ADVERTISEMENT FOR PROPOSALS

Sealed proposals will be received by the Wentzville R-IV School District, at the Wentzville Central Office, 280 Interstate Drive, Wentzville, MO 63385, until **WEDNESDAY, FEBRUARY 20, 2019 AT 10:00 a.m. CDT,** for the **Commissioning Services** for the Wentzville New High School at North Pointe Prairie and West Meyer Roads.

Proposal information for this project is included with this document.

Drawings and specifications for this project are available through the office of the Architect, Hoener Associates, Inc., 6707 Plainview Avenue, St. Louis, MO 63109, (314) 781-9855, FAX (314) 781-0163.

Request for Commissioning Services
Wentzville School District - New High School

Issuance Date: January 29, 2019

Closing Date: Wednesday, February 20, 2019 at 10:00 a.m.

The Wentzville School District (WSD), (Owner), requests written proposals to secure commissioning authority (CxA) services for the New High School at 2255 W. Meyer Road, Wentzville, Missouri 63385. The Owner is committed to commissioning this facility to systematically optimize the building and ancillary systems so that they operate efficiently and effectively in accordance with the Owner's project requirements, and that the facility staff has adequate system documentation, and training; specifically in compliance of section C408, System Commissioning of the 2015 International Energy Conservation Code (2015 IECC). It is the intent of the Owner to ensure that the fundamental systems are calibrated and operating as required to deliver functional and efficient performance.

This project is a 310,271 gross sq.ft., 2 story building with a project budget of approximately $75 million. The expected schedule is to start construction by Late Spring 2019, and occupy by July 2021.

The CxA will market, plan, manage, perform and report on the commissioning activities, utilizing the reporting formats and standardized forms provided by the CxA whenever required. The CxA will submit deliverable report to WSD according to a project schedule set by CxA and agreed upon by WSD. It is extremely important that all commissioning tasks be conducted in a transparent manner and involve the design engineer and operations staff to the greatest degree possible.

The management structure is traditional bid/build with full design documents and specifications developed by an architectural/engineering firm. The construction documents have been bid and Wright Construction (General Contractor) has been hired to complete the construction. The commissioning authority will be hired by and report directly to the Owner.

The systems to be commissioned are:

Mechanical systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes but is not necessarily limited to the work listed for each system. The foregoing includes all the following:

1. Heating water, chilled water, and condenser water piping systems – work includes installation inspections and checks; expansion tanks; confirmation of flow balancing completion.

2. Duct and air-handling systems – work includes installation inspections and checks; confirmation of flow balancing completion.
3. Chillers – work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of documented performance measurements including capacity, evaporator and condenser flows, motor amperage and controls operation.
4. Refrigerant Alarm Systems - work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of warning and alarm levels, confirmation of appropriate sequence and action for shutdown/start-up of equipment and notification.
5. Cooling Towers – work includes installation inspection and checks; supervision of checkout and startup by manufacturer's representative in conjunction with chiller; verification of documented performance measurements including capacity, motor amperage, basin heater operation, makeup water, overflow, and capacity controls.
6. Boilers – Work includes installation inspections and checks; verification of chemical treatment; supervision of checkout and startup by manufacturer's representative; verification of documented performance measurements including capacity test, burner and controls operation.
7. Chemical Treatment Systems - work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of appropriate treatment levels for closed and open systems.
8. Pumps – Work includes documented checks on alignment; verification of testing and balancing including rotation, motor current draw, flows and pressures.
9. Supply, Return, Relief and Exhaust Fans – Work includes checks on installation (including dampers and other accessories); verification of testing and balancing including rotation, motor current draw, airflows and pressures.
10. Air Handling Units – Work includes installation inspections and checks; supervision of checkout and startup by manufacturer's representative as specified; verification of documented tests for air flow and static pressures; verification of operation of all controls.
11. Air Terminal Devices – Work includes installation inspections and checks; for VAV units, verification of flow adjustments and calibration coordinated with controls and air balancing; controls operation including flow modulation, reheat, controls responses.
12. Direct digital controls system – Work includes inspections and checks of installation and operation of control devices; verification of complete operation of controls sequences, in coordination with commissioning of all controlled systems.
13. Domestic Hot Water Systems – Work includes checks on installation; verification of testing and balancing including water flows and pressures; verification of mixing valve operation.
14. Non-potable Hot Water Systems – Work includes checks on installation; verification of testing and balancing including water flows and pressures; verification of mixing valve operation.

Electrical systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes but is not necessarily limited to the work listed for each system. The foregoing includes all the following:

1. Lighting control systems – work includes installation inspections and checks; confirmation of photocells, schedule timers, occupancy controls, and daylighting controls. A minimum of 10 percent of occupancy sensors shall be verified.
2. Emergency generators – work includes installation inspections and checks; confirmation of operation of automatic transfer switch and generator.

Terms and Conditions

1. This RFQ does not commit WSD to award a contract, issue a purchase order, or to pay any costs incurred in the preparation of a qualification in response to the RFQ.

2. The qualification will become part of WSD's official files without any obligation on WSD's part.

3. Proposer(s) shall not collude in any manner, or engage in any practices, with any other Proposer(s) that may restrict or eliminate competition or otherwise restrain trade. This is not intended to preclude subcontracts and joint ventures for the purpose of: a) responding to this RFQ, or b) establishing a project team with the required experience and/or capability to provide the goods or services specified herein.

4. Proposer(s), their authorized representatives, and their agents are responsible for obtaining, and will be deemed to have full, knowledge of the conditions, requirements, and specifications of this RFQ.

5. The proposer must promptly report to WSD any conditions, transactions, situation, or circumstances that would impede, impair or delay the submission of the qualifications, or the proper and timely performance of the work.

6. WSD reserves the right to cancel this RFQ or to reject any or all qualifications received prior to contract award.

7. WSD reserves the right to request clarification of any qualification after all qualifications have been received. The request can be in the form of oral presentation or personal meetings.

8. WSD reserves the right to open qualifications privately or unannounced and to reject any and all submittals and waive irregularities and informalities in any qualifications that are submitted and to be the sole and final judge of all qualifications.

9. WSD reserves the right to discontinue its evaluation of submittals from any respondents who submit false, misleading or incorrect information.

Scope of Work

Commissioning is required as one quality measure of the construction of this building in order to assure that the final building meets the original intent of the Owner's design. The proposer is free to suggest changes and improvements to this process.

Following is a summary of the commissioning process and scope of work the Owner requests for this project.

Commissioning Process During the Construction Phase

The commissioning process activities accomplished by the commissioning authority during the construction phase includes:

1. Develop commissioning plan and submit to owner for review.

2. Organize the commissioning process components and incorporate the commissioning process requirements into the construction meetings with the commissioning team.

3. Coordinate and direct commissioning activities in a logical, sequential and efficient manner using consistent protocols, clear and regular communications and consultations with all necessary parties, frequently updated timelines, schedules, and technical expertise.

4. Perform site visits, as necessary, to observe component and system installations.

5. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction-meeting minutes for revisions/substitutions relating to the Owner's design intent.

6. Organize and conduct periodic commissioning team meetings necessary to plan, develop the scope, coordinate, schedule activities and resolve problems. Maintain and distribute the minutes of these meetings to all members of the commissioning team. Note on commissioning budget table the number of anticipated meetings that will be scheduled.

7. Develop and document construction checklists as required. Submit to Owner for review and to contractors for coordination.

8. Coordinate with contractors in completing construction checklists. This may consist of scheduling efforts only or may entail scheduling of resources, depending on the commissioning approach.

9. If construction checklists are completed by the contractor and not the commissioning authority, statistically sample completion of construction checklists on a periodic basis to verify that contractor's quality process is achieving the Owner's project requirements.

10. Approve systems start-up by reviewing start-up reports and by site observation for small systems, and by attending start-up and reviewing start-up reports for major systems.

11. With necessary assistance and review from installing contractors, write the test procedures. Submit to Owner for review and approval.

12. Coordinate the execution of the tests by the contractors, when not performed by commissioning authority.

13. Coordinate witness and recommend approval of manual functional performance tests performed by installing contractors, when not conducted by the commissioning authority. Coordinate retesting as necessary until satisfactory performance is achieved.

14. Recommend approval of air and water systems balancing through thorough review of the report and statistical sampling in a separate field verification.

15. Maintain a master issues log and a separate testing record. Provide to the GC and Owner written progress reports and test results with recommended actions.

16. Document the correction and retesting of non-compliance items by the contractor.

17. Coordinate assembly of the systems manual for achieving the Owner's project requirements. Final form shall include electronic pdf format.

18. Review, recommend pre-approval, and verify the training provided by the contractors. Attend Owner training sessions to verify appropriate communication of system requirements. Coordinate documentation and archival of training session, including video recordings, electronic training media and physical training media.

19. Verify delivery of the systems manual.

Deliverables by Phase

The commissioning authority shall produce the deliverables described below.

<u>Construction Phase</u>

1. Commissioning Plan
2. Issues Log
3. Status Reports
4. Commissioning Meeting Minutes
5. Functional Test Performance Reports
6. Systems Manual
7. Training Documentation
8. Final Commissioning Report

Commissioning Authority Responsibilities

In addition to duties described above, the commissioning authority (CxA) will have the following responsibilities and authority:

1. Issue deficiency notices and verify that they have been corrected. A deficiency log will be maintained and reviewed at the commissioning meetings. Deficiencies that are not corrected in a timely manner will be report to the Owner.

The commissioning authority (CxA) is not required to:

1. Establish design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving or resolving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the design team. The CxA will report to the Owner any deficiencies or discrepancies.

2. Issue changes orders; they do review change orders for compliance with the construction documents. Non-compliances will be reported to the Owner.

Observation and Testing Requirements

Equipment or Systems	Sampling Rate
HVAC Systems	
Chillers	100%
Cooling towers	100%
Boilers and Associated Equipment	100%
Heating Heat Exchangers	100%
All Pumps	100%
Air Handling Units	100%
Laboratory Exhaust Fan Systems	100%
Ventilation Fans	25%
VFDs	100%

ECMs	100%
Air Terminal Units	100%
Ductwork	50%
Pipework	25%
Temperature Control	75%

Building Automation Systems

Temperature/Humidity Sensors	10%
Pressure Sensors and Controllers	10%
Sequence of Operation	100%
Airflow Stations	100%
Damper/Valve Actuators	100%

Plumbing And Fire Protection Systems

Plumbing Equipment	25%
Plumbing Piping Systems	25%
Domestic Hot Water Heating System	100%
Non Potable Hot Water Heating System	100%

Electrical Systems

Normal Power Electrical Systems	50%
Emergency Power Systems	100%
Fire/Life Safety Systems	50%
Security Systems	100%
Lighting Systems	100%
Occupancy Sensors	10% (for each type)

Desired Qualifications:

It is the Owner's desire for the person(s) designated as the site commissioning agent to satisfy as many of the following requirements as possible:

1. Acted as the principal commissioning authority for at least three projects of comparable size, type and scope.

2. Extensive experience in the operation and troubleshooting of HVAC systems and energy management control systems.

3. Extensive field experience. A minimum of five full years in this type of work is required.

4. Knowledgeable in building operation and maintenance and O & M training.

5. Knowledgeable in national building and fire codes as well as water-based fire extinguishing systems, detection systems and alarm systems.

6. Knowledgeable in test and balance of both air and water systems.

7. Experienced in energy-efficient equipment design and control strategy optimization.

8. Demonstrated experience with total building commissioning approach including building envelope, data and communication systems and other specialty systems.

9. Direct experience in monitoring and analyzing system operation using energy management control system trending and stand-along data logging equipment.

10. Excellent verbal and writing communication skills. Highly organized and able to work with both management and trade contractors.

11. Experienced in writing commissioning specifications.

12. A bachelor's degree in mechanical or electrical engineering is strongly preferred, and P.E. license is desired. However, other technical training, past commissioning, and field experience will be considered as a substitute.

13. Membership and certification as a Certified Commissioning Professional with the Building Commissioning Association, Building System Commissioning Certification with the National Environmental Balancing Bureau or Commissioning Process Management Professional Certification with the American Society of Heating, Refrigerating and Air-Conditioning Engineers, is desired but not required.

The required expertise for this project will be based on the skill and experience set of the full team making the proposal. A member of the prime firm will be the designated commissioning agent who is the member of the team that will coordinate the commissioning activities from the technical perspective. This party may not necessarily be the team's overall project or contract manager. The commissioning agent must have significant in-building commissioning experience, including technical and management expertise on projects of similar scope. If the commissioning agent or prime firm does not have sufficient skills to commission a specific system, the prime firm shall subcontract with a qualified party to do so. Subcontractor qualifications shall be included and clearly designated in the response to this scope of work.

Proposal

Proposals need not be voluminous, but shall provide sufficient information to allow the Owner to evaluate the consultant's approach, experience, staff and availability.

The proposer shall:

1. Limit their proposal to 20 single-sided pages, including graphics. A letter of introduction, section dividers, detailed resumes, sample work products and the required attachments are not included in this limit.

2. Have the proposal signed by an officer of the proposing firm with the authority to commit the firm.

3. Fill out the attached Commissioning Responsibility Assignment Matrix (Attachment A) to indicate your firm's approach to commissioning at it pertains to level of participation for each of the listed tasks.

4. Fill out the attached Commissioning Firm Experience form and the Commissioning Task Listing form (Attachments B and C) for each firm on the team. List no more than four projects in Attachment C.

5. List the individual(s) who will serve as the lead CxA for the construction phase of the contract.

6. Provide resumes for key staff and subconsultants. The resumes shall include specific information about expertise in commissioning tasks, (e.g., commissioning management, troubleshooting, test writing, test execution, energy management, sustainable design, etc.).

7. Briefly describe "relevant" experience (project phasing, life cycle costing, testing, adjusting and balancing, building simulation, IAQ, campus projects, etc.) of the proper's team in the following areas. List involvement of key team members.

    a. Projects similar to this one;
    b. O&M experience;
    c. Energy-efficient equipment design and control strategy optimization;
    d. Project and construction management;
    e. System design (specify);
    f. Troubleshooting.

8. Describe your proposed approach to managing the project expertly and efficiently, including distribution of tasks, travel, and duration of which staff will be on site during what periods of time, etc. Describe how you intend to determine the appropriate level of commissioning effort for the various systems and equipment.

9. As an attachment, provide the following work products that members of the proposer's team developed. List the team member who actually wrote the

document and the projects on which they were used. Work from the designated CxA is preferred.

a. Retro-commissioning plan that was executed (the process part of the plan); and
b. An actual functional test procedure form that was executed.

10. Provide a statement of proposer's liability insurance coverage (type, and dollar amount of coverage). Proof of this insurance will be required prior to the award of this contract to the winning proposal.

11. Provide a fixed, lump sum total cost to accomplish the work. All task amounts include associated meetings, progress reports and direct costs (travel, mileage, per diem, communications, etc.). Use the budget table show in Attachment D (or a suitable equivalent) to provide a cost breakdown. Also provide an hourly rate for each team member for work that may exceed the scope. For each phase, provide the percentage level of effort for each primary team member.

12. Provide compliance with e-verify.

13. Provide a statement of proposer's liability insurance coverage (type, and dollar amount of coverage). Proof of this insurance will be required prior to the award of this contract to the winning proposal.

14. Use the budget table shown in Attachment D (or a suitable equivalent) to provide a cost breakdown. Also provide an hourly rate for each team member for work that may exceed the scope.

Attachment A
Commissioning Responsibility Assignment Matrix

	Owner	Commissioning Authority	Design Team	Construction Team
Develop Commissioning Plan	I	R/A	C	N/A
Construction Observation				C
Submittal Review	I			C
Commissioning Meetings	R	A	R	R
Maintain Issues Log	I	R/A	I	I
Installation Verification	I		C	
Operational Testing	I	R	C	
Functional Testing	I	R	C	
Testing and Balancing	I	I	I	
TAB Procedure Review	I			I
Schedule Training	C	A	I	R
Perform Training	R		I	R
Witness Training	R		I	R
Document/Record Training			I	
O & M Submittal Review	I			I

RACI Participation Legend

R	Responsible	Assigned to perform the work
A	Accountable	Makes final decision and has ultimate ownership
C	Consulted	Must be consulted prior to work being done
I	Informed	Must be informed what work was done

Responsibilities are outlined in the RFP document. Responsibilities already populated in the matrix expresses the Owner's expectation and if a variation is desired it must be specifically addressed in the Proposal.

Attachment B
Commissioning Firm Experience

(Fill out a separate form for each firm on the team)

Company Name	Contact Person	Title

Address	City	State	Zip/Postal Code

Telephone	FAX	E-mail

Description of Business

Commissioning Activities

Percentage of overall business devoted to commissioning _____ %
How long has the firm offered commissioning services _____ years
Average number of commissioning projects performed each year: _____projects

Number of registered engineers on staff on who have directed commissioning projects:

The firm has provided commissioning services in the following: (check all that apply)

Building Sector	**Construction Renovation**	**Existing Building Retro/Re**	**Equipment Replacement**
Institutional (K-12, University)	☐	☐	☐
Hospitals	☐	☐	☐
Assisted Living	☐	☐	☐
Laboratories	☐	☐	☐
Multi Family	☐	☐	☐
Industrial/Manufacturing	☐	☐	☐
Special purpose-prisons, Museums, libraries, etc.	☐	☐	☐
Other, Describe	☐	☐	☐

Attachment C
Commissioning Task Experience for Similar Projects

(Fill out a separate form for each firm on the team)

Project

Name: _____

Date: _____

Bldg Size: _____ Type _____ New ____ Existing _____

Owner Contact

Title _____

City, State, Zip _____

Phone _____

Name and Role of Person(s) Assigned to Project by Firm
(Identify any sub-consultants)

_____

_____

_____

Commissioning Tasks Performed and Comments

1. Wrote the commissioning plan.

_____

_____

2. Wrote the construction checklists.

_____

_____

3. Wrote the functional test procedures.

4. Witnessed and documented the functional tests.

5. Performed functional tests (hands-on).

6. Wrote the systems manual.

7. Used data loggers or EMS trend logs for testing.

8. Developed or approved staff training.

9. Reviewed completed O & M Manuals.

Management

1. Commissioning provider was part of the firm.

_____

_____

2. Supervised a sub-consultant commissioning provider to our firm.

_____

_____

3. Worked with a commissioning provider hired by others.

_____

_____

Commissioning Tasks Performed

☐ Central building automation system.

☐ All equipment of the heating, ventilating and air conditioning systems.

☐ Enhanced filtration units.

☐ Scheduled or occupancy sensor lighting controls.

☐ Daylight dimming controls.

☐ Refrigeration systems.

☐ Emergency power generators and automatic transfer switching.

☐ Uninterruptible power supply systems.

☐ Life Safety systems (fire alarm, egress pressurization, fire protection).

☐ Electrical (service switchgear, switchboards, distribution panels, transformers, motor control center power.

☐ Monitoring and metering, transient voltage surge suppressors, variable speed drives, grounding _____ ground.

☐ Fault systems, over current protective devices, low voltage bussway, thermographic survey, _____ System.

☐ Domestic and process water pumping and mixing systems.

☐ Equipment sound control systems and testing.

☐ Data and communication.

☐ Paging systems.

☐ Security systems.

☐ Plumbing.

☐ Building envelope including the different types of curtain wall assemblies (specify roofing, windows, doors, construction joints, etc.

☐ Sustainability features.

☐ Effluent decontamination systems.

☐ Process instrumentation and controls.

☐ Other: Describe as an attachment to this exhibit.

ATTACHMENT D
Budget Table

Task		**Fee ($)**
Construction		
1.	Commissioning plan	_____
2.	Construction checklists; observation of installation and startup	_____
3.	Functional test writing.	_____
4.	Functional Test execution and documentation	_____
5.	O & M Manual review and training review.	_____
6.	Compilation of commissioning record.	_____
7.	Systems manual development.	_____
8.	Site Visits (Expected Qty. ____)	_____
9.	Commissioning Meetings (Expected Qty. ____)	_____
10.	Other	_____
	TOTAL	_____

SECTION 01650 – COMMISSIONING OF BUILDING SYSTEMS

01650.0 COMMISSIONING AGENT

1. The Commissioning Agent (CxA) has been contracted directly with the Owner for this project. The CxA has overall responsibility for planning, coordinating and conducting the commissioning process. However, commissioning involves all parties to the design and construction process, including the contractor.

01650.1 CONTRACTOR RESPONSIBILITY

1. This Section of the specifications defines the contractor's responsibilities with respect to the commissioning process. Each contractor and sub-contractor shall review this Section, and shall include in their bids for carrying out the work described, as it applies to each Division and Section of these specifications, individually and collectively.

01650.2 DESCRIPTION OF WORK

1. The purpose of the commissioning process is to provide the Owner/operator of the facility with assurance that the mechanical systems, and lighting have been installed according to the contract documents and operate within the performance guidelines set out in the contract documents. The CxA will provide the Owner with an unbiased, objective view of the system's installation, operation, and performance. The commissioning process does not take away or reduce the responsibility of the installing contractors to provide a finished product, installed and fully functional in accordance with the contract documents.

2. Commissioning is intended to enhance the quality of system start-up and aid in the orderly completion and transfer of systems for beneficial use by the Owner. The CxA will be the leader of the commissioning team, planning, coordinating and conducting all commissioning activities in conjunction with the design professionals, construction manager, subcontractors, manufacturers and equipment suppliers.

3. The General Contractor, Mechanical Contractor, all Division 20-28 sub-contractors, and the Electrical Contractor shall be responsible for cooperating and coordinating their work with the CxA. They shall be responsible for accommodating testing time required by the CxA into the project schedule. They shall <u>not</u> be responsible for carrying out the physical activities required for operation of systems during the functional performance testing as part of the commissioning process as required in this Section. Although their participation is not required, it is welcomed if the installing contractor so desires.

4. The Commissioning Agent is contracted directly to the Owner for this project. Despite this arrangement, the contractors performing the work under this contract are required to coordinate their efforts as described herein to support the Commissioning effort. Those efforts shall be coordinated with the same rigor as if those disciplines were provided directly under their contract.

5. The approach of the Commissioning Agent is to integrate into the construction process as much as possible to avoid the duplication of work and dedication of resources to the commissioning process. The Commissioning Agent utilizes their own staff for inspections and testing. The roles and responsibilities of the construction team is to assist the CxA in their effort.

6. Commissioning considerations will be integrated into project meetings already being held during the construction process. When a sensitive or specialized system startup is upcoming, or if commissioning issues are not being resolved in a timely fashion, a supplemental commissioning meeting will be added to address those situations. That is to say, that specific commissioning

meetings will be an exception in the process. When otherwise scheduled meetings can be leveraged to achieve the needs of commissioning, they will be utilized.

06150.3 RELATED DOCUMENTS

1. Drawings and general provisions of the contract, including general and supplementary conditions, general mechanical provisions and applicable Divisions 20-28 Specification sections, apply to work of this section.

06150.4 REFERENCES

1. ASHRAE Guideline 0-2013 – The Commissioning Process

2. ASHRAE Standard 202-2013 – Commissioning Process for Buildings and Systems

06151.0 SYSTEMS TO BE COMMISSIONED

1. Mechanical systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes, but is not necessarily limited to the work listed for each system. The foregoing includes all the following:
   a) Heating water, chilled water, and condenser water piping systems – work includes installation inspections and checks; expansion tanks; confirmation of flow balancing completion.
   b) Duct and air-handling systems – work includes installation inspections and checks; confirmation of flow balancing completion.
   c) Chillers – work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of documented performance measurements including capacity, evaporator and condenser flows, motor amperage and controls operation.
   d) Refrigerant Alarm Systems - work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of warning and alarm levels, confirmation of appropriate sequence and action for shutdown/start-up of equipment and notification.
   e) Cooling Towers – work includes installation inspection and checks; supervision of checkout and startup by manufacturer's representative in conjunction with chiller; verification of documented performance measurements including capacity, motor amperage, basin heater operation, makeup water, overflow, and capacity controls.
   f) Boilers – Work includes installation inspections and checks; verification of chemical treatment; supervision of checkout and startup by manufacturer's representative; verification of documented performance measurements including capacity test, burner and controls operation.
   g) Chemical Treatment Systems - work includes installation inspections and checks; checkout and startup by manufacturer's representative; confirmation of appropriate treatment levels for closed and open systems.
   h) Pumps – Work includes documented checks on alignment; verification of testing and balancing including rotation, motor current draw, flows and pressures.
   i) Supply, Return, Relief and Exhaust Fans – Work includes checks on installation (including dampers and other accessories); verification of testing and balancing including rotation, motor current draw, airflows and pressures.
   j) Air Handling Units – Work includes installation inspections and checks; supervision of checkout and startup by manufacturer's representative as specified; verification of documented tests for air flow and static pressures; verification of operation of all controls.
   k) Air Terminal Devices – Work includes installation inspections and checks; for VAV units, verification of flow adjustments and calibration coordinated with controls and air balancing; controls operation including flow modulation, reheat, controls responses.

l) Direct digital controls system – Work includes inspections and checks of installation and operation of control devices; verification of complete operation of controls sequences, in coordination with commissioning of all controlled systems.
m) Domestic Hot Water Systems – Work includes checks on installation; verification of testing and balancing including water flows and pressures; verification of mixing valve operation.
n) Non-potable Hot Water Systems – Work includes checks on installation; verification of testing and balancing including water flows and pressures; verification of mixing valve operation.

2. Electrical systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes but is not necessarily limited to the work listed for each system. The foregoing includes all the following:
   a) Lighting control systems – work includes installation inspections and checks; confirmation of photocells, schedule timers, occupancy controls, and daylighting controls. A minimum of 10 percent of occupancy sensors shall be verified.
   b) Emergency generators – work includes installation inspections and checks; confirmation of operation of automatic transfer switch and generator.

01652.0 MEMBERS OF THE COMMISSIONING TEAM

1. The commissioning team will consist of representatives of the following:
   a. Owner
   b. Architect
   c. Mechanical design Engineer (ME)
   d. Electrical design Engineer (EE)
   e. Plumbing design Engineer (PE)
   f. Commissioning Agent (CxA)
   g. General Contractor (GC)
   h. Mechanical Contractor (MC)
   i. Electrical Contractor (EC)
   j. Controls Contractor (ATC)
   k. Testing, adjusting, and balancing agency (TAB)
   l. Owner's O&M staff

01652.1 COMMISSIONING RESPONSIBILITIES – NON-CONTRACTOR TEAM MEMBERS

1. Introduction - As noted, a multi-disciplinary team carries out commissioning. The commissioning responsibilities of some non-contractor team members during the construction and acceptance phases of the project are provided here for information, and to provide some context for the overall process.

2. Commissioning Agent Responsibilities - The commissioning agency will:
   a. Plan, organize and implement the commissioning process as specified herein.
   b. Prepare the commissioning plan, and ensure its distribution for review and comment.
   c. Revise the commissioning plan as required during construction.
   d. Chair commissioning meetings, and prepare and distribute minutes to all commissioning team members, whether or not they attended the meeting.
   e. Facilitate a Controls Integration Meeting between the design team and construction team members to encourage a more successful implementation of the design intent in the temperature control system.
   f. In conjunction with the General Contractor, coordinate commissioning activities among all contractors, sub-trades and suppliers.
   g. Monitor system verification checks, and ensure the results are documented as the checks are done.
   h. Monitor controls point-to-point checks done by the controls contractor, and ensure the results documented as the checks are done.
   i. Observe all start-ups and initial system operations tests and checks.

j. Direct the contractors to operate equipment and systems as required to ensure that all required functional performance tests are carried out for verification purposes.
k. Perform all functional performance tests and document the results.
l. Prepare and submit a Commissioning Report which documents all checks and tests done throughout the Commissioning process, and the results obtained from each.

3. Mechanical Engineer Responsibilities - The Mechanical Engineer will review the Commissioning Plan, and will participate, as appropriate, in on-site commissioning meetings. During the acceptance phase of the commissioning process, the Mechanical Engineer may be on site to review commissioning documentation, to witness functional performance tests, and to analyze the installation and its performance. The Mechanical Engineer will participate in the Controls Integration meeting to take place prior to submittal of controls shop drawings to communicate expectations and understand interpretations of the contract documents by the controls contractor for a more complete shop drawing submittal.

4. Owner's Responsibilities - The Owner will ensure the availability of operating staff for all scheduled instruction and demonstration sessions. This staff will possess sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions. The Owner will also ensure the appropriate involvement of the Electrical Engineer, Architect, and any other consultants as required, in the commissioning process.

01652.3 COMMISSIONING RESPONSIBILITIES – GENERAL CONTRACTOR

1. The General Contractor has responsibility to ensure the overall completion of the Work. In this regard, they shall:
   a. Participate as required in the HVAC commissioning process.
   b. Ensure the Mechanical Contractor performs all assigned HVAC commissioning responsibilities as specified.
   c. Assist in scheduling the testing, adjusting and balancing agency responsibilities.
   d. Ensure the Electrical Contractor performs all assigned HVAC commissioning responsibilities as specified.
   e. Ensure the cooperation and participation in the HVAC commissioning process of all other sub-contractors as applicable.

2. The General Contractor shall assign a representative to the commissioning team, and submit the person's name to the Commissioning Agency, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the General Contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall facilitate communications among all contractors and suppliers and other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.

01652.4 COMMISSIONING RESPONSIBILITIES – MECHANICAL CONTRACTOR

1. The Mechanical Contractor, and all the sub-contractors and suppliers within Divisions 20-25, shall cooperate with the Commissioning Agent and other commissioning team members to facilitate the successful completion of the commissioning process.

2. The Contractor shall assign a representative to the commissioning team, and submit the person's name to the Commissioning Agency. The representative shall have the authority to make decisions on behalf of the Mechanical Contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall ensure communications between Division 20-25 contractors and suppliers and all other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.

3. The Mechanical Contractor, and all mechanical sub-contractors and suppliers, shall cooperate with the Commissioning Agent in carrying out the HVAC commissioning process. In this context, the Mechanical Contractor shall:
    a. Each contractor and sub-contractor in this division shall include in their quotes the cost of witnessing the commissioning process as specified herein if so desired.
    b. Ensure the automatic temperature controls (ATC) contractor performs HVAC commissioning responsibilities as listed.
    c. Provide instruction and demonstrations for the Owner's designated operating staff, in conjunction with the Commissioning Agency and Mechanical Engineer, and with the participation of qualified technicians from major equipment suppliers and the Controls Contractor.
    d. Include requirements for submittal data, O&M data, and training information in each purchase order or sub-contract written.
    e. Ensure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and water treatment as applicable.
    f. Ensure participation of major equipment manufacturing in appropriate start-up, testing and training activities.
    g. Attend HVAC commissioning meetings scheduled by the CxA.
    h. Notify the CxA a minimum of two weeks in advance of scheduled equipment and system start-ups, so that the CxA may witness system verifications, and equipment and system start-ups.
    i. As an option, provide personnel to witness the CxA during system verification and functional performance testing.
    j. Prior to start-up, inspect, check and confirm the correct and complete installation of all equipment. Document the results of all inspections and startups on standard startup reports provided by the manufacturer or in use by the Mechanical Contractor. If deficient or incomplete work is discovered, ensure corrective action is taken and re-check until the results are satisfactory and the system is ready for safe startup. Provide the CxA one electronic copy of standard startup report.
    k. Notify the CxA a minimum of two weeks in advance, of the time for start of the TAB work.
    l. Provide equipment and systems start-up resources as specified and required. If during an attempted equipment or system start-up, deficient or incomplete work is discovered that would preclude safe operation, the start-up shall be aborted until corrective action has been taken. Ensure such action is taken and verified before re-scheduling a new start-up.
    m. Carry out installation checks to ensure that all equipment and systems are fully functional and ready for the CxA to perform functional performance tests (FPTs).
    n. If improper function is observed by the CxA during testing due to incomplete work, or other deficiencies affecting system performance are discovered, testing will be stopped by the CxA. Those responsible for deficient or incomplete work will be responsible to ensure that all corrections necessary for full and complete system operation as specified are completed; then notifying the CxA that functional performance checks may resume to confirm correct operation for the system in question.
    o. Prepare preliminary schedule for mechanical system orientation and inspections. O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up TAB, and task completion for use by the CxA. Update schedule as appropriate throughout the construction period.
    p. Attend initial O&M staff training session.
    q. Conduct mechanical system orientation and inspection at the equipment placement completion stage.
    r. Update drawings to as-built condition and review with the design team.
    s. Gather O & M data on all equipment, and assemble in binders as required by the specification. Submit to General Contractor prior to the completion of construction.
    t. Participate in, and schedule vendors and contractors to participate in the O&M staff training sessions as set up by the General Contractor.
    u. Provide written notification to the General Contractor and CxA that the following work has been completed in accordance with the contract documents and the equipment, systems and sub-systems are operating as required.
        1. HVAC equipment including all fans, air handling units, ductwork, dampers, terminals and all Division 23 equipment.

2. Refrigeration equipment, pumping systems and heat rejection equipment.
3 Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gaskets and sealing of smoke barriers.
4. Fire detection and smoke detection devices furnished under other divisions of this specification as they affect the operation of the smoke control systems.
5. That the building control system is functioning to control mechanical equipment and smoke control systems as specified.
6. Provide a complete set of as-built drawings and O & M manuals to the General Contractor.

01652.5 COMMISSIONING RESPONSIBILITIES – TAB AGENCY

1. With respect to HVAC commissioning, the TAB agency shall:
   a. Include costs for HVAC commissioning requirements in the quoted price.
   b. Attend commissioning meetings scheduled by the CxA prior to, and during, on-site TAB work being done.
   c. Submit proposed TAB procedures to the CxA and Mechanical Engineer for review and acceptance.
   d. At the completion of the TAB work, submit the final TAB report to the Owner, with copies to the General Contractor, who will distribute to the CxA and Mechanical Engineer.

01652.6 COMMISSIONING RESPONSIBILITIES – CONTROLS CONTRACTOR

1. With respect to HVAC commissioning, the Controls Contractor shall:
   a. Include cost for commissioning requirements in the quoted price.
   b. Review design for controllability with respect to equipment selected for the project.
      i. Review and confirm that a proper hardware specification exists to permit functional performance testing as required by specification and sequence of operation.
      ii. Review and confirm that proper safeties and interlocks are included in design.
      iii. Ensure the proper sizing of control valves and actuators, based on design pressure drops. Ensure that control valve authority will result in capacity control as specified. Include valve sizing and authority information in submittal to Mechanical Engineer.
      iv. Ensure the proper sizing of control dampers. Ensure damper authority to control air flows as specified. Review and confirm in writing proper damper positioning for mixing to prevent stratification. Ensure correct actuator vs. damper movement for smooth operation. Include damper sizing, control authority and actuator selection data in submittal to Mechanical Engineer.
      v. Ensure the proper selection of sensor ranges, and include data with submittal to Mechanical Engineer.
      vi. Clarify all questions concerning sequences of operation with the Mechanical Engineer.
   c. Attend commissioning meetings scheduled by the CxA.
   d. Provide the following submittals for review:
      i. Hardware and software submittals.
      ii. Control panel construction shop drawings.
      iii. Diagrams showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access, all superimposed on diagrams of the physical equipment.
      iv. Narrative description of all control sequences for each piece of equipment controlled.
      v. Logic diagrams showing the logic flow of all control sequences.
      vi. A list of all control points, including analog inputs, analog outputs, digital inputs and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
      vii. A complete control language program listing including all software routines employed in operating the control system. Also provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and sub-routine. It

should also explain individual math or logic operations that are not clear from reading the software listing.

viii. Hardware operation and maintenance manuals.

e. Inspect, check, and confirm the proper installation and performance of controls/BAS hardware and software provided by others.

f. Integrate installation and programming scheduling with construction and commissioning schedules.

g. Inspect, check and confirm the correct installation and operation of input and output field points and devices through documented and signed off point-to-point checkouts.

h. Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system, in accordance with the O&M staff training program in the commissioning plan.

i. Assist CxA in demonstration system performance including all modes of system operation (e.g. occupied, unoccupied, emergency) during the functional performance tests (FPTs). If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, correct action in coordination with the CxA.

j. Provide control system access for CxA for system verification and functional performance testing, make technician available to assist process.

k. Provide support and coordination with TAB contractor on all interfaces between controls and TAB scopes of work. Provide, at no additional cost to the TAB and commissioning agencies, all devices, such as portable operator's terminals and all software for the TAB agency to use in completing TAB procedures.

01652.7 COMMISSIONING RESPONSIBILITIES – ELECTRICAL CONTRACTOR

1. With respect to HVAC commissioning, the electrical contractor shall:
   a. Include cost for HVAC commissioning requirements in the quoted price.
   b. Review design with respect to providing power to the HVAC equipment.
   c. Verify that proper hardware specifications exist for functional performance required by specification.
   d. Verify that proper safeties and interlocks are included in the design of electrical connections for HVAC equipment.
   e. Attend commissioning meetings scheduled by the CxA.
   f. Schedule work so that required electrical installations are completed, so systems verification checks and functional performance tests can be carried out by the CxA on schedule.
   g. Inspect, check and confirm in writing the proper installation and performance of all electrical services provided.
   h. If so desired by the contractor, provide electrical system technicians to witness system verification and functional performance testing as performed by the CxA.

END OF SECTION 01650