

SECTION 019114- PLUMBING COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

- A. This Section includes requirements for commissioning the plumbing system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."
- B. Related Sections include the following:
 - 1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.
- C. The following systems and/or equipment shall be commissioned (**if applicable**):
 - 1. Oil/Sand Interceptor for the Vehicle Bay
 - 2. Backflow Preventers for Chemical Fill Stations, Fire Protection System, and Incoming
 - 3. Potable Water System
 - 4. Electric Water Cooler with Bottle Filling Station
 - 5. Mop Sink
 - 6. Compressed Air Hose Reels
 - 7. Floor Drains with Trap Primers in all Toilet Rooms, Janitor's Closet, and Vehicle Bay
 - 8. Utility Sink in the Vehicle Bay
 - 9. Flush Valve Wall Hung Water Closet
 - 10. Urinals
 - 11. Domestic Hot Water Heater
 - 12. Domestic Cold Water Piping
 - 13. Domestic Hot Water Piping with Hot Water Re-Circulation Piping
 - 14. Domestic Recirculation Pump
 - 15. Thermostatic Mixing Valves at all Lavatories
 - 16. Domestic Hot Water System Expansion Tank
 - 17. Condensate Neutralizer for the Water Heater
 - 18. Combustion Air Duct
 - 19. Flue Duct
 - 20. Natural Gas Piping
 - 21. Emergency Fixture with Thermostatic Mixing Valve for Vehicle Bay

1.3. DEFINITIONS

- A. Engineer: Includes Engineer identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of plumbing

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

systems, electrical, communications, controls for plumbing systems, and other related systems.

- B. CxA: Commissioning Authority.
- C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- D. TAB: Testing, Adjusting, and Balancing.

1.4. CONTRACTOR'S RESPONSIBILITIES

- A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."
- B. Contractor:
 - 1. Attend procedures meeting for TAB Work.
 - 2. Certify that TAB Work is complete.
 - 3. Assist performing functional performance tests.
- C. Mechanical Contractor:
 - 1. Attend TAB verification testing.
 - 2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.
 - 3. Assist performing functional performance tests.
 - 4. Assist testing flow rates of all plumbing fixtures.
- D. HVAC Instrumentation and Control Contractor: With the CxA, review control designs for compliance with the Contract Documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.
- E. TAB Subcontractor:
 - 1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.
 - a. Verify the following:
 - i. Accessibility of equipment and components required for TAB Work.
 - ii. Verify flush valve gallons per flush matches schedules/submittals.
 - iii. Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
 - iv. Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

- commissioning testing.
 - v. Flow rates and aerations have been specified and compared to central equipment output capacities.
 - b. Identify discontinuities and omissions in the Contract Documents.
 - c. Assist performing functional performance tests.
 - 2. Additional Responsibilities: Participate in tests related to "Instrumentation & Controls of HVAC & Plumbing Systems."
- F. Electrical Contractor:
- 1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and plumbing systems, subsystems, and equipment.
 - 2. Attend TAB verification testing.

1.5. COMMISSIONING DOCUMENTATION

- A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."
- B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for plumbing systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:
 - 1. Calibration of sensors and sensor function.
 - 2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
 - 3. Control sequences for plumbing systems and equipment.
 - 4. Strength of control signal for each set point at specified conditions.
 - 5. Responses to control signals at specified conditions.
 - 6. Sequence of response(s) to control signals at specified conditions.
 - 7. Electrical demand or power input at specified conditions.
 - 8. Power quality and related measurements.
 - 9. Expected performance of systems, subsystems, and equipment at each step of test.
 - 10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
 - 11. Interaction of auxiliary equipment.
 - 12. Issues log.

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

1.6. SUBMITTALS

- A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."
- B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.
- C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.
- D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor.
- E. Certified Pipe Cleaning and Flushing Report: CxA shall certify that pipe cleaning, flushing, hydrostatic testing, and chemical treating have been completed.
- F. Test and Inspection Reports: CxA shall submit test and inspection reports to the Construction Manager, the Engineer, and the Design Engineers.
- G. Corrective Action Documents: CxA shall submit corrective action documents to the Construction Manager, the Engineer, and the Design Engineers.
- H. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1. TESTING PREPARATION

- A. Prerequisites for Testing:
 - 1. Certify that plumbing systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
 - 2. Certify that plumbing instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

3. Certify that plumbing procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
 4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
 5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
 6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
 7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.
 8. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
 9. Annotate checklist or data sheet when a deficiency is observed.
 10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:
 - a. Backflow preventer cross connection tests.
 - b. Compressor operation including refrigerated air dryers.
 - c. Discharge temperatures of water heaters.
 - d. Domestic booster pump system pressure.
 - e. Domestic water meter total volume in gallons.
 - f. Flow rates for domestic re-circulating systems.
 - g. Flow rates in gallons per minute for showerheads.
 - h. High/low and thermostatic mixing valve temperatures and water flow rates.
 - i. Re-circ. pump pressures and flow rates.
 - j. Temperature for emergency eyewash/shower systems.
 - k. Trap priming station water discharge.
 - l. Water heater temperatures and set points.
 11. Verify proper responses of monitoring and control system controllers and sensors to include the following:
 - a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
 - b. Report deficiencies and prepare an issues log entry.
 12. Verify that plumbing equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup.
 13. Verify flow rates of all aerators.
 14. Verify the operation and flow rates of all plumbing fixtures.
- B. Testing Instrumentation: Install measuring instruments and logging devices to record test

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. Operational modes include the following:

1. Occupied and unoccupied.
2. Emergency power supply.
3. Life-safety and safety systems.
4. Temporary upset of system operation.
5. Partial occupancy conditions.
6. Special cycles.
7. Alarm conditions.
8. Lead/lag operation where redundant equipment is indicated.
9. All alarms.

3.2. TAB VERIFICATION

- A. TAB Subcontractor shall coordinate with CxA for work required and shall copy CxA with required reports, sample forms, checklists, and certificates.
- B. Contractor, Plumbing Contractor, and CxA shall witness TAB Work.
- C. TAB Preparation:
 1. TAB Subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports."
 - a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.
- D. Verification of Final TAB Report:
 1. CxA shall select, at random, 10 percent of report for field verification.
 2. CxA shall notify TAB Subcontractor 10 days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 3. Failure of an item is defined as follows:
 - a. A deviation of more than 10 percent.
 4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.
- E. If deficiencies are identified during verification testing, CxA shall notify the HVAC Contractor and Engineer and shall take action to remedy the deficiency. Engineer shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

- F. CxA shall certify that TAB Work has been successfully completed.

3.3. TESTING

- A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.
- B. Perform tests using design conditions whenever possible.
 - 1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
 - 2. Altering set points when simulating conditions is not practical and when written approval is received from CxA.
 - 3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.
- C. Scope of Plumbing Contractor Testing:
 - 1. Testing scope shall include the entire plumbing installation, from central hot water heating equipment for heat generation through distribution systems to each fixture. It shall include measuring capacities and effectiveness of operational and control functions.
 - 2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
 - 3. Test all plumbing fixtures.
 - 4. Test all domestic water booster pumps.
 - 5. Test time to reach temperature and temperature of hot water at all fixtures with thermostatic mixing valves.
 - 6. Test discharge temperature of high/low mixing valves.
 - 7. Test discharge of water at all trap priming stations.
 - 8. Verify that all backflow preventers have been tested. Document in writing.
 - 9. Test operation and interlock of all sump pumps, where applicable.
 - 10. Test the operation of all water meters.
 - 11. Test domestic hot water generators, safeties, and operating controls.
 - 12. Test domestic water heaters.
 - 13. Test water meters and interlock with ATC system.
 - 14. Test operation, set points, and safeties of water heaters.
 - 15. Verify that backflow preventers have been tested.
 - 16. Test discharge of water at all trap priming stations.
 - 17. Test the operation of all domestic water and gas solenoid valves, including interlocks to switches.
 - 18. Test operation, set points, and safety of the compressed air system.
 - 19. Test operation and flow rates of river flow through systems.
- D. Detailed Testing Procedures: CxA, with Plumbing Contractor, TAB Subcontractor, and

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

Plumbing Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for plumbing systems, subsystems, and equipment.

- E. HVAC Instrumentation and Control System Testing:
1. The CxA, Plumbing Contractor, and the HVAC Instrumentation and Control Contractor shall collaborate to prepare testing plans.
 2. CxA shall convene a meeting of appropriate entities to review the test report of HVAC instrumentation and control systems.
- F. Plumbing System Testing: Plumbing Contractor shall prepare a testing plan to verify performance of water heaters, emergency eyewash/shower systems, domestic re-circulating systems, backflow preventers, plumbing fixtures, trap priming stations, high/low mixing valves, domestic pumps, domestic water meters, solenoid valves, compressed air systems, thermostatic mixing valves, domestic booster pumps, and duplex sump pumps. Plan shall include the following:
1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
 2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
 3. Design and actual measurements for all equipment.
- G. Deferred Testing:
1. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
 2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.
- H. Testing Reports:
1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
 2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
 3. Prepare a preliminary test report. Deficiencies will be evaluated by Engineer to determine corrective action. Deficiencies shall be corrected and test repeated.

WOR-WIC COMMUNITY COLLEGE
MAINTENANCE BUILDING EXPANSION
COMMISSIONING SERVICES

END OF SECTION 019114