

DYLAN MECHANICAL CONSTRUCTION
SERVICES, INC

HVAC COMMISSIONING
CHECKLISTS

BT COLLINS HIGH TECH RTS, SACRAMENTO, CA

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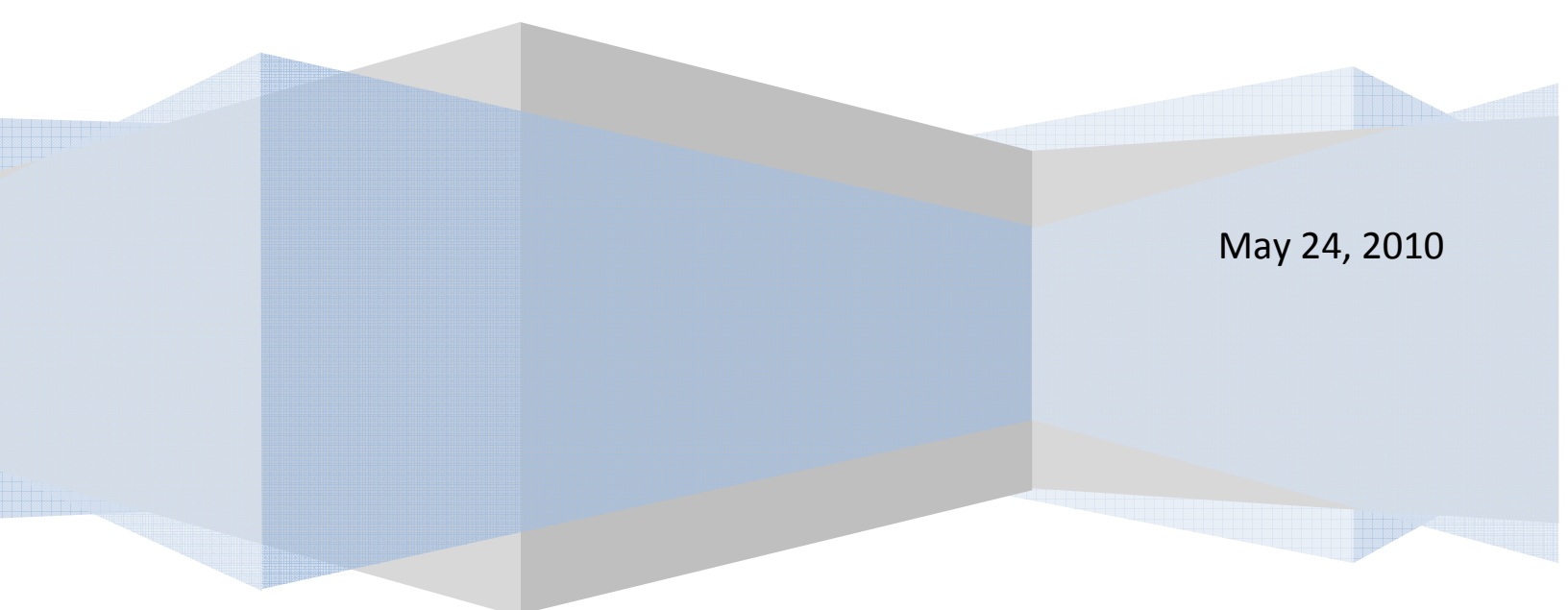


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Pre-commissioning checklist – Piping

For Chilled Water Piping System

Checklist Item	QA	QC	CA
Installation			
a. Piping complete.	___	___	___
b. As-built shop drawings submitted.	___	___	___
c. Piping flushed and cleaned.	___	___	___
d. Strainers cleaned.	___	___	___
e. Valves installed as required.	___	___	___
f. Piping insulated as required.	___	___	___
g. Thermometers and gauges installed as required.	___	___	___
h. Verify operation of valves.	___	___	___
i. Air vents installed as specified.	___	___	___
j. Flexible connectors installed as specified	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Hydrostatic test complete.	___	___	___
b. TAB operation complete.	___	___	___

Pre-commissioning checklist – Piping

For Hot Water Piping System

Checklist Item	QA	QC	CA
Installation			
a. Piping complete.	_____	_____	_____
b. As-built shop drawings submitted.	_____	_____	_____
c. Piping flushed and cleaned.	_____	_____	_____
d. Strainers cleaned.	_____	_____	_____
e. Valves installed as required.	_____	_____	_____
f. Piping insulated as required.	_____	_____	_____
g. Thermometers and gauges installed as required.	_____	_____	_____
h. Verify operation of valves.	_____	_____	_____
i. Air vents installed as specified.	_____	_____	_____
j. Flexible connectors installed as specified	_____	_____	_____
k. Verify that piping has been labeled and valves identified as specified.	_____	_____	_____
Testing, Adjusting, and Balancing (TAB)			
a. Hydrostatic test complete.	_____	_____	_____
b. TAB operation complete.	_____	_____	_____

Pre-commissioning checklist – Piping

For Refrigerant Piping System

Checklist Item	QA	QC	CA
Installation			
a. Piping complete.	_____	_____	_____
b. As-built shop drawings submitted.	_____	_____	_____
c. Piping flushed and cleaned.	_____	_____	_____
d. Strainers cleaned.	_____	_____	_____
e. Valves installed as required.	_____	_____	_____
f. Piping insulated as required.	_____	_____	_____
g. Thermometers and gauges installed as required.	_____	_____	_____
h. Verify operation of valves.	_____	_____	_____
i. Air vents installed as specified.	_____	_____	_____
j. Flexible connectors installed as specified	_____	_____	_____
k. Verify that piping has been labeled and valves identified as specified.	_____	_____	_____
Testing, Adjusting, and Balancing (TAB)			
a. Hydrostatic test complete.	_____	_____	_____
b. TAB operation complete.	_____	_____	_____

Pre-commissioning Checklist - Ductwork

For Air Handler: AHU #1

Checklist Item	QA	QC	CA
Installation			
a. Ductwork complete.	___	___	___
b. As-built shop drawings submitted.	___	___	___
c. Ductwork leak test complete.	___	___	___
d. Fire dampers, smoke dampers, and access doors installed as required.	___	___	___
e. Ductwork insulated as required.	___	___	___
f. Thermometers and gauges installed as required.	___	___	___
g. Verify open/closed status of dampers.	___	___	___
h. Verify smoke dampers operation.	___	___	___
i. Flexible connectors installed as specified	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. TAB operation complete.	___	___	___

Pre-commissioning Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU #1

Checklist Item QA QC CA

Installation

- a. Vibration isolation devices installed. ___ ___ ___
- b. Inspection and access doors are operable and sealed. ___ ___ ___
- c. Casing undamaged. ___ ___ ___
- d. Insulation undamaged. ___ ___ ___
- e. Condensate drainage is unobstructed.
 (Visually verify drainage by pouring a
 cup of water into drain pan.) ___ ___ ___
- f. Fan belt adjusted. ___ ___ ___
- g. Manufacturer's required maintenance clearance provided. ___ ___ ___

Electrical

- a. Power available to unit disconnect. ___ ___ ___
- b. Power available to unit control panel. ___ ___ ___
- c. Proper motor rotation verified. ___ ___ ___
- d. Verify that power disconnect is located
 within sight of the unit it controls. ___ ___ ___
- e. Power available to humidifier. ___ ___ ___

Coils

- a. Chilled water piping properly connected. ___ ___ ___
- b. Chilled water piping pressure tested. ___ ___ ___
- c. Hot water piping properly connected. ___ ___ ___
- d. Hot water piping pressure tested. ___ ___ ___
- e. Air vents installed on water coils with
 shutoff valves as specified. ___ ___ ___
- f. Any damage to coil fins has been repaired. ___ ___ ___

Heat Recovery Unit

- a. Controls operable. ___ ___ ___
- b. Power connected and rotation check. ___ ___ ___

c. Bypass dampers operable. _____

Controls

- a. Control valves/actuators properly installed. _____
- b. Control valves/actuators operable. _____
- c. Dampers/actuators properly installed. _____
- d. Dampers/actuators operable. _____
- e. Verify proper location, installation and calibration of duct static pressure sensor. _____
- f. Fan air volume controller operable. _____
- g. Air handler controls system operational. _____

Testing, Adjusting, and Balancing (TAB)

- a. Construction filters removed and replaced. _____
- b. TAB report submitted. _____
- c. TAB results within +10%/-0% of L/s cfm shown on drawings _____
- d. TAB results for outside air intake within +10%/-0% of both the minimum and maximum L/s cfms shown on drawings. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 1

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 2

Checklist Item

QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 3

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 4

Checklist Item

QA QC CA

Installation

- a. VAV terminal in place. _ _ _
- b. VAV terminal ducted. _ _ _
- c. VAV terminal connected to controls. _ _ _
- d. Reheat coil connected to hot water pipe. _ _ _
- e. Manufacturer's required maintenance clearance provided. _ _ _

Controls

- a. Reheat VAV terminal controls set. _ _ _
- b. Reheat terminal/coil controls verified. _ _ _

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _ _ _
- b. Verify terminal minimum air flow set. _ _ _
- c. TAB operation complete. _ _ _

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 5

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 6

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 7

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 8

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 9

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 10

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 11

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 12

Checklist Item	QA	QC	CA
----------------	----	----	----

Installation

- | | | | |
|--|-----|-----|-----|
| a. VAV terminal in place. | ___ | ___ | ___ |
| b. VAV terminal ducted. | ___ | ___ | ___ |
| c. VAV terminal connected to controls. | ___ | ___ | ___ |
| d. Reheat coil connected to hot water pipe. | ___ | ___ | ___ |
| e. Manufacturer's required maintenance clearance provided. | ___ | ___ | ___ |

Controls

- | | | | |
|--|-----|-----|-----|
| a. Reheat VAV terminal controls set. | ___ | ___ | ___ |
| b. Reheat terminal/coil controls verified. | ___ | ___ | ___ |

Testing, Adjusting, and Balancing (TAB)

- | | | | |
|--|-----|-----|-----|
| a. Verify terminal maximum air flow set. | ___ | ___ | ___ |
| b. Verify terminal minimum air flow set. | ___ | ___ | ___ |
| c. TAB operation complete. | ___ | ___ | ___ |

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 13

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 14

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 15

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 16

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. _____
- b. VAV terminal ducted. _____
- c. VAV terminal connected to controls. _____
- d. Reheat coil connected to hot water pipe. _____
- e. Manufacturer's required maintenance clearance provided. _____

Controls

- a. Reheat VAV terminal controls set. _____
- b. Reheat terminal/coil controls verified. _____

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _____
- b. Verify terminal minimum air flow set. _____
- c. TAB operation complete. _____

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 17

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 18

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 19

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 20

Checklist Item	QA	QC	CA
----------------	----	----	----

Installation

- | | | | |
|--|-----|-----|-----|
| a. VAV terminal in place. | ___ | ___ | ___ |
| b. VAV terminal ducted. | ___ | ___ | ___ |
| c. VAV terminal connected to controls. | ___ | ___ | ___ |
| d. Reheat coil connected to hot water pipe. | ___ | ___ | ___ |
| e. Manufacturer's required maintenance clearance provided. | ___ | ___ | ___ |

Controls

- | | | | |
|--|-----|-----|-----|
| a. Reheat VAV terminal controls set. | ___ | ___ | ___ |
| b. Reheat terminal/coil controls verified. | ___ | ___ | ___ |

Testing, Adjusting, and Balancing (TAB)

- | | | | |
|--|-----|-----|-----|
| a. Verify terminal maximum air flow set. | ___ | ___ | ___ |
| b. Verify terminal minimum air flow set. | ___ | ___ | ___ |
| c. TAB operation complete. | ___ | ___ | ___ |

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 21

Checklist Item

QA QC CA

Installation

- a. VAV terminal in place. _ _ _
- b. VAV terminal ducted. _ _ _
- c. VAV terminal connected to controls. _ _ _
- d. Reheat coil connected to hot water pipe. _ _ _
- e. Manufacturer's required maintenance clearance provided. _ _ _

Controls

- a. Reheat VAV terminal controls set. _ _ _
- b. Reheat terminal/coil controls verified. _ _ _

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. _ _ _
- b. Verify terminal minimum air flow set. _ _ _
- c. TAB operation complete. _ _ _

Pre-commissioning Checklist - VAV Terminal

For VAV Terminal: 22

Checklist Item QA QC CA

Installation

- a. VAV terminal in place. ___ ___ ___
- b. VAV terminal ducted. ___ ___ ___
- c. VAV terminal connected to controls. ___ ___ ___
- d. Reheat coil connected to hot water pipe. ___ ___ ___
- e. Manufacturer's required maintenance clearance provided. ___ ___ ___

Controls

- a. Reheat VAV terminal controls set. ___ ___ ___
- b. Reheat terminal/coil controls verified. ___ ___ ___

Testing, Adjusting, and Balancing (TAB)

- a. Verify terminal maximum air flow set. ___ ___ ___
- b. Verify terminal minimum air flow set. ___ ___ ___
- c. TAB operation complete. ___ ___ ___

Pre-commissioning Checklist - DX Air Cooled Condensing Unit

For Condensing Unit: CU-1 and AC-1 for the Demarcation Room

Checklist Item	QA	QC	CA
Installation	___	___	___
b. Refrigerant pipe leak tested.	___	___	___
c. Refrigerant pipe evacuated and charged in accordance with manufacturer's instructions.	___	___	___
d. Check condenser fans for proper rotation.	___	___	___
e. Any damage to coil fins has been repaired.	___	___	___
f. Manufacturer's required maintenance/operational clearance provided.	___	___	___
Electrical			
a. Power available to unit disconnect.	___	___	___
b. Power available to unit control panel.	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls	___	___	___
Controls			
a. Unit safety/protection devices tested.	___	___	___
b. Control system and interlocks installed.	___	___	___
c. Control system and interlocks operational.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-1A Hot Water Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-1B Hot Water Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-2A Chilled Water Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-2B Chilled Water Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-3A Hot Water Coil Recirc Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist – Pumps

For Pump: P-3B Hot Water Coil Recirc Pump

Checklist Item	QA	QC	CA
Installation			
a. Pumps grouted in place.	___	___	___
b. Pump vibration isolation devices functional.	___	___	___
c. Pump/motor coupling alignment verified.	___	___	___
d. Piping system installed.	___	___	___
e. Piping system pressure tested.	___	___	___
f. Pump not leaking.	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	___
Electrical			
a. Power available to pump disconnect.	___	___	___
b. Pump rotation verified.	___	___	___
c. Control system interlocks functional.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___
Testing, Adjusting, and Balancing (TAB)			
a. Pressure/temperature gauges installed.	___	___	___
b. Piping system cleaned.	___	___	___
c. Chemical water treatment complete.	___	___	___
d. Water balance complete.	___	___	___
e. Water balance with design maximum flow.	___	___	___
f. TAB Report submitted.	___	___	___

Pre-commissioning Checklist - Packaged Air Cooled Chiller

For Chiller: CH-1 _____

Checklist Item	QA	QC	CA
Installation			
a. Chiller properly piped.	___	___	___
b. Chilled water pipe leak tested.	___	___	___
c. Verify that refrigerant used complies with specified requirements.	___	___	___
d. Any damage to coil fins has been repaired.	___	___	___
e. Manufacturer's required maintenance clearance provided.	___	___	___

Electrical

a. Power available to unit disconnect.	___	___	___
b. Power available to unit control panel.	___	___	___
c. Separate power is supplied to electric heating tape.	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___

Controls

a. Factory startup and checkout complete.	___	___	___
b. Chiller safety/protection devices tested.	___	___	___
c. Chilled water flow switch installed.	___	___	___
d. Chilled water flow switch tested.	___	___	___
e. Chilled water pump interlock installed.	___	___	___
f. Chilled water pump interlock tested.	___	___	___

Pre-commissioning Checklist - Hot Water Boiler

For Boiler: HWB-1

Checklist Item	QA	QC	CA
Installation			
a. Boiler flue installed.	___	___	___
b. Boiler hot water piping installed.	___	___	___
c. Boiler hot water piping tested.	___	___	___
d. Boiler makeup water piping installed.	___	___	___
e. Boiler gas piping installed.	___	___	___
f. Boiler gas piping tested.	___	___	___
g. Manufacturer's required maintenance clearance provided.	___	___	___
Startup			
a. Boiler system cleaned and filled with treated water.	___	___	___
b. Boiler safety/protection devices, including high temperature burner shut-off, low water cutoff, flame failure, pre and post purge, have been tested.	___	___	___
c. Verify that PRV rating conforms to boiler rating.	___	___	___
d. Boiler water treatment system functional.	___	___	___
e. Boiler startup and checkout complete.	___	___	___
f. Combustion efficiency demonstrated.	___	___	___
Electrical			
a. Verify that power disconnect is located within sight of the unit served.	___	___	___
Controls			
a. Hot water pump interlock installed.	___	___	___
b. Hot water pump interlock tested.	___	___	___
c. Hot water heating system balanced.	___	___	___
d. Hot water heating controls operational.	___	___	___

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Pre-commissioning Checklist - Demarc Room Vent Fan For Vent Fan: _____

Checklist Item QA QC CA

Installation

- a. Ductwork connected properly. _____
- b. Fan hung or supported properly and with vibration isolation. _____

Electrical

- a. Power available to unit disconnect. _____
- b. Proper motor rotation verified. _____
- c. Verify that power disconnect is located within sight of the unit it controls. _____
- d. Power available to electric heating coil. _____

Controls

- a. Control valves properly installed. _____
- b. Control valves operable. _____
- c. Verify proper location and installation of thermostat. _____

Testing, Adjusting, and Balancing (TAB)

- a. TAB Report submitted. _____

Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan: EF-1

Checklist Item

QA QC CA

Installation

a. Fan belt adjusted.

Electrical

a. Power available to fan disconnect.

b. Proper motor rotation verified.

c. Verify that power disconnect is located within sight of the unit it controls.

Controls

a. Control interlocks properly installed.

b. Control interlocks operable.

c. Dampers/actuators properly installed.

d. Dampers/actuators operable.

e. Verify proper location and installation of thermostat.

Testing, Adjusting, and Balancing (TAB)

a. TAB results +10%/-0% to L/s (cfm) shown on drawings

b. TAB Report submitted.

Pre-commissioning Checklist - HVAC System Controls

For HVAC System: All HVAC CONTROLS

BT Collins High Tech RTS, Sacramento, CA

Checklist Item	QA	QC	CA
Installation			
a. As-built shop drawings submitted.	_____	_____	_____
b. Layout of control panel matches drawings.	_____	_____	_____
c. Framed instructions mounted in or near control panel.	_____	_____	_____
d. Components properly labeled (on inside and outside of panel).	_____	_____	_____
e. Control components piped and/or wired to each labeled terminal strip.	_____	_____	_____
f. EMCS connection made to each labeled terminal strip as shown.	_____	_____	_____
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	_____	_____	_____
h. Shielded wiring used on electronic sensors.	_____	_____	_____
i. Water drain installed as specified.	_____	_____	_____
Main Power and Control Air			
a. 110 volt AC power available to panel.	_____	_____	_____
b. 20 psig compressed air available to panel.	_____	_____	_____
Testing, Commissioning, and Balancing			
a. Testing, Commissioning, and Balancing Report submitted.	_____	_____	_____

Functional Performance Test Checklist - Pumps

For Pump: P-1A Hot Water Pump

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig
 Strainer outlet pressure _____ psig

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

DESIGN TAB ACTUAL

Pump inlet pressure (psig) _____
 Pump outlet pressure (psig) _____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

b. Minimum flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____

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Voltage to ground _____

3. Unusual vibration, noise, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - Pumps

For Pump: P-1B Hot Water Pump

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig

Strainer outlet pressure _____ psig

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

DESIGN TAB ACTUAL

Pump inlet pressure (psig) _____

Pump outlet pressure (psig) _____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

b. Minimum flow:

PHASE 1 PHASE 2 PHASE 3

Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date
Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - Pumps

For Pump: P-2A Chilled Water Pump

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig

Strainer outlet pressure _____ psig

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

DESIGN TAB ACTUAL

Pump inlet pressure (psig) _____

Pump outlet pressure (psig) _____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

b. Minimum flow:

PHASE 1 PHASE 2 PHASE 3

Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - Pumps

For Pump: P-2B Chilled Water Pump

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is

operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig

Strainer outlet pressure _____ psig

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

DESIGN TAB ACTUAL

Pump inlet pressure (psig) _____

Pump outlet pressure (psig) _____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (psig)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (gpm)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

b. Minimum flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

**Functional Performance Test Checklist -
VAV Terminals VAV No _____ Tested**

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 3.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

b. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 5 degrees F above ambient and measure maximum air flow.
Turn thermostat to 5 degrees F below ambient and measure minimum air flow.

Maximum flow _____ cfm
Minimum flow _____ cfm

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ cfm
Minimum flow setting _____ cfm

Reheat coil operation range (full open to full closed) _____

Contractor's Quality Control Representative _____ Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

**Functional Performance Test Checklist -
VAV Terminals VAV No _____ Tested**

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 3.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

b. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 5 degrees F above ambient and measure maximum air flow.
Turn thermostat to 5 degrees F below ambient and measure minimum air flow.

Maximum flow _____ cfm
Minimum flow _____ cfm

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ cfm
Minimum flow setting _____ cfm

Reheat coil operation range (full open to full closed) _____

Contractor's Quality Control Representative _____ Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - VAV Terminals VAV No _____ Tested

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 3.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

b. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment.
Turn thermostat to 5 degrees F above ambient and measure maximum air flow.
Turn thermostat to 5 degrees F below ambient and measure minimum air flow.

Maximum flow _____ cfm
Minimum flow _____ cfm

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ cfm
Minimum flow setting _____ cfm

Reheat coil operation range (full open to full closed) _____

Contractor's Quality Control Representative _____ Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU#1

Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply and return fans operating mode is initiated:

(1) All dampers in normal position and fan inlet vanes modulate to maintain the required static pressure. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

(4) VAV fan controller shall "soft-start" fan. _____

(5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the design static pressure Class shown.

b. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper at minimum position. _____

(4) Chilled water control valve modulating to maintain leaving air temperature set point. _____

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point.

c. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. _____

(2) Relief air damper modulates with outside air damper according to sequence of operation.

(3) Chilled water control valve modulating to maintain leaving air

temperature set point.

(4) Hot water control valve modulating to maintain leaving air temperature set point.

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point.

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

(2) Verify low limit space temperature is maintained as specified in sequence of operation. _____

e. The following shall be verified when the supply and exhaust fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

f. Verify the chilled water coil control valve operation by setting all VAV's to maximum and minimum cooling.

	Max cooling	Min cooling
Supply air volume _____ cfm)	_____	_____
Supply air temp. (_____ degrees F)	_____	_____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative

Contractor's Mechanical Representative

Contractor's Electrical Representative

Contractor's Testing, Adjusting and Balancing Representative

Contractor's Controls Representative

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Commission Agent: Harold Cullick, PE
May 24, 2010

Contracting Officer's Representative

Using Agency's Representative

Commissioning Agent

Design Agency's Representative

Functional Performance Test Checklist - Packaged Air Cooled Chiller

For Chiller: CH-1

1. Functional Performance Test: Contractor shall demonstrate operation of chilled water system as per specifications including the following: Start building air handler to provide load for chiller. Activate controls system chiller start sequence as follows.

- a. Start chilled water pump and establish chilled water flow. Verify chiller-chilled water proof-of-flow switch operation. _____
- b. Verify control system energizes chiller start sequence. _____
- c. Verify chiller senses chilled water temperature above set point and control system activates chiller start. _____
- d. Verify functioning of "soft start" sequence. _____
- e. Shut off air handling equipment to remove load on chilled water system. Verify chiller shutdown sequence is initiated and accomplished after load is removed. _____
- f. Restart air handling equipment one minute after chiller shut down. Verify chiller restart sequence. _____

2. Verify chiller inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, chiller design conditions, and chiller manufacturer's performance data.

	DESIGN	TAB	ACTUAL
Chiller inlet pressure (psig)	_____	_____	_____
Chiller outlet pressure (psig)	_____	_____	_____

3. Verify chiller amperage each phase and voltage phase-to-phase and phase-to-ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

4. Record the following information:

Ambient dry bulb temperature _____ degrees F
Ambient wet bulb temperature _____ degrees F
Entering chilled water temperature _____ degrees F
Leaving chilled water temperature _____ degrees F

5. Unusual vibration, noise, etc.

Dylan Mechanical Construction Services, Inc
Commission Agent: Harold Cullick, PE
May 24, 2010

6. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____
Commissioning Agent	_____
Design Agency's Representative	_____

Functional Performance Test Checklist - Air Cooled Condensing Unit For Condensing Unit and DX Fan Coil: CU-1 and AC-1

1. Functional Performance Test: Contractor shall demonstrate operation of refrigeration system as per specifications including the following: Start building air handler to provide load for condensing unit. Activate controls system start sequence as follows.

a. Start air handling unit. Verify control system energizes condensing unit start sequence. _____

b. Shut off air handling equipment to verify condensing unit de-energizes. _____

c. Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence. _____

2. Verify condensing unit amperage each phase and voltage phase to phase and phase to ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Record the following information:

Ambient dry bulb temperature	_____	degrees F
Ambient wet bulb temperature	_____	degrees F
Suction pressure	_____	psig
Discharge pressure	_____	psig

4. Unusual vibration, noise, etc.

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Contractor's Quality Control Representative _____ Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Dylan Mechanical Construction Services, Inc
Commission Agent: Harold Cullick, PE
May 24, 2010

Commissioning Agent

Design Agency's Representative

Functional Performance Test Checklist - Hot Water Boiler

For Boiler: HWB-1

1. Functional Performance Test: Contractor shall demonstrate operation of hot water system as per specifications including the following: Start building heating equipment to provide load for boiler. Activate controls system boiler start sequence as follows.

a. Start hot water pump and establish hot water flow. Verify boiler hot water proof-of-flow switch operation. _____

b. Verify control system energizes boiler start sequence. _____

c. Verify boiler senses hot water temperature below set point and control system activates boiler start. _____

d. Shut off building heating equipment to remove load on hot water system. Verify boiler shutdown sequence is initiated and accomplished after load is removed. _____

2. Verify boiler inlet/outlet pressure reading, compare to Test and Balance (TAB) Report, boiler design conditions, and boiler manufacturer's performance data.

	DESIGN	TAB	ACTUAL
Boiler inlet pressure (psig)	_____	_____	_____
Boiler outlet pressure (psig)	_____	_____	_____
Boiler flow rate (gpm)	_____	_____	_____
Flue-gas temperature at boiler outlet	_____	_____	_____
Percent carbon dioxide in flue-gas	_____	_____	_____
Draft at boiler flue-gas exit	_____	_____	_____
Draft or pressure in furnace	_____	_____	_____
Stack emission pollutants Concentration	_____	_____	_____
Fuel type	_____	_____	_____
Combustion efficiency	_____	_____	_____

3. Record the following information:

Ambient temperature _____ degrees F
 Entering hot water temperature _____ degrees F
 Leaving hot water temperature _____ degrees F

4. Verify temperatures in item 3 are in accordance with the reset schedule. _____

5. Verify proper operation of boiler safeties. _____

6. Unusual vibration, noise, etc.

7. Visually check refractory for cracks or spalling and refractory and

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tubes for flame impingement. _____

8. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____

Functional Performance Test Checklist - HVAC Controls For HVAC System: All HVAC Controls

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 2.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following tests:

a. Verify that controller is maintaining the set point by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.

b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

Sensor _____
Manual measurement _____
Panel reading value _____

c. Verify system stability by changing the controller set point as follows:

- (1) Air temperature - 10 degrees F
- (2) Water temperature - 10 degrees F
- (3) Static pressure - 10 percent of set point
- (4) Relative humidity - percent (RH)

The control system shall be observed for 10 minutes after the change in set point. Instability or excessive hunting will be unacceptable.

d. Verify interlock with other HVAC controls.

e. Verify interlock with fire alarm control panel.

f. Verify interlock with EMCS.

g. Change controller set point 10 percent with EMCS and verify correct response.

2. Verify that operation of control system conforms to that specified in the sequence of operation.

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Dylan Mechanical Construction Services, Inc
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May 24, 2010

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and
Balancing Representative _____

Contractor's Controls Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

Commissioning Agent _____

Design Agency's Representative _____