

- C. Scheduling - The CxA/CM, will provide sufficient notice for scheduling commissioning activities with respect to the owner's participation. The CM will integrate all commissioning activities into the overall project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.04 COMMISSIONING PLAN

- A. The CxA will develop the commissioning plan which shall be included in the project schedule when approved by the owner and CM. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
- 1) Commissioning during construction begins with an initial commissioning meeting conducted by the CxA where the commissioning process is reviewed with the project commissioning team members.
 - 2) Additional meetings will be required throughout construction, scheduled by the CxA, through the CM, with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve problems.
 - 3) Equipment documentation/submittals are reviewed by the CxA during the normal submittal process, including detailed startup procedures.
 - 4) The construction checklists are to be completed by the contractor (or its subcontractors), before the startup process. These will be provided as early as possible so that the CxA can review them and reconcile them against the Project Documents to ensure complete accuracy with respect to the project documents.
 - 5) Construction checklists, TAB and startup must be completed before functional performance testing.
 - 6) Items of non-compliance in material, installation, or setup shall be corrected at no expense to the owner.
 - 7) The CxA/CM ensures that the subcontractors' construction checklists are executed and documented and that startup and initial checkout are performed. The CxA verifies that the TAB, construction checklists and startup were completed according to the approved plans. This includes the CxA approving TAB, checklists and startup plans. This also includes witnessing startup of selected equipment. Any testing failure is to be corrected at no additional cost to the owner, and a re-test is to be performed, observed, and documented.
 - 8) The CxA develops and implements equipment and system performance test procedures. The forms and procedures are approved by the owner, CM and A/E.
 - 9) The performance tests are executed by the subcontractors under the direction of the CxA with the assistance of the facility staff. All documentation is by the CxA.
 - 10) The CxA reviews the O&M documentation for completeness and provides the

commissioning record for the O&M manuals.

- 11) Commissioning should be completed before substantial completion.
- 12) The CxA develops procedures, reviews, pre-approves, coordinates, and implements the training provided by the contractor.
- 13) Deferred testing is conducted as specified or required.

Attachment A: Sample Functional Performance Tests for similar equipment to the equipment on this project. These are not the Functional Performance Tests that will be executed on this project. Those forms will be similar but will be created after the respective Engineer has approved the submittal data provided by the subcontractor.

Attachment B: Excel spreadsheet that details what equipment will be part of the Commissioning Process. This list may be modified in accordance with the owner's requirements but is representative of the scope of the process.

Attachment C: Prefunctional Checklists. These forms are not for this job. They are generic in nature. These forms will be supplementary to the startup forms provided by the subcontractors and their equipment providers. Any project requirements not captured by the subcontractors forms will be in these forms. These forms will not impose any additional requirements on the subcontractor not contained in the Project Documentation.

Chiller Construction Checklist

Project:	Guilford County Detention Center
Completion Date:	
Chiller Tag:	CH-1
Building:	
Location:	

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This construction checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ **List attached.**

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Construction checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Authority	Date	Owner's Representative	Date

Chiller 1 Information					
Make		Model Number			
Serial Number		Capacity		GPM	
Volts/Phase		Refrigerant		Charge	
Comments:					

Chiller 2 Information					
Make		Model Number			
Serial Number		Capacity		GPM	
Volts/Phase		Refrigerant		Charge	
Comments:					

Associated Checklists					
Condenser Water Pump	<input type="checkbox"/>	Chilled Water Piping	<input type="checkbox"/>	Cooling Tower	<input type="checkbox"/>
Condenser Water Piping	<input type="checkbox"/>	Chilled Water Pump	<input type="checkbox"/>	BAS	<input type="checkbox"/>
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	<input checked="" type="checkbox"/>	
Performance data (pump curves, coil data, etc.)	<input checked="" type="checkbox"/>	
Installation and startup manual and plan	<input checked="" type="checkbox"/>	
O&M manuals	<input type="checkbox"/>	
Factory test results	<input type="checkbox"/>	
Sequences and control strategies	<input checked="" type="checkbox"/>	
Warranty Certificate	<input type="checkbox"/>	
Comments:		

Installation Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
General		
General appearance good, no apparent damage	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Proper vibration isolators installed and adjusted	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Seismic restraints in place	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pipe fittings and accessories complete	<input type="checkbox"/>	<input type="checkbox"/>
Hydronic system flushing complete and strainers cleaned	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cooling tower or condenser system checked out	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Evaporator air vent provided	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Water cooled condenser air vent provided	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Refrigerant relief pipe extended to outside	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Test plugs (P/T) installed near all control sensors and as per spec	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Flow switch installed as required	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Proper refrigerant level	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Proper oil level	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Purge unit installed, if specified	<input type="checkbox"/>	<input type="checkbox"/>
Equipment labels affixed	<input type="checkbox"/>	<input type="checkbox"/>
Oil heater installed properly	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oil filter clean	<input checked="" type="checkbox"/>	<input type="checkbox"/>
No leaking apparent	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Piping		
Piping installation checked against the drawings and all devices gages and appurtenances are in place	<input type="checkbox"/>	<input type="checkbox"/>
Piping supported independently of the chiller	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Piping type and flow direction labeled on piping	<input type="checkbox"/>	<input type="checkbox"/>
Isolation valves, balancing valves and piping specialties installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
System flushing complete and strainers cleaned	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hydronic system flushing complete and strainers cleaned	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Electrical and Controls		
Power disconnect is located within site of the unit it controls and labeled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All electric connections tight	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Grounding installed for components and unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safeties installed and operational	<input type="checkbox"/>	<input type="checkbox"/>
Starter overload breakers installed and correct size	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All control devices and wiring complete	<input type="checkbox"/>	<input type="checkbox"/>
Control system interlocks connected and functional	<input type="checkbox"/>	<input type="checkbox"/>
Operation of HOA switch checked in all positions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Proper safeties in control when HOA switch in Hand position	<input type="checkbox"/>	<input type="checkbox"/>
Sensors and Gages		

Installation Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
Temperature, pressure and flow gages and sensors installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Piping gages, BAS and associated panel temperature and pressure readouts match	<input type="checkbox"/>	<input type="checkbox"/>
TAB		
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	<input type="checkbox"/>	<input type="checkbox"/> Not completed

Operational Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
Measure line to line voltage phase imbalance for compressor: (%Imbalance = 100 x (avg. - lowest) / avg.) Record imbalance of compressor. Imbalance less than 2%?	<input type="checkbox"/>	<input type="checkbox"/>
Record full load running amps for compressor. _____ rated FL amps x _____ svc factor = _____ (Max amps). Running less than max?	<input type="checkbox"/>	<input type="checkbox"/>
No unusual noise and vibration when running	<input type="checkbox"/>	<input type="checkbox"/>
Compressor interlocking with oil pressure	<input type="checkbox"/>	<input type="checkbox"/>
Adequate oil pressure when compressor shaft is turning	<input type="checkbox"/>	<input type="checkbox"/>
Pre-rotation vane closed before compressor reaches full speed	<input type="checkbox"/>	<input type="checkbox"/>
Pre-rotation vane steady when load changes	<input type="checkbox"/>	<input type="checkbox"/>
Specified sequences of operation and operating schedules have been implemented with all variations documented	<input type="checkbox"/>	<input type="checkbox"/>
Specified point-to-point checks have been completed and documentation record submitted for this system	<input type="checkbox"/>	<input type="checkbox"/>
Startup report completed with this checklist attached. (Includes full listing of all internal settings with notes as to which settings are BAS controlled or monitored and which are integral	<input type="checkbox"/>	<input type="checkbox"/>
Startup report includes written certification from chiller manufacturer that all specified features, controls and safeties have been installed and are functioning properly and that the installation and application comply with the manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>
Piping gages, BAS and chiller panel temperature and pressure readouts match (see calibration section below)	<input type="checkbox"/>	<input type="checkbox"/>

Sensor and Actuator Calibration

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12

months: **Y/N**_____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator Tag & Location	Location OK	1st Gage or BAS Value	Instrument Measured Value	Final Gage or BAS Value	Pass Y / N

Comments:

Chiller System Functional Testing

Project:	Guilford County Detention Center
Date:	

Pre-test Verification:

1. Verify Chiller CH-U-1 Pre-functional Checklists are complete. _____
2. Verify Chiller CH-U-2 Pre-functional Checklists are complete. _____
3. Verify Chiller CH-U-3 Pre-functional Checklists are complete. _____
4. Verify Chiller CH-U-4 Pre-functional Checklists are complete. _____
5. Verify PCHP-U-1 Pre-functional Checklists are complete. _____
6. Verify PCHP-U-2 Pre-functional Checklists are complete. _____
7. Verify PCHP-U-3 Pre-functional Checklists are complete. _____
8. Verify PCHP-U-4 Pre-functional Checklists are complete. _____
9. Verify SCHP-U-1 Pre-functional Checklists are complete. _____
10. Verify SCHP-U-2 Pre-functional Checklists are complete. _____
11. Verify SCHP-U-3 Pre-functional Checklists are complete. _____
12. Verify SCHP-U-4 Pre-functional Checklists are complete. _____

Verify the following through Point to Point Verification by the Controls Contractor.
 With the Chiller System and associated equipment in the **Disabled** state verify the following:

Determine LEAD Chiller:

1. Chiller CH-U-1 Runtime _____
2. Chiller CH-U-2 Runtime _____
3. Chiller CH-U-3 Runtime _____
4. Chiller CH-U-4 Runtime _____
5. Note Lead Chiller based on Runtimes _____
6. Note BAS Lead Chiller command _____

Determine LEAD Secondary Chilled Water Pump:

7. SCHP-U-1 Runtime _____
8. SCHP-U-2 Runtime _____
9. SCHP-U-3 Runtime _____
10. SCHP-U-4 Runtime _____
11. Note Lead SCHP based on Runtimes _____
12. Note BAS Lead SCHP command _____

Bringing Lead Chiller On-line:

Using the scheduling feature of the BAS, schedule the Chilled Water System to **Active** and verify the following:

1. Lead SCHP is commanded to **ON** _____

2. Verify that the associated Flow Meter is operational _____
3. Upon verification of Flow by the BAS system verify **LEAD CHILLER** is **ENABLED**. _____
4. With LEAD Chiller Enabled:
 - a. Verify associated Cooling Tower Supply and Return Isolation Valves are commanded **OPEN**. _____
 - b. Verify associated PCHP and CWP commanded **ON** _____
 - c. Verify Cooling Tower associated with on-line CWP is **ENABLED**. _____
 - d. Verify the Water Treatment system is Activated. _____
 - e. 30 seconds after pumps are on, verify **EVAPORATOR ISOLATION VALVE** is **OPEN**. _____
 - f. Evaporator Flow Verified. _____
 - g. Chiller Internal Safeties Verified. _____
 - h. With Evaporator Isolation Valve open, Flow verified and the Safeties all verified, verify the chiller compressor start sequence is enabled. _____
5. Maintaining Water temperatures and pressures:
 - a. Verify the Chiller Internal Controls maintain leaving water temperature at 42 °F. _____
 - b. Verify the by-pass and main Discharge Condenser Water Control valves to maintain pressure equivalent to 70 °F. _____
 - i. Verify by-pass valve commanded open prior to main valve on a call for increase in pressure. _____
 - ii. Verify valves operate in reverse order on a call for decrease in pressure. _____
6. Verify Chiller Leaving Water Temperature Setpoint Reset is performed by DDC programming. _____
7. Verify Chiller Demand Limit reset is performed by DDC programming. _____

Secondary Pump Addition:

1. Lower the value of the scheduled Secondary Chilled Water Supply Flow rate. _____
2. After a period of 10 minutes verify that the Secondary Water pump with the next lowest runtime is commanded **ON**. _____
3. Immediately (within 30 minutes) increase the Scheduled Secondary Chilled Water Supply Flow Rate to a value 2000 gpm (adjustable setpoint) greater than the current flow rate. _____
4. Verify that both SCHPs remain running and online. _____
5. After 30 minutes verify the following:
 - a. Verify the Secondary Chilled Water pump with the highest run time is commanded to **OFF**. _____
 - b. Verify the SCHP running is shown is updated to the LEAD SCHP if not the original LEAD SCHP. _____

VAV 4-1 Functional Testing

Project:	Guilford County Detention Center
Date:	

Pre-test Verification:

1. Verify VAV box Pre-functional Checklist is complete. _____

Verify the following through Point to Point Verification by the Controls.

With the Air Handling Unit in the **UNOCCUPIED** state (scheduled Unoccupied) verify the following:

1. VAV Box Damper positioned at 50% _____

Using the scheduling feature of the BAS, schedule the AHU to **OCCUPIED** and verify the following:

1. VAV Box Damper modulates to maintain Space Temperature Set point:
 - a. Decrease the Space Temp Set point below current Space temp + dead band.
 - b. Verify that the VAV Box Damper modulates in the **OPEN** direction. _____
 - c. Increase the Space Temp Set point above current Space temp + dead band.
 - d. Verify that the VAV Box Damper modulates in the **CLOSED** direction. _____
2. Return all set points and values back to **NORMAL**. _____

This concludes the Verification of Primary Air Unit Sequence of Operations.

2. Duct Heater Verification:
 - a. Verify Supply Duct Temperature 60.4 °F
 - b. Verify Return Air Temperature 72.3 °F
 - c. Verify Return Air Temperature Setpoint 70 °F
 - d. Simulate a call for duct heaters
 - i. Increase Return Air Temperature Setpoint to a value 4 degrees greater than the actual Return Air Temperature plus Deadband. (78 °F)
 - ii. Verify duct heaters commanded **ON** to maintain Return Air Temperature Setpoint. _____
 - iii. Verify Supply Air Temperature rises. _____
 - e. Return the Return Air Temperature Setpoint to original setting.
 - i. Verify Duct Heaters are Commanded **OFF**. _____

3. Scheduled Unoccupied Shutdown
 - a. Using the BAS Scheduling, set the schedule for the AHU as follows:
 - i. Schedule the AHU to **UNOCCUPIED**
 - ii. Schedule the unit to return to **OCCUPIED** 5 minutes after shutdown and a second **OCCUPIED** command 20 minutes after shutdown.
 - iii. Verify AHU shutdown occurs in the following order:
 1. Verify the AHU is commanded to **UNOCCUPIED MODE**. Note 1
 2. Verify the Supply Fan commanded to **OFF**. Note 1
 3. Verify Supply Fan Status = **OFF** Note 1
 4. Verify that the Chilled Water Valve is commanded to **0% open** Note 1
 5. Verify Duct Heater commanded To **OFF (De-energized)**. Note 1
 6. Verify Outside Air Damper **100% Closed** (after Fan status OFF) Note 1
 7. Verify Return Air Damper **100% Closed** (after Fan status OFF) Note 1
 - iv. Verify the AHU is not command **ON** after the 5 minute command. Note 1
 - v. Verify the AHU is commanded **ON** after the 20 minute command. Note 1

4. Duct Smoke Detector Verification: AHU 4, 5, 5A, 6, 7, 8, 9 & 10
 - a. With AHU in Normal operating Mode:
 - i. Simulate Smoke conditions for Supply Duct Smoke detector
 - ii. Verify the following:
 1. Verify alarm at FAS panel Note 2
 2. Verify alarm at BAS Note 2
 3. Supply Fan Commanded **OFF** Note 2
 4. Outside Air dampers **0% OPEN** Note 2
 5. Chilled Water Valve **0% OPEN** Note 2
 6. Duct Heater commanded **OFF** Note 2
 - b. With AHU shutdown for Duct Smoke Detector:
 - i. Place the FOP, HOA switch for AHU in the **ON** position.
 - ii. Verify the following:
 1. Outside Air Dampers commanded tot **100% OPEN.** Note 2
 2. Chilled Water Valve Commanded to **0% Open** Note 2
 - a. Decrease Cold Deck Setpoint to verify Chilled Water Valve *does not* Modulate. Note 2
 3. Duct Heater commanded to **OFF** Note 2
 - a. Increase Supply Air Temperature setpoint to verify Duct Heaters *do not* Energize. Note 2
5. Duct Smoke Detector Verification: AHU 1,3
 - a. With the building NOT in a FIRE MODE:
 - b. With AHU in Normal operating Mode:
 - i. Simulate Smoke conditions for Supply Duct Smoke detector
 - ii. Verify the following:
 1. Verify alarm at FAS panel Note 2
 2. Verify alarm at BAS Note 2
 3. Supply Fan Commanded **OFF** Note 2
 4. Outside Air dampers **0% OPEN** Note 2
 5. Chilled Water Valve **0% OPEN** Note 2
 6. Duct Heater commanded **OFF** Note 2
 - c. With AHU shutdown for Duct Smoke Detector:
 - i. Place the FOP, HOA switch for AHU in the **ON** position.
 - ii. Verify the following:
 1. Outside Air Dampers commanded tot **100% OPEN.** Note 2
 2. Chilled Water Valve Commanded to **0% Open** Note 2
 - a. Decrease Cold Deck Setpoint to verify Chilled Water Valve *does not* Modulate. Note 2

3. Duct Heater commanded to **OFF** Note 2
 - a. Increase Supply Air Temperature setpoint to verify Duct Heaters *do not* Energize. Note 2
 - iii. Return the FOP, HOA switch to **OFF**.
 - iv. Return the AHU to Normal Occupied Mode:
- d. With the building in a FIRE MODE:
 - e. With AHU in Normal operating Mode:
 - i. Simulate Smoke conditions for Supply Duct Smoke detector
 - ii. Verify the following:
 1. Verify alarm at FAS panel Note 2
 2. Verify alarm at BAS Note 2
 3. Supply Fan **Normal Operation** Note 2
 4. Outside Air dampers **Normal Operation** Note 2
 5. Chilled Water Valve **Normal Operation** Note 2
 6. Duct Heater **Normal Operation** Note 2
 - f. With AHU shutdown for Duct Smoke Detector:
 - i. Place the FOP, HOA switch for AHU in the **ON** position.
 - ii. Verify the following:
 1. Outside Air Dampers commanded tot **100% OPEN**. Note 2
 2. Chilled Water Valve Commanded to **0% Open** Note 2
 - a. Decrease Cold Deck Setpoint to verify Chilled Water Valve *does not* Modulate. Note 2
 3. Duct Heater commanded to **OFF** Note 2
 - a. Increase Supply Air Temperature setpoint to verify Duct Heaters *do not* Energize. Note 2

This concludes the Verification of Air Handling Unit Sequence of Operations.

Notes:

1. Specifications call for unique occupied and unoccupied schedules. Schedules required by specifications were not programmed at the time of testing. This Air Handling Unit operates on a 24 hour schedule.
2. Smoke control and Smoke removal Sequence testing was not performed at the time of functional testing. If verification of these sequences was performed during Fire System testing paperwork outside of this testing form will be provided.

3. Return Air High Temperature Alarm - Good
4. Supply Fan Alarm - Good

AHU-4 Functional Testing

Project:	Guilford County Detention Center
Date:	

Pre-test Verification:

1. Verify AHU-4 Pre-functional Checklists are complete. _____
2. Log the following to verify proper SA-T set point reset based on RA-T:

	Test #1	Test #2	Test #3
a. RA-T Set point	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F
b. RA-T Minimum	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F
c. RA-T Maximum	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F
d. SA-T Minimum	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F
e. SA-T Maximum	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F
f. SA-T Set point	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F	_____ <input type="checkbox"/> F

3. SA-T Reset functioning properly. _____

Verify the following through Point to Point Verification by the Controls.

With the unit in the **UNOCCUPIED** state (scheduled Unoccupied) verify the following:

1. Supply fan is commanded **OFF** _____
2. Variable Frequency Drive is **0%** _____
3. Outside Air Damper is commanded to **100% CLOSED** _____
4. Return Air Damper is commanded to **100% CLOSED** _____
5. Chilled Water Valve is commanded to **0% OPEN** _____
6. Electric Duct Heaters are **OFF (De-energized)** _____

Using the scheduling feature of the BAS, schedule the AHU to **OCCUPIED** and verify the following: (signatures)

1. Outside Air Dampers are commanded to **100% OPEN** _____
2. Return Air Dampers are commanded to **100% OPEN** _____
3. Supply Fan is commanded **ON** (Following 90 seconds) _____
4. Supply Fan proves **ON** _____
5. Variable Frequency Drive Ramps up to establish the Static Pressure Set point. _____

Upon completed general start up set the system follows:

1. Return Air Temperature = Return Air Temperature Setpoint

Sequence of Operation Verification:

1. Chilled Water Valve Control Verification:

- a. Verify Supply Air Temp Setpoint value: _____
- b. Simulate a call for cooling:
 - i. Increase Return Air Temp Setpoint to a value greater than the current Return Air Temperature plus Deadband and verify the following:
 1. Verify that the Supply Air Temp Setpoint resets based on Return Air Temp setpt. _____
 2. Verify that the Chilled Water Valve modulates in the **OPEN** direction to maintain Supply Air Temperature Setpoint. _____
 - ii. With the AHU in a call for cooling verify that VAV boxes are functioning properly for a call for cooling. Follow the functional testing procedure for VAV Boxes – Cooling Mode.
- c. Simulate a satisfied Return Air Temperature
 - i. Decrease the Return Air Temp Setpoint to a value less than the current setpoint.
 1. Verify that the Supply Air Temp Setpoint resets based on Return Air Temp setpt. _____
 2. Verify that the Chilled Water Valve modulates in the **CLOSED** direction to maintain Supply Air Temperature Setpoint. _____
- d. Return Temperatures to original settings.

2. Duct Heater Verification:

- a. Verify the following:
 - i. Set Outdoor Air Temp to a value less than 60 °F. value - _____
 - ii. Override the Space Average Temperature to a value 4 °F below the Return Air Temp Setpoint. value - _____
 - iii. Ensure lowest Space Temp is Lower than the Space Temp Setpoint. value - _____
 - iv. Decrease (Manually override) Return Air Temp value to reset Supply Air Temp setpoint to a value greater than the SA-T Setpoint Max value.
SA-T setpt - _____
SA-T value - _____
 - v. Verify that the Duct Heaters energize and Supply Air Temperature begins to increase based on call for heating. SA-T value - _____
 - vi. Return all Temperature and setpoint values back to **Normal**.

3. Static Pressure Control Verification:

- a. Verify the Static Pressure Setpoint Value. _____
- b. Simulate a 100% call for cooling resulting in all VAV boxes opening 100%.
(Simulates a decrease in Static Pressure).
 - i. Verify decrease in static pressure as read by sensor. _____
 - ii. Verify increase in VFD speed. _____
 - iii. Allow Speed to settle out.
- c. Simulate a 0% call for cooling resulting in all VAV boxes closing to minimum air flow positions as set by TAB. (Simulates an increase in Static Pressure).
 - i. Verify increase in static pressure as read by sensor. _____
 - ii. Verify decrease in VFD speed. _____
 - iii. Allow Speed to settle out.
 - iv. Return all Temperature and setpoint values to **NORMAL**.

4. Scheduled Unoccupied Shutdown

- a. Using the BAS Scheduling, set the schedule for the AHU as follows:
 - i. Schedule the AHU to **UNOCCUPIED**
 - ii. Schedule the unit to return to **OCCUPIED** 5 minutes after shutdown and a second **OCCUPIED** command 20 minutes after shutdown.
 - iii. Verify AHU shutdown occurs in the following order:
 - 1. Verify the AHU is commanded to **UNOCCUPIED MODE**. _____
 - 2. Verify the Supply Fan commanded to **OFF**. _____
 - 3. Verify Supply Fan Status = **OFF** _____
 - 4. Verify that the Chilled Water Valve is commanded to **0% open** _____
 - 5. Verify Duct Heater commanded To **OFF (De-energized)**. _____
 - 6. Verify Outside Air Damper **100% Closed** (after Fan status OFF) _____
 - 7. Verify Return Air Damper **100% Closed** (after Fan status OFF) _____
 - iv. Verify the AHU is not command **ON** after the 5 minute command. _____
 - v. Verify the AHU is commanded **ON** after the 20 minute command. _____

5. Duct Smoke Detector Verification: AHU 4, 5, 5A, 6, 7, 8, 9 & 10

- a. With AHU in Normal operating Mode:
 - i. Simulate Smoke conditions for Supply Duct Smoke detector (FOP switch in **NORMAL/OFF** position.)
 - ii. Verify the following:

1. Verify alarm at FAS panel _____
2. Verify alarm at BAS _____
3. Supply Fan Commanded **OFF** _____
4. VFD commanded to **0%** _____
5. Outside Air dampers **0% OPEN** _____
6. Return Air dampers **0% OPEN** _____
7. Chilled Water Valve **0% OPEN** _____
8. Duct Heater commanded **OFF** _____

b. With AHU shutdown for Duct Smoke Detector verify FOP operation (**EVAC Mode**)

- i. Place the FOP, HOA switch for AHU in the **ON** position.
- ii. Verify the following:
 1. Outside Air Dampers commanded to **100% OPEN**. _____
 2. Return Air Dampers remain at **0% OPEN**. _____
 3. Chilled Water Valve Commanded to **0% Open** _____
 - a. Decrease Cold Deck Setpoint to verify Chilled Water Valve *does not* Modulate. _____
 4. Duct Heater commanded to **OFF** _____
 - a. Increase Supply Air Temperature setpoint to verify Duct Heaters *do not* Energize. _____
- iii. Return the FOP, HOA switch to **OFF**.
- iv. Return the AHU to Normal Occupied Mode:

c. Place the building in a FIRE MODE situation:

- d. With AHU in Normal operating Mode, verify the following:
 - i. Simulate Smoke conditions for Supply Duct Smoke detector
 - ii. Verify the following:
 1. Verify alarm at FAS panel _____
 2. Verify alarm at BAS _____
 3. Supply Fan Commanded **OFF** _____

- 4. VFD commanded to **0%** _____
- 5. Outside Air dampers **0% OPEN** _____
- 6. Return Air dampers **0% OPEN** _____
- 7. Chilled Water Valve **0% OPEN** _____
- 8. Duct Heater commanded **OFF** _____

- e. With AHU shutdown for Duct Smoke Detector verify FOP operation:
 - i. Place the FOP, HOA switch for AHU in the **ON** position.
 - ii. Verify the following:
 - 1. Outside Air Dampers commanded tot **100% OPEN.** _____
 - 2. Return Air Dampers remain at **0% OPEN.** _____
 - 3. Chilled Water Valve Commanded to **0% Open** _____
 - a. Decrease Cold Deck Setpoint to verify Chilled Water Valve *does not* Modulate. _____
 - 4. Duct Heater commanded to **OFF** _____
 - a. Increase Supply Air Temperature setpoint to verify Duct Heaters *do not* Energize. _____

This concludes the Verification of Primary Air Unit Sequence of Operations.

UH-U-7 Functional Testing

Project:	Guilford County Detention Center
Date:	

Pre-test Verification:

1. Verify UH-U-7 Pre-functional Checklists are complete. _____

Sequence of Operation Verification:

With the UH energized and the Space Temperature above the Space Temperature setpoint verify the following Sequence:

1. CALL FOR HEATING CONTROL VERIFICATION:

- a. Verify Space Temperature _____ F
- b. Verify Space Temp. Setpoint _____ F
- c. Simulate a call for heating:
 1. Increase the Space Temperature Setpoint to a value greater than the current Space Temperature plus deadband.
 2. Verify that the Electric Heat Coil Energizes to maintain Space Temperature setpoint. _____
 3. Return Space Temperature to the original value.
 4. Verify the Electric Heat Coil De-energizes. _____
- d. Return UH-U-7 to **NORMAL** operations.

This concludes the verification of Unit Heater #7 Sequence of Operations.

Water Piping Construction Checklist

Project:	Guilford County Detention Center
Completion Date:	
Building:	
Location:	Complete building

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This construction checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ **List attached.**

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date		
TAB Contractor	Date	General Contractor	Date

Construction checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer’s recommended checkout and startup procedures or report.
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Authority	Date	Owner’s Representative	Date

Associated Checklists					
Chiller	X	Heat Exchanger		BAS	X
Chilled Water Pump(s)	X	Other		Other	
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	<input checked="" type="checkbox"/>	
Flushing and cleaning plan	<input checked="" type="checkbox"/>	
Leak test reports	<input type="checkbox"/>	
Water treatment report	<input type="checkbox"/>	
Welder Certification	<input type="checkbox"/>	
Comments:		

Installation Checks			
Check if Acceptable; Provide comment if unacceptable	NA	Comment	
Piping			
Piping installed per the drawings and details	<input type="checkbox"/>	<input type="checkbox"/>	
Piping, fittings, valves and equipment properly supported per the details	<input type="checkbox"/>	<input type="checkbox"/>	
Piping, fittings and valves insulated per specification	<input type="checkbox"/>	<input type="checkbox"/>	
In-line equipment insulated per specification	<input type="checkbox"/>	<input type="checkbox"/>	
Piping labeled per specification with flows indicated in the correct direction	<input type="checkbox"/>	<input type="checkbox"/>	
Strainers and low-point drains opened and verified to be clean	<input type="checkbox"/>	<input type="checkbox"/>	
Construction strainers removed	<input type="checkbox"/>	<input type="checkbox"/>	
Test plugs (P/T) installed near all control sensors and as per spec	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Flushing and cleaning plan submitted and approved	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Piping system properly flushed and cleaned and temporary piping removed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Piping pressure tested according to contract documents	<input type="checkbox"/>	<input type="checkbox"/>	
Chemical treatment system or plan installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
No leaking apparent	<input type="checkbox"/>	<input type="checkbox"/>	
ASME pressure vessel data sheet or certification tag posted and inspection complete for each expansion tank	<input type="checkbox"/>	<input type="checkbox"/>	
Expansion tanks verified to not be air bound and system completely full of water. System completed purged of air	<input type="checkbox"/>	<input type="checkbox"/>	
Air vents and bleeds at high points of systems functional	<input type="checkbox"/>	<input type="checkbox"/>	

Installation Checks			
Check if Acceptable; Provide comment if unacceptable	NA	Comment	
Piping in mechanical rooms painted per spec section 15100.19.0.D			
Piping in concealed spaces indentified with bands and arrows. Manufacturer “Seton Name Plate Company”			
Vibration isolation per spec section 15400.5.0 and 6.0			
Valves			
Isolation valves provided at all branches and main takeoffs to facilitate isolation (as required by contract)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Valve installation per manufacturer’s instructions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Valve manufacturer labels permanently affixed	<input type="checkbox"/>	<input type="checkbox"/>	
Manual isolation valves checked for proper seal and found to travel freely	<input type="checkbox"/>	<input type="checkbox"/>	
Valves installed in proper direction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Valves stroke fully and easily and spanning is calibrated (see calibration section below)	<input type="checkbox"/>	<input type="checkbox"/>	
Valves that require a positive shut-off are verified to not be leaking when closed at normal operating pressure	<input type="checkbox"/>	<input type="checkbox"/>	
No leaking apparent	<input type="checkbox"/>	<input type="checkbox"/>	
Valves tagged and valve schedule submitted and displayed as required	<input type="checkbox"/>	<input type="checkbox"/>	
Adequate maintenance clearance in provided and valve is accessible	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Sensors and Gages			
Temperature, pressure and flow gages and sensors installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Piping gages, BAS and associated panel temperature and pressure readouts match	<input type="checkbox"/>	<input type="checkbox"/>	
TAB			
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	<input type="checkbox"/>	<input type="checkbox"/>	

Sensor and Actuator Calibration

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N** _____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator Tag & Location	Location OK	1 st Gage or BAS Value	Instrument Measured Value	Final Gage or BAS Value	Pass Y / N

Sensor or Actuator Tag & Location	Location OK	1 st Gage or BAS Value	Instrument Measured Value	Final Gage or BAS Value	Pass Y / N

Comments:

Chilled Water Pump Construction Checklist

Project:	Guilford County Detention Center
Completion Date:	
Pump tags:	
Building:	
Location:	

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This construction checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ **List attached.**

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date		
TAB Contractor	Date	General Contractor	Date

Construction checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer’s recommended checkout and startup procedures or report.
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Authority	Date	Owner’s Representative	Date

Pump 1 Information					
Make		Model Number			
Serial Number		GPM		Head	
Volts/Phase		Function		Service Area	
Motor Hp		Motor Eff		RPM	
Comments:					

Pump 2 Information					
Make		Model Number			
Serial Number		GPM		Head	
Volts/Phase		Function		Service Area	
Motor Hp		Motor Eff		RPM	
Comments:					

Pump 3 Information					
Make		Model Number			
Serial Number		GPM		Head	
Volts/Phase		Function		Service Area	
Motor Hp		Motor Eff		RPM	
Comments:					

Associated Checklists					
Chiller	<input checked="" type="checkbox"/>	Chilled Water Piping	<input checked="" type="checkbox"/>	Condenser Water Pumps	<input checked="" type="checkbox"/>
Heat Exchanger	<input type="checkbox"/>	Condenser Water Piping	<input checked="" type="checkbox"/>	BAS	<input checked="" type="checkbox"/>
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	<input checked="" type="checkbox"/>	
Performance data (pump curves, coil data, etc.)	<input checked="" type="checkbox"/>	
Installation and startup manual and plan	<input checked="" type="checkbox"/>	
O&M manuals	<input type="checkbox"/>	

Factory test results	<input type="checkbox"/>	
Sequences and control strategies	<input type="checkbox"/>	
Warranty Certificate	<input type="checkbox"/>	
Pump alignment report	<input type="checkbox"/>	
Vibration testing report	<input type="checkbox"/>	
Comments:		

Installation Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
General		
Installation is per manufacturers instructions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Equipment label permanently affixed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump lubricated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump drive properly aligned	<input type="checkbox"/>	<input type="checkbox"/>
Pump turns freely	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Drive guard or shield is properly installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pumps in place and properly anchored	<input type="checkbox"/>	<input type="checkbox"/>
Pipes are supported independently of the pump	<input type="checkbox"/>	<input type="checkbox"/>
Vibration isolation devices installed and functional (non-short circuiting)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Isolation valves and piping specialties installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Shaft seal is leak free	<input type="checkbox"/>	<input type="checkbox"/>
Pump detail checked against the drawings and all devices gages and appurtenances are in place	<input type="checkbox"/>	<input type="checkbox"/>
Insulation installed per requirements; pumps for cold water insulated to avoid condensation yet allow for service	<input type="checkbox"/>	<input type="checkbox"/>
Electrical and Controls		
Power disconnect is located within site of the unit it controls and labeled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All electric connections tight	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Grounding installed for components and unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safeties installed and operational	<input type="checkbox"/>	<input type="checkbox"/>
Starter overload breakers installed and correct size	<input type="checkbox"/>	<input type="checkbox"/>
All control devices and wiring complete	<input type="checkbox"/>	<input type="checkbox"/>
Control system interlocks connected and functional	<input type="checkbox"/>	<input type="checkbox"/>
Operation of HOA switch checked in all positions	<input type="checkbox"/>	<input type="checkbox"/>
Proper safeties in control when HOA switch in hand position	<input type="checkbox"/>	<input type="checkbox"/>
Installation per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>
Rotates in the correct direction	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Installation Checks			
Check if Acceptable; Provide comment if unacceptable	NA	Comment	
Sensors and Gages			
Temperature, pressure and flow gages and sensors installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Piping gages, BAS and associated panel temperature and pressure readouts match	<input type="checkbox"/>	<input type="checkbox"/>	
TAB			
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	<input type="checkbox"/>	<input type="checkbox"/>	

Operational Checks			
Check if Acceptable; Provide comment if unacceptable	NA	Comment	
Specified sequences of operation and operating schedules have been provided with all variations documented	<input type="checkbox"/>	<input type="checkbox"/>	
Specified point-to-point checks have been completed and documentation record submitted for this system	<input type="checkbox"/>	<input type="checkbox"/>	
Startup report completed with this checklist attached (includes full listing of all internal settings with notes as to which settings are BAS controlled or monitored and which are integral	<input type="checkbox"/>	<input type="checkbox"/>	
Start-up complete	<input type="checkbox"/>	<input type="checkbox"/>	

Sensor and Actuator Calibration

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N** _____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator Tag & Location	Location OK	1 st Gage or BAS Value	Instrument Measured Value	Final Gage or BAS Value	Pass Y / N

Comments:



Fire Pump Construction Checklist

Project:	Guilford County Detention Center
Completion Date:	
Pump tag:	
Building:	
Location:	

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This construction checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ **List attached.**

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date		
TAB Contractor	Date	General Contractor	Date

Construction checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing.

- **This checklist does not take the place of the manufacturer’s recommended checkout and startup procedures or report.**
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Authority	Date	Owner’s Representative	Date

Fire Pump Information					
Make		Model Number			
Serial Number		GPM		Head	
Volts/Phase		Function		Service Area	
Motor Hp		Motor Eff		RPM	
Comments: Information unreadable on pump. KMP is getting new labels to replace the damaged one.					

Jockey Pump Information					
Make		Model Number			
Serial Number		GPM		Head	
Volts/Phase		Function		Service Area	
Motor Hp		Motor Eff		RPM	
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	<input checked="" type="checkbox"/>	
Performance data (pump curves, coil data, etc.)	<input checked="" type="checkbox"/>	
Installation and startup manual and plan	<input checked="" type="checkbox"/>	
O&M manuals	<input type="checkbox"/>	
Factory test results	<input type="checkbox"/>	
Sequences and control strategies	<input checked="" type="checkbox"/>	
Warranty Certificate	<input type="checkbox"/>	
Pump alignment report	<input type="checkbox"/>	
Vibration testing report	<input type="checkbox"/>	
Comments:		

Installation Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
General		
Installation is per manufacturers instructions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Manufacturers recommended spare parts are provided	<input type="checkbox"/>	<input type="checkbox"/>
Equipment label permanently affixed	<input type="checkbox"/>	<input type="checkbox"/>

Installation Checks		
Check if Acceptable; Provide comment if unacceptable	NA	Comment
Pump lubricated	<input type="checkbox"/>	<input type="checkbox"/>
Pump drive properly aligned	<input type="checkbox"/>	<input type="checkbox"/>
Pump turns freely	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Drive guard or shield is properly installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump foundation is level within manufacturer's tolerances	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pumps in place and properly anchored	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pipes are supported independently of the pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Vibration isolation devices installed and functional (non-short circuiting)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Isolation valves and piping specialties installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Shaft seal is leak free	<input type="checkbox"/>	<input type="checkbox"/>
Pump detail checked against the drawings and all devices gages and appurtenances are in place	<input type="checkbox"/>	<input type="checkbox"/>
Electrical and Controls		
Power disconnect is located within site of the unit it controls and labeled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All electric connections tight	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Grounding installed for components and unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safeties installed and operational	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Starter overload breakers installed and correct size	<input type="checkbox"/>	<input type="checkbox"/>
All control devices and wiring complete	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Control system interlocks connected and functional	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fire Pump Controller powered and operational	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Installation per manufacturer's instructions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Rotates in the correct direction	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sensors and Gages		
Pressure and flow gages installed	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

Domestic Water Booster Pump Test Procedure

Project:	Guilford County Detention Center
-----------------	----------------------------------

Date:	
Pump Tag:	
Building:	
Location:	

First Test Date	Re-Test Date	Reason for Re-Test	Seasonal Test Required

Conditions of Testing

Ambient Conditions					
DB		WB		RH	
Bar Press		Wind Speed		Wind Dir	

Occupancy Schedule							
M-F		Saturday		Sunday		Holiday	

Setpoints	Design	Actual
Temperature Sensor		
Static Pressure Sensor		

Describe Overrides / Status and Operating Condition of Equipment:

Test Participants

Manufacturers:	
Contractors:	
Building Owner / Representatives:	
Commissioning Specialists:	

Test Instruments

Instrumentation				
Manufacturer/Model	Serial Number	Range	Accuracy/Resolution	Last Calibration Date

Approvals. This filled-out test procedure has been reviewed. Its completion is approved with the exceptions noted below.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date
Commissioning Authority	Date	Owner's Representative	Date

System Description

Domestic Water Booster Pump Sequence of Operation:

(Insert Sequence of Operation here) I do not have a sequence listed that I could find.

Sensor Calibration Verification

Check the sensors listed below for calibration and adequate location. All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N** _____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor	Location OK	1 st Gage or BAS Value	Instrument Measured Value	Final Gage or BAS Value	Pass Y / N

Device Calibration Verification

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N** _____. Devices installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Device or Actuator Tag & Location	Procedure / State	1 st BAS Value	Site Observation	Final BAS Value	Pass Y / N

Load Verification Testing

Load Parameter	Design	Actual	Comments
GPM			
Pressure			
RPM			
Voltage			
Amperage			

Functional Testing Record General

Function / Mode	Test Method: Manual, Automatic, Either or Both	Required Seasonal Test Y or N
1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with.	Manual	
2. Verify schedules and setpoints to be reasonable and appropriate	Review	
3. Speed controls	Both	
4. Sensor calibration checks on any controlling temperature or pressure sensor	Manual	

Test Procedure

Test Procedure	Expected Response	P	F	Comments	Req'd Retest
Standby check. HOA in Auto position. Unit commanded Off by BAS	Verify by visual inspection that: a) Pump is off.				
HOA in Auto position. Unit commanded On by BAS.	Verify by visual inspection that: a) System maintaining pressure setpoint. b) Pump may be on.				

Test Procedure	Expected Response	P	F	Comments	Req'd Retest
With units running at low flow condition, open valves to increase flow.	Verify by visual inspection that: a) System maintaining pressure setpoint. b) Record pressure: _____psig c) Lag pump stages On.				
Record full load running amps for each pump. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?	Pump runs within design parameters. Record FLA: _____A				
With unit running at high flow condition, close valves to decrease flow.	Verify by visual inspection that: a) System maintaining pressure setpoint. b) Record pressure: _____psig c) Lag pump stages Off.				
With unit running at low flow, close all valves until unit stops. Once unit stops, open valve for very low flow.	Verify by visual inspection that: a) Hydrostatic tank maintaining pressure setpoint.				
Verification of safeties and alarms.	Record setpoints and time delays: a) Low suction pressure alarm (x second delay) b) Low suction pressure shutdown c) Low system pressure alarm (30 second delay) d) High system pressure alarm e) High system pressure shutdown f) Pump failure g) BAS failure contacts				

Required Monitoring

All points listed below shall be trended by the BAS for the period indicated.

Point	Trend Interval (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
Pressure				
Pump status				
Alarm				

Remarks:

Acceptance Criteria (referenced by function or mode ID)

For the conditions, sequences and modes tested, the fans, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

Comments with Acceptance Criteria: