account

for the duration of the construction schedule. Other tasks should also be completed at the start of the project.

A.1 Prepare construction emergency contacts list, post on the Facilities FM network and Facilities CxAlloy website. Distribute to all stakeholders.

The Facilities project manager shall prepare and maintain a directory of emergency contact telephone numbers for the architect, consulting engineers, contractor and primary subcontractors (particularly site, mechanical, electrical and fire protection subcontractors). The emergency contacts list should include the network communications help desk number for emergencies, such as scheduled and unscheduled outages for splices, cable cuts or other line damage.

A.2 Facilities management administrative activities

The Facilities Project Management Team will accomplish the following tasks:

A.2.1 Project construction overview meeting

As described above this meeting shall be conducted to adjust project plan and schedule, with consideration for proper advance notices, for the quantity and recipient(s) of deliverables, activities and inspections.

A.2.2 Building plans to building services / facilities management

Building Services / Resource Management will analyze the design documents to determine the requirements for building maintenance and custodial staffing, supervisory assignments, schedule for hiring, etc.

A.2.3 Building equipment preventative maintenance identification designations

From facility management reviews of the 100% design construction documents, the ID numbers for all of the building equipment and appropriate building systems shall be provided to the general contractor and subcontractors for tagging this equipment as it is installed. These ID’s should include identification of utilities, valves, tap points, equipment, service access, test points, and related features.

A.2.4 Facilities management and other Facilities customers notified of anticipated occupancy date.

The anticipated occupancy date will be used to establish a milestone to benchmark the entire checklist against.

A.2.5 Date confirmed with Facilities FM Security for lock installation and keying.

The FM lock shop will be informed early in the construction process about issues related to door and hardware deliveries. With consideration of the anticipated occupancy date, their schedule for lock installation and keying can be planned to assure that the building is ready before occupancy.

B CONSTRUCTION PROGRESS INSPECTIONS

During the construction phase of the project, the CxA and other consultants will perform regular site observations. The CxA will provide detailed reports as to the status and adherence to the construction documents, in compliance with Facilities' design and construction standards and with consideration to the maintenance and operation of the building systems. This is a contractual requirement for our commissioning providers. This is part of the on-going quality process that is commissioning. We ask for this because this is what commissioning buildings is all about.

B.1 Periodic inspections by the Facilities commissioning coordinator and/or project manager to invite other Facilities FM personnel as appropriate.

B.2 Environmental Health and Safety office

The EH&S personnel use these opportunities to inspect the building regarding the issues as required by Facilities policies and regulations. They will verify that buildings are capable of handling any hazardous waste products that may be generated.

C COMMISSIONING ACTIVITIES

Commissioning is a critical component of the construction process at Facilities. The commissioning authority is charged with the responsibility of defining the testing necessary to validate that each new building will perform in accordance with its intended design.

C.1 Construction Tests

Construction tests are performed on building systems to verify that the in-place construction will perform as it is intended, i.e. to keep the rain and weather out, to insulate properly and in the case of building equipment, to operate at 100% of its designed / manufactured capacity.

Examples of these tests are:

C.1.1 Roof Assembly test
Test to validate the roof system will withstand the live loads and wind loads that may bear on it, AND

To keep the rain and weather out…

C.1.2 Window Assembly Water Test
Test to validate the windows will withstand the rain and wind loads that may bear on it, AND
To keep the rain and weather out…

C.2 Special Equipment (Customer or Building Operations)
Any special equipment that will be installed in a building shall be defined as to purpose, location, operation, testing for functionality and accessibility for maintenance and future replacement.

C.2.1 Review location and required utility connections

C.2.2 Review special maintenance requirements

C.3 Fire alarm inspection by engineer/consultant and system certification by (sub)contractor (NPFA13,72)

C.4 Elevator inspection by commissioning authority or consultant, and elevator coordinator for use by general contractor

C.5 Elevator inspection by state inspector, consultant, PMC project manager and FM elevator coordinator for Facilities use and operation

Facilities network to verify elevator phone line

C.6 Chiller inspection by project managers, engineers and mechanics for construction operation

C.7 Chiller inspection by project managers, engineers and mechanics for Facilities use and operation
See C.6 above.

C.8 Endorsement of general contractor's insurance company for beneficial occupancy (if applicable)

This activity provides the project manager a confirmation that aspects of the construction contract have been fulfilled with regard to proper insurance coverage and release.

C.9 Endorsement of Facilities Surety for beneficial occupancy (if applicable)

C.10 Contact Facilities Risk Management to start Facilities insurance coverage

D NETCOM

The Network Communications Department at Facilities Information Systems (IT) is responsible for the inspection and acceptance of contractor installed wiring & wiring pathways and the spaces dedicated to communications within the facility. Typically (IT) is responsible for the equipment and final installation activities to properly connect each building to the Facilities telephone and computer systems, including making the terminations at each telephone and computer connection. In some cases, IT may directly install wiring and wiring pathways within the facility. To properly install, service and maintain these systems within the facility, IT must have the opportunity to inspect the contractor-installed systems before they are enclosed in wall and ceiling assemblies. As part of fulfilling this checklist, the project manager shall coordinate with IT personnel and the contractor to establish the schedule for fulfilling these inspection and installation requirements as the construction work progresses.

D.1 Communication rooms - inspection & acceptance by IT

Completion to include wall, ceiling and floor finishes plus backboards and grounding. A door with a construction lock is required at this stage as well as "live" power to AC outlets.

D.2 Horizontal & vertical pathways - IT acceptance of contractor installed raceways, conduits and wiring (station cable)

Inspection for cable pathways completion to Facilities' specs and wiring installation to acceptable practices.

D.3 Entrance pathways - IT acceptance of contractor installed building service entrance

D.4 Installation of IT provided equipment and terminations (and possible vendor installed wiring) and system activation.

Contingent upon communications room completion and acceptance.

D.5 Installation of IT vendor installed entrance cable

D.6 Removal of provided AE/contractor telephone equipment

D.7 Final shut-off of construction telephone and network access connections, including stopping monthly invoicing. If applicable.

E FACILITIES FM TRAINING

E.1 Training of facilities operations personnel on building systems

The need for the training to occur during this time frame is so the appropriate personnel can be trained on the actual operation of the equipment. They will be responsible for this equipment, and they need to fully understand it and have the opportunity to ask questions, before the building is turned over to facilities operations.

F 30 DAY MEETING

Status update on schedule and issues 30 days from acceptance.

G FINAL INSPECTIONS AND PUNCH LISTS

G.1 General contractor's preliminary punch list

A preliminary punch list by the contractor should be accomplished towards the end of the construction phase of the project. Ideally, the contractors punch list should be documented in writing and distributed to the rest of the project team. All items on the punch list should be completed by the contractor and his subcontractors prior to the start of the architects and engineers punch list.

G.2 Punchlists prepared by architect, engineers and consultants

The creation of the architect's punch list should be coordinated by Facilities' project management team and attended by an owner's representative who has been active and familiar with the project. The engineers and consultants punch list should be coordinated and input on an ongoing basis in Facilities' database (TBD) commissioning tool.
Punch list for substantial completion

G.3 Punchlists prepared by commissioning consultant, Facilities' project manger and team should be documented in Facilities' database tool (TBD).

G.4 Owner Insurance Provider inspection of life safety systems, PMC project manager and other Facilities personnel present

These are all life safety issues and equipment functionality needs to be verified at least 30 days before building turnover. These items need to be approved for proper operation before the facility is accepted and documented in Facilities' database (TBD).

G.5.1 Fire alarm system
G.5.1.1 Connect fire alarm system to fire & police department (if applicable)

G.5.2 Fire sprinkler/suppression systems

G.5.2.1 Connect fire pump alarm to fire & police department (if applicable)

G.5.3 Fire pump test

G.5.4 Emergency generator operation/load bank test

G.5.5 Fire extinguishers (installed and functional)

G.5.6 Other life safety systems and equipment

G.6 Local jurisdiction fire protection inspection completed

G.7 Local jurisdiction building inspections completed

G.8 Local jurisdiction certificate of occupancy issued

H FACILITIES FINAL CLOSE-OUT TASKS

H.1 Facilities' locks installed

Locks are required to assume ownership of the building and ensure the security of customer areas, mechanical rooms, etc.

H.1.1 Maintenance shops and custodial receive keys

H.1.2 Facilities security receive (master) keys

H.1.3 Communications rooms keyed

H.2 Building signage installed

H.3 General Contractor's final building cleaning

H.4 Facilities custodial final inspection for acceptance

Final cleaning by the contractor and acceptance by Facilities custodial provides a positive hand-off of cleaning responsibilities.

H.5 Facilities custodial first cleaning

H.6 Facilities utility meter activation

Facilities utility meter activation transfers utility cost from the construction budget to the building operating expense.

I PROJECT CLOSE-OUT DOCUMENTS

We ask for this volume of work to allow us to have the tools we need to take over the care of a new building. These documents will be used to facilitate our effort to care for the structure and its occupants.

I.1 Project construction records transferred to PM central filing for reference.

Including all construction correspondence, change orders, test reports, financial records, surveys, etc.

I.2 Project records transferred to FM archives and/or Facilities Management

I.3 All of the general contractor's close-out documents shall be reviewed and approved by the architect and received and accepted by Facilities.

I.3.1 Index of complete GC close-out documents attached to all parts of the GC Close-out Documents Submittal

We ask for this document to have an organized list of all documents furnished on a project for our reference at any time. We use this list to quickly determine just what has been prepared for that particular building.

I.3.2 Directory of all contractor, subcontractor, manufacturer and vendor information

We ask for this information so that we can find names, addresses, and phone numbers of all players in the project. We use this to contact anyone we need to in the care of the building. The information should include contact name, company address, telephone number, facsimile number and email address with each referenced to service provided or system or material installed, etc.

I.3.3 Copies of all certifications

We ask for this so we will know what issues have been documented. We use this to find out the particulars of any single issue that has been noted or certified in case we need to look into this particular part.

Include the following items:
Appropriate certifications and acceptance information
Use and occupancy permits
Certificate of inspection from fire marshall
DOL on pressure vessels, boilers, elevators, etc.
Public health inspections
Inspections by other governing authorities

I.3.4 Copies of all general contractor-provided maintenance agreements and service contracts

We ask for these so we will have the information gathered on these agreements. We use this to find out what the particulars of these agreements are when a question arises about the doing of any one issue. This allows us to get into the details and fix the problem. The information should include contact name, company address, telephone number, facsimile number and email address referenced to service provided or system or material installed, etc.

I.3.5 Copies of all general contractor obtained construction materials testing reports

We ask for these in order to be aware of just what issues of testing, such as concrete strength, the contractor did and recorded. We use these to answer questions that come up in the care of the building such as add-ons or repairs.

I.3.6 As-built drawings

As-Built drawings are needed to be able to maintain and troubleshoot building systems from the first day of ownership. Locations and descriptions of equipment are required prior to ownership to establish the preventative maintenance program for the building.

We ask for copies of the as-builts so that we can see that they are distributed to everyone who needs them. We all use these to do our particular thing – such as answer questions about adding on to some utility line, etc. We know the groups that have this need for such archives; building mechanic, zone shop, and IT.

A copy of construction drawings with the contractor's construction notes added may be submitted to Facilities for reference until the final as-built electronic and hard-copy documents have been delivered. The project manager should consider delivery and acceptance of these preliminary and final documents as a prerequisite for reductions in withholding and final payment.

As-built drawings must show all field changes.

I.3.6.1 As-built drawings reviewed and approved by architect, engineer, and commissioning authority

I.3.6.2 As-built Drawings (electronic and hard copy) received and accepted by Facilities and posted in Facilities Management database (TBD)

I.3.6.3 As Built drawings distributed within Facilities (commissioning coordinator) using CAFM Tool in FMIS pulled from Facilities database (TBD).

I.3.7 O&M manuals completed, reviewed by A/E team, and commissioning authority. O&M manuals are needed so we can familiarize the building mechanics with the equipment before it is covered up and they can compare the manuals to the actual equipment. Equipment specs provide repair/replace material requirements to establish warehouse requirements for maintenance support.

The O&M manuals should be delivered to the commissioning authority in advance of the thirty-day delivery target in the schedule. The ONLY exception to this O&M manual delivery goal is for projects of 90 days or less duration, in which case these manuals must be delivered as soon as possible, but, at a minimum, prior to completion of the project.

O&M manuals must include the information as outlined in the specifications but at a minimum contain the following information:

a. Description of each unit and component parts, clearly identifying the specific part installed – if cut sheets are used, plainly mark the item included in the work
b. Manufacturer's printed operating and maintenance instructions with drawings and text to clearly illustrate proper operation and a logical sequence of maintenance procedure.
c. Servicing and lubrication schedule with list of lubricants. Show last contractor service and date for first FM service.
d. Preventative maintenance instructions for each piece of equipment.
e. As-installed control diagrams by controls manufacturer including sequence of operations.
f. Performance data information on all mechanical components and equipment, such as pump curves.

The general contractor and architect shall be directed to finish the submittal process as early in the construction schedule as possible.

Goal for O&M manuals delivery to be as soon as contractor's completed submittals are approved.

I.3.8 As-installed building finishes data submitted, reviewed by A/E team, and received and accepted by Facilities.

We ask for these specific paint formulas and for their usage location to be shown on the prints so that we can care for the building. This is particularly important for touch-up work. As-built building finishes data must include the following information:

a. Schedule of installed finishes.
b. Cleaning care instructions with manufacturers recommended agents and methods.
c. Paint Schedule for all surfaces, with paint manufacturer's paint mixture formulas.

I.3.9 As-built building systems data submitted, reviewed by A/E team, commissioning authority and received and accepted by Facilities.

We ask for this in order to have information necessary to care for the building, to be able to adjust systems to optimize performance, and for training of our staff. As-built building systems data must include the following information:

a. Installer’s coordinated drawings with installed color-coded piping diagrams and wiring diagrams.
b. As-installed electric circuit directories of panel boards.
c. Charts of valve tag numbers with the location and function of each valve.

I.3.10 Attic stock received and accepted

Attic stock needs to be stored before the customers start moving into the building. Materials are often needed immediately after the customers move in due to minor damages associated with the move. If attic stock is not stored before move in, customers tend to need extra storage space and will acquire the unclaimed open areas.

I.3.11 Computer for monitoring building systems installed and functioning

Mechanics need the ability to monitor the building systems prior to customers moving in so that they can monitor what is going on in the building. This also allows time for training on the computer.

I.3.12 Warranty summary information
I.3.14 Warranties, including all guarantees and bonds executed by vendors, manufacturers, suppliers and subcontractors received and accepted

Warranty information is needed so that we can determine who has the repair responsibility and for how long. We do not want to void any such warranty by performing maintenance that prematurely places equipment liability with facilities operations.

I.4 All of the Facilities close-out documents shall be prepared by facilities management and reviewed by project management & construction and plant.

I.4.1 Copy of Owner-Contractor Agreement

We ask for this to have the document that states the particulars of the arrangements between these two entities. We use this to answer any potential questions about this agreement that might come up such as who exactly is responsible for a particular issue.

I.4.2 Test and Balance Report delivered and accepted

Test and Balance is needed as a baseline to ensure proper air distribution and as a reference for future troubleshooting.

I.4.3 Copies of all Facilities-provided maintenance agreements and service contracts

We ask for these so we will have the information gathered on these agreements. We use this to find out what the particulars of these agreements are when a question arises about the doing of any one issue. This allows us to get into the details and fix the problem. The information should include contact name, company address, telephone number, facsimile number, and email address referenced to service provided or system or material installed, etc.

I.4.4 Copies of all Facilities obtained Construction Materials Testing Reports

We ask for these in order to be aware of just what issues of testing, such as concrete strength, the contractor executed and recorded. We use these to answer questions that come up in the care of the building such as add-ons or repairs.

I.4.5 Copy of the final Design Intent program document

I.4.6 Copy of all Owners obtained final surveys

I.4.7 Copy of all Owner obtained geotechnical reports and soils analysis reports

I.4.8 Copy of all Owners obtained seismic reports

I.4.9 Final Commissioning Report delivered

I.4.10 COMMISSIONING IS SUBSTANTIALLY COMPLETE

I.5 Complete sets of final building close-out documents distributed within Facilities (project manager & commissioning coordinator). See action J.3.6.3 above.

J BUILDING COMPLETION

J.1 Jurisdiction Certificate of Occupancy

The local jurisdiction Certificate of Occupancy is merely an instrument of the county's acknowledgement that the building appears to comply with the minimum requirements of applicable building and life safety codes for occupancy. It does NOT constitute formal approval that the building is completely finished nor completely functional and serviceable.

J.2 General contractor certification of training completion and Facilities acceptance

J.3 General contractor notice to architect of substantial completion

J.4 Substantial Completion Certificate prepared and signed by the architect

J.4.1 Outstanding punchlist inspection attached.

J.5 Substantial Completion Certificate signed by general contractor

J.6 Substantial Completion Certificate received and accepted by Facilities

J.7 FM directors final building inspection (walk-through)

K POST-OCCUPANCY INSPECTIONS & EVALUATIONS

K.1 WARRANTY INSPECTIONS

K.2 General contractor evaluations

K.2.1 Optional subcontractor evaluations

K.3 Architect, engineer and consultant evaluations

SECTION 8 - DEFINITIONS

***Acceptance*:** A contractually defined action that permits an activity to commence or continue.

***Basis of Design*:** 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.

Construction Management: Construction management is a professional service that applies management techniques to the planning, design, and construction of a project from inception to completion for the purpose of controlling time, cost and quality. PMs and CMs share a commonality which focuses resources on time, cost, and schedule.

***Commissioning*:** See Commissioning Process.

***Commissioning Activity*:** A component of the commissioning process.

***Commissioning Authority*:** An entity identified by the Owner who plans, schedules, and coordinates the commissioning team to implement the commissioning process.

***Commissioning Plan*:** A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

***Commissioning Process*:** A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's project requirements.

***Commissioning Process Progress Report*:** A written document that details activities completed as part of the commissioning process and significant findings from those activities; it is continuously updated during the course of a project.

***Commissioning Process Report*:** A document that records the activities and results of the commissioning process.

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

***Construction Checklist*:** A form used by the contractor to verify that appropriate components are on-site, ready for installation, correctly installed, and functional.
ASHRAE Guideline 0-200X, *The Commissioning Process.*

***Construction Documents*:** This includes a wide range of documents, which will vary from project to project, Owner's needs, regulations, laws, and countries. Construction documents usually include the project manual (specifications), plans (drawings) and general terms of the contract, especially those required by subcontractors and vendors, suppliers and manufacturers of equipment, assemblies and systems.

***Continuous Commissioning Process*:** A continuation of the commissioning process well into the occupancy and operations phase to verify that a project continues to meet current and evolving Owner's project requirements. The continuous commissioning process activities are on-going for the life of the facility.

***Contract Documents*:** This includes a wide range of documents, which will vary from project to project, Owner's needs, regulations, laws, and countries. It frequently includes price agreements, construction management process, sub-contractor agreements or requirements, requirements and procedures for submittals, changes, and other construction requirements, timeline for completion, and the construction documents.

***Coordination Drawings*:** Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

***Issues Log*:** A formal and ongoing record of problems or concerns, and their resolution, which have been raised by members of the commissioning team during the course of the commissioning process.

***Nominal Group Technique*:** A formal, structured brainstorming process used to obtain the maximum possible ranked input from a variety of viewpoints in a short period of time. The typical approach is a workshop session where a question is presented, the attendees record their responses individually on a piece of paper, the individual responses are recorded on a flip chart without discussion in a round-robin fashion, all of the responses are discussed, and then the individuals rank their top five responses.

***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. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

Project Manager: A project manager is the person assigned responsibility and accountability for the project. This person is responsible for delivering the project in the agreed schedule, to the correct technical specifications, i.e., defined to meet user requirements, and within the approved budget and other specified criteria.

***Retro-Commissioning*:** The commissioning process applied to an existing project that was not previously commissioned; this guideline does not specifically address retro-commissioning.

***Systems Manuals*:** A system-focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the occupancy and operations phase.

***Test Procedure*:** A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

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

***Verification*:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's project Requirements.

SECTION 9 - ROLES AND RESPONSIBILITIES

Understanding and defining the role of each participant is vital to the success of the commissioning process. This section provides an example of the responsibilities of each participant in a comprehensive commissioning process. These responsibilities shall be documented in the contracts between Facilities and the contractor(s), and Facilities and the design professionals. The responsibilities of each participant should be included in the contract documents.

The responsibilities of Facilities, commissioning authority, design professionals, Facilities project manager, general contractor, and manufacturers are detailed below.

9.1 Facilities PM

- Include a statement regarding design professional commissioning responsibilities and scope in the request for design services.
- Develop and commit to the Owner's project requirements for the facility and its use.
- Assign operations and maintenance personnel and schedule them to participate in the various meetings, training sessions, and observations/inspections as follows:
    - Design phase coordination meetings
    - Construction phase coordination meetings
    - Initial owner-training session at initial placement of major equipment
    - Maintenance orientation and inspection
    - System testing verification meetings
    - Procedures meeting for testing systems
    - Owner's training session
    - Verification demonstrations
    - Functional performance tests
    - Final review at acceptance meeting
- Review and approve any changes made to Owner’s project requirements
- Review and approve the construction documents
- Review and comment on the commissioning authority’s commissioning process
- Review and comment on the commissioning authority’s progress reports
- Review and comment on the commissioning authority's verification reports
- Review and accept the commissioning authority's commissioning process report

9.2 Commissioning Authority

- Organize and lead the commissioning team.
- Facilitate and document the Owner's project requirements.
- Verify that the commissioning process activities are clearly stated in all scopes of work.
- Integrate the commissioning process activities into the project schedule.
- Prepare a commissioning plan that describes the extent of the commissioning process to accomplish the Owner's project requirements. Update the commissioning plan during each phase of the project to incorporate changes and additional information.
- Review and comment on the ability of the design documents to achieve the Owner' project requirements for the commissioned systems and assemblies.
- Prepare the commissioning process activities to be included as part of the project specification. Include a list of all individual trade contractor responsibilities for all the commissioning process activities (list contractors by name, firm, and trade specialty, if known).
- Execute the commissioning process through the writing and review of commissioning process reports, organization of all commissioning team meetings, tests, demonstrations, and training events described in the contract documents and approved commissioning plan. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each commissioning process activity. The commissioning authority shall act as chair at all commissioning events and ensure execution of all agenda items. The commissioning authority shall prepare minutes of every commissioning process activity and send copies to all commissioning team members and attendees within five workdays of the event.
- Review the plans and specifications (during pre-design and the design phases) with respect to their completeness in all areas relating to the commissioning process. This includes verifying that the Owner's project requirements have been achieved, and that there are adequate devices included in the design to properly test the systems and assemblies and to document the performance of each piece of equipment, system, or assembly.
- Schedule all document review coordination meetings.
- Attend the project's pre-bid meeting to detail the design professional or contractor commissioning process requirements.

- Schedule the pre-design and pre-construction commissioning process meeting within 45 days of the award of the contract at some convenient location and at a time suitable to the attendees. The purpose of this meeting will be reviewing the complete commissioning process and establishing tentative schedules for the design phase and construction phase commissioning activities.
- Develop the initial format to be used for issues logs throughout and for each phase of the commissioning process.
- Schedule the initial Owner training session so that it will be held immediately before the contractor training. This session will be attended by Facilities' O&M personnel, the design professionals, the contractor, and the commissioning authority. The commissioning authority will review the Owner's project requirements and the design professional(s) will review the basis of design.
- Coordinate the development of contractor training.
- Attend a portion of the contractor training sessions to verify the Owner's project requirements are achieved.
- Receive and review the systems manuals as submitted by the contractor. Verify that they achieve the Owner's project requirements. Insert systems descriptions as provided by the design professional(s) in the systems manuals.
- Witness system and assembly testing. Verify the results and include a summary of deficiencies.
- Supervise the commissioning team members in completion of tests. The test data will be part of the commissioning process report.
- Periodically review record drawings for accuracy with respect to the installed systems. Request revisions to achieve accuracy.
- Verify that the systems manuals and all other design and construction records have been updated to include all modifications made during the construction phase.
- Repeat implementing tests to accommodate seasonal tests or to correct any performance deficiencies. Revise and resubmit the commissioning process report.
- Prepare the final commissioning process report.
- Assemble the final documentation, which includes the commissioning process report, the systems manuals, and all record documents. Submit this documentation to Facilities for review and acceptance.
- Recommend acceptance of the individual systems and assemblies to the Owner (per the defined project requirements).

9.3 Design Professional

- Participate and assist in the documentation of the initial Owner's project requirements.
- Document revisions to the Owner's project requirements and obtain approval from the Owner.
- Document the basis of design.
- Prepare contract documents, including the integration of the commissioning process requirements and activities provided by the commissioning authority.
- Prepare contract documents that coordinate required interfaces between systems and assemblies.
- Attend the pre-design and design phase coordination and review meetings.
- Attend the construction phase pre-bid and pre-construction meetings as scheduled by the commissioning authority.
- Specify and verify that the operation and maintenance of the systems and assemblies has been adequately detailed in the construction documents.
- Review and incorporate, as appropriate, the commissioning authority's comments from their submittal reviews.
- Participate in the initial operation and maintenance personnel and occupant training session by presenting the project basis of design.
- Participate in other training as detailed in the training program.
- Review test procedures submitted by the contractor and or CxA.
- Review and comment on the commissioning authority's periodic commissioning process progress reports and issues log reports.
- Review and accept record documents as required by contract documents.
- Review and comment on the final commissioning process report.
- Recommend final acceptance of the systems to Facilities.

9.6 General Contractor

- Include costs for commissioning process activities in the contract price.
- Include commissioning process requirements and activities in all contractors' contracts.
- Provide adequate accessibility as required to properly operate and maintain the facility.
- Issue a statement that certifies all work has been completed and the facility is operational, in accordance with contract documents.
- Provide acceptable representation with the means and authority to prepare and

coordinate implementation of the commissioning process as detailed in the contract documents.

- Issue the appropriate final reports to the design professionals for review and acceptance.
- Remedy deficiencies identified by the commissioning authority during their verification of the installation or tests.
- Review and comment on the final commissioning process report.

9.7 Trade Contractor(s)

- Include costs for commissioning process activities in the contract price.
- Include commissioning process requirements and activities in each purchase order or subcontract written.
- Obtain cooperation and participation of all subcontractors and manufacturers.
- Attend the pre-construction and commissioning team meetings.
- Include commissioning process milestones in the project schedule.
- Implement the training program as detailed in the contract documents.
- Provide submittals to Facilities, design professionals, and the commissioning authority.
- Notify the commissioning authority when systems and assemblies are ready for testing.
- Demonstrate the performance of assemblies and/or operation of systems to the commissioning authority.
- Complete the construction checklists as the work is accomplished. Provide the completed construction checklists to the commissioning authority.
- Continuously maintain the record drawings and submit as detailed in the contract documents.

9.8 Manufacturers

- Provide all the information required for the operation and maintenance of the system or assembly as part of the initial submittal.
- Provide the requirements to maintain the warranty as part of the initial submittal.
- Coordinate and accomplish factory tests as detailed in the contract documents.
- Provide training as detailed in the training program contained in the contract documents.
- Demonstrate operation and performance of the system or assembly as detailed in the contract documents.

APPENDIX A – SCOPE OF WORK (SAMPLE DOCUMENT)

1.0 General

The **[Facilities Inc., *insert Project Name]*** is committed to commissioning this facility to ensure that all systems are complete and functioning properly prior to substantial completion and that facility staff have adequate system documentation and training.

The commissioning process shall oversee and coordinate the traditionally separate functions of equipment startup, system performance testing and balancing, control system calibration, construction and system documentation, and training.

Specific requirements of the commissioning process and responsibilities, duties, and obligations of the commissioning authority (CxA) team are described in Section 2, Commissioning Tasks. To accomplish these tasks, the CxA shall be required to coordinate his or her activities with other entities. The specific responsibilities of the mechanical contractor and his or her associated subcontractors are defined in Division 15, and those of the electrical contractor and his or her associated subcontractors in Division 16 of the contract documents. The commissioning process does not take away from or reduce the responsibility of the project designers or installing contractor to provide a finished and fully functioning product.

The primary role of the CxA shall be to develop and coordinate the execution of a commissioning plan; observe and document the installation, checkout, startup, and equipment and system testing to establish that equipment and systems are functioning in accordance with the requirements of the contract documents; and to assist Facilities in developing correct and complete documentation of the construction effort. The CxA will not be responsible for design concept, design criteria, compliance with codes, design, or general construction scheduling, cost estimating, construction management, or construction supervision. The CxA may assist the design team with design issues, problem solving, or the correction of construction non-conformance or deficiencies, but ultimate responsibility for meeting the project objectives and requirements resides with the A/E team and general contractor.

2.0 Commissioning Tasks

The following tasks will be accomplished by the CxA to provide commissioning during programming, design and construction, acceptance, and warranty phases of the project.

2.1 Systems to Commission

Specific systems that shall be commissioned include:

- Building automation systems, including linkages to remote monitoring and control sites.
- Chillers, pumps, piping, cooling towers, and associated equipment.
- Boilers, pumps, piping, and associated equipment.
- Air handling units.
- Exhaust fans.
- Terminal units.
- Unit heaters and unit ventilators.
- Heat exchangers.
- Computer room A/C units.
- HVAC and control systems.
- Plumbing systems.
- Fire protection systems.
- Service water heaters, pumps, and associated equipment.
- Compressed air and vacuum system equipment.
- Emergency power and uninterruptible power supply (UPS) system.
- Utility metering systems.
- Smoke control systems – interfaces, egress pressurization.
- Fire alarm systems.
- Security, access control, and CCTV systems.
- Lighting control systems.
- Voice/data communications systems.
- Public address systems.
- Power distribution system.
- Electrical system from the building entrance through the main switchboard, switchgear, and to the distribution panels.

2.2 Design Phase

The CxA shall complete the following tasks during the design phase:

- Coordinate and supervise the commissioning work during design.
- Prepare and distribute the design phase commissioning plan.

- Attend initial meetings with **[*insert date*]** and design team to discuss role of CxA, and coordination of design.
- Obtain the **[*insert Project Name*]** "Owner's Performance Requirements" information and the "Basis of Design" information from the Owner and design team.
- Provide design and constructor team members with commissioning items to be considered during design.
- Perform a focused design review at the end of design development, 50%,75% and 95% design stages, which shall include the following: a) input regarding making the building easier to commission; b) how building O&M can be made easier (accessibility and system control, etc.); and c) how utility usage and indoor environmental quality can be improved.
- Revise and prepare commissioning specifications for the construction bid documents for all systems and equipment that are to be commissioned.
- Have the commissioning specifications approved by the A/E team and included in the A/E construction specifications.
- Prepare draft functional tests for equipment and systems to include in specifications.
- Submit test procedures to design team for review and comments.
- Attend three-design team review meetings to discuss comments on plans and coordinate specifications.
- Review bids and contractor pricing regarding commissioning activities and submit evaluations to the **[*Project Name/PM*]**.

It is assumed that the A/E will provide adequate written design intent, basis of design, and full sequences of operations, complete with points lists and control schematics for all equipment and systems for inclusion in the O&M manuals and for the CxA to use in writing functional tests.

2.3 Construction Phase

The CxA shall complete the following tasks during the construction phase:

- Conduct a partnering meeting with the constructor team to discuss commissioning scope, plan, and schedule.
- Coordinate the commissioning work and, with the general constructor (GC) and Facilities project manager (PM), ensure that commissioning activities are being scheduled into the master schedule.
- Continue to update schedule and coordination throughout construction with GC and subcontractors.

- Submit final commissioning plan for construction with coordination and activities for **[*insert Project Name*]** and GC review.
- Review and approve normal contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
- Ensure that O&M material is submitted to the CxA team as the contractor receives it. This material will be needed to assist in finalizing startup and testing procedures.
- Prepare final pre-functional and final functional test procedures for the equipment and systems.
- Submit test procedures to contractor for comments on appropriate startup, operations, and systems safety.
- Coordinate with the contractor to witness startup of major equipment.
- Review and approve TAB execution plan.
- Perform monthly site inspection during rough-in of systems and equipment.
- Maintain a deficiency log of any items found to be a problem, poorly installed, or discrepancies.
- Attend up to **[*insert quantity*]** on-site meetings for review of progress, coordination, and issues resolution. More than **[*insert quantity*]** on-site meetings will be considered work outside the normal scope of work.
- Witness a sample of pipe test and flushing procedure, sufficient to be confident that proper procedures were followed.
- Witness a sample of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed.
- Witness a sample of checkout, TAB, end-to-end testing, and calibration of controls.
- Observe first pre-functional test of each type of system, including mechanical, controls, electrical, and specialty systems.

2.4 Acceptance Phase

The CxA shall complete the following tasks during the acceptance phase:

- Continue to update schedule and coordination throughout construction with GC and subcontractors.
- Obtain pre-functional reports from constructor with sign-offs that the systems have been checked out.
- Oversee TAB, including 25% check of diffusers, grilles, hoods, terminal devices, and equipment testing, and document findings.

- Witness performance testing of smoke control systems.
- Witness functional testing of each major piece of equipment to demonstrate that each item of equipment and system is operating according to the OPR and contract documents. Functional testing shall include operating the system and components through each of the written sequences of operation. Test on respective HVAC equipment shall be executed during both heating and cooling seasons.
- Provide troubleshooting to assist in resolving control problems, as they are uncovered. Functional testing shall be performed on all control points.
- Check system graphics to assure all graphics are developed and points are mapped to graphics.
- Keep a detailed log of testing of each piece of equipment.
- Maintain a deficiency log of any items found to be a problem, poorly installed, or discrepancies. Provide the log and test results to the Facilities PM, SDR, and GC with recommended actions.
- Coordinate retesting as necessary. One retest will be provided as part of normal checkout. More than one retest will be considered work outside the normal scope of work.
- Notify the Facilities PM and GC of the unacceptable findings if 10% of identical pieces of equipment fail to perform to the requirements of the contract documents due to manufacturing defects not allowing it to meet its submitted performance spec, and request explanation of problem and proposed solution from the GC; then review the proposed solutions.
- Attend weekly meetings while on-site for functional testing.
- Attend up to [***insert quantity***] additional on-site meetings for review of progress, coordination, and issues resolution. More than [***insert quantity***] on-site meetings will be considered work outside the normal scope of work.
- Review O&M documentation for completeness. This review shall be in parallel with the A/E team's review of the O&M documentation for conformance to the project specification.
- Provide the user staff with a one-day systems training on "how the building is supposed to operate."
- Review, pre-approve, and coordinating training of the [***insert project name***] operating personnel by the contractor.
- Perform seasonal testing checkout of equipment, September for cooling system and January for heating systems.
- Prepare three copies of the commissioning management report (commissioning final report). The report shall include an executive summary, list of participants and roles, brief building description, and the following sections:
    - OPR

- Basis of Design
- Pre-functional checklists complete
- Functional checklists complete
- TAB reports
- System schematics
- Control strategies and set points
- Deficiency Log
- Guidelines for energy accounting

2.5 Warranty Phase

The CxA shall complete the following tasks during the warranty phase:

- Return to the site quarterly and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning.
- Interview facility staff and identify problems or concerns they have with operating the building as originally intended.
- Identify deficiencies that may come under warranty or under the original construction contract.
- Provide one day of additional training for users and staff in building system operations.
- Prepare a detailed evaluation after ten months on the status of warranty issues for the **[*insert project name*]**.
- Attend up to four on-site meetings—in addition to the quarterly site reviews—to discuss warranty issues.

2.6 Systems and Equipment <u>Not Included</u> in Commissioning:

- **[*Insert systems*]**

3.0 Schedule

The project design and construction is scheduled as follows:

Schematic design	**[*insert date*]**
Design development documents	**[*insert date*]**
30% design	**[*insert date*]**
60% design	**[*insert date*]**
90% design	**[*insert date*]**
Construction documents	**[*insert date*]**
Bid date	**[*insert date*]**

Award date	**[*insert date*]**
Construction notice to proceed	**[*insert date*]**
Final commissioning & punch list	**[*insert date*]**
Beneficial occupancy	**[*insert date*]**

4.0 Test Equipment

The installing contractors shall provide all tools, or the use of tools required to start, checkout, and functionally test equipment and systems, except for specified testing with supplemental portable data loggers, which shall be supplied and installed by the CxA.

To expedite air-water balance testing, and to minimize additional cost to the contractor, the CxA will verify the TAB contractor's air-water balance values, using their own engineers, field technicians, and test equipment.

Data logging equipment, monitoring devices, specialized equipment, and software not required to be provided by the installing contractor in the contract documents, and provided by the CxA to monitor, confirm, or verify the contractor's testing procedures, shall remain the property of the CxA. Equipment provided shall meet the minimum accuracy, calibration, and performance standards required by the performance test.

APPENDIX B - WHAT IS AN OWNER'S PERFORMANCE REQUIREMENT (OPR)/DESIGN INTENT?

An OPR/Design Intent is a document that defines the building Owner's expectations and goals for a building. The OPR is the basis for evaluating whether or not the design and construction of the building will be satisfactory to the Owner. Proposed changes and deviations from the original design must be weighed against the OPR. The OPR is a "living" document in that it is updated and revised throughout the design and construction process based upon the decisions made along the way.

The purpose of the OPR is to provide clear documentation of the Owner's requirements for a successful project, for communication to all parties involved in the project. Therefore, it should be written in non-technical language, and avoid the use of terminology that may be specific to only one group of people. It should be understandable by everyone involved in the project, including the Owner, maintenance staff, constructor team, architect, engineers, and equipment manufacturers

The reason that an OPR document is required, regardless of the project stage when starting commissioning, is that the OPR sets forth the goals and criteria against which the success of the project is to be evaluated.

No single format is required for use to document an OPR because of the variation in different Owners' requirements for a successful building, the type of building being constructed, and the writing style of the person creating the OPR document.

However, the information in the OPR is usually presented from general to specific. Items such as background on the building, a description of commissioning, functional uses of the spaces in the building, and general goals for the building are presented first. Information that is more detailed, such as measurable values to test or obtain during design, (e.g., lighting levels, energy savings, and reduced occupant complaints), is then presented.

A possible OPR format list is shown below as an example.

- General project description
- Objectives
- Functional uses
- General quality of materials and construction
- Occupancy requirements
- Indoor environmental quality requirements
- Performance criteria
- Budget considerations and limitations

Appendix B – Owner's Performance Requirement

This list of one possible format for an OPR begins with a general project description to familiarize the reader with the size, features, and history of the building that is to be constructed. The objectives that are to be met during design and construction are listed second.

Next, the functional uses of the buildings are listed, which are the general types of usable spaces, that will be present in the building. Examples include cafeteria, closed office space, open office space (partitions), classrooms, and computer rooms. Each functional use area generally requires distinct building features, systems and equipment in order to be able to perform the intended tasks.

The general quality of materials and construction required for the project are then described. Typically, this description includes a specific quality requirement for a specific type for equipment, material, or construction. An example might be a requirement that all HVAC equipment shall have a lifespan not less than 20 years, or there shall be no constructor callbacks due to defective materials/construction for a period of five years.

Occupancy requirements are listed next, to include the intended number of people and the occupancy schedule for each functional use area. Indoor environmental quality requirements, such as lighting levels, noise levels, temperature and humidity requirements, and ventilation requirements for each functional use area, would be also included.

Performance criteria for the various building systems and equipment are included next. These criteria are used to select the types of equipment systems for the building during the design stage and are used in the turnover stage to develop the functional performance test procedures.

Finally, budget considerations and limitations are included. While building Owners would like to receive the best possible building they can get, they are nearly always bound by budget limitations.

The OPR should be as specific as possible to provide clear direction to designers and constructors in effort to eliminate the need on their part to guess or interpret an Owner's requirements. For example, instead of only stating that comfort in the space shall be maintained, the OPR should provide a definition of what the Owner considers comfort to be, such as specific temperature, humidity, and noise level. In addition, there must be some way to verify the content of the OPR. In order to do so, a specific value, or range of values, that is acceptable and testable, should be included. For example, an area specified to be "quiet" cannot be verified because of subjective interpretations of quiet. However, an area specified to be below 35NC when occupied can be tested and verified. Note the difference in the example below.

Typical Statement:

Appendix B – Owner's Performance Requirement

Comfort in space shall be maintained.

Contrast that with the OPR content, would / should read (with blanks filled):
Comfort in the space shall be maintained; Owner defines comfort as:

- Temperature of
- Humidity of
- Airflow of
- Noise
- No glare

This narrative is developed directly from the Owner's program information. This narrative is prepared almost entirely by the project architect and contains "performance" criteria as opposed to design solutions (although tentative design solutions may need to be identified in the course of verifying the budget).

- Function of structure
- Location
- Utilities
- Life expectancy
- Level of quality
- Size and/or population
- Functional floor plan
- Temperature
- Humidity
- Fume control
- Particulates
- Environmental system requirements by area:
- Illumination
- Noise
- Vibration
- Acoustics
- O&M access
- Energy efficiency
- Emergency systems
- Life safety criteria
- Special design concerns
- Special O&M concerns
- Budget
- Reliability of environmental systems-redundancy

APPENDIX C – FACILITIES COMMISSIONING PLAN

Facilities Building Commissioning Plan for *Facilities Project Name*

Appendix C – Commissioning Plan

Section 1 Overview

The Facilities Building Commissioning Plan is a source of information on the key steps that must be completed throughout the design, construction, acceptance, and operation of the new facility to assure the Owner's Performance Requirements are met. Commissioning has been adopted as the process for quality assurance in building design and construction. Commissioning is a systematic process for designing, constructing, and operating a building/system using lessons and tools from industrial quality programs. During the construction phase, commissioning focus is placed on key systems. This includes verification of the installation**,** training**,** and system documentation.

This Facilities Building Commissioning Plan has been specifically developed for this project to aid the building design, construction, and operation team in ensuring the quality of the project. It is important to understand that the Facilities Building Commissioning Plan provides a framework for the commissioning and quality assurance process. It may be modified and adapted to meet unforeseen quality control issues and opportunities throughout the project.

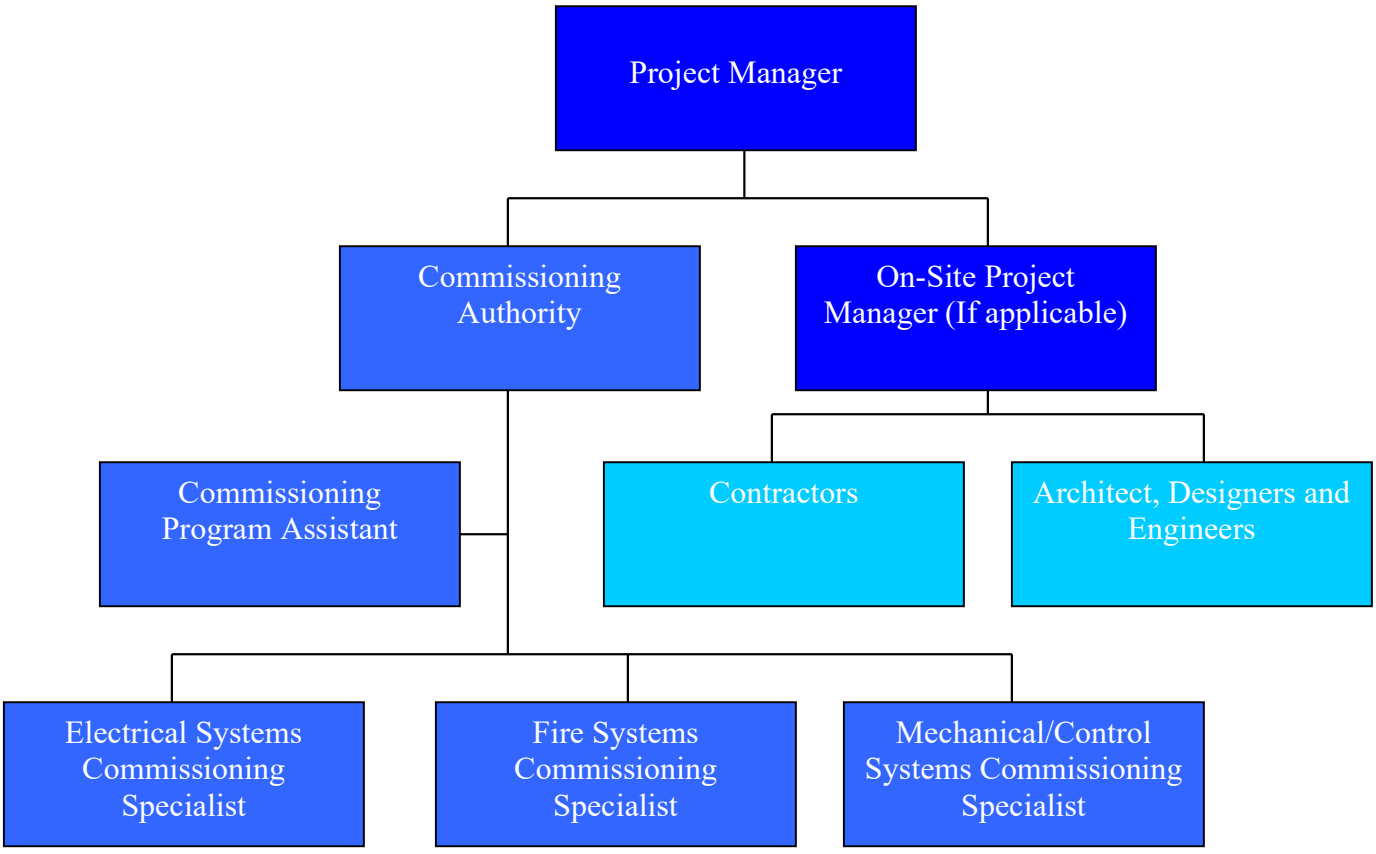
This quality assurance process is the quality program for achieving a collaborative and systematic process of review, testing and confirmation that all components, assemblies, and systems will perform as required.

The commissioning process has many benefits to the entire commissioning team. Construction commissioning benefits the Owners by providing a nonbiased, third-party system expert, who can help identify issues early and reduce first year operation costs. This is accomplished by verification and documentation that systems function as designed and meet the intent of the OPR. Construction commissioning benefits the contractors by providing coordination between trades and identifying potential rework issues, warranty calls, and service callbacks.

Section 2 Communication Protocol and Organization Chart

The key to an effective project is to ensure that there are well-defined lines of communication between all parties involved in the project. Communication is maintained throughout the project by a conscious effort of the various commissioning team members. The specific communication structures developed for this project ensure efficient identification and resolution to issues through the use of clear and concise procedures.

The commissioning team for this project is as follows: The reporting structure is as indicated.



Section 3 Cx Plan Overview

The high-level overview for this Cx project is as follows:

Pre-design Activities:
- Develop Owner's Performance Requirements (OPR)
- Train project team on use of Facilities Management database (TBD)

Design Phase Activities:
- Maintain master issue's log in Facilities Management database (TBD)
- Review Basis of Design (BoD) document for thoroughness
- Review engineer's drawing packages including schematic design, design development, and construction documents
- Development of commission specifications
- Development commissioning plan
- Development of pre-functional checklists for all commissioned equipment
- Development of functional performance tests for all commissioned equipment

Bid Stage Activities
- Provide responses to questions regarding commissioning requirements

Construction Phase Activities:
- Maintain master issues log in Facilities Management database (TBD)
- Develop commissioning activity schedule
- Perform submittal reviews of commissioned equipment/systems
- Perform site observation visits
- Witness start-up of critical systems
- Perform test and balance verification
- Review draft O&M manuals
- Review training program
- Collect and track completion of pre-functional checklists

Acceptance Phase Activities
- Initial functional performance testing
- Integrated functional performance testing
- Deficiency resolution tracking
- Review as-built documentation
- Review final O&M manuals (hard and soft copies)

Warranty Phase Activities
- Review status of outstanding issues
- Perform deferred functional testing
- Perform seasonal testing
- Review system performance and optimization needs
- Conduct lessons learned workshop

Section 4 Design Phase

Design Review

Design reviews will be performed in conjunction with the design document submittals. The design review consists of a review of the schematic design documents, the design development documents, and the construction documents. These reviews are to ensure proper coordination has occurred between the disciplines, the design is constructible, and the design meets the requirements of the owner.

Installation/Pre-startup Checklists

The Installation/Pre-startup Checklist is a document that provides key information and allows tracking of the construction activities and progress. It documents that the equipment is installed properly, adequately accessible, in good condition, and ready for startup and functional performance testing.

- A checklist will be issued for each major piece of equipment or for components in a system. CxA will determine what will be included in each checklist.
- The CxA will provide the checklists to the contractor early on the construction phase. If the contractor has his own checklists, he may use them upon agreement from the CxA.
- The contractor will complete the checklists and return them to the CxA.
- The contractor should return the checklists to the CxA as he completes them.
- Equipment checklists must be returned to the CxA before commencement of functional performance testing of that equipment or system.

See Figure 4-1 for an example checklist.

Figure 4-1 – Example Checklist

Section 5 Written Work Products

Table 5-1 lists the formal written work products related to commissioning that will be developed over the course of the project.

Table 5-1: Formal Written Work Products

Product	Created By	Product Description and Form	Expected by Date	Received By
Cx Plan	CxA	Final Cx plan for construction phase	10/31/24	All Cx team
Cx Schedule	CxA	Initial summary schedule and detailed version	11/27/24	All Cx team/PM and Senior Staff.
Equipment Submittals	All Contractors	Detailed data on all commissioned equipment.	11/21/24 and 11/27/24 Request made to PM	Cx Team currently does not have this information.
Site Observation Reports	CxA	Report of observations made during site visit	12/12/24 through 12/18/24 and 1/13/25 through 1/18/07	PM Team
Issues Log	CxA	List of deficiencies and non-compliance with Contract Documents identified during Cx	1st published 01/02/25 Updated weekly after 1st publication.	PM Team and GC
Cx Progress Reports	CxA	Gives scheduling needs and update, deficiency report, Cx progress	01/15/25 to 01/19/25 and Cx Alloy Implemented	PM Team
Start-up Plan	All Contractors	Plan for the start-up of each commissioned piece of equipment or system.	Cx Team Created and delivered on 01/13/25 However -Equipment was already started. Cx Team Requested Start-up documents from PM and GC.	PM Team and GC
Blank Start-up Data Forms	All Contractors	Forms for recording start-up information.	01/13/25	CxA
Completed Start-up and Pre-functional Data Forms	All Contractors	Filled out verification checklists, tests, startup and initial checkout.	1 week after startup completion	
Pre-functional Checklists	CxA	Checklists to be used by the Contractors to formally communicate readiness for functional testing.	01/13/25	PM Team and GC
TAB Data Forms	TAB Contractor	Forms to be used to record TAB data.	6weeks before TAB	CxA
Final TAB report	TAB Contractor	Final TAB report with method and results.	Within 3 weeks after TAB completion	CxA
Functional Performance Test Procedures and Forms	CxA	Full description of test procedures in “form” format.	01/13/25	PM Team and GC
Functional Performance Test Deficiency Report Form	CxA	Documentation of deficiency discovered during testing.	3 days after test	Owner; A/E
Completed Functional Performance Test Forms	Contractors and CxA	Recorded documentation of the test on the form	1 week after test	Owner; A/E
O&M Manuals	All Contractors	Documentation of design, equipment, operations and maintenance, as-builts, etc.	90 days after approved submittals	CxA; Normal others
Training Plan	Contractors	Topics and methods	60 days before training	CxA; Normal others

Table 5-1: Formal Written Work Products

Product	Created By	Product Description and Form	Expected by Date	Received By
Training Completion Documentation	CxA	List of trainees, completed hrs and topics and approvals	Within 2 weeks after training completion	Owner
Final Cx Report	CxA	4-6 page summary report with important findings, etc.	Draft within 60 days of substantial completion	Owner
Deferred Testing Reports	CxA	Documentation of seasonal and deferred tests	Within 2 weeks of test	Owner
Recommissioning Manual	CxA			Owner

Section 6 Commissioned Systems and Equipment

The following systems, equipment, and their components are included in the scope of the commissioning activities and are considered to be commissioned systems and equipment.

Table 6-1: Commissioned Systems and Equipment

System and Equipment	Sampling Rate
Electrical	
Power Distribution System	
Switchboard	100%
Panelboards	100%
Dry-Type Transformers	100%
Disconnects/Starters	100%
Wiring Devices	100%
Lighting System	
Luminaires	100%
Occupancy Sensors	100%
Dimming System	100%
Emergency Power System	
Engine-Generator Set	100%
Automatic Transfer Switches	100%
Egress Lighting	100%
Exit Signage	100%
Grounding System	
Counterpoise	100%
Lightning Protection	100%
Data Center	
UPS and PDU	100%
CRAC Units	100%
Generator	100%
Mechanical	
HVAC	
Air Handling Unit Function & Building Pressurization	100%
Dampers	100%

Fans & Drive Motors	100%
Terminal Units	100%
Unit Heaters	100%
Variable Frequency Drives	100%
Valves	100%
Chilled Water System	
Chiller	100%
Pumps	100%
Control Valves	100%
Distributed Digital Control – Building Automation	
Alarms	100%
BACnet Compatibility	100%
Control Points	100%
Man Machine Interface	100%
Monitored Points (Digital And Analog)	100%
Offsite Monitoring	100%
Programming	100%
Sequences of Operation	100%
Set Points and Archives	100%
Exhaust System	
Dampers, Louvers	100%
Controls	100%
Fans & Drive Motors	100%
Plumbing Systems	
Domestic Potable Water System	
Backflow Preventers	100%
Controls	100%
Hot Water Recirculation Pumps	100%
Pressure Regulators	100%
Vacuum Breaks	100%
Valves	100%
Water Heaters and Pressure Relief Valves	100%
Sanitary Sewer Systems	
Cleanouts	100%
Piping and Supports	100%
Traps (Self Priming and Non Self-Priming)	100%
Vents	100%
Storm Sewer Systems	
Piping and Supports	100%
Roof Drains	100%
Fire Protection Systems	
Sprinkler Systems	
Panels	100%
Sprinkler Heads	100%

Standpipe	100%
Valves	100%
Fire Alarm	
Control Panel	100%
Addressable Devices	100%
Tamper & Flow Switches	100%

Section 7 Commissioning Meetings

The CxA shall conduct a commissioning kick-off meeting early in the construction phase to discuss specific roles and responsibilities of the contractors. During this meeting the CxA shall review the OPR, Basis of Design, and unique contract document requirements.

Throughout construction, most commissioning issues will be handled during regularly scheduled project meetings. If specific topics require additional discussion, the commissioning team shall meet immediately after the project meeting.

Other commissioning meetings may occur at other times mutually agreed to by the commissioning team.

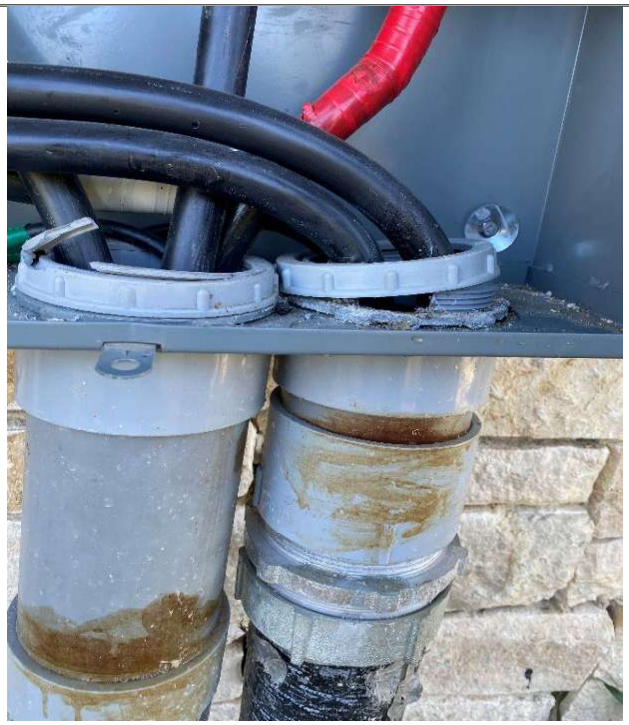
Section 8 Site Visits

Site visits are the primary method used during the Construction Phase to verify that installed systems and equipment comply with the OPR. The site visit procedures use a statistical approach to verify compliance. This includes performing general inspections, verifying installed equipment complies with the contract documents, and verifying pre-functional checklists have been accurately completed.

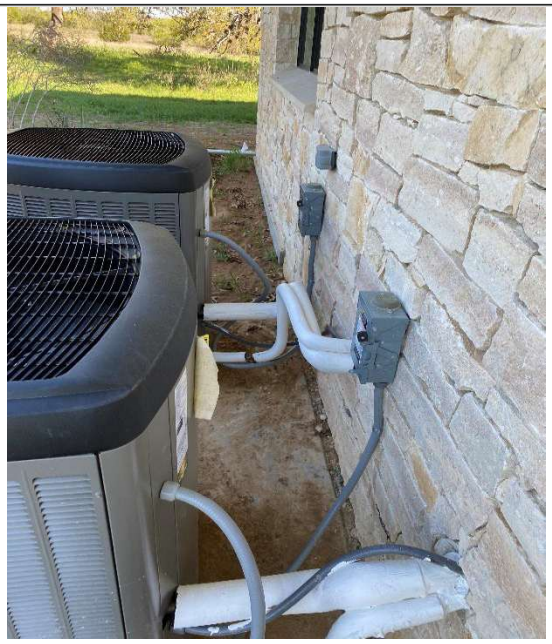
The CxA team will perform site visits, with increasing frequency. As construction progresses and systems and equipment installations are completed.

Upon arrival, the CxA team shall notify the PM before entering the jobsite. The CxA's shall follow all safety policies and regulations implemented by the General Contractor. After completing the site visit, the CxA shall meet with the PM to discuss any potential issues observed or to note any safety concerns. A Site Observation Report shall be published on the Facilities Management database (TBD) website. This report will outline any observed issues and provide recommendations for resolution. The SOR may include construction issues, access and maintenance issues, safety issues, or other issues. The General Contractor shall respond to the issues within the contractual response time. See Figure 8-1 for an example Site Observation Report.

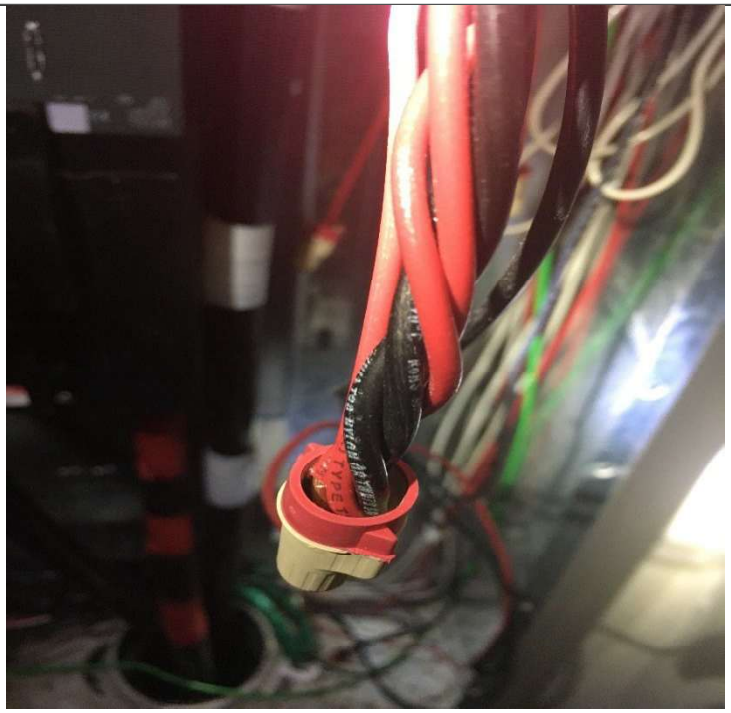
Figure 8-1 – Example Site Observation Report



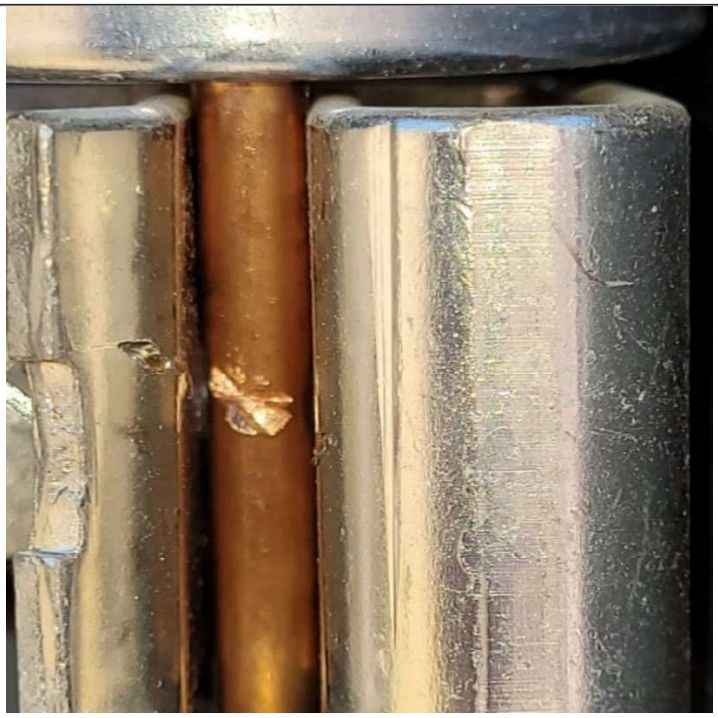
1. **Photo Description – Building Main - PVC male adapters and bushings are damaged and broken.**



2. **Photo Description – Condenser disconnects are located behind the units not allowing adequate working space for the disconnect.**



3. **Photo Description – Panel LE - Wire joints in the panel have exposed copper past the covering of the connector.**



4. **Photo Description – Main Service – fuse installation method caused damage to the fuse and fuse clips.**

Section 9 Installation/Pre-startup Checklists.

The Installation/Pre-startup Checklist is a document that provides key information and allows tracking of the construction activities and progress. It documents that the equipment is installed properly, adequately accessible, in good condition, and ready for startup and functional performance testing.

- A checklist will be issued for each major piece of equipment or for components in a system. CxA will determine what will be included in each checklist.
- The CxA will provide the checklists to the contractor. If the contractor has his own checklists, he may use them upon agreement from the CxA.
- The contractor will complete the checklists and return them to the CxA.
- The contractor should return the checklists to the CxA as he completes them.
- Equipment checklists must be returned to the CxA before commencement of functional performance testing of that equipment or system.

See Figure 9-1 for an example checklist.

Figure 9-1 Example Checklist

AC-3.2

Checklist

Equipment Tag: AC-3.2 *Complete By:* *Notes:*

System: Rooftop Air Conditioning *Checklist Type: Pre-Functional*

Date: *Equipment Type:* Air Handler Unit

Item No.	Description	Answer	Comment
1.	Correct model number and configuration		
2.	Unit free of damage		
3.	Damaged paint surface repaired.		
4.	Coil surface area is free of damage.		
5.	All access doors open fully and freely		
6.	Manufacturer's startup completed an report attached.		
7.	All shipping bolts and installation materials are removed.		
8.	Access clearance maintained.		
9.	Record drawings accurate.		
10.	Access is provided to all dampers and sensors (access doors installed)		
11.	Smoke detector installed in supply duct and return duct.		
12.	Ductwork is clean and free of debris.		
13.	Flex connector installed at supply and return duct connections.		
14.	Condensate drain piping routed to roof drain.		
15.	All condensate drain pipe insulated.		
16.	Disconnect and safety switch installed.		
17.	Supply fan and motor lubricated and aligned.		
18.	Return fan and motor lubricated and aligned.		
19.	Unit starts ad runs without any unusual noise or vibration.		
20.	Test and balance complete.		

Note: This is an example and can be reconstructed to match the functional testing required

Section 10 O&M Manual Reviews

The Contractor will forward a copy of each related O&M manual submittal to the CxA for review. The draft of the O&M manual should be completed and submitted for review 90 days after approved equipment submittals are returned to the contractor. Since each specification section is a different O&M manual section, the O&M manual can be completed and submitted one section at a time.

See Figure 10-1 for an example Submittal Review report.

Figure 10-1 – Example Submittal Review

TBD

Section 11 Issue Log Description

All issues identified during the course of the project shall be tracked using the Facilities Management database Issues Log (TBD). The purpose of the Issues Log is to communicate issues identified during the course of the project to the commissioning team and track those issues to resolution. All issues shall have responses within two weeks from identification.

The Issues Log shall contain detailed descriptions of problems identified during the construction phase, along with recommended corrective actions. Each issue is tracked in a database with the following information:

- Unique identifier
- Date of issue identification
- Applicable test number
- Applicable system or equipment number
- Location of issue
- Description of issue
- Recommended corrective action
- Responsible party
- Expected date of response

Issues can be sorted by any of the above information and provided to the commissioning team in customized reports. See Figure 11-1 for an example Issues Log report.

TBD

Figure 11-1 Example Issues Log Report

TBD

Figure 10-1 – Example Submittal Review

Section 12 Functional Performance Tests

The CxA shall develop Functional Performance Tests to demonstrate that the commissioned systems and equipment operate properly in all modes of operation. Testing shall begin at the component level and progress upwards in complexity to the equipment and system level. When all systems have passed their functional performance tests, the systems shall be tested together to verify operation as a whole in a building wide System Integration Test.

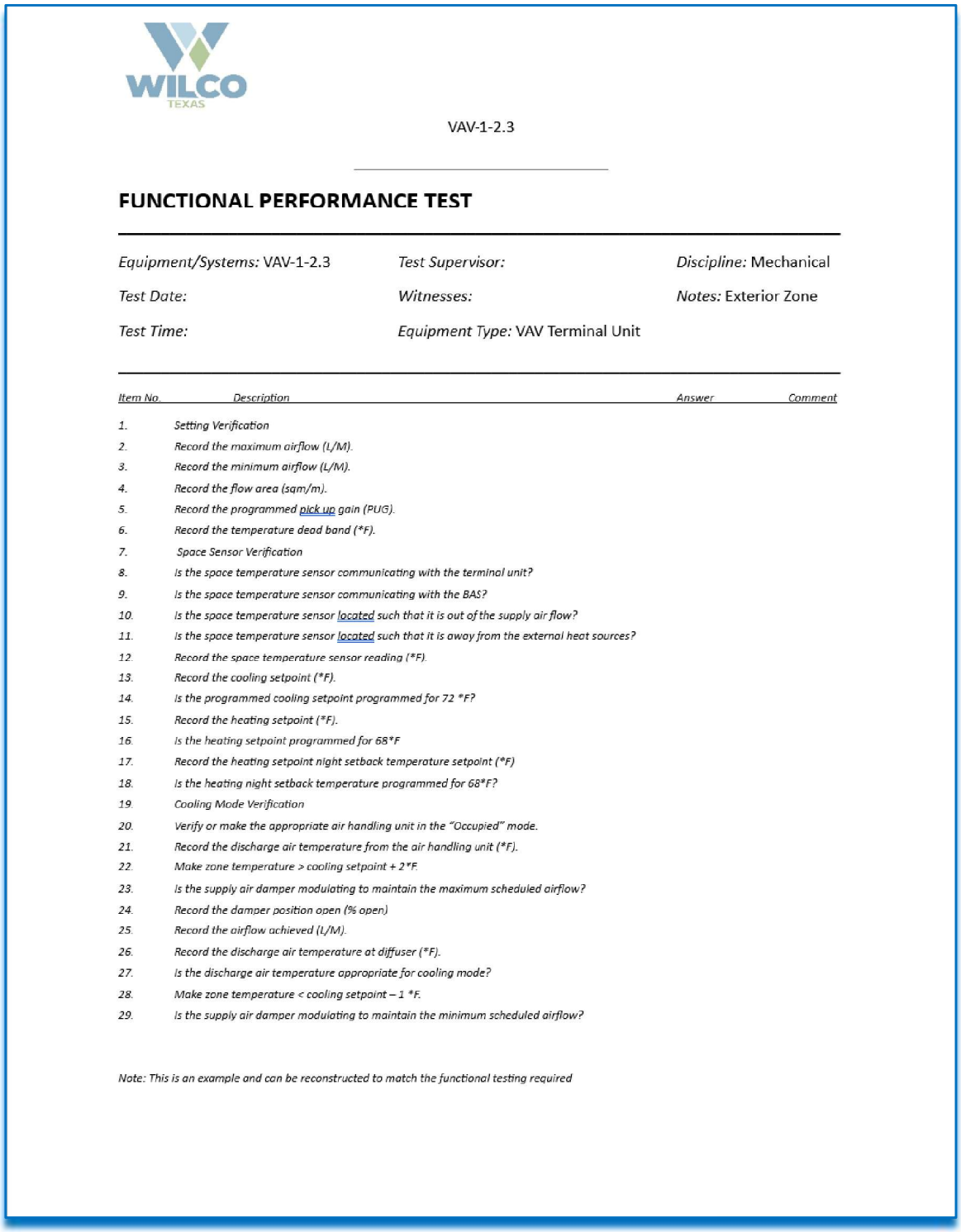
Each FPT is written in a pass/fail format, with yes being the correct response and no being a failed response. Prior to testing the CxA will provide the FPT procedures to the Contractor and all applicable subcontractors for review.

The Contractor shall complete and submit all applicable equipment pre-functional checklists prior to scheduling of testing. When the equipment and systems are ready to test, the FPT will be scheduled for a time mutually convenient to the Contractors and the CxA. The CxA will orchestrate the Functional Performance Test and provide attendee sign-in sheets shall be used to verify the attendance of all witnesses. The Contractor shall be responsible to provide personnel and equipment to perform the testing and to correct problems found during the testing.

If the total time required to correct minor problems during testing is greater that fifteen (15) minutes, the test shall be considered failed and must be repeated in its entirety. If a major problem is discovered during the test, the Contractor shall correct the problem. Prior to retesting, the Contractor shall submit to the CxA the required data indicating that the deficient items have been corrected. After review of this information by the CxA, a retest will be scheduled. During the course of the retest, if at any point a major deficiency is discovered, the test will be stopped.

See Figure 12-1 for an example FPT.

Figure 12-1 Example FPT



VAV-1-2.3

FUNCTIONAL PERFORMANCE TEST

Equipment/Systems: VAV-1-2.3	*Test Supervisor:*	*Discipline:* Mechanical
Test Date:	*Witnesses:*	*Notes:* Exterior Zone
Test Time:	*Equipment Type:* VAV Terminal Unit	

Item No.	Description	Answer	Comment
1.	Setting Verification		
2.	Record the maximum airflow (L/M).		
3.	Record the minimum airflow (L/M).		
4.	Record the flow area (sqm/m).		
5.	Record the programmed pick up gain (PUG).		
6.	Record the temperature dead band (*F).		
7.	Space Sensor Verification		
8.	Is the space temperature sensor communicating with the terminal unit?		
9.	Is the space temperature sensor communicating with the BAS?		
10.	Is the space temperature sensor located such that it is out of the supply air flow?		
11.	Is the space temperature sensor located such that it is away from the external heat sources?		
12.	Record the space temperature sensor reading (*F).		
13.	Record the cooling setpoint (*F).		
14.	Is the programmed cooling setpoint programmed for 72 *F?		
15.	Record the heating setpoint (*F).		
16.	Is the heating setpoint programmed for 68*F		
17.	Record the heating setpoint night setback temperature setpoint (*F)		
18.	Is the heating night setback temperature programmed for 68*F?		
19.	Cooling Mode Verification		
20.	Verify or make the appropriate air handling unit in the "Occupied" mode.		
21.	Record the discharge air temperature from the air handling unit (*F).		
22.	Make zone temperature > cooling setpoint + 2 *F.		
23.	Is the supply air damper modulating to maintain the maximum scheduled airflow?		
24.	Record the damper position open (% open)		
25.	Record the airflow achieved (L/M).		
26.	Record the discharge air temperature at diffuser (*F).		
27.	Is the discharge air temperature appropriate for cooling mode?		
28.	Make zone temperature < cooling setpoint – 1 *F.		
29.	Is the supply air damper modulating to maintain the minimum scheduled airflow?		

Note: This is an example and can be reconstructed to match the functional testing required

Section 13 Training

The CxA will review training materials prior to scheduled training sessions. These reviews are to verify that that the trainees receive pertinent information to operate and maintain the facility according to the manufacturer's instructions and the OPR. The contractors will submit proposed training agendas and materials to the CxA for review and comment at least sixty (60) days before the anticipated training date. The contractor will incorporate and modify the proposed material based on these comments and other comments submitted by the Owner or the Architect. The contractor will coordinate with the Owner's O&M personnel for a mutually convenient time to conduct the training sessions.

Section 14 Lessons Learned Workshop

After final completion, a lessons-learned workshop will be held to determine what went well during the project and what could be improved in the next project. This workshop will focus on the identification and documentation of clear and unbiased views of all team members. The information gained during this workshop may then be integrated into the next construction project in order to improve the process.

The lessons learned workshop will use a nominal group process to facilitate discussion. The workshop will be facilitated by the CxA to elicit the key concerns of the project team. The workshop will be organized to encourage the identification of all relevant issues and to encourage the interaction and discussion among all team members.