Tates Creek High School Commissioning RFP

1111 Centre Parkway, Lexington, KY 40517

7/15/20

RFP 26-20

SECTION 019113 – COMMISSIONING

(To Be Bid under separate Contract. The Commissioning Agent will work directly for Fayette County Schools.)

This request is for a proposal for commissioning services for the new Tates Creek High School and Fieldhouse as described herein. The Commissioning agent will be contracted directly with Fayette County Public Schools.

Client Contact Information:	Melinda Joseph-Dezarn, Director of Planning and Construction Fayette County Public Schools 400 Springhill Drive Lexington, KY 40503
Project Address:	1111 Centre Parkway Lexington, KY 40517
Project Start Date:	7/2020
Expected End Date:	11/2022

The proposal shall be lump sum fee.

The commissioning service fee proposal is $_____

RFP responses to be sent to Melinda Joseph-Dezarn via email **on or before 7/30/20**.

melinda.josephdezarn@fayette.kyschools.us

Following are five (5) K-12 school projects where EUI upon completion of commissioning was 25 Kbtu/SF or less

1. _____
    a. HVAC System Type: _____
    b. Total Building Square Footage: _____
2. _____
    a. HVAC System Type: _____
    b. Total Building Square Footage: _____
3. _____
    a. HVAC System Type: _____
    b. Total Building Square Footage: _____
4. _____
    a. HVAC System Type: _____
    b. Total Building Square Footage: _____
5. _____
    a. HVAC System Type: _____
    b. Total Building Square Footage: _____

Following are five (5) K-12 school projects where the building's envelope was commissioned to have no greater than 0.15 CFM per square feet of building envelope:

1. _____
2. _____
3. _____
4. _____
5. _____

Briefly describe the approach your firm will take in commissioning Tates Creek High School and Fieldhouse. List challenges and thoughts to overcome. List your firm's goals for the Tates Creek High School Commissioning:

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PART 1 – GENERAL

1.0 COMMISSIONING AGENT EXPERIENCE

A. On the bid form above, the prospective commissioning agent shall list and briefly describe 5 completed K-12 School projects where the EUI (Energy Usage Intensity) upon completion of commissioning is 25 kbtu/SF or less:
   1. Include description of HVAC system type
   2. Include total building square footage

B. On the bid form above, the prospective commissioning agent shall list and briefly describe 5 completed K-12 School projects where the building envelope was successfully commissioned to a loss no greater than 0.15 cfm/SF of envelope area.

C. On the bid form above, the prospective commissioning agent shall briefly describe their overall approach to the commissioning of Tates Creek High School. List any prospective challenges and outline your firm's goals for the Tates Creek High School Commissioning.

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and other Division-1 Specification Sections, apply to work of this Section.
B. Division 07 – Thermal and Moisture Protection
C. Division 08 – Openings
D. Division 20 – General Provisions - Mechanical
E. Division 23 – Heating Ventilating and Air Conditioning
F. Division 25 – Building Automation System
G. Division 26 – Electrical
H. Division 20 – Geo-Thermal Loop Piping System
I. Division 21 – Pipe, Pipe-Fitting & Pipe Support

1.2 SUMMARY

A. Section includes commissioning process requirements for the following systems:

1. Building Envelope – Blower Door Test.
2. Building Envelope - Infrared Scan.
3. HVAC + HVAC Controls
4. Lighting and Day Lighting Controls
5. Geo-Thermal Well Field
6. Under-Slab Sanitary and Storm Piping

B. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning documentation and contractor submittal requirements
4. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
5. Commissioning tests and commissioning test demonstration.
6. Adjusting, verifying, and documenting identified systems and assemblies.

1.3 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the commissioned systems have been installed in the prescribed manner, and operate within the performance guidelines set out in the Owner's Project Requirements (OPR). The Commissioning Authority (CxA) shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to eliminate or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CxA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, general contractor, subcontractors, manufacturers and equipment suppliers.

B. The independent commissioning authority (CxA) is contracted directly with the owner for this project. This commissioning plan has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

1.4 INSTALLING CONTRACTORS CLOSE-OUT SUBMITTALS –

A. Commissioning Report Supplemental Information:

1. At Construction Phase Commissioning Completion, provide the following:
   a. Startup reports
   b. approved test procedures
   c. Test data forms, completed and signed
   d. Controls point-to-point verification documentation
   e. Preliminary test and balance report(s)
   f. Progress reports
   g. Commissioning issues reports showing resolution of issues
   h. Correspondence or other documents related to resolution of issues
   i. Other reports required by commissioning authority
   j. Geothermal Drill Logs and Pressure/Leakage Tests – 5%

B. Provide Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

C. Provide As-Built Redlines (Existing Conditions) of Drawings and Documents.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

A. Building Envelope – Blower Door Test + Infrared Scan
B. Outside Air Handlers
C. Energy Recovery Ventilators

D. Water Source Heat Pumps - 30%
E. VAV/CAV Terminal Units – 30%
F. Electric Heaters
G. Hydronic Pumps
H. Circulation Fan
I. Exhaust Fans
J. DDC Control Systems
K. Lighting Controls
L. Geothermal Field
M. Camera Verification of Under-Slab Sanitary and Storm Mains

3.3 CONTRACTOR SCHEDULING

A. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule.

1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.

2. Schedule the start date and duration for the following commissioning activities:
   a. Submittals
   b. Preliminary operation and maintenance manual submittals
   c. System verification checklists
   d. Operation & Maintenance Manuals
   e. Startup
   f. Functional performance tests

g. Operation & Maintenance Training
h. As-Built/Existing Conditions Documents
i. Near End of Warranty Review

B. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.

3.4 COMMISSIONING PLAN

A. Commissioning Team

1. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project.
Team members shall be provided by each of the parties listed below:
a. Fayette County Public Schools, Owner Representative (FCPS)
b. Tate Hill Jacobs, Project Architect (THA)
c. CMTA Consulting Engineers, MEP Engineer (CMTA)
d. Commissioning Authority (CxA)
e. General Contractor (GC)
f. Mechanical Contractor (MC)
g. Plumbing Contractor (PC)
h. Geothermal Well Field Contractor (GWFC)
i. Sheet Metal Contractor (SM)
j. Controls Installation Contractor (CIC)
k. Controls Supplier (CS)
l. Test and Balance Contractor (TABC)
m. Electrical Contractor (EC)
n. Lighting Controls Equipment Contractor (LCEC)
o. Building Envelope -Exterior Enclosures Contractors

B. Commissioning Meetings

1. Commissioning meetings will be held in conjunction with progress meetings as necessary. The CxA will be on site for the Cx meetings. Commissioning meetings will be used to address problems that alter the design intent or affect the commissioning process.

C. Resolution Tracking Forms (RTF)

1. The use of Resolution Tracking Forms is a method employed by the CxA to monitor and record problems, their causes, and solutions.

2. The CxA will regularly submit RTF’s to the Commissioning Team in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

D. Start-Up

1. Start-up of major commissioned systems will be witnessed the CxA. The appropriate contractors and/or manufacturer’s representative will be required on site to perform start-up.

E. Controls Monitoring

1. Close monitoring of the Control Supplier's (CS) progress will promote efficient coordination of the TAB work. The CS will be expected to submit point-to-point checklists verifying that his work has been completed and all systems are ready for TAB work and Functional Performance Testing, including controls programming, graphics and systems integrations.

F. TAB Monitoring

1. The preliminary TAB report set-up will be reviewed prior to HVAC equipment start-up, in order to assure that the final TAB report format and content are acceptable.

2. TAB work will be monitored so that any problems that prevent or hinder proper air and water balance can be addressed and corrected with minimal delays.

3. A pencil copy of the TAB report will be reviewed prior to submission of the final TAB report and before Functional Performance Testing can be carried out. A written CxA review will be submitted to the TAB contractor and to the DT. A TAB report approved by the DT will be required before Functional Performance Testing can be carried out. The CxA will visit the site during the TAB process in order to assist TABC and CC in the effective completion of their scope of work.

G. Functional Performance Tests (FPTs) - The Functional Performance Tests shall include the following:
1. Building Envelope Air Leakage Diagnostic Test. The air leakage [Blower Door] test must be performed in accordance with ASTM E 779 with the following additions and exceptions:

i. The test consists of measuring the flow rates required to establish a minimum of 12 positive and 12 negative building pressures. The lowest test pressure shall be 0.1 in wg; the highest test pressure shall be 0.3 in wg (75 Pa); and there must be at least 0.1 in wg difference between the lowest and highest test pressures.
ii. The test pressure must be measured in a representative location such that pressures in the extremities of the enclosure can be shown to not exceed 10% of the measured test pressure. At least 12 bias pressure readings must be taken across the envelope and averaged over at least 20 seconds each before and after the flow rate measurements. None of the bias pressure readings must exceed 30% of the minimum test pressure when testing in both directions.
iii. Where it can be shown that it is impossible to test in both directions, then the building may be tested in the positive direction only, provided the bias pressure does not exceed 10% of the minimum test pressure.

iv. The mean value of the air leakage flow rate calculated from measured data at 0.3 in wg (75 Pa) must not exceed 0.15 CFM per square foot of envelope area. Measurements must be referenced at standard conditions of 14.696 PSI and 68F.
v. The test shall be conducted with ventilation fans and exhaust fans turned off and the outdoor air inlets and exhaust outlets sealed (by dampers or masking). The contractor must provide a responsible HVAC technician with the authority to place the HVAC system in the correct mode for the pressure test. The test technician must have unhindered access to mechanical rooms, air handlers, exhaust fans, and outdoor air and exhaust dampers.
vi. The contractor must ensure that all windows in the enclosure are kept closed. Entry and exit through doors in the test enclosure must be prohibited during the test. Data collected while the pressures and flows are affected by a door opening and closing shall be discarded.
vii. A report shall be provided to Engineer and Architect after the first Air Leakage Test and the first diagnostic evaluation. After corrective measures are taken by the appropriate subcontractors, a second and final test Air Leakage Test shall be provided by the testing agency. An infrared imaging diagnostic evaluation shall again be provided after the second Air Leakage Test, should the second Air Leakage test reveal the building still does not meet air tightness requirements.

viii. Any subsequent testing and evaluation after the second Air Leakage Test and second infrared imaging diagnostic evaluation shall be considered additional scope, ~~and~~ the cost of which shall be paid by the responsible party.

2. Building Envelope Thermography will be conducted in conjunction with Building Envelope Air Leakage Diagnostic Tests according to ISO 6781 & ASTM C-1060 to qualitatively detect thermal irregularities and ASTM E1186 to locate air leakage sites.

3. HVAC Systems & Lighting Controls

   a. The Outside Air Unit (OA-1) will be tested in designed operating modes. Proper operation will be verified at minimum OA, maximum OA, automatic control, and other modes, if necessary, to achieve OPR conformance.
   b. Energy Recovery Ventilators will be tested in designed operating modes. Proper operation will be verified at minimum OA, maximum OA, automatic control, and other modes, if necessary, to achieve OPR conformance.
   c. Water Source Heat Pumps, both air-to-water and water-to-water will be tested at minimum and maximum airflow/waterflow setpoints, and under automatic control. Intermediate settings will be tested as necessary.
   d. Fan Coils will be tested at minimum and maximum temperature setpoints, and under automatic control. Intermediate settings will be tested as necessary.
   e. Electric Heaters will be tested for conformance to OPR.
   f. Hydronic pumps will be tested under relevant operating conditions.
   g. Circulation Fans will be tested under relevant operating conditions.
   h. Exhaust Fans will be tested for conformance to OPR.

4. Lighting Controls

   a. DDC control systems will be tested as necessary to achieve OPR conformance.
   b. Lighting Controls will be tested to assure that the building as an integrated system operates properly.

5. Geo-Thermal Well Field will be tested per specification requirements for conformance to OPR.

6. Under-Slab Sanitary and Storm Piping will be tested per specification requirements for conformance to OPR, including camera verification. Commissioning Agent to select piping sections to be videoed. Contractor to provide camera and labor while commissioning authority reviews results.

7. Off-season mode testing will be implemented as necessary to assure conformance with the OPR. Installing contractors will be expected to participate as required.

3.5 ROLES AND RESPONSIBILITES OF INSTALLING CONTRACTORS

A. General Contractor Responsibilities (GC)

1. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the commissioning program as described in the contract documents.

2. Assure that the CxA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.

3. Coordinate inclusion of commissioning activities in the construction schedule.

4. Facilitate resolution of deficiencies identified by observation or performance testing.

B. Mechanical Contractor (MC) and Plumbing Contractor (PC) Responsibilities

1. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.

2. Assure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, water treatment, temperature controls, and TAB in commissioning activities.

3. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.

4. Attend commissioning meetings scheduled by the CxA.

5. Assist the CxA in system verification and performance testing.

6. Prepare preliminary schedule for commissioned system inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period.

7. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of commissioned equipment.

8. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

9. Notify the CxA a minimum of two weeks in advance of scheduled system start-up.

10. Update drawings to as-built condition and review with the CxA throughout the construction process.

11. Schedule vendor and subcontractor provided training sessions as required by project specifications.

12. Provide written notification that the following work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent.

    a. HVAC equipment including fans, air handling units, dehumidification units, ductwork, dampers, terminal devices, etc.

    b. Fire detection and smoke detection devices furnished under other divisions as they affect the operation of the HVAC systems.

    c. That BAS is functioning in accordance with design intent.

13. Participate in the Functional Performance Tests as required to achieve design intent.

14. Participate in the off-season mode testing as required to achieve design intent.

15. Participate in O&M Training as required by project specifications.

16. Provide a complete set of as-built drawings and O&M manuals for review.

17. Camera verify 5% of the underfloor storm and sanitary piping.

18. Confirm that it is installed with continuous pitch as defined by the Kentucky Plumbing Code.

C. Sheet Metal Contractor Responsibilities (SMC)

1. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.

2. Assure cooperation and participation of specialty sub-contractors such as piping, refrigeration, water treatment, temperature controls, and TAB in commissioning activities.

3. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.

4. Attend commissioning meetings scheduled by the CxA.

5. Assist the CxA in system verification and performance testing.

6. Prepare preliminary schedule for commissioned system inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period.

7. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of commissioned equipment.

8. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

9. Notify the CxA a minimum of two weeks in advance of scheduled system start-up.

10. Update drawings to as-built condition and review with the CxA throughout the construction process.

11. Schedule vendor and subcontractor provided training sessions as required by project specifications.

12. Provide written notification that the following work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent.

    a. HVAC equipment including fans, air handling units, dehumidification units, ductwork, dampers, terminal devices, etc.
    b. Fire detection and smoke detection devices furnished under other divisions as they affect the operation of the HVAC systems.

13. Participate in the Functional Performance Tests as required to achieve design intent.

14. Participate in the off-season mode testing as required to achieve design intent.

15. Participate in O&M Training as required by project specifications.

16. Provide a complete set of as-built drawings and O&M manuals for review.

D. Test and Balance Contractor Responsibilities (TABC)

1. Attend commissioning meetings scheduled by the CxA.

2. Submit the TAB procedures and preliminary TAB report to the CxA for review at least two weeks prior to beginning TAB work.

3. Notify the CxA a minimum of two weeks in advance of scheduled TAB work.

4. Provide partial, preliminary TAB Reports by phase, by building section, by system, or as required by the CxA.

5. Assist the CxA in system verification and performance testing.

6. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

7. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the CxA for verification or diagnostic purposes.

8. Participate in the Functional Performance Tests as required to achieve design intent.

9. Provide sound and vibration measurements where required to assist in diagnosis of areas exhibiting unacceptable levels of noise or vibration.
10. Participate in the off-season mode testing as required to achieve design intent.

11. Participate in O&M Training as required by project specifications.

E. Temperature Control Contractor Responsibilities (TCC)

1. Review control sequence and component selection for conformance with design intent.

   a. Verify that specified safeties and interlocks have been selected.
   b. Verify proper selection of control valves and actuators based on design parameters.
   c. Verify proper selection of control dampers and actuators based on design parameters.
   d. Verify that sensor selection conforms to design intent.

2. Attend commissioning meetings scheduled by the CxA.

3. Provide the following submittals to the CxA:

   a. Hardware and software submittals.
   b. Control panel construction shop drawings.
   c. Narrative description of control sequences for each commissioned system and subsystem.
   d. Schematics showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access.
   e. 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.

   f. A complete listing of all software routines employed in operating the control system. Also provide a program narrative that describes the logic flow of the software and the functions of each routine and sub-routine. The narrative should also explain individual math or logic operations that are not clear from reading the software listing.
   g. Hardware operation and maintenance manuals.
   h. Application software and project applications code manuals.
   i. Panel and equipment insert documents.

4. Verify that specified interfaces provided by others are compatible with BAS hardware and software.

5. Coordinate installation and programming of BAS with construction and commissioning schedules.

6. Complete System Verification Checklists and manufacturer’s pre-start checklists prior to scheduling

startup of commissioned equipment.

7. Provide control system technician to assist during equipment startup.

8. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

9. Participate in the Functional Performance Tests as required by the project specifications.

10. Provide a control system technician to assist during verification and performance testing.

11. Provide system modifications to achieve system operation as defined by the design intent.

12. Provide support and coordination for TAB contractor. Provide all devices, such as portable operator terminals and all software for the TAB to use in completing TAB procedures.

13. Provide written notification that the TCC scope of work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent, and that BAS is functioning in accordance with design intent.

14. Participate in the Functional Performance Tests as required to achieve design intent.

15. Participate in the off-season mode testing as required to achieve design intent.

16. Participate in O&M Training as required by project specifications. Include training on hardware operations and programming.

F. Electrical Contractor Responsibilities (EC, LCEC)

1. Review design for provision of power to the commissioned equipment.

   a. Verify proper hardware specifications exist for performance as defined by the OPR.
   b. Verify proper safeties and interlocks are included in the design of electrical connections for HVAC equipment.
   c. Lighting Controls.

2. Attend commissioning meetings scheduled by the CxA.

3. Verify proper installation and performance of all electrical services provided.

4. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of commissioned equipment.

5. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

6. Provide an electrical system technician to assist during verification and performance testing.

7. Participate in the Functional Performance Tests as required to achieve design intent.

8. Participate in the off-season mode testing as required to achieve design intent.

9. Participate in O&M Training as required by project specifications.

10. Provide a complete set of as-built drawings and O&M manuals for review.

G. General Contractor with Building Envelope Exterior Enclosures Subcontractors

1. Assure acceptable representation with the means and authority to prepare and coordinate execution of the building envelope.

2. Assure that the CxA receives copies of change orders and appropriate approved submittals and shop drawings for review and use in development of the diagnostic tests.

3. Coordinate inclusion of CxA in the construction schedule planned installation and testing activities.

4. Manage participation with appropriate contractors and vendors according to the contract documents and construction schedule.

5. Issue a statement when work has been completed, and when the final test reports have been submitted for review.

6. Facilitate resolution of deficiencies identified by diagnostic testing.

7. Provide assistance to the CxA in preparing specific diagnostic test procedures.

8. Provide installation supervisors to witness execution of specified tests conducted on the mock-up assemblies to resolve installation issues and establish future installation practices necessary to correct deficiencies observed prior to commencing with installation of the exterior wall systems. Supervisors will be available and present during agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem solving.

9. Correct deficiencies discovered by the commissioning process and diagnostic tests.

10. Prepare Operations & Maintenance (O&M) documents as required by specifications and contract documents, including accurate existing conditions documentation.

11. Coordinate with product manufacturers to provide the owner with specific requirements for maintaining valid warranty conditions.

12. Following with the commissioning authority's guidance, contractor items to be performed prior to and after the building envelope/exterior enclosure testing includes the following as applicable:

    a. Disable any HVAC ERUs, exhaust fans and outside air intake dampers and louvers to prevent air leakage then re-enable the HVAC systems after the tests if needed.
    b. Remove one ceiling panel in each office and in large rooms, one ceiling panel per 500 SF of ceiling area and reinstall ceiling panels.
    c. Install and adjust door hardware and weather stripping on the exterior doors so they will latch closed and seal to prevent air leakage.
    d. Install blank covers or seal open electrical and data/communication junction boxes in the air barrier system.
    e. Disable specific door closure arms at the CxA designated exterior doors that the blower door fan systems will be installed and reinstall door closure arms after testing.

    f. Confirm each penetration in the building envelope/air barrier has been sealed.
    g. Open and/or install doorstops at the conditioned rooms and close the doors to non-conditioned rooms and remove stops after testing.
    h. Confirm each floor drain, mop sink, sink, lavatory, urinal, shower, and/or water closet plumbing traps have water installed or sealed to prevent air leakage during testing.
    i. Confirm windows and exterior doors remain closed during the testing and no workmen are mobilizing in and out of the exterior doors during testing.
    j. Seal each kitchen exhaust hood, dryer vent and exhaust vent (not a part of the ERU) prior to testing and remove sealing materials after test completed.

k. Seal openings and doors between test areas prior to test and remove sealing materials after test.

l. Seal ductwork transferring between the test areas to prevent sources of air leakage during the testing of the various areas and remove the sealing materials after test.

H. Geo-Thermal Well Field Commissioning by CxA

1. Assist the CxA in system verification and performance testing.

2. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of commissioned equipment.

3. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

4. Notify the CxA a minimum of two weeks in advance of scheduled system start-up.

5. Provide drilling logs to CxA and Designer of Record.

6. Provide a complete set of as-built drawings and O&M manuals for review.

7. Confirm Delta Pressure for each zone. Calculate pressure drop and compare to actual.

8. Confirm Delta Temperature for each zone.

9. Observe static pressure test of well field for 6-week period.

10. Confirm well field flushing and purging velocities.

11. Verify grouting for 10% of wells.

12. Verify well depth for 10% of wells.

I. Contractor Commissioning Compliance Issues (Applies to all Installing Contractors):

1. Test results that are not within the range of acceptable results are commissioning compliance issues.

2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.

3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.

4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
b. Submit commissioning compliance issue report form to the Commissioning Team.

c. Determine the cause of the failure.

d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.

a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
b. Complete and submit the commissioning compliance issue report immediately when the condition is observed.
c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
d. Resolve commissioning compliance issues promptly and report resolutions to the Commissioning Team.

6. Diagnose and correct failed test demonstrations as follows:

   a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
   b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
   c. Record the results of each step of the diagnostic procedure.
   d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
   e. Determine and record corrective measures.
   f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

   a. Schedule and repeat the complete Functional Performance Test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.

8. Do not correct commissioning compliance issues during test demonstrations.

   a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in a mutually agreed upon brief timeframe by the Commissioning Team. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report.

END OF SECTION