SECTION 23 08 00

COMMISSIONING OF HVAC

**BASED ON DFD MASTER SPECIFICATION DATED 01/17/17**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# P A R T 1 ‑ G E N E R A L

SCOPE

This section includes commissioning forms for construction verification and functional performance testing. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Submittals

PART 2 - PRODUCTS

(Not Used)

PART 3 – EXECUTION

DO NOT INCLUDE ANY COMMISSIONING FORMS for PRELIMINARY review. Just edit the list below and only submit pages 23 08 00-1 through 23 08 00-3 with strikethroughs.

Commissioning Forms

CV-23 05 14 Variable Frequency Drives

CV-23 05 15 Air Separators

CV-23 05 15 Centrifugal Separators

CV-23 05 15 Expansion Tanks

CV-23 05 15 Steam Traps

CV-23 05 15 Suction Diffusers

CV-23 07 00 HVAC Ductwork Insulation

CV-23 07 00 HVAC Piping Insulation

CV-23 09 14 Air Compressors

CV-23 09 14 Control Wiring and Devices

CV-23 09 14 Pneumatic Piping and Devices

CV-23 09 14 Refrigerated Air Driers

CV-23 09 23 Local Control Panels

CV-23 09 24 Local Control Panels

CV-23 09 25 Local Control Panels

CV-23 11 00 Facilities Fuel Piping

CV-23 12 13 Facility Fuel Oil Pumps

CV-23 21 13 Hydronic Piping

CV-23 22 13 Pumps

CV-23 22 23 Steam and Condensate Heating Piping

CV-23 22 23 Condensate Pumps

CV-23 23 00 Refrigerant Piping

CV-23 24 00 Engine Exhaust Piping

CV-23 24 00 Remote Radiator Piping

CV-23 25 00 HVAC Water Treatment

CV-23 31 00 Ductwork and Casings

CV-23 33 00 Control Dampers

CV-23 33 00 Intake/Relief Hoods

CV-23 33 00 Smoke and Fire/Smoke Dampers

CV-23 33 00 Sound Attenuators

CV-23 34 00 Ceiling Exhaust Fans

CV-23 34 00 Centrifugal Fans

CV-23 34 00 Destratification Fans

CV-23 34 00 Sidewall Propeller Fans

CV-23 34 00 Vaneaxial Fans

CV-23 36 00 Air Terminal Units

CV-23 37 13 Diffuser, Grilles and Registers

CV-23 41 00 Filter Racks

CV-23 51 00 Breechings, Chimneys and Stacks

CV-23 52 00 Fire Tube Boilers

CV-23 52 00 Condensing Boilers

CV-23 52 00 Boiler Blowdown Separators

CV-23 52 00 Continuous Blowdown Heat Recovery System

CV-23 53 00 Deaerator Assemblies

CV-23 53 00 Feedwater Pump Assemblies

CV-23 54 00 Gas Fired Furnaces

CV-23 55 00 Direct Fired MUA Units

CV-23 55 00 Gas Fired Unit Heaters

CV-23 55 00 Indirect Gas Fired MUA Units

CV-23 55 00 Infra-Red Heating Devices

CV-23 57 00 Heat Exchangers

CV-23 62 13 Air Cooled Chillers

CV-23 64 15 Water Cooled Chillers

CV-23 65 00 Cooling Towers

CV-23 65 00 Remote Cooling Tower Sumps

CV-23 72 00 Air-to-Air Heat Exchangers-Fixed Plate

CV-23 72 00 Air-to-Air Heat Exchangers-Heat Pipe

CV-23 72 00 Air-to-Air Heat Exchangers-Rotary Wheels

CV-23 73 12 Refrigerant Coils

CV-23 73 12 Steam Coils

CV-23 73 12 Water Coils

CV-23 73 13 Modular Indoor Central Station AHU

CV-23 73 23 Factory Fabricated Custom Air Handling Units

CV-23 73 24 Factory Fabricated Custom Laboratory Exhaust Energy Recovery Units

CV-23 81 23 Split System Ductless Air Conditioners

CV-23 82 00 Cabinet Heaters

CV-23 82 00 Convectors

CV-23 82 00 Fan Coil Units

CV-23 82 00 Fin Tube Radiation

CV-23 82 00 Reheat Coils

CV-23 82 00 Unit Heaters

CV-23 82 00 Unit Ventilators

CV-23 84 13 Electric Steam Humidifiers

CV-23 84 13 Evaporative Humidifiers

CV-23 84 13 Steam Grid Humidiers

Functional Performance Test Forms

FPT-23 05 14 Variable Frequency Drives

FPT-23 05 93 Testing Adjusting and Balancing

FPT-23 09 23 BAS Communication/Calibration

FPT-23 09 24 BAS Communication/Calibration

FPT-23 09 25 BAS Communication/Calibration

FPT-23 12 13 Facility Fuel Oil Pumps

FPT-23 21 13 Pumps

FPT-23 22 23 Condensate Pumps

FPT-23 34 00 HVAC Fans

FPT-23 36 00 Air Terminal Units

FPT-23 52 00 Boiler

FPT-23 53 00 Deaerator Assemblies

FPT-23 54 00 Feedwater Pump Assemblies

FPT-23 55 00 Gas Fired Furnaces

FPT-23 55 00 Direct Fired MUA Units

FPT-23 55 00 Gas Fired Unit Heaters

FPT-23 55 00 Indirect Fired MUA Units

FPT-23 55 00 Infra-Red Heating Devices

FPT-23 57 00 Heat Exchangers

FPT-23 62 13 Packaged Air-Cooled Refrigeration Compressor and Condensing Units

FPT-23 64 15 Water Cooled Chillers

FPT-23 65 00 Cooling Towers

FPT-23 72 00 Air-to-Air Heat Exchangers-Fixed Plate

FPT-23 72 00 Air-to-Air Heat Exchangers-Heat Pipe

FPT-23 72 00 Air-to-Air Heat Exchangers-Rotary Wheel

FPT-23 73 13 Air Handling Units

FPT-23 73 23 Factory Fabricated Custom Air Handling Units

FPT-23 73 24 Factory Fabricated Custom Laboratory Exhaust Energy Recovery Units

FPT-23 81 23 Split System Ductless Air Conditioners

FPT-23 82 00 Cabinet Heaters

FPT-23 82 00 Convectors and Fin Tube Radiation

FPT-23 82 00 Fan Coil Units

FPT-23 82 00 Reheat Coils

FPT-23 82 00 Unit Heaters

FPT-23 82 00 Unit Ventilators

FPT-23 84 13 Humidifiers

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

Reference Section 01 91 01 or 01 91 02 Commissioning Process for Construction Verification Checklist and Functional Performance Test submittal requirements.

# P A R T 2 – P RO D U C T S

(Not Used)

# P A R T 3 – E X E C U T I O N

COMMISSIONING FORMS

Commissioning forms are to be filled in as work progresses by the individuals responsible for installation and shall be completed for each installation phase.

Provide a description of the work completed since the last entry, the percentage of the total work completed for the system for that area and the step of installation or finalization.

Circle Yes or No for each commissioning form item. If the information requested for an item does not apply to the given stage of installation for the system, list it as “N/A”. Explain all discrepancies, negative responses or N/A responses in the negative responses section.

Once the work is 100% complete and the responses to each item are complete and resolved for a given commissioning forms group, mark as complete, initial and date in the spaces provided.

Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress meetings.

Edit the individual construction verification checklists and provide additional checklists as needed to reflect the verification requirements of assemblies, components, equipment and systems to be commissioned on this project.

***DO NOT INCLUDE ANY of the following***

***COMMISSIONING FORMS for PRELIMINARY review. Just edit the list in Part I above and only submit pages***

***23 08 00-1 through 23 08 00-3 with strikethroughs.***

CV-23 05 14 – Variable Frequency Drives

**Equipment Identification/Tag: \_\_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Associated Motor | | |  |  |
| 5 | Associated Motor Power (hp) | | |  |  |
| 6 | Voltage / Phase / Frequency (V / - / Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components and accessories present. | | | YES | NO |
| 3 | All penetrations sealed properly. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications | | | YES | NO |
| 2 | Adequate clearance around unit for service. | | | YES | NO |
| 3 | All components accessible for maintenance. | | | YES | NO |
| 4 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *ELECTRICAL-INCOMING* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Conductors run in conduit separate from outgoing and control conductors. | | | YES | NO |
| 2 | Wires are bundled, trained, and supported in enclosure. | | | YES | NO |
| 3 | Unit is properly grounded to a resistance of 10 ohms to ground. | | | YES | NO |
| 4 | Incoming supply line is connected to drive input terminals and permanently labeled. | | | YES | NO |
| 5 | Bypass circuit or starter installed and wired per manufacturer instructions (if applicable). | | | YES | NO |
| 6 | AC line reactor installed and wired per manufacturer instructions (if applicable). | | | YES | NO |
| 7 | All electrical connections are tight. | | | YES | NO |
| 8 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL-OUTGOING* | | | | |
| 1 | Conductors run in conduit separate from incoming and control conductors. | | | YES | NO |
| 2 | Wires are bundled, trained, and supported in enclosure. | | | YES | NO |
| 3 | Outgoing supply line is connected to drive output terminals and permanently labeled. | | | YES | NO |
| 4 | Bypass circuit or starter installed and wired per manufacturer instructions (if applicable). | | | YES | NO |
| 5 | Output line filter installed and wired per manufacturer instructions for all 460 VAC applications with conductor lengths >120’ (if applicable). | | | YES | NO |
| 6 | All electrical connections are tight. | | | YES | NO |
| 7 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Conductors run in conduit separate from incoming and outgoing conductors. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Status, start/stop and safety interlock wiring has been wired to permit operation and monitoring of unit in bypass mode. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL STARTUP* | | | | |
| 1 | Unit has been cleaned of all debris and dirt on interior of unit. | | | YES | NO |
| 2 | All switches and circuit breakers have been manually tested. | | | YES | NO |
| 3 | Motor circuit protector has been adjusted to the full load amperes of the motor it serves. | | | YES | NO |
| 4 | All wiring connections verified for proper torques values and are acceptable. | | | YES | NO |
| 5 | Phase-to-phase, phase-to-ground, and neutral-to-ground, and dielectric tests have been accomplished and results are acceptable. | | | YES | NO |
| 6 | Insulation megger test accomplished and results acceptable. | | | YES | NO |
| 7 | Voltages for each phase tested and within acceptable ranges for unit. | | | YES | NO |
| 8 | Unit energized by authorized personnel. | | | YES | NO |
| 9 | Motor rotation in the proper direction for associated motor. | | | YES | NO |
| 10 | Motor overload verified for associated motor. | | | YES | NO |
| 11 | Motor voltage and amps verified for each phase for associated motor and are acceptable. | | | YES | NO |
| 12 | Motor overload verified for associated motor. | | | YES | NO |
| 13 | Maximum full load amps (FLA) acceptable for associated motor. | | | YES | NO |
| 14 | Deceleration occurs without causing a bus overload condition. | | | YES | NO |
| 15 | There are no motor/drive vibrations at any speed, with any frequencies which result in motor drive vibrations locked out. | | | YES | NO |
| 16 | Bypass circuit or starter tested and operation acceptable. | | | YES | NO |
| 17 | Power interruptions of two (2) and thirty (30) seconds tested and unit operation acceptable. | | | YES | NO |
| 18 | All damage to unit finish is repaired | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Unit minimum speed set per associated motor. | | | YES | NO |
| 2 | Status monitor adjusted to account for belt loss or coupling failure. | | | YES | NO |
| 3 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 05 15 – Air Separators

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (gpm) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | Installation and startup manual provided. | | | YES | NO |
| 4 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service | | | YES | NO |
| 4 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Drain line with isolation valve piped to nearest floor drain. | | | YES | NO |
| 4 | Piping/separator supported as required by specifications. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping and unit insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Drain valve opened and strainer purged after system cleaning (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 05 15 – Centrifugal Separators

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (gal) | | |  |  |
| 5 | Flow (gpm) | | |  |  |
| 6 | Voltage / Phase / Frequency (V / - / Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Pressure gauge provided to measure inlet and outlet pressures across the unit. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping and unit insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| 4 | Controller secured per manufacturer and specification requirements. | | | YES | NO |
| 5 | Purge duration and schedule set and operation verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 05 15 – Expansion Tanks

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (gal) | | |  |  |
| 5 | Maximum pressure (psi) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Tank charge verified and acceptable for minimum system pressure at connection point. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping is pitched down or level to tank. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Drain valve installed between isolation valve and tank. | | | YES | NO |
| 6 | Pressure gauge installed on tank side of isolation valve. | | | YES | NO |
| 7 | Tank allows for field replacement of bladder (bladder tank only). | | | YES | NO |
| 8 | Pressure gauge and a drain valve with a hose adapter installed in piping connection to unit (bladder tanks ONLY). | | | YES | NO |
| 9 | Drain valve with hose adapter provided in the drain connection of the tank (bladder tanks ONLY). | | | YES | NO |
| 10 | Pressure and temperature relief valve(s) for correct pressure and temperature installed. | | | YES | NO |
| 11 | Pressure and temperature relief valve(s) piped with sufficient pipe diameter to drain designed for boiling water. | | | YES | NO |
| 12 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 13 | Piping and unit insulation is complete and installed as per specifications. | | | YES | NO |
| 14 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Pressure and temperature relief valve(s) set to proper pressure and temperature and manually checked for functionality. | | | YES | NO |
| 3 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 05 15 – Steam Traps

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Type | | |  |  |
| 5 | Inlet Pressure (psi) | | |  |  |
| 6 | Capacity (lb/hr) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components present. | | | YES | NO |
| 3 | Installation and startup manual provided. | | | YES | NO |
| 4 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Adequate clearance around unit for service. | | | YES | NO |
| 3 | All components accessible for maintenance. | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Unit elevation is at least 1’ below equipment outlet connection. | | | YES | NO |
| 6 | Isolation valves installed on inlet and outlet of trap. | | | YES | NO |
| 7 | Strainer installed on inlet to trap and isolation valve provided in blowdown connection of unit. | | | YES | NO |
| 8 | Valve test tee provided at discharge of unit. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping and unit insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 05 15 – Suction Diffusers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (gpm) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | Installation and startup manual provided. | | | YES | NO |
| 4 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service and strainer removal. | | | YES | NO |
| 4 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Drain line with isolation valve piped in blowdown connection. | | | YES | NO |
| 4 | Pressure gauge provided to measure inlet and outlet pressures across the strainer of the unit and pressure across pump impellor. | | | YES | NO |
| 5 | Piping supported as required by specifications. | | | YES | NO |
| 6 | Floor mounted support leg installed beneath suction diffuser. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Piping and unit insulation is complete and installed as per specifications. | | | YES | NO |
| 9 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Drain valve opened and strainer purged after system cleaning (if applicable). | | | YES | NO |
| 12 | Startup screen removed from strainer. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 07 00 – HVAC Ductwork Insulation

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Ductwork clean, dry, pressure tested and approved prior to application of insulation.
2. Type and thickness of insulation complies with listed specification requirements for given system.
3. Insulation installed with smooth and even surfaces.
4. Insulation is secured per specification requirements for given insulation type and ductwork width.
5. Insulation seams and joints firmly butted together and covered with 4” tape of same material as jacket.
6. Insulation and vapor barrier continuous through non-rated sleeves.
7. Insulation is butted tightly against the fire stop with butt joints taped in rated construction.
8. Insulation stopped and pointed around access doors and damper operators to allow operation without disturbing insulation or jacket material.
9. Complete vapor barrier provided for all insulated ductwork.
10. Exposed fiberglass insulation covered and sealed at all permanent terminations and at end of work day.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) DEVICE & EQUIPMENT INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
|  |  |  |  | YES  NO | YES  NO | YES  NO |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Insulated easily removable galvanized steel metal boxes or insulated easily removable elastomeric insulation sections provided for equipment, devices, labels and access panels.per specifications.
2. Air handling unit casings, chambers, or plenums (filters, mixing chambers, sound attenuators, etc.) insulated in accordance with requirements of adjacent duct insulation.
3. All control devices are mounted over ductwork insulation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 07 00 – HVAC Piping Insulation

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
|  |  |  |  | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping clean, dry, pressure tested and approved prior to application of insulation.
2. Type and thickness of insulation complies with listed specification requirements for given system and pipe size.
3. Insulation installed with smooth and even surfaces, without the use of filler in voids.
4. Butt joints and longitudinal seams closed tightly with a minimum of 2” lap on jacket seams and 2” tape on butt joints.
5. All longitudinal seams stapled as specified.
6. All seams and staples sealed with vapor barrier mastic on systems that require a vapor barrier.
7. Full-length material installed, with no piecing of scraps or stretching of material.
8. Insulation continuous through sleeves and openings with vapor barriers continuous through all penetrations.
9. Complete vapor barrier and vapor dams provided for all piping systems operating below 65ºF including at high density inserts at hanger locations.
10. Exposed fiberglass insulation covered and sealed at all permanent terminations and at end of work day.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) VALVE, FITTING & EQUIPMENT INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** |  | **Questions (See details below)** | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | | |  | | | **DATE:** | |  |  | | |

**Question Details**

1. Fittings, valves, unions, flanges, couplings and specialties insulated with factory molded or built up insulation of the same thickness as adjoining insulation.
2. Where temperatures exceed 150°F fittings, valves, unions, flanges, couplings and specialties are covered with fabric reinforcing and mastic. PVC fitting covers may be used where temperatures do not exceed 150° F.
3. PVC fitting covers secured with tack fasteners and 1-1/2” band of mastic over ends, throat, seams or penetrations or for systems requiring vapor barrier, vapor barrier mastic.
4. Equipment access manholes, fittings, nameplates or ASME stamps left un-insulated with insulation beveled and sealed at these locations.
5. Equipment insulation installed with smooth and even surfaces per specifications requirements.
6. No insulation provided at hot water piping inside radiation, convector, or cabinet heater enclosures, steam traps and piping unions for systems not requiring a vapor barrier.
7. Reheat coil piping, fittings and valves (with the exception of unions) up to coil connection are insulated.
8. For systems with fluid temperatures 65° F or less, removable elastomeric insulation covers, plugs or caps with complete vapor barrier provided for all equipment, devices, labels and valves.
9. Vapor dams have been provided per specification for piping systems requiring a vapor barrier.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 09 14 – Air Compressors

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (scfm @ psi) | | | @ | @ |
| 5 | Receiver capacity (gal) | | |  |  |
| 6 | Power / Speed (hp / rpm) | | |  |  |
| 7 | Voltage / Phase / Frequency (V / - / Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The air openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is isolated from the building structure (to reduce vibration and noise) | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Pressure relief valve installed and is operational. | | | YES | NO |
| 5 | Piping flexible connector installed at unit. | | | YES | NO |
| 6 | Automatic condensate drain installed and piped to nearest floor drain. | | | YES | NO |
| 7 | Cartridge filter-silencer with pre and post isolation valves installed in piping for each compressor. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Motor rotation in the proper direction | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | All electrical components are grounded. | | | YES | NO |
| 5 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *MECHANICAL STARTUP* | | | | |
| 1 | Belt sheaves have been properly aligned per the specifications. | | | YES | NO |
| 2 | Belt tension has been reviewed and adjusted after start-up of unit and again after 80 hours of operation. | | | YES | NO |
| 3 | Motor / compressor rotation is in the proper direction | | | YES | NO |
| 4 | System starts and runs free from unusual noise or vibration | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached | | | YES | NO |
| 6 | Protective shrouds for belts in place and secure | | | YES | NO |
| 7 | Log compressor run time. Compressor does not start more than 6 times per hour and operate more than 1/3 of the time. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 09 14 – Control Wiring and Devices

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) WIRING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All cabling identified at both ends according to Section 23 09 14.
2. A minimum of 5’ of cable provided in DDC panel for all electronic input/output devices, sensors, relays and interlocking wiring to allow for termination by the DDC Contractor.
3. All high voltage and low voltage wiring (includes low voltage cable) installed in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled per specifications.
4. All conduit installed and supported in accordance with electrical sections (Division 26) of this specification and the National Electrical Code.
5. Bushings installed at all conduit terminations.
6. Conduit is a minimum of 1/2 " for low voltage control wiring and pipe fill does not exceed 40%.
7. Control panels serving equipment fed by emergency power also served by emergency power.
8. "Hand/off/auto" selector switches installed on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled.
9. All equipment requiring maintenance is accessible (valves, junction boxes, etc.).

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) CONTROL DEVICES INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | | **Initials** | **Questions (See details below)** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | | **3)** | **4)** | | **5)** | **6)** | **7)** | | **8)** | **9)** | | **10)** | **11)** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | | | | **INITIALS:** | | |  | | | | **DATE:** | | |  | | |

**Question Details**

1. Thermometers installed at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed.
2. Room thermostats and sensors installed at the location and height indicated on the drawings and aligned with light switches and humidistats.
3. Any room thermostats or sensors mounted on an exterior wall mounted on a thermally insulated sub-base.
4. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity the conduit and any other opening that will effect the measurement are sealed.
5. Guards provided on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.
6. For horizontal steam or hot water coils, low limit thermostat elements distributed (serpentine) horizontally across the coil to cover every square foot of coil.
7. For integral face and bypass coils the low limit thermostat elements are installed on the leaving face of the heating coil inside the damper enclosure.
8. Straightening vanes installed upstream of air flow measuring stations where required per manufacturers recommendations.
9. Where flow meters are located more than five feet above the floor or where they cannot be read due to equipment location, provide remote mounting of the flow meter display and programming controls four to five feet above finished floor.
10. For VFD installations, a separate current switch provided in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.
11. All control devices and boxes mounted on insulated ductwork are mounted over the insulation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
2. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.
3. All wiring is properly labeled with control ID number of circuit within ½” of device and terminal connection.
4. All control devices with the exception of dampers, valves, and terminal unit devices labeled with permanent printed labels that correspond to control drawings.
5. Temperature control wiring and tubing junction and pullboxes identified utilizing spray painted green covers.
6. Pressure and/or differential set points of pressure sensors re-adjusted after final balancing is completed.
7. Threshold settings for current switch adjusted to indicate belt or coupling loss after final balancing.
8. As-built control drawings of all systems served by each local panel provided in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 09 14 – Pneumatic Piping and Devices

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, devices, etc. are clean and free of damage prior to installation.
2. Temporary end caps are provided on piping and fittings until installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) GENERAL PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Air supply from compressor assembly isolated from piping with wire braid reinforced rubber hose or polyethylene tubing.
3. Take-offs enter top of main air piping wherever possible.
4. All polyethylene tubing in excess of 18” from device connections is installed in conduit per specifications.
5. Minimum poly tubing utilized is ¼” OD, with exception to instruments with barbed fittings that will only accept 5/32” tubing, connections to the device are made with 5/32” tubing that is as short as is practical.
6. All piping and tubing is supported per specification requirements and is not be attached to existing cabling, existing tubing, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.
7. Hard copper tubing provided for all device connections to smoke dampers and steam valve actuators.
8. No concealed splices of tubing are present.
9. All equipment requiring maintenance is accessible (valves, junction boxes, etc.).
10. All tubing installed within walls and other concealed spaces installed in conduit.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) VALVES & CONTROL DEVICES INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All valves are in an upright vertical position with handles in a horizontal position and fully operated without removal or alteration of handle.
2. Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
3. Piping purged with oil free compressed air prior to connection to control devices.
4. Pilot positioners provided on all valves where more than one pneumatic operator is controlled in sequence, for all valves 3” and larger, or where required to provide sufficient power.
5. Pressure gauges provided at damper and valve operators with pilot positioners , transducers, etc. according to Section 23 09 14.
6. Thermometers installed at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed.
7. Capped tees installed in air piping at air pressure transducers for connection of calibration equipment.
8. All control devices and boxes mounted on insulated ductwork are mounted over the insulation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) TESTING & FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping tested at 20 psig for a duration of 24 hours with air.
2. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
3. Test conducted with all piping of tested system or section visible during testing.
4. Piping labels and direction of flow is provided per specification requirements.
5. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
6. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.
7. All piping is properly labeled with control ID number of circuit within ½” of device and terminal connection.
8. All control devices with the exception of dampers, valves, and terminal unit devices labeled with permanent printed labels that correspond to control drawings.
9. Temperature control wiring and tubing junction and pullboxes identified utilizing spray painted green covers.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 09 14 – Refrigerated Air Driers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Duty | | |  |  |
| 5 | Refrigerant Type | | |  |  |
| 6 | Capacity (scfm @ psi) | | | @ | @ |
| 7 | Power (hp) | | |  |  |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The air and water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is isolated from the building structure (to reduce vibration and noise) | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
|  |  | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Automatic drain piped to nearest floor drain. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Bypass valve installed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| 4 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *MECHANICAL STARTUP* | | | | |
| 1 | System starts and runs free from unusual noise or vibration | | | YES | NO |
| 2 | Manufacturer's startup checklist completed and attached | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 09 23 – Local Control Panels

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Voltage / Phase / Frequency (V / - /Hz) | | | / / | / / |
| 5 | # of Controllers | | |  |  |
| 6 | UPS Manufacturer | | |  |  |
| 7 | UPS Model | | |  |  |
| 8 | UPS Serial Number | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacture and specifications requirements. | | | YES | NO |
| 2 | Unit display located 60” above finished floor level. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | Conduit feeds are aligned with openings and accommodate seismic motion. | | | YES | NO |
| 5 | Panel mounted near controlled equipment/system on vibration free wall or free-standing support. | | | YES | NO |
| 6 | Unit is level, plumb and square. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *WIRING* | | | | |
| 1 | Unit is adequately grounded for intended use. | | | YES | NO |
| 2 | All connections are terminated properly. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | All cables are permanently labeled relative to use. | | | YES | NO |
| 5 | Circuit breaker for panel installed and labeled within panel. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *E* | *WIRING-DEVICES* | | | | |
| 1 | All connections are terminated properly. | | | YES | NO |
| 2 | A minimum of 5’ spare cabling and/or tubing provided for all controller terminations to panel. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | Shutdown toggle switch provide for each air handling unit controller contained within panel (if applicable). | | | YES | NO |
| 5 | All cables are permanently labeled relative to use. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Response** | |
| *F* | *STARTUP* | | | | |
| 1 | All points given address and list provided in panel. | | | YES | NO |
| 2 | All switches and circuit breakers have been manually tested. | | | YES | NO |
| 3 | Fuses have been installed in all controllers and switches (if applicable). | | | YES | NO |
| 4 | All toggle and HOA switches checked and fully operational. | | | YES | NO |
| 5 | Point-to-point communication test conducted and all points found to be acceptable. | | | YES | NO |
| 6 | Record drawings and instructions noted within specifications provided in panel enclosure. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 09 24 – Local Control Panels

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Voltage / Phase / Frequency (V / - /Hz) | | | **/ /** | **/ /** |
| 5 | # of Controllers | | |  |  |
| 6 | UPS Manufacturer | | |  |  |
| 7 | UPS Model | | |  |  |
| 8 | UPS Serial Number | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacture and specifications requirements. | | | YES | NO |
| 2 | Unit display located 60” above finished floor level. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | Conduit feeds are aligned with openings and accommodate seismic motion. | | | YES | NO |
| 5 | Panel mounted near controlled equipment/system on vibration free wall or free-standing support. | | | YES | NO |
| 6 | Unit is level, plumb and square. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *WIRING* | | | | |
| 1 | Unit is adequately grounded for intended use. | | | YES | NO |
| 2 | All connections are terminated properly. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | All cables are permanently labeled relative to use. | | | YES | NO |
| 5 | Circuit breaker for panel installed and labeled within panel. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *E* | *WIRING-DEVICES* | | | | |
| 1 | All connections are terminated properly. | | | YES | NO |
| 2 | A minimum of 5’ spare cabling and/or tubing provided for all controller terminations to panel. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | Shutdown toggle switch provide for each air handling unit controller contained within panel (if applicable). | | | YES | NO |
| 5 | All cables are permanently labeled relative to use. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Response** | |
| *F* | *STARTUP* | | | | |
| 1 | All points given address and list provided in panel. | | | YES | NO |
| 2 | All switches and circuit breakers have been manually tested. | | | YES | NO |
| 3 | Fuses have been installed in all controllers and switches (if applicable). | | | YES | NO |
| 4 | All toggle and HOA switches checked and fully operational. | | | YES | NO |
| 5 | Point-to-point communication test conducted and all points found to be acceptable. | | | YES | NO |
| 6 | Record drawings and instructions noted within specifications provided in panel enclosure. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 09 25 – Local Control Panels

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Voltage / Phase / Frequency (V / - /Hz) | | | / / | / / |
| 5 | # of Controllers | | |  |  |
| 6 | UPS Manufacturer | | |  |  |
| 7 | UPS Model | | |  |  |
| 8 | UPS Serial Number | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacture and specifications requirements. | | | YES | NO |
| 2 | Unit display located 60” above finished floor level. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | Conduit feeds are aligned with openings and accommodate seismic motion. | | | YES | NO |
| 5 | Panel mounted near controlled equipment/system on vibration free wall or free-standing support. | | | YES | NO |
| 6 | Unit is level, plumb and square. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *WIRING* | | | | |
| 1 | Unit is adequately grounded for intended use. | | | YES | NO |
| 2 | All connections are terminated properly. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | All cables are permanently labeled relative to use. | | | YES | NO |
| 5 | Circuit breaker for panel installed and labeled within panel. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *E* | *WIRING-DEVICES* | | | | |
| 1 | All connections are terminated properly. | | | YES | NO |
| 2 | A minimum of 5’ spare cabling and/or tubing provided for all controller terminations to panel. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | Shutdown toggle switch provide for each air handling unit controller contained within panel (if applicable). | | | YES | NO |
| 5 | All cables are permanently labeled relative to use. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Response** | |
| *F* | *STARTUP* | | | | |
| 1 | All points given address and list provided in panel. | | | YES | NO |
| 2 | All switches and circuit breakers have been manually tested. | | | YES | NO |
| 3 | Fuses have been installed in all controllers and switches (if applicable). | | | YES | NO |
| 4 | All toggle and HOA switches checked and fully operational. | | | YES | NO |
| 5 | Point-to-point communication test conducted and all points found to be acceptable. | | | YES | NO |
| 6 | Record drawings and instructions noted within specifications provided in panel enclosure. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 11 00 – Facilities Fuel Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Temporary protective coating is provided on cast iron and steel valves during storage.
3. Temporary end caps are provided on piping and fittings until installation.
4. Contractors installing fuel oil piping in the City of Madison are approved installers by the Madison Fire Department and plans have been submitted and approved by the Madison Fire Department.
5. Welder procedure qualification records (PQR) and welding procedure specifications (WPS) submitted to A/E and DFD.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) GENERAL PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
3. Pipe hanger spacing complies with specification requirements.
4. All equipment requiring maintenance is accessible (valves, etc.).
5. Piping allows access to equipment that is part of this system or another system.
6. Piping is not run through any plenums rated for ventilation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) FUEL OIL PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Double or triple swing joints provided in the pipe lines connected to underground fuel oil tanks, except straight fill lines and test wells, to permit the tanks to settle without impairing the tightness of the pipe connections.
2. Tank fill piping terminated at least two feet from any building wall.
3. Vent pipe pitched to drain toward tank without sags or traps in which liquid may collect.
4. Where two or more tanks are indicated to be vented through a common line, the point of connection between the individual vent lines is not be lower than the top of any fill pipe opening.
5. All vent pipes terminated outside of the building, not less than two feet measured vertically or horizontally from any building opening, not less than twenty five feet from any outside air intake louver, and with a weatherproof and flameproof vent cap or hood.
6. Flexible piping connections installed in supply and return lines at each engine.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) NATURAL GAS PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Horizontal piping pitched down 1" in 60 feet in the direction of flow.
2. 4" minimum depth dirt leg installed at the bottom of each vertical run and at each appliance.
3. All branch connections to the main branched from the top or side of the main.
4. If an above ground vent terminates in an area subject to snow accumulation, line terminated at least five feet above grade.
5. Each gas pressure reducing valve vent and relief valve vent run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) VALVE & FITTING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All welded piping cleaned before all regulators and control valves by placing target cloth over piping and blowing compressed air through line until cloth is clean and free of debris.
2. All valves are in an upright vertical position with handles in a horizontal position and fully operated without removal or alteration of handle.
3. Isolation valves provided at all equipment connections, main branches and sub-branches.
4. Horizontal fuel oil supply, return, gauge and vent pipes are at least 18" below grade at its highest point and slopes 1/4" per foot upwards from the tank or special monitoring.
5. Fuel oil return line from each engine to the main oil tank or the day tank contains no manual or automatic valves to restrict the flow.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**F) TESTING CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping tested utilizing air at specified pressure and duration as per specification for given fuel type.
2. For natural gas piping, testing completed with air at specified pressure and duration as per specification with no measurable loss of pressure during test period.
3. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
4. Test conducted with all piping of tested system or section visible during testing.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**G) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All exposed piping which passes through a wall, ceiling or floor is provided with escutcheon plates.
2. Piping labels and direction of flow is provided per specification requirements.
3. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
4. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 12 13 – Facility Fuel Oil Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Fuel Type | | |  |  |
| 5 | Pump Type | | |  |  |
| 6 | Inlet / Outlet Size (in) | | | / | / |
| 7 | Impeller Diameter (in) | | |  |  |
| 8 | Capacity / Head (gpm / ft w.g.) | | | / | / |
| 9 | Motor Speed / Power (rpm / hp) | | | / | / |
| 10 | Voltage / Phase / Frequency (V / - /Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit is set on concrete housekeeping pad or concrete inertia pad and is level. | | | YES | NO |
| 2 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 3 | 2” deep welded drain pan provided beneath pump. | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported independent of unit and as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Suction diffuser, long radius reducing elbows or concentric reducers/increasers provided at inlet to unit. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Pressure gauges supplied on supply and return lines. | | | YES | NO |
| 10 | Integral relief valve piped to pump drain pan. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation in the proper direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit checked, aligned, and certified prior to startup and report submitted. | | | YES | NO |
| 2 | Unit and motor lubricated before startup. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Pump shaft rotates easily with power turned off. | | | YES | NO |
| 5 | System flushed, filled, and air purged. | | | YES | NO |
| 6 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 7 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| 2 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *I* | *TAB* | | | | |
| 1 | Motor rotation in the proper direction. | | | YES | NO |
| 2 | Motor overload verified. | | | YES | NO |
| 3 | Motor voltage and amps verified for each phase and are acceptable. | | | YES | NO |
| 4 | Final TAB values for unit or system complies with design values specified given the tolerances specified under 23 05 93. | | | YES | NO |
| 5 | All final settings and positions of TAB have been permanently labeled on component or unit. | | | YES | NO |
| 6 | Start-up strainer removed after 8 hours of operation. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 21 13 – Hydronic Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Temporary protective coating is provided on cast iron and steel valves during storage.
3. Temporary end caps are provided on piping and fittings until installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
3. Piping is installed with sufficient pitch and arranged in a manner to ensure drainage of entire system, including provision of auxiliary drains as necessary.
4. Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
5. Piping connections at air handling unit coils provide sufficient clearance such that valve handles will not interfere with adjacent piping insulation.
6. A minimum of two elbows provided in each pipe line prior to a piece of terminal equipment.
7. Pipe hanger spacing complies with Section 23 05 29, including provision of individual hangers within 1’ of each horizontal elbow, strainer, valve, etc.
8. All equipment requiring maintenance is accessible (valves, strainers, etc.).
9. Piping allows access to equipment that is part of this system or another system.
10. Open pipe ends capped at completion of work day.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) VALVE, FITTING & VENT INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All valves are in an upright vertical position with handles in a horizontal position.
2. All valves can be fully operated without removal or alteration of handle, including provisions for specified insulation thickness of piping.
3. Where valves 2-1/2" and larger are located more than 12' above mechanical room floors, valve is installed with stem in the horizontal position and a chain wheel operator is provided.
4. Drainage valves provided at all low points and downstream of riser isolation valves.
5. Manual air vents are provided at all high points in closed water systems.
6. Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
7. Riser shutoff valve and a capped hose thread drain valve at the bottom of each riser provided.
8. All strainers in piping system have ball valves installed at the tapped screen retainer.
9. Each cooling coil drain pan connection is trapped with a trap seal of sufficient depth to prevent conditioned air from moving through the piping, with drain piping extended to nearest code approved drain location and plugged tee provided at trap for cleanout.
10. All ball valves installed in insulated piping are furnished with stem extensions to allow the handles to clear the insulation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) TESTING AND CLEANING CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping tested utilizing water at specified pressure and duration as per specification.
2. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished, DFD test report submitted.
3. Test conducted with all piping of tested system or section visible during testing.
4. After pressure testing system flushed with clean potable water according to procedures detailed in specifications and report provided.
5. All hydronic system piping is flushed in accordance with Section 23 21 13, DFD flushing report submitted.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. System filled and vented per specifications requirements for given system type.
2. Piping labels and direction of flow is provided per specification requirements.
3. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
4. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 21 13 – Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Pump Type | | |  |  |
| 5 | Inlet / Outlet Size (in) | | | / | / |
| 6 | Impeller Diameter (in) | | |  |  |
| 7 | Capacity / Head (gpm / ft w.g.) | | | / | / |
| 8 | Motor Speed / Power (rpm / hp) | | | / | / |
| 9 | NEMA Nominal Efficiency | | |  |  |
| 10 | Voltage / Phase / Frequency (V / - /Hz) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit is set on concrete housekeeping pad or concrete inertia pad and is level (base mounted pumps only). | | | YES | NO |
| 2 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 3 | Unit is supported independently of surrounding piping (inline pumps only). | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| 8 | Base filled with non-shrinking grout if required by manufacturer’s installation instructions (base mounted pumps only). | | | YES | NO |
| 9 | Pump coupling realigned after pump installation and prior to putting the pump into service. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported independent of unit and as required by specifications. | | | YES | NO |
| 4 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 5 | Suction diffuser, long radius reducing elbows or concentric reducers/increasers provided at inlet to unit. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Thermometers and pressure gauges supplied on supply and return lines. Gauges are plumbed across the strainer in the suction diffuser and the across the impellor. | | | YES | NO |
| 8 | Air vent and drain valve supplied on horizontal pump casings. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | Drains provided for bases and seals and piped to nearest drain. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor NEMA Nominal Efficiency complies with Section 23 05 13. | | | YES | NO |
| 4 | Motor rotation in the proper direction. | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit checked, aligned, and certified prior to startup and report submitted. | | | YES | NO |
| 2 | Unit and motor lubricated before startup. | | | YES | NO |
| 3 | Pump shaft rotates easily with power turned off. | | | YES | NO |
| 4 | System flushed, filled, and air purged. | | | YES | NO |
| 5 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 6 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| 2 | AHU coil circulation sequence verified and acceptable. | | | YES | NO |
| 3 | Tertiary loop sequence verified and acceptable. | | | YES | NO |
| 4 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 22 13 – Steam and Condensate Heating Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Temporary protective coating is provided on cast iron and steel valves during storage.
3. Temporary end caps are provided on piping and fittings until installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
3. Piping is installed with 1” in 40’ pitch down in the direction of flow for all steam piping and 1” in 2’ for all condensate piping.
4. Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
5. Condensate is not raised without permission from A/E.
6. A minimum of two elbows provided in each pipe line prior to a piece of terminal equipment.
7. Pipe hanger spacing complies with Section 23 05 29s, including provision of individual hangers within 1’ of each horizontal elbow, strainer, valve, etc.
8. All equipment requiring maintenance is accessible (valves, strainers, etc.).
9. Piping allows access to equipment that is part of this system or another system.
10. Open pipe ends capped at completion of work day.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) VALVE, FITTING & VENT INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All valves are in an upright vertical position with handles in a horizontal position.
2. All valves can be fully operated without removal or alteration of handle, including provisions for specified insulation thickness of piping.
3. Where valves 2-1/2" and larger are located more than 12' above mechanical room floors, valve is installed with stem in the horizontal position and a chain wheel operator is provided.
4. Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
5. Steam safety and relief valves vented to a location outside of building, in the most direct manner possible with drip pan elbow installed as detailed at first vertical rise of the vent pipe and as short and straight as possible piping provided between safety/relief valve and drip pan elbow.
6. All piping, accessories, valves and fittings are supported independently of adjacent accessories, valves and fittings.
7. Drain lines for drip pan elbows and relief valves extended to nearest drain with shortest and straightest piping possible.
8. Relief valves installed in locations indicated on drawings, downstream of all pressure reducing valves, and on all boilers.
9. Capped full sized dirt pockets at all traps, riser heels, and wherever dirt and scale may accumulate are provided.
10. Drip traps installed at each rise, at the horizontal termination of each steam main and as needed to prevent water hammer but at a maximum spacing of 250’.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) TESTING CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Boiler external piping as defined by specifications has been tested in accordance with ANSI B31.1, paragraph 137.1.1 and ASME Boiler and Pressure Vessel Code, Section 1, paragraph PG-99 and results submitted.
2. Piping tested utilizing water at specified pressure and duration as per specification.
3. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished, DFD test report submitted.
4. Test conducted with all piping of tested system or section visible during testing.
5. After pressure testing system flushed with clean potable water according to procedures detailed in specifications and report provided.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping labels and direction of flow is provided per specification requirements.
2. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
3. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 22 23 – Condensate Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Receiver Tank Storage Capacity (gal.) | | |  |  |
| 5 | Pump Type | | |  |  |
| 6 | # of Pumps | | |  |  |
| 7 | System Capacity (gpm) | | |  |  |
| 8 | Inlet / Outlet Size (in) | | | **/** | **/** |
| 9 | Capacity per Pump (gpm) | | |  |  |
| 10 | Head per Pump (ft w.g.) | | |  |  |
| 11 | Motor Speed per Pump (rpm) | | |  |  |
| 12 | Motor Power per Pump (hp) | | |  |  |
| 13 | Voltage / Phase / Frequency (V / - /Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| 7 | Control panel shipped independent from receiver unit. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Unit is isolated from the building structure (to reduce vibration and noise) | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Full size vent installed for receiver tank. | | | YES | NO |
| 8 | Receiver tank overflow and drain connections trapped and piped to nearest drain rated for boiling water. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | **Response** | |
| --- | --- | --- | --- |
| *D* | *PIPING* | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | YES | NO |
| 2 | Piping arranged for ease of unit removal. | YES | NO |
| 3 | Piping supported independent of unit and as required by specifications. | YES | NO |
| 4 | Unit connected to supply piping using unions or flanges and isolation valves. | YES | NO |
| 5 | Suction diffuser, long radius reducing elbows or concentric reducers/increasers provided at inlet to unit. | YES | NO |
| 6 | Pressure gauge with gauge valves provided across discharge piping of each pump. | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | YES | NO |
| 8 | Piping insulation is complete and installed as per specifications. | YES | NO |
| 9 | All valves and test ports are easily accessible. | YES | NO |
| 10 | Check valves and globe valves installed at pump discharge. | YES | NO |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12”, maximum 36” piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation in the proper direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Control panel installed by Division 26 Contractor per NEC requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Local control panel accessible and labeled properly. | | | YES | NO |
| 2 | Lead, lag and alarm float wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and tank filled. | | | YES | NO |
| 2 | Pumps checked, aligned, and certified prior to startup and report submitted. | | | YES | NO |
| 3 | Pumps and motors lubricated before startup. | | | YES | NO |
| 4 | Pump shafts rotate easily with power turned off. | | | YES | NO |
| 5 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 6 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Unit controller programmed per contract documents and manufacturer recommendations. | | | YES | NO |
| 2 | Unit controller accurately depicts condition of unit and pumps. | | | YES | NO |
| 3 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| 4 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 5 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 23 00 – Refrigerant Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Temporary end caps are provided on piping and fittings until installation
3. Copper pipe is marked “ACR”.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
3. Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
4. Pipe hanger spacing complies with Section 23 05 29 requirements, including provision of individual hangers within 1’ of each horizontal elbow, valve, etc.
5. All equipment requiring maintenance is accessible (valves, etc.).
6. Piping allows access to equipment that is part of this system or another system.
7. All solder joints are Grade 4 or 5 and have a melting point of 1,250° F.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) VALVE & SPECIAL EQUIPMENT INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All valves are in an upright vertical position with handles in a horizontal position.
2. All valves can be fully operated without removal or alteration of handle, including provisions for specified insulation thickness of piping.
3. Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
4. For circuits 15 tons and over angle pattern filter dryers with replaceable core provided.
5. For circuits below 15 tons straight pattern filter dryers without replaceable core provided.
6. Sight glass, filter dryer, TXV, liquid line solenoid valves are installed as detailed.
7. Charging valves with ¼” SAE brass male flare access ports with finger tight, quick seal caps and 2” long copper extension sections provided.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) TESTING CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping tested utilizing HFC refrigerant and nitrogen at specified pressures and duration as per specification.
2. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
3. Test conducted with all piping of tested system or section visible during testing.
4. Following completion of approved leak tests, piping evacuated in accordance with procedures detailed in specification.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. System charged with type and quantity of refrigerant per charging procedure detailed in specification.
2. Final refrigerant charge recorded and submitted.
3. Piping labels and direction of flow is provided per specification requirements.
4. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
5. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 24 00 – Engine Exhaust Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | | **4)** | **5)** | **6)** | | **7)** | **8)** | | **9)** | **10)** | **11)** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | | |  | | | | **DATE:** | | |  | | | |  |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Piping installed as indicated on the drawings, including mufflers, flexible connections, and other required exhaust line components furnished with the engine.
3. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
4. Muffler installed and supported by non-combustible mechanisms.
5. Pipe hanger spacing complies with Section 23 05 29 requirements.
6. Termination of vent piping is above and/or at least 10’ from any outside air intake, operable window, door, or equipment intake.
7. Piping is installed with sufficient pitch down in the direction of flow and away from the muffler.
8. A drain valve provided on the muffler body (if it has provision for a drain connection), and at all low points in the exhaust piping.
9. Piping passing directly through combustible roofs is guarded at the point of passage by ventilated metal thimbles extended not less than 9” above and below roof construction and which are at least 6” larger in diameter than the pipe.
10. Exhaust piping anchored according to Contract Documents.
11. Uncoated Grade 8 bolts and nuts used.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 24 00 – Remote Radiator Piping

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All piping, valves, etc. are clean and free of damage prior to installation.
2. Temporary protective coating is provided on cast iron and steel valves during storage.
3. Temporary end caps are provided on piping and fittings until installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) PIPING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
2. Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
3. All piping pitched upward from heat exchanger to radiator and from heat exchanger to engine.
4. Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
5. Connections between dissimilar pipe materials are made with dielectric fittings.
6. Pipe hanger spacing complies with Section 15 05 29 requirements.
7. All equipment requiring maintenance is accessible (valves, strainers, etc.).
8. Piping allows access to equipment that is part of this system or another system.
9. Open pipe ends capped at completion of work day.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) VALVE & FITTING INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Heat exchanger is mounted below cylinder head of engine.
2. Radiator surge tank installed 4" above radiator or as recommended by the equipment supplier.
3. Engine surge tank installed 4" above highest engine water outlet piping.
4. All valves are in an upright vertical position with handles in a horizontal position.
5. All valves can be fully operated without removal or alteration of handle, including provisions for specified insulation thickness of piping.
6. Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
7. All piping, accessories, valves and fittings are supported independently of adjacent accessories, valves and fittings.
8. Radiator surge tank installed 4" above radiator or as recommended by the equipment supplier.
9. Engine surge tank installed 4" above highest engine water outlet piping.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) TESTING CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping tested utilizing water at specified pressure and duration as per specification.
2. All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
3. Test conducted with all piping of tested system or section visible during testing.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. System filled with proper water and chemical mixture as defined in contract documents.
2. Piping labels and direction of flow is provided per specification requirements.
3. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
4. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 25 00 – HVAC Water Treatment

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) PRE-TREATMENT CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Piping system flushed, filled, vented and started.
2. Piping system and associated equipment are operational.
3. System capacity has been determined and documented.
4. Terminal control valves are in the full-open position.
5. MSDS sheets are submitted.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) CLEANING TREATMENT CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All chemicals added to system according to manufacturer recommendations.
2. Water filter elements removed from the system before starting circulation.
3. Neutralizer agents used on recommendation of system cleaner supplier and approval of Architect/Engineer.
4. Cleaning treatment procedures, metrics and circulation durations follow specification requirements for system type.
5. Open systems flushed for a minimum of one hour before being drained and re-filled.
6. Strainer screens removed, cleaned and replaced after cleaning treatment.
7. Startup screen removed from strainers in suction diffusers.
8. Low points inspected, sludge removed and flushed with clean water.
9. DFD standard cleaning report completed and submitted.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) FINAL TREATMENT CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. System verified by chemical testing to be free of cleaning chemicals prior to final treatment.
2. All chemicals added to system according to manufacturer recommendations.
3. Corrosion and scale inhibitors provided at specified levels for closed loop systems.
4. Glycol water solutions mixed in separate polyethylene drum to specified concentration prior to introduction to system.
5. Treatment processes, amounts, and dates recorded on DFD standard report format.
6. Test cabinet, meters, and test kits are furnished and installed according to the requirements of Section 23 25 00.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 31 00 – Ductwork and Casings

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) GENERAL DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Ductwork is clean and free of damage prior to installation.
2. Ductwork is installed in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition, 1995.
3. Where two different metal ducts meet, the joint is installed in such a manner that metal ducts do not contact each other by using proper seal or compound.
4. No reductions to duct to less than six inches in any dimension and/or aspect ratio greater than 8:1 are present.
5. Duct is pitched toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
6. All equipment and systems requiring maintenance are accessible (valves, junction boxes, etc.).
7. All seams, joins and penetrations sealed in accordance with SMACNA seal class "A" standards, except transfer ductwork with pressure classification below 2”.
8. All duct openings sealed to maintain duct system cleanliness.
9. Ductwork supported in accordance with SMACNA HVAC Duct Construction Standards, except secure wire method is not utilized.
10. Sheet metal thickness complies with the requirements of Section 23 21 00.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) SUPPLY DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Duct is pitched toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
2. All seams, joins and penetrations sealed in accordance with SMACNA seal class "A", except transfer ductwork with pressure classification below 2”.
3. Manual balancing damper installed in each branch duct and for each diffuser or grille.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) KITCHEN, DUST COLLECTION & GENERAL EXHAUST DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Bracing and reinforcement provided to the outside of the kitchen ductwork to prevent breathing, rattling, vibration or sagging of duct.
2. Ductwork supports provided at intervals no greater than 5’ for kitchen ductwork, and no fasteners or hangers penetrate duct.
3. Horizontal kitchen ductwork is pitched back to hood at 1 inch per foot.
4. Grease tight access doors of the same material and thickness as the duct and as large as possible, up to 24 inches in any dimension provided on duct sides of all kitchen ductwork at each change in direction, not less than every 10 lineal feet of duct, including risers, and not less than 1-1/2 inches from the bottom of the duct.
5. Exhaust ductwork is pitched to drain back to equipment or exhaust grille.
6. Water tight drain pan provided at all low points or at locations where moisture may collect, with drain pan piped to nearest floor drain.
7. Access doors and clean out doors provided on duct sides of dust collection exhaust ductwork at each change in direction, at junctions with vertical ducts, at devices requiring periodic inspection and maintenance, and not less than every 10 lineal feet of duct, including risers.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**D) FUME & PERCHLORIC ACID EXHAUST DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. For all rectangular duct and round duct 36 inch diameter and larger, PCD sealant provided at the corrosive side of the gasket.
2. For round duct less than 36-inch diameter, slip coupling connection sealed with PCD sealant provided.
3. Duct sealer applied on male end connectors before and after insertion to cover the entire joint.
4. 316 stainless steel fasteners provided at all couplings, with maximum screw spacing of 12 inches o. c. and a minimum of 3 equally spaced screws per joint.
5. Fasteners not located at bottom of duct.
6. Any damage to the PVC coating repaired with a PVC aerosol spray or similar PVC product as soon as installation of the piece with a damaged coating is completed.
7. Interior and exterior joints and seams ground and polished smooth for perchloric duct.
8. Duct pitched to drain back to hood or other drain point detailed on the drawings.
9. Perchloric acid exhaust ducts labeled with 4 inch high red stenciled "Perchloric Acid Exhaust" legend every ten feet.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**E) DUCT ACCESSORIES INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Turning vanes installed in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.
2. Fire dampers installed in sleeves with retaining angles on both sides of rated partition, with ductwork connections meeting manufacturer requirements.
3. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper or replacing the fusible link.
4. Access doors provided in size, location and quantity specified under contract documents, including before and after all duct mounted coils.
5. Pressure relief doors provided on VAV systems to protect ductwork damage in the case of equipment or controls malfunction.
6. Flexible duct connections provided for all connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment.
7. Flexible duct connections in corrosive environments or fume exhaust systems, provided with a double layer of the Teflon coated fabric.
8. Manual volume dampers are constructed with continuous shafts according to SMACNA Duct Construction Standards Fig. 2-12 and Fig. 2-13.
9. Manual volume damper blades are two gauges thicker than the surrounding duct according to SMACNA Duct Construction Standards Fig. 2-12 and Fig. 2-13.
10. Manual volume damper handles are extended beyond the surface of external duct insulation according to Section 23 33 00.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**F) FLEXIBLE DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Flexible ductwork is clean and free from damage prior to installation.
2. Flexible duct used for final connections of air inlets and outlets at diffuser, register, and grille locations only.
3. Where flexible duct is used, it is installed with the minimum length required to make the final connections, but no greater than 5 feet in length, and no more than one (1) 90° bend.
4. Inner jacket of flexible duct secured in place with stainless steel metal band clamp.
5. Insulation vapor barrier jacket secured in place with steel or nylon draw band.
6. Flexible ductwork does not penetrate walls.
7. Individual sections of flexible ductwork are of one piece construction.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**G) FINALIZATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** | **10)** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All penetrations through fire rated wall assemblies have been sealed per specification requirements.
2. All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.
3. Each fire damper manually tested for proper operation and any defective dampers repaired or replaced. Access doors labeled “FIRE DAMPER” according to IMC requirements.
4. Fire/smoke damper linkages coordinated with operators so dampers are closed when the air system is not operating.
5. All dirt and foreign matter removed from the entire duct system and diffusers, registers, grilles and the inside of air-handling units cleaned before operating fans.
6. Duct systems with cleaned with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction.
7. All ductwork leakage tested in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual, with test pressure equal to the duct pressure class.
8. Leakage rate does not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
9. Leakage rate does not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
10. Ductwork randomly tested for structural integrity and deflection limits do not exceed those listed in accordance with Chapter 7 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 33 00 – Control Dampers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Height / Width (in / in) | | | / | / |
| 5 | Capacity (fpm / in W.C.) | | | / | / |
| 6 | Actuator Manufacturer | | |  |  |
| 7 | Actuator Model | | |  |  |
| 8 | Control Air Pressure (psig) (if applicable) | | |  |  |
| 9 | Voltage (V) (if applicable) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *HANGING* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is level. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| 6 | Access door provided at unit for inspection of linkages and actuator. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *CONTROLS INSTALLATION* | | | | |
| 1 | Damper actuator installed and wiring/tubing terminated properly. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *E* | *STARTUP* | | | | |
| 1 | Damper open/close sequence verified and acceptable. | | | YES | NO |
| 2 | Operation of end switch verified and acceptable (if applicable). | | | YES | NO |
| 3 | Damper opens and closes smoothly. | | | YES | NO |
| 4 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 33 00 – Intake/Relief Hoods

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Height / Width (in / in) | | | / | / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Dampers operate freely and smoothly. | | | YES | NO |
| 4 | Unit tags affixed. | | | YES | NO |
| 5 | Installation manual provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Adequate clearance around unit for service. | | | YES | NO |
| 3 | All components accessible for maintenance. | | | YES | NO |
| 4 | Dampers are free of debris and have full range of motion. | | | YES | NO |
| 5 | Openings sealed for duration of construction. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 33 00 – Smoke and Fire/Smoke Dampers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Height / Width (in / in) | | | / | / |
| 5 | Capacity (fpm / in W.C.) | | | / | / |
| 6 | Actuator Manufacturer | | |  |  |
| 7 | Actuator Model | | |  |  |
| 8 | Control Air Pressure (psig) (if applicable) | | |  |  |
| 9 | Voltage / Phase / Frequency (V / - /Hz) (if applicable) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components/accessories present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *HANGING* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is level. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| 6 | Access door provided at unit for inspection of linkages and actuator. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *D* | *CONTROLS INSTALLATION* | | | | |
| 1 | Damper actuator installed and wiring/tubing terminated properly. | | | YES | NO |
| 2 | Damper actuator wired/piped from single line/feed for simultaneous closure (multiple damper applications ONLY). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *E* | *STARTUP* | | | | |
| 1 | Damper open/close sequence verified and acceptable. | | | YES | NO |
| 2 | Operation of end switch verified and acceptable. | | | YES | NO |
| 3 | Damper opens and closes smoothly. | | | YES | NO |
| 4 | Damper closes on loss of power/air and shut down of associated AHU. | | | YES | NO |
| 5 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 33 00 – Sound Attenuators

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Associated Unit | | |  |  |
| 4 | Type (Forward or Reverse) | | |  |  |
| 5 | Airflow (cfm) | | |  |  |
| 6 | Height / Length / Width (in / in / in) | | | / / | / / |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic sheeting. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| 4 | Installation manual provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is level and all sections plumb, square and seams sealed. | | | YES | NO |
| 3 | Ductwork is clean and free of debris. | | | YES | NO |
| 4 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 34 00 – Ceiling Exhaust Fans

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity / Static Pressure (cfm / in. w.g.) | | | **/** | **/** |
| 5 | Motor Power / Speed (hp / rpm) | | | **/** | **/** |
| 6 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is supported independently of ceiling framework (recessed lay-in units only). | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Unit is flush to finished ceiling (recessed or lay-in units ONLY). | | | YES | NO |
| 8 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing unit. | | | YES | NO |
| 2 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 5 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Unit grille attached and is clean. | | | YES | NO |
| 3 | Light of proper wattage and type installed (if applicable). | | | YES | NO |
| 4 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 34 00 – Centrifugal Fans

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Fan Type | | |  |  |
| 5 | Capacity / Static Pressure (cfm / in. w.g.) | | | **/** | **/** |
| 6 | Motor Power / Speed (hp / rpm) | | | **/** | **/** |
| 7 | NEMA Nominal Efficiency | | |  |  |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
|  |  | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 4 | Shipping bolts have been removed (if applicable). | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Drain pipe extended to collection pan (grease laden roof exhaust fans ONLY). | | | YES | NO |
| 8 | Drain connection reduced down to ½” fitting and left open (non-grease laden roof exhaust fans ONLY). | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Inlet and outlet ductwork are free of transitions and/or obstructions for ductwork length or distance specified by manufacturer. | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor NEMA Nominal Efficiency complies with Section 23 05 13. | | | YES | NO |
| 4 | Motor rotation is in correct direction. | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 2 | Remote status wiring installed and communication verified. | | | YES | NO |
| 3 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 4 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 5 | Damper actuators installed and calibration verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fan and motor lubricated and aligned. | | | YES | NO |
| 3 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 4 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 5 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 6 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 7 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 8 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Remote start/stop from BAS verified and acceptable. | | | YES | NO |
| 2 | Interlock with associated unit/system verified and acceptable. | | | YES | NO |
| 3 | Temperature control sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 34 00 – Destratification Fans

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components present. | | | YES | NO |
| 3 | Installation manual provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Adequate clearance around unit for service. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Speed control module installed and operation verified. | | | YES | NO |
| 3 | All electrical connections are tight. | | | YES | NO |
| 4 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 3 | Blades adjusted and balanced for stable operation. | | | YES | NO |
| 4 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 34 00 – Side Wall Propeller Fans

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity / Static Pressure (cfm / in. w.g.) | | | **/** | **/** |
| 5 | Motor Power / Speed (hp / rpm) | | | **/** | **/** |
| 6 | NEMA Nominal Efficiency | | |  |  |
| 7 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Backdraft damper is installed at distance from fan as specified by manufacturer. | | | YES | NO |
| 4 | Shipping bolts have been removed (if applicable). | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor NEMA Nominal Efficiency complies with Section 23 05 13. | | | YES | NO |
| 4 | Motor rotation is in correct direction. | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fan and motor lubricated and aligned. | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 8 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 9 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 34 00 – Vaneaxial Fans

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Blade Control Type | | |  |  |
| 5 | Capacity / Static Pressure (cfm / in. w.g.) | | | **/** | **/** |
| 6 | Motor Power / Speed (hp / rpm) | | | **/** | **/** |
| 7 | NEMA Nominal Efficiency | | |  |  |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 4 | Shipping bolts have been removed (if applicable). | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Access door provided for fan and motor service and sealed tight. | | | YES | NO |
| 8 | Drain connection reduced down to ½” fitting and left open. | | | YES | NO |
| 9 | Belt tube provided to isolate belt from air stream (if applicable). | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Inlet and outlet ductwork are free of transitions and/or obstructions for ductwork length or distance specified by manufacturer. | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor NEMA Nominal Efficiency complies with Section 23 05 13. | | | YES | NO |
| 4 | Motor rotation is in correct direction. | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 2 | Remote status wiring installed and communication verified. | | | YES | NO |
| 3 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 4 | Control air at specified pressure provided to unit (if applicable). | | | YES | NO |
| 5 | Damper and blade actuators installed and calibration verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fan and motor lubricated and aligned. | | | YES | NO |
| 3 | All blades have been set and positioned uniformly. | | | YES | NO |
| 4 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 5 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 6 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 7 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 8 | All damage to unit finish is repaired. | | |  |  |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Remote start/stop from BAS verified and acceptable. | | | YES | NO |
| 2 | Interlock with associated unit/system verified and acceptable. | | | YES | NO |
| 3 | Blades modulate uniformly and smoothly in response to changes to static pressure (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 36 00 – Air Terminal Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Size (in) | | |  |  |
| 5 | Max / Min Capacity (cfm / cfm) | | | **/** | **/** |
| 6 | Pressure Drop Air (in. wc) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | The airflow sensing tubing is plugged. | | | YES | NO |
| 4 | The grommets for the airflow sensing tubing are secure. | | | YES | NO |
| 5 | The enclosure for the DDC control panel is in the proper location. | | | YES | NO |
| 6 | All components present. | | | YES | NO |
| 7 | Installation and startup manual provided. | | | YES | NO |
| 8 | Unit tags affixed. | | | YES | NO |
| 9 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *HANGING* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit supported independent from adjacent ductwork. | | | YES | NO |
| 3 | Unit is level. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| 7 | Unit openings temporarily sealed to maintain system cleanliness. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Minimum of 3’ of straight ductwork present prior to unit inlet. | | | YES | NO |
| 2 | Downstream ductwork free of transitions for sufficient length per manufacturer recommendations. | | | YES | NO |
| 3 | Minimum of 12” of straight ductwork provided between unit and re-heat coil (if applicable). | | | YES | NO |
| 4 | Access door provided at air flow sensing tubing or sensor is removable from unit (exhaust and return applications only). | | | YES | NO |
| 5 | 5’ of 1” liner provided immediately downstream of unit outlet or re-heat coil discharge. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION* | | | | |
| 1 | Control panel accessible and labeled properly. | | | YES | NO |
| 2 | Controller and associated devices are readily accessible for servicing and not obstructed by ductwork, piping or electrical conduit. | | | YES | NO |
| 3 | Damper actuator installed and wiring terminated at controller. | | | YES | NO |
| 4 | Air flow sensing tubing terminated at controller. | | | YES | NO |
| 5 | Re-heat coil actuator wiring installed and communication verified. | | | YES | NO |
| 6 | Temperature sensor wiring installed and communication verified. | | | YES | NO |
| 7 | Interconnection wiring between units installed and communication verified (air flow tracking applications only). | | | YES | NO |
| 8 | Fume hood sash position indicator wiring installed and communication verified. | | | YES | NO |
| 9 | Occupancy sensor wiring installed and communication verified (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence verified and acceptable. | | | YES | NO |
| 2 | Heating sequence verified and acceptable. | | | YES | NO |
| 3 | Exhaust/return air flow tracking sequence verified and acceptable (exhaust and return applications only). | | | YES | NO |
| 4 | Supply air tracking sequence verified and acceptable (air valve applications only). | | | YES | NO |
| 5 | Fume hood tracking sequence verified and acceptable (air valve applications only). | | | YES | NO |
| 6 | Constant volume sequence verified and acceptable (if applicable). | | | YES | NO |
| 7 | Occupancy schedule programmed and verified (if applicable). | | | YES | NO |
| 8 | Occupancy override sequence verified and acceptable (if applicable). | | | YES | NO |
| 9 | Differential pressure reset sequence verified and acceptable (terminal unit applications only). | | | YES | NO |
| 10 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 37 13 – Diffuser, Grilles and Registers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) GENERAL DUCTWORK INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Diffusers, grilles and registers installed as shown in contract documents.
2. Where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser, equalizing grids are furnished.
3. Connections between ductwork drops and diffusers, grilles and registers sealed airtight.
4. Unused portions of linear slot diffusers and linear bar diffusers and grilles are blanked off.
5. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, inside of duct is painted with flat black paint to reduce visibility.
6. In clean rooms and animal holding rooms, space between diffusers, registers and grilles and ceiling or wall to be air and watertight using clear, non-hardening, microbiological resistant silicone sealant compatible with ceiling or wall surfaces.
7. All diffusers, grilles and registers temporary sealed at end of work day to maintain duct system cleanliness.
8. All mars and blemishes are repaired.
9. Throw pattern and direction adjusted per contract document requirements.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 41 00 – Filter Racks

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer (Housing) | | |  |  |
| 2 | Model (Housing) | | |  |  |
| 3 | Manufacturer (Filters) | | |  |  |
| 4 | Model (Filters) | | |  |  |
| 5 | # of Filter Banks | | |  |  |
| 6 | Filter Bank Filter(s) Width / Height / Depth (in.) | | | **/ /** | **/ /** |
| 7 | Filter Bank # of Filters. | | |  |  |
| 8 | Filter Bank Filter Efficiency | | |  |  |
| 9 | Filter Bank Filter Type | | |  |  |
| 10 | Capacity (CFM) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All components present. | | | YES | NO |
| 3 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit and adjoining ductwork sealed as per specifications. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Filter gauge is secured to exterior of unit. | | | YES | NO |
| 6 | Filter gauge is piped with aluminum tubing, with static pressure tips and vent valves installed according to Section 23 41 00. | | | YES | NO |
| 7 | Filter gauge has proper scale range according to Section 23 41 00. | | | YES | NO |
| 8 | Separate filter gauge provided for each filter rack. | | | YES | NO |
| 9 | Filters are clean and free from damage. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| 11 | Unit is constructed to prevent air from bypassing the filter media. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 51 00 – Breechings, Chimneys and Stacks

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**A) CONDENSING APPLIANCE VENTS INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |  |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. All vents pitched up from equipment to point of termination outside of facility.
2. Hanger spacing complies with specification requirements.
3. Termination of vent is above and/or at least 10’ from any outside air intake, operable window, door, or equipment intake.
4. Vents are leak tight.
5. Drain connection provided at base of exhaust vent and piped to nearest drain.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**B) DOUBLE WALL METAL STACKS & BREECHINGS INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** | **9)** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Stack, breeching and accessories installed in accordance with minimum clearances for combustibles as specified in UL listing.
2. All breechings pitched up from equipment to chimney or stack.
3. Minimum number of joints utilized in breechings and all connections aligned and smooth internally.
4. Hanger and support spacing complies with specification requirements.
5. Vent dampers provided at draft hood outlet for all natural draft applications.
6. All joints sealed with manufacturer recommended sealants for positive pressure stacks and breechings.
7. Slip joints provided at equipment connections to allow removal of equipment without removal or dismantling of breechings, chimneys, or stacks.
8. Open breeching and chimney ends capped at completion of work day.
9. Breechings, chimneys and stacks cleaned internally and externally at conclusion of installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

**C) REFRACTORY LINED STACKS & BREECHINGS INSTALLATION CHECKS**

| **Date** | **Description of Work Performed** | **%**  **Complete** | **Initials** | **Questions (See details below)** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1)** | **2)** | **3)** | **4)** | **5)** | **6)** | **7)** | **8)** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
|  |  |  |  | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** | **YES**  **NO** |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | | | **INITIALS:** | |  | | | **DATE:** | |  | | |

**Question Details**

1. Stack, breeching and accessories installed in accordance with minimum clearances for combustibles as specified in UL listing.
2. All breechings pitched up from equipment to chimney or stack.
3. Minimum number of joints utilized in breechings as possible and all connections aligned and smooth internally.
4. Hanger and support spacing complies with specification requirements.
5. Condensate drain provided at base of stack with piping to nearest drain.
6. Slip joints provided at equipment connections to allow removal of equipment without removal or dismantling of breechings, chimneys, or stacks.
7. Open breeching and chimney ends capped at completion of work day.
8. Breechings, chimneys and stacks cleaned internally and externally at conclusion of installation.

**Negative Responses**

| **Group/Item** | **Date**  **Found** | **Found**  **By** | **Location** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |
|  |  |  |  |  | **YES / NO** |  |  |

CV-23 52 00 – Fire Tube Boilers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Total Input / Output Capacity (MBH) | | | **/** | **/** |
| 5 | Gas inlet pressure (psi) | | |  |  |
| 6 | Burner motor HP | | |  |  |
| 7 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water and gas openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit located indoors and protected from freezing temperatures. | | | YES | NO |
| 2 | Unit not located near an air-moving device. | | | YES | NO |
| 3 | Proper clearances from combustible surfaces maintained per manufacturer’s instructions and applicable codes. | | | YES | NO |
| 4 | Installation area free of corrosive elements and flammable materials. | | | YES | NO |
| 5 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 6 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 7 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 8 | Adequate clearance around unit for service. | | | YES | NO |
| 9 | All components accessible for maintenance. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *VENTILATION AND COMBUSTION AIR SUPPLY* | | | | |
| 1 | Fresh air not taken from areas that contain negative pressure producing devices. | | | YES | NO |
| 2 | Fresh air supply free of corrosive elements and flammable vapors. | | | YES | NO |
| 3 | Fresh air openings located correctly with consideration given to the blocking effect of louvers and grilles. | | | YES | NO |
| 4 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 5 | Ductwork is the same cross-sectional area as openings. | | | YES | NO |
| 6 | All ductwork is properly sealed and sloped per manufacturer specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *VENT PIPE SYSTEM* | | | | |
| 1 | Draft hood for atmospheric burners properly installed. | | | YES | NO |
| 2 | Vent connectors securely fastened with screws and supported properly to maintain 6-inch clearance. | | | YES | NO |
| 3 | Vent connector made of approved material and sloped correctly. | | | YES | NO |
| 4 | Vent pipe system in accordance with “National Fuel Gas Code”, NFPA 54, ANSI Z223.1-Latest Edition or prevailing provisions of local codes. | | | YES | NO |
| 5 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 6 | Flue baffle engaged in slots provided in the flue tube. | | | YES | NO |
| 7 | Flue way, draft hood or vent pipe system not obstructed in any way. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply, return, and drain piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Balancing valve supplied for each boiler branch (multiple boiler arrangements only). | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| 13 | Pressure and temperature relief valve(s) for correct pressure and temperature installed. | | | YES | NO |
| 14 | Pressure and temperature relief valve(s) piped with sufficient pipe diameter to drain designed for boiling water. | | | YES | NO |
| 15 | Drain valve provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (IF APPLICABLE)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Pressure relief valve installed prior to heat exchanger for steam supply pressures above maximum recommended pressure ratings for unit. | | | YES | NO |
| 5 | Safety and pressure relief devices installed in manner to minimize personnel and property damage. | | | YES | NO |
| 6 | Piping pitched for proper condensate flow. | | | YES | NO |
| 7 | Piping arranged for ease of unit removal. | | | YES | NO |
| 8 | Piping supported as required by specifications. | | | YES | NO |
| 9 | Piping is clean. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure reducing valves provide correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure relief valves are piped to outdoors. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Proper gas train provided (FM/IRI arrangements). | | | YES | NO |
| 8 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS INSTALLATION* | | | | |
| 1 | Control panel accessible and labeled properly. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Hot water temperature reset signal verified and programmed. | | | YES | NO |
| 6 | Actuators installed and calibration verified. | | | YES | NO |
| 7 | Low water cutoff switch installed and operational. | | | YES | NO |
| 8 | High temperature limit sensor installed and programmed per contract documents. | | | YES | NO |
| 9 | High pressure limit sensor installed and programmed per contract documents (steam boilers only). | | | YES | NO |
| 10 | Hot water supply and return temperature sensors installed and communication verified. | | | YES | NO |
| 11 | Steam supply pressure sensor installed and communication verified (steam boilers only). | | | YES | NO |
| 12 | Circulation pump wired and operational (if applicable). | | | YES | NO |
| 13 | Test ports installed near all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Burner adjusted to proper settings and CO2, CO, and combustion efficiencies are acceptable. | | | YES | NO |
| 3 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 4 | Pressure and temperature relief valve(s) set to proper pressure and temperature and manually checked for functionality. | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *CONTROLS STARTUP* | | | | |
| 1 | Low water cut off sequence verified and acceptable. | | | YES | NO |
| 2 | High temperature limit sequence verified and acceptable. | | | YES | NO |
| 3 | High pressure limit sequence verified and acceptable (steam boilers ONLY). | | | YES | NO |
| 4 | Flame safety sequences verified and acceptable. | | | YES | NO |
| 5 | Heating sequence verified and acceptable. | | | YES | NO |
| 6 | Temperature reset schedule verified and acceptable. | | | YES | NO |
| 7 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 52 00 –Condensing Boilers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Total Input / Output Capacity (MBH) | | | **/** | **/** |
| 5 | Gas inlet pressure (psi) | | |  |  |
| 6 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water and gas openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit located indoors and protected from freezing temperatures. | | | YES | NO |
| 2 | Unit not located near an air-moving device. | | | YES | NO |
| 3 | Proper clearances from combustible surfaces maintained per manufacturer’s instructions and applicable codes. | | | YES | NO |
| 4 | Installation area free of corrosive elements and flammable materials. | | | YES | NO |
| 5 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 6 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 7 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 8 | Adequate clearance around unit for service. | | | YES | NO |
| 9 | All components accessible for maintenance. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *VENTILATION AND COMBUSTION AIR SUPPLY* | | | | |
| 1 | Fresh air not taken from areas that contain negative pressure producing devices. | | | YES | NO |
| 2 | Fresh air supply free of corrosive elements and flammable vapors. | | | YES | NO |
| 3 | Fresh air openings located correctly with consideration given to the blocking effect of louvers and grilles. | | | YES | NO |
| 4 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 5 | Ductwork is the same cross-sectional area as openings. | | | YES | NO |
| 6 | All ductwork is properly sealed and sloped per manufacturer specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *VENT PIPE SYSTEM* | | | | |
| 1 | Draft hood for atmospheric burners properly installed. | | | YES | NO |
| 2 | Vent connectors securely fastened with screws and supported properly to maintain 6-inch clearance. | | | YES | NO |
| 3 | Vent connector made of approved material and sloped correctly. | | | YES | NO |
| 4 | Vent pipe system in accordance with “National Fuel Gas Code”, NFPA 54, ANSI Z223.1-Latest Edition or prevailing provisions of local codes. | | | YES | NO |
| 5 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 6 | Flue baffle engaged in slots provided in the flue tube. | | | YES | NO |
| 7 | Flue way, draft hood or vent pipe system not obstructed in any way. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply, return, and drain piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Balancing valve supplied for each boiler branch (multiple boiler arrangements only). | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| 13 | Pressure and temperature relief valve(s) for correct pressure and temperature installed. | | | YES | NO |
| 14 | Pressure and temperature relief valve(s) piped with sufficient pipe diameter to drain designed for boiling water. | | | YES | NO |
| 15 | Drain valve provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (IF APPLICABLE)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Pressure relief valve installed prior to heat exchanger for steam supply pressures above maximum recommended pressure ratings for unit. | | | YES | NO |
| 5 | Safety and pressure relief devices installed in manner to minimize personnel and property damage. | | | YES | NO |
| 6 | Piping pitched for proper condensate flow. | | | YES | NO |
| 7 | Piping arranged for ease of unit removal. | | | YES | NO |
| 8 | Piping supported as required by specifications. | | | YES | NO |
| 9 | Piping is clean. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure reducing valves provide correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure relief valves are piped to outdoors. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Proper gas train provided (FM/IRI arrangements). | | | YES | NO |
| 8 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS INSTALLATION* | | | | |
| 1 | Control panel accessible and labeled properly. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Hot water temperature reset signal verified and programmed. | | | YES | NO |
| 6 | Actuators installed and calibration verified. | | | YES | NO |
| 7 | Low water cutoff switch installed and operational. | | | YES | NO |
| 8 | High temperature limit sensor installed and programmed per contract documents. | | | YES | NO |
| 9 | High pressure limit sensor installed and programmed per contract documents (steam boilers only). | | | YES | NO |
| 10 | Hot water supply and return temperature sensors installed and communication verified. | | | YES | NO |
| 11 | Steam supply pressure sensor installed and communication verified (steam boilers only). | | | YES | NO |
| 12 | Circulation pump wired and operational (if applicable). | | | YES | NO |
| 13 | Test ports installed near all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Burner adjusted to proper settings and CO2, CO, and combustion efficiencies are acceptable. | | | YES | NO |
| 3 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 4 | Pressure and temperature relief valve(s) set to proper pressure and temperature and manually checked for functionality. | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *CONTROLS STARTUP* | | | | |
| 1 | Low water cut off sequence verified and acceptable. | | | YES | NO |
| 2 | High temperature limit sequence verified and acceptable. | | | YES | NO |
| 3 | High pressure limit sequence verified and acceptable (steam boilers only). | | | YES | NO |
| 4 | Flame safety sequences verified and acceptable. | | | YES | NO |
| 5 | Heating sequence verified and acceptable. | | | YES | NO |
| 6 | Temperature reset schedule verified and acceptable. | | | YES | NO |
| 7 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 52 00 – Boiler Blowdown Separators

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Steam pressure (psig) | | |  |  |
| 5 | Steam Flow (lb. / hr.) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 2 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply, return, and drain piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Balancing valve supplied for each boiler branch (multiple boiler arrangements ONLY). | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| 13 | Pressure and temperature relief valve(s) for correct pressure and temperature installed. | | | YES | NO |
| 14 | Pressure and temperature relief valve(s) piped with sufficient pipe diameter to drain designed for boiling water. | | | YES | NO |
| 15 | Drain valve provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (IF APPLICABLE)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Pressure relief valve installed prior to heat exchanger for steam supply pressures above maximum recommended pressure ratings for unit. | | | YES | NO |
| 5 | Safety and pressure relief devices installed in manner to minimize personnel and property damage. | | | YES | NO |
| 6 | Piping pitched for proper condensate flow. | | | YES | NO |
| 7 | Piping arranged for ease of unit removal. | | | YES | NO |
| 8 | Piping supported as required by specifications. | | | YES | NO |
| 9 | Piping is clean. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Control panel accessible and labeled properly. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Hot water temperature reset signal verified and programmed. | | | YES | NO |
| 6 | Actuators installed and calibration verified. | | | YES | NO |
| 7 | High temperature limit sensor installed and programmed per contract documents. | | | YES | NO |
| 8 | Steam supply pressure sensor installed and communication verified (steam boilers ONLY). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 52 00 – Continuous Blowdown Heat Recovery System

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Steam pressure (psig) | | |  |  |
| 5 | Recovery Capacity (MBH) | | |  |  |
| 6 | Temperature rise (deg. F) | | |  |  |
| 7 | Flow (gpm) | | |  |  |
| 8 | Pressure Drop (ft. wg) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 2 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply, return, and drain piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Balancing valve supplied for each boiler branch (multiple boiler arrangements ONLY). | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| 13 | Pressure and temperature relief valve(s) for correct pressure and temperature installed. | | | YES | NO |
| 14 | Pressure and temperature relief valve(s) piped with sufficient pipe diameter to drain designed for boiling water. | | | YES | NO |
| 15 | Drain valve provided. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (IF APPLICABLE)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Pressure relief valve installed prior to heat exchanger for steam supply pressures above maximum recommended pressure ratings for unit. | | | YES | NO |
| 5 | Safety and pressure relief devices installed in manner to minimize personnel and property damage. | | | YES | NO |
| 6 | Piping pitched for proper condensate flow. | | | YES | NO |
| 7 | Piping arranged for ease of unit removal. | | | YES | NO |
| 8 | Piping supported as required by specifications. | | | YES | NO |
| 9 | Piping is clean. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Control panel accessible and labeled properly. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Hot water temperature reset signal verified and programmed. | | | YES | NO |
| 6 | Actuators installed and calibration verified. | | | YES | NO |
| 7 | High temperature limit sensor installed and programmed per contract documents. | | | YES | NO |
| 8 | Steam supply pressure sensor installed and communication verified (steam boilers ONLY). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 53 00 – Deaerator Assemblies

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Associated Boiler | | |  |  |
| 5 | Boiler BHP | | |  |  |
| 6 | Surge / Deaerator Tank Storage Capacity (gal / gal) | | |  |  |
| 7 | Transfer Pump Type | | |  |  |
| 8 | # of Transfer Pumps | | |  |  |
| 9 | Capacity per Transfer Pump (gpm) | | |  |  |
| 10 | Head per Transfer Pump (ft w.g.) | | |  |  |
| 11 | Motor Speed per Transfer Pump (rpm) | | |  |  |
| 12 | Motor Power per Transfer Pump (hp) | | |  |  |
| 13 | Feed Pump Type | | |  |  |
| 14 | # of Feed Pumps | | |  |  |
| 15 | Capacity per Feed Pump (gpm) | | |  |  |
| 16 | Head per Feed Pump (ft w.g.) | | |  |  |
| 17 | Motor Speed per Feed Pump (rpm) | | |  |  |
| 18 | Motor Power per Feed Pump (hp) | | |  |  |
| 19 | Voltage / Phase / Frequency (V / - /Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Unit is isolated from the building structure (to reduce vibration and noise) | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Full size vent installed for surge tank. | | | YES | NO |
| 8 | Surge and deaerator tank overflows and drain connections piped to nearest drain rated for boiling water. | | | YES | NO |
| 9 | Deaerator automatic air vent has been set to specified pressure per contract documents. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Make-up float has been adjusted to surge tank maximum capacity level. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONDENSATE PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 8 | All valves and test ports are easily accessible. | | | YES | NO |
| 9 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *STEAM PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Piping arranged for ease of unit removal. | | | YES | NO |
| 6 | Piping supported as required by specifications. | | | YES | NO |
| 7 | Piping is clean. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation in the proper direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | Local control panel accessible and labeled properly. | | | YES | NO |
| 2 | Boiler start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Deaerator temperature sensor installed and calibration verified. | | | YES | NO |
| 6 | Deaerator level switch installed and communication verified. | | | YES | NO |
| 7 | Actuators installed and calibration verified. | | | YES | NO |
| 8 | Safety items installed and verified (pump failure, high temperature, etc.) | | | YES | NO |
| 9 | Test ports installed near all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and surge tank filled. | | | YES | NO |
| 2 | Pumps checked, aligned, and certified prior to startup and report submitted. | | | YES | NO |
| 3 | Pumps and motors lubricated before startup. | | | YES | NO |
| 4 | Pump shafts rotate easily with power turned off. | | | YES | NO |
| 5 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 6 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Unit controller programmed per contract documents and manufacturer recommendations. | | | YES | NO |
| 2 | Unit controller accurately depicts condition of unit and pumps. | | | YES | NO |
| 3 | Boiler start and stop sequence verified and acceptable. | | | YES | NO |
| 4 | Deaerator heating sequence verified and acceptable. | | | YES | NO |
| 5 | Deaerator level control sequence verified and acceptable. | | | YES | NO |
| 6 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 7 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *TAB* | | | | |
| 1 | Motor rotation in the proper direction for all motors. | | | YES | NO |
| 2 | Motor overload verified for each motor. | | | YES | NO |
| 3 | Motor voltage and amps verified for each phase of each motor and are acceptable. | | | YES | NO |
| 4 | Final TAB values for unit or system complies with design values specified given the tolerances specified under 23 05 93. | | | YES | NO |
| 5 | All final settings and positions of TAB have been permanently labeled on component or unit. | | | YES | NO |
| 6 | Start-up strainer removed after 8 hours of operation. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 53 00 – Feedwater Pump Assemblies

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Associated Boiler | | |  |  |
| 5 | Boiler BHP | | |  |  |
| 6 | Receiver Tank Storage Capacity (gal.) | | |  |  |
| 7 | Pump Type | | |  |  |
| 8 | # of Pumps | | |  |  |
| 9 | System Capacity (gpm) | | |  |  |
| 10 | Inlet / Outlet Size (in) | | | **/** | **/** |
| 11 | Capacity per Pump (gpm) | | |  |  |
| 12 | Head per Pump (ft w.g.) | | |  |  |
| 13 | Motor Speed per Pump (rpm) | | |  |  |
| 14 | Motor Power per Pump (hp) | | |  |  |
| 15 | Voltage / Phase / Frequency (V / - /Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Unit is isolated from the building structure (to reduce vibration and noise) | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Adequate clearance around unit for service. | | | YES | NO |
| 6 | All components accessible for maintenance. | | | YES | NO |
| 7 | Full size vent installed for receiver tank. | | | YES | NO |
| 8 | Receiver tank overflow and drain connections piped to nearest drain rated for boiling water. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | **Response** | |
| --- | --- | --- | --- |
| *D* | *WATER PIPING* | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | YES | NO |
| 2 | Piping arranged for ease of unit removal. | YES | NO |
| 3 | Piping supported as required by specifications. | YES | NO |
| 4 | Piping is clean. | YES | NO |
| 5 | Unit connected to supply piping using unions or flanges and isolation valves. | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | YES | NO |
| 7 | Make-up float has been adjusted to receiver tank maximum capacity level. | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | YES | NO |
| 10 | All valves and test ports are easily accessible. | YES | NO |
| 11 | Valve tags attached. | YES | NO |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONDENSATE PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 8 | All valves and test ports are easily accessible. | | | YES | NO |
| 9 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *STEAM PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Piping arranged for ease of unit removal. | | | YES | NO |
| 6 | Piping supported as required by specifications. | | | YES | NO |
| 7 | Piping is clean. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation in the proper direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | Local control panel accessible and labeled properly. | | | YES | NO |
| 2 | Boiler start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Feedwater temperature sensor installed and calibration verified. | | | YES | NO |
| 6 | Actuators installed and calibration verified. | | | YES | NO |
| 7 | Safety items installed and verified (pump failure, high temperature, etc.) | | | YES | NO |
| 8 | Test ports installed near all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and tank filled. | | | YES | NO |
| 2 | Pumps checked, aligned, and certified prior to startup and report submitted. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Pumps and motors lubricated before startup. | | | YES | NO |
| 5 | Pump shafts rotate easily with power turned off. | | | YES | NO |
| 6 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 7 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Unit controller programmed per contract documents and manufacturer recommendations. | | | YES | NO |
| 2 | Unit controller accurately depicts condition of unit and pumps. | | | YES | NO |
| 3 | Boiler start and stop sequence verified and acceptable. | | | YES | NO |
| 4 | Feedwater pre-heat sequence verified and acceptable. | | | YES | NO |
| 5 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 6 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 54 00 – Gas Fired Furnaces

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Outside Air Flow (cfm) | | |  |  |
| 6 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 7 | Refrigerant Type (if applicable) | | |  |  |
| 8 | Heating Input / Output (MBH / MBH) | | | **/** | **/** |
| 9 | Fuel Type | | |  |  |
| 10 | Gas Inlet Pressure (psig) | | |  |  |
| 11 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 12 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Shipping bolts have been removed. | | | YES | NO |
| 7 | Unit labeled and is easy to see. | | | YES | NO |
| 8 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure reducing valves provide correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure relief valves are piped to outdoors. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement complies with manufacturer instructions. | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS INSTALLATION* | | | | |
| 1 | Exterior condensing unit wiring installed and communication verified (if applicable). | | | YES | NO |
| 2 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 3 | Vent pressure switch wiring installed and communication verified. | | | YES | NO |
| 4 | Safety items installed and verified (blower access, etc.) | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fan and motor lubricated and aligned. | | | YES | NO |
| 3 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 4 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 5 | All bent or crushed fins have been combed out. | | | YES | NO |
| 6 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 7 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 8 | Final filters installed. | | | YES | NO |
| 9 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *CONTROLS STARTUP* | | | | |
| 1 | Occupancy schedule programmed and verified. | | | YES | NO |
| 2 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Heating sequence of control verified and acceptable. | | | YES | NO |
| 4 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 5 | Blower de-energizes when blower access door is opened. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 55 00 – Direct Fired MUA Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 6 | Outside Air Flow (cfm) | | |  |  |
| 7 | Heating Input / Output (MBH / MBH) | | |  |  |
| 8 | Fuel Type | | | **/** | **/** |
| 9 | Gas Inlet Pressure (psig) | | |  |  |
| 10 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 11 | Motor NEMA Nominal Efficinecy | | |  |  |
| 12 | Voltage / Phase / Frequency (V / - / Hz) | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit is level. | | | YES | NO |
| 7 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 8 | Unit labeled and is easy to see. | | | YES | NO |
| 9 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure reducing valves provide correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure regulator vent are piped to outdoors and terminated at least 10-feet from fresh air intake louvers, operable windows and doors.. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12”, maximum 36” piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Motor nominal efficiency complies with the requirements of Section 23 05 13. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Safety items installed and verified (low limit, low gas flow, high gas flow, etc.) | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 8 | Gas operating, pilot and manifold pressures tested and comply with manufacturer requirements (with blowers running). | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | **Response** | |
| --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | |
| 1 | Discharge air temperature control sequence verified and acceptable (if applicable). | YES | NO |
| 2 | Space temperature control sequence verified and acceptable (if applicable). | YES | NO |
| 3 | All safeties and alarms verified and acceptable. | YES | NO |
| 4 | Control wiring labeled per specification requirements. | YES | NO |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 55 00 – Gas Fired Unit Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (cfm) | | |  |  |
| 5 | Heating Input / Output (MBH / MBH) | | | **/** | **/** |
| 6 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 7 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| 8 | Fuel Type | | |  |  |
| 9 | Gas Inlet Pressure (psig) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water and gas openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit suspended at height specified in contract documents as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| 6 | Protective covering applied. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *VENTILATION AND COMBUSTION AIR SUPPLY* | | | | |
| 1 | Sufficient fresh air supply for proper unit operation. | | | YES | NO |
| 2 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 3 | Ductwork is the same cross-sectional area as openings. | | | YES | NO |
| 4 | All ductwork is properly sealed and sloped per manufacturer specifications. | | | YES | NO |
| 5 | Vertical gas vents terminate with a listed cap or other roof assembly and are installed according to their manufacturer’s instructions. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *VENT PIPE SYSTEM* | | | | |
| 1 | Draft hood for atmospheric burners properly installed. | | | YES | NO |
| 2 | Vent connectors securely fastened with screws and supported properly to maintain 6-inch clearance. | | | YES | NO |
| 3 | Vent connector made of approved material and sloped correctly. | | | YES | NO |
| 4 | Vent pipe system in accordance with “National Fuel Gas Code”, NFPA 54, ANSI Z223.1-Latest Edition or prevailing provisions of local codes. | | | YES | NO |
| 5 | Combustion air and venting is extended to outside of building as indicated on the drawings and terminated according to the manufacturer's instructions. | | | YES | NO |
| 6 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 7 | Flue baffle engaged in slots provided in the flue tube. | | | YES | NO |
| 8 | Flue way, draft hood or vent pipe system not obstructed in any way. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure regulators are provide correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure regulator vent is piped to the exterior of the building and is terminated at least 10-feet from fresh air intakes, operable windows and doors.. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | Motor rotation in the proper direction | | | YES | NO |
| 3 | All electrical connections are tight | | | YES | NO |
| 4 | All electrical components are grounded | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 2 | Combustion and vent pressure switches installed and communication verified. | | | YES | NO |
| 3 | Safety items installed and verified (pump failure, high temperature, etc.) | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Fan and motor lubricated and aligned. | | | YES | NO |
| 4 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 6 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 2 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 3 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 55 00 – Indirect Fired MUA Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 6 | Outside Air Flow (cfm) | | |  |  |
| 7 | Heating Input / Output (MBH / MBH) | | |  |  |
| 8 | Fuel Type | | | **/** | **/** |
| 9 | Gas Inlet Pressure (psig) | | |  |  |
| 10 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 11 | Voltage / Phase / Frequency (V / - / Hz) | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit is level. | | | YES | NO |
| 7 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 8 | Unit labeled and is easy to see. | | | YES | NO |
| 9 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *VENTILATION AND COMBUSTION AIR SUPPLY* | | | | |
| 1 | Sufficient fresh air supply for proper unit operation. | | | YES | NO |
| 2 | Fresh air not taken from areas that contain negative pressure producing devices. | | | YES | NO |
| 3 | Fresh air supply free of corrosive elements and flammable vapors. | | | YES | NO |
| 4 | Fresh air openings located correctly with consideration given to the blocking effect of louvers and grilles. | | | YES | NO |
| 5 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 6 | Ductwork is the same cross-sectional area as openings. | | | YES | NO |
| 7 | All ductwork is properly sealed and sloped per manufacturer specifications. | | | YES | NO |
| 8 | Vertical gas vents terminate with a listed cap or other roof assembly and are installed according to their manufacturer’s instructions. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *VENT PIPE SYSTEM* | | | | |
| 1 | Draft hood for atmospheric burners properly installed. | | | YES | NO |
| 2 | Vent connectors securely fastened with screws and supported properly to maintain 6-inch clearance. | | | YES | NO |
| 3 | Vent connector made of approved material and sloped correctly. | | | YES | NO |
| 4 | Vent pipe system in accordance with “National Fuel Gas Code”, NFPA 54, ANSI Z223.1-Latest Edition or prevailing provisions of local codes. | | | YES | NO |
| 5 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 6 | Flue baffle engaged in slots provided in the flue tube. | | | YES | NO |
| 7 | Flue way, draft hood or vent pipe system not obstructed in any way. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure regulatorprovides correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure regulator vent is piped to the exterior of the building and is terminated at least 10-feet from fresh air intakes, operable windows and doors. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Combustion and vent pressure switches installed and communication verified. | | | YES | NO |
| 6 | Safety items installed and verified (low limit, low gas flow, high gas flow, etc.) | | | YES | NO |
| 7 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 8 | Gas operating, pilot and manifold pressures tested and comply with manufacturer requirements (with blowers running). | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *CONTROLS STARTUP* | | | | |
| 1 | Discharge air temperature control sequence verified and acceptable (if applicable). | | | YES | NO |
| 2 | Space temperature control sequence verified and acceptable (if applicable). | | | YES | NO |
| 3 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 4 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 55 00 – Infra-Red Heating Devices

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (cfm) | | |  |  |
| 5 | Heating Input / Output (MBH / MBH) | | | **/** | **/** |
| 6 | Tube Length (ft) | | |  |  |
| 7 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| 9 | Fuel Type | | |  |  |
| 10 | Gas Inlet Pressure (psig) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water and gas openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit suspended at height specified in contract documents as required by manufacturer, specifications, ANSI/NFPA 409, and ANSI/NFPA 88A-B. | | | YES | NO |
| 2 | “U” bend of tube minimum clearances are maintained per manufacturer recommendations. | | | YES | NO |
| 3 | Tube sections are level for full length of installation and joined per manufacturer requirements. | | | YES | NO |
| 4 | All penetrations tube through wall assemblies comply with ANSI Z223.1 and a steel type “B” or better vent duct. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Reflectors, shields and grilles installed per manufacturer instructions and aimed per contract documents or Engineer direction. | | | YES | NO |
| 9 | Burner assembly and vent exhauster supported independent of tube. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| 11 | Protective covering applied. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *VENTILATION AND COMBUSTION AIR SUPPLY* | | | | |
| 1 | Sufficient fresh air supply for proper unit operation. | | | YES | NO |
| 2 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 3 | Ductwork is the same cross-sectional area as openings. | | | YES | NO |
| 4 | All ductwork is properly sealed and sloped per manufacturer specifications. | | | YES | NO |
| 5 | Vertical gas vents terminate with a listed cap or other roof assembly and are installed according to their manufacturer’s instructions. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *VENT PIPE SYSTEM* | | | | |
| 1 | Vent arrangement complies with manufacturer recommendations. | | | YES | NO |
| 2 | Draft hood for atmospheric burners properly installed. | | | YES | NO |
| 3 | Vent connectors securely fastened with screws and supported properly to maintain 6-inch clearance. | | | YES | NO |
| 4 | Vent connector made of approved material and sloped correctly. | | | YES | NO |
| 5 | Vent pipe system in accordance with “National Fuel Gas Code”, NFPA 54, ANSI Z223.1-Latest Edition or prevailing provisions of local codes. | | | YES | NO |
| 6 | Overall ductwork length and restrictions comply with manufacturer requirements. | | | YES | NO |
| 7 | Flue baffle engaged in slots provided in the flue tube. | | | YES | NO |
| 8 | Flue way, draft hood or vent pipe system not obstructed in any way. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *GAS PIPING* | | | | |
| 1 | Gas supply is the same type as listed on the unit data plate. | | | YES | NO |
| 2 | Pressure regulator provides correct pressure to unit. | | | YES | NO |
| 3 | Gas cock / valve and union provided on gas supply. | | | YES | NO |
| 4 | Drip / dirt leg and cap provided on gas supply. | | | YES | NO |
| 5 | Pressure regulator vent is piped to the exterior of the building and is terminated at least 10-feet from fresh air intakes, operable windows and doors. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Connection to burner assembly is via stainless steel flexible connector. | | | YES | NO |
| 8 | Gas utility company inspected installation (if required). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | Motor rotation in the proper direction | | | YES | NO |
| 3 | All electrical connections are tight | | | YES | NO |
| 4 | All electrical components are grounded | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 2 | Vent differential airflow switch installed and communication verified. | | | YES | NO |
| 3 | Safety items installed and verified (flame failure, etc.) | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Fan and motor lubricated and aligned. | | | YES | NO |
| 4 | Current draw of vent exhauster tested and complies with nameplate. | | | YES | NO |
| 5 | Vacuum of burner has been set per manufacturer instructions. | | | YES | NO |
| 6 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 7 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 8 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 2 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 57 00 – Heat Exchangers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Heat Exchanger Type | | |  |  |
| 5 | Primary / Secondary Media Type | | | **/** | **/** |
| 6 | Primary / Secondary Capacity (MBH / MBH) | | | **/** | **/** |
| 7 | Primary / Secondary Flow (gpm / gpm) (water-water applications only) | | | **/** | **/** |
| 8 | Primary / Secondary Flow (lb/hr / gpm) (steam-water applications only) | | | **/** | **/** |
| 9 | Primary / Secondary Flow (lb/hr / lb/hr) (steam-steam applications only) | | | **/** | **/** |
| 10 | Primary / Secondary Pressure Loss (ft W.C. / ft W.C.) (water-water applications only) | | | **/** | **/** |
| 11 | Primary / Secondary Pressure Loss (psig / ft W.C.) (steam-water applications only) | | | **/** | **/** |
| 12 | Primary / Secondary Pressure Loss (psig / psig) (steam-steam applications only) | | | **/** | **/** |
| 13 | Primary / Secondary Max Operating Temperature (ºF / ºF) | | | **/** | **/** |
| 14 | Primary / Secondary Max Operating Pressure (psi / ) | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 3 | Unit is pitched to accommodate condensate drainage (shell & tube w/ steam applications only). | | | YES | NO |
| 4 | Vacuum breaker installed on shell (shell & tube w/ steam applications only). | | | YES | NO |
| 5 | Safety relief valve installed between unit and isolation valves. | | | YES | NO |
| 6 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 7 | Adequate clearance around unit for service. | | | YES | NO |
| 8 | All components accessible for maintenance. | | | YES | NO |
| 9 | Unit sections attached per manufacturer instructions (plate heat exchangers only). | | | YES | NO |
| 10 | Unit is level. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PRIMARY WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Temperature and pressure gauges installed on inlet and outlet piping. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *PRIMARY STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Piping arranged for ease of unit removal. | | | YES | NO |
| 6 | Piping supported as required by specifications. | | | YES | NO |
| 7 | Piping is clean. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *SECONDARY WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Temperature and pressure gauges installed on inlet and outlet piping. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *SECONDARY STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Piping arranged for ease of unit removal. | | | YES | NO |
| 6 | Piping supported as required by specifications. | | | YES | NO |
| 7 | Piping is clean. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Pressure gauges supplied on supply lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Safety items installed and verified (pump failure, high temperature, etc.) | | | YES | NO |
| 3 | Test ports installed near all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | System starts without any unusual noise or vibration. | | | YES | NO |
| 3 | All bolted and gasketed joints/connections tightened and checked for leaks. | | | YES | NO |
| 4 | Manufacturer’s startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | General heat exchange sequence verified and acceptable. | | | YES | NO |
| 2 | Converter sequence verified and acceptable. | | | YES | NO |
| 3 | Steam to steam humidification sequence verified and acceptable. | | | YES | NO |
| 4 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 5 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 62 13 – Air Cooled Chillers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (tons) | | |  |  |
| 5 | Compressor Type | | |  |  |
| 6 | Refrigerant Type | | |  |  |
| 7 | Compressor Motor Power (hp) | | |  |  |
| 8 | # of Condenser Fans | | |  |  |
| 9 | Condenser Motor Speed / Power per Fan (rpm / hp) | | | **/** | **/** |
| 10 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components/accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 3 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Unit location is clear of trees, rubbish, dust, etc. to prevent fouling. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Access ladder reaches grade level. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *REFRIGERENT PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Filter driers of type specified for given unit capacity installed. | | | YES | NO |
| 3 | Sight glasses provided for each circuit per specification requirements. | | | YES | NO |
| 4 | Piping arranged for ease of unit removal. | | | YES | NO |
| 5 | Piping supported as required by specifications. | | | YES | NO |
| 6 | Piping is clean. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 9 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Flexible connections used for chilled water piping connections. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 6 | Local alarms and safeties wiring installed and operational. | | | YES | NO |
| 7 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | System filled and charged with correct refrigerant and oil. | | | YES | NO |
| 3 | Unit is clean. | | | YES | NO |
| 4 | Fans and motors lubricated and aligned. | | | YES | NO |
| 5 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 6 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 7 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 8 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 9 | All bent or crushed fins have been combed out. | | | YES | NO |
| 10 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 11 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 12 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | Unloading sequence programmed and verified to be operational. | | | YES | NO |
| 2 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| 3 | Chiller sequencing verified and acceptable. | | | YES | NO |
| 4 | Chilled water temperature reset sequence verified and acceptable. | | | YES | NO |
| 5 | Local alarms tested and verified to generate general alarm at BAS head end. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 64 15 – Water Cooled Chillers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (tons) | | |  |  |
| 5 | Compressor Type | | |  |  |
| 6 | Refrigerant Type | | |  |  |
| 7 | Compressor Motor Power (hp) | | |  |  |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components/accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit is registered with the WI Dept. of Commerce in accordance with Comm 45.07 (units ≥ 50 tons using Group A1 or Group B1 refrigerants). | | | YES | NO |
| 2 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 3 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 4 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 5 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 6 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 7 | Pump out system provided for units with >1000 lbs. of refrigerant. | | | YES | NO |
| 8 | Refrigerant monitor installed per manufacturer directions with sampling tube placed per specifications. | | | YES | NO |
| 9 | Adequate clearance around unit for service. | | | YES | NO |
| 10 | All components accessible for maintenance. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *REFRIGERENT PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Relief valves provided for condenser and evaporator. Vent piping extended to exterior of the building and terminated at least 20-feet away from fresh air intakes, operable windows and doors. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 8 | All valves and test ports are easily accessible. | | | YES | NO |
| 9 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CHILLED WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Flexible connections used for chilled water piping connections. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONDENSER WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Flexible connections used for condenser water piping connections. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 6 | Local alarms and safeties wiring installed and operational. | | | YES | NO |
| 7 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed, filled, and air purged. | | | YES | NO |
| 2 | Unit pressure and vacuum tested and results are acceptable. | | | YES | NO |
| 3 | System filled and charged with correct refrigerant and oil. | | | YES | NO |
| 4 | Unit is clean. | | | YES | NO |
| 5 | Motors lubricated and aligned. | | | YES | NO |
| 6 | Oil sump heater operational and temperature setpoint set per manufacturer recommendations. | | | YES | NO |
| 7 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 8 | Unit insulated per specification requirements. | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Lead/lag sequence verified and acceptable. | | | YES | NO |
| 2 | Chiller sequencing verified and acceptable. | | | YES | NO |
| 3 | Chilled water temperature reset sequence verified and acceptable. | | | YES | NO |
| 4 | Local alarms tested and verified to generate general alarm at BAS head end. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 65 00 – Cooling Towers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Tower Type | | |  |  |
| 5 | Cooling Capacity (MBH / gpm) | | | **/** | **/** |
| 5 | Fan Speed / Power (rpm / hp) | | | **/** | **/** |
| 7 | Basin Heater Capacity (kW) | | | **/** | **/** |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Unit is isolated from the building structure (to reduce vibration and noise). | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Unit location is clear of trees, rubbish, dust, etc. to prevent fouling. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Access ladder reaches grade level. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *MAKE-UP WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Make-up float has been adjusted to sump maximum capacity level. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *DRAIN PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Sump drain and overflow piping routed to nearest drain per contract documents. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | All valves are easily accessible. | | | YES | NO |
| 10 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONDENSER WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and sump filled. | | | YES | NO |
| 2 | Unit, sump strainers and nozzles are clean. | | | YES | NO |
| 3 | Fans, motors and gearbox lubricated and aligned. | | | YES | NO |
| 4 | Fan pitch adjusted. | | | YES | NO |
| 5 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 6 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 7 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 8 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 9 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 10 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| 12 | System water treatment completed and report submitted. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Condenser water temperature setpoint method programmed and verified. | | | YES | NO |
| 2 | Condenser pump and chiller interlock verified and operational. | | | YES | NO |
| 3 | Condenser water bypass sequence verified and acceptable. | | | YES | NO |
| 4 | Fan control sequence verified and acceptable. | | | YES | NO |
| 5 | All safeties and alarms verified and acceptable. | | | YES | NO |
| 6 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 65 00 – Remote Cooling Tower Sumps

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Storage Capacity (gal.) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is set on concrete housekeeping pad and is level. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Manhole provided for access to tank and make-up water valve. | | | YES | NO |
| 7 | Vent pipe provided as specified in contract documents. | | | YES | NO |
| 8 | Gauge glass provided for unit. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *MAKE-UP WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to supply piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Make-up float has been adjusted to sump maximum capacity level. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *DRAIN PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Sump drain and overflow piping routed to nearest drain per contract documents. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | All valves are easily accessible. | | | YES | NO |
| 10 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONDENSER WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Thermometers and pressure gauges supplied on supply and return lines. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and tank filled. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 72 00 – Air-to-Air Heat Exchangers-Fixed Plate

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 6 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 7 | Exhaust Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 8 | Pre-Heat Capacity (kW) (if applicable) | | |  |  |
| 9 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit is level. | | | YES | NO |
| 9 | Condensate/washdown drain pan slopes correctly and is piped to nearest drain. | | | YES | NO |
| 10 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| 12 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 5 | Filter gauges and thermometers installed at unit inlets and outlets of both airstreams. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Washdown piped to each side of heat exchanger. | | | YES | NO |
| 3 | Piping arranged for ease of unit removal. | | | YES | NO |
| 4 | Piping supported independent of unit and as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | All valves and test ports are easily accessible. | | | YES | NO |
| 9 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Washdown valve wiring installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | All bent or crushed fins have been combed out. | | | YES | NO |
| 8 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | Economizer sequence verified and acceptable. | | | YES | NO |
| 2 | Pre-heat sequence verified and acceptable (if applicable). | | | YES | NO |
| 3 | Maintenance sequence verified and acceptable. | | | YES | NO |
| 4 | Washdown sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 72 00 – Air-to-Air Heat Exchangers-Heat Pipe

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 6 | Refrigerant Type | | | **/** | **/** |
| 7 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 8 | Exhaust Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 9 | Pre-Heat Capacity (kW) (if applicable) | | |  |  |
| 10 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit is level. | | | YES | NO |
| 9 | Condensate drain pan slopes correctly and is piped to nearest drain. | | | YES | NO |
| 10 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| 12 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 5 | Filter gauges and thermometers installed at unit inlets and outlets of both airstreams. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | All bent or crushed fins have been combed out. | | | YES | NO |
| 8 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Economizer sequence verified and acceptable (if applicable). | | | YES | NO |
| 2 | Pre-heat sequence verified and acceptable (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 72 00 – Air-to-Air Heat Exchangers - Rotary Wheels

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 6 | Energy Recovery Wheel Type | | | **/** | **/** |
| 7 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 8 | Exhaust Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 9 | Heat Exchanger Wheel Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 10 | Pre-Heat Capacity (kW) (if applicable) | | |  |  |
| 11 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit is level. | | | YES | NO |
| 9 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 10 | Unit labeled and is easy to see. | | | YES | NO |
| 11 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 5 | Filter gauges and thermometers installed at unit inlets and outlets of both airstreams. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Rotation detector wiring installed and communication verified. | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Heat Exchanger wheel and motor lubricated and aligned. | | | YES | NO |
| 4 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 5 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 6 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 7 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 8 | Heat Exchanger wheel seals have been adjusted according to manufacturer specifications. | | | YES | NO |
| 9 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 10 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 11 | Final filters installed. | | | YES | NO |
| 12 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Economizer sequence verified and acceptable (if applicable). | | | YES | NO |
| 2 | Frost protection sequence verified and acceptable (if applicable). | | | YES | NO |
| 3 | Pre-heat sequence verified and acceptable (if applicable). | | | YES | NO |
| 4 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 12 – Refrigerant Coils

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Refrigerant Type | | |  |  |
| 5 | # Rows | | | **/** | **/** |
| 6 | Equipment or Area Served | | |  |  |
| 7 | Cooling Capacity (MBH) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The refrigerant openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit and adjoining ductwork sealed as per specifications. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | 1-1/2" deep 18 gauge welded stainless steel drain pan provided for duct mounted or field erected AHU coils. | | | YES | NO |
| 6 | Unit is labeled and is easy to see | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION* | | | | |
| 1 | Temperature sensor installed and calibration verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *MECHANICAL STARTUP* | | | | |
| 1 | System purged and filled with correct refrigerant type and charge. | | | YES | NO |
| 2 | Bent or crushed fins combed out. | | | YES | NO |
| 3 | Dust and debris cleaned from unit casing and face. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS STARTUP* | | | | |
| 1 | Point-to-point connections of control wiring verified | | | YES | NO |
| 2 | Central system accurately represents conditions of unit. | | | YES | NO |
| 3 | Cooling sequence of control verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 12 – Steam Coils

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | # Rows | | | **/** | **/** |
| 5 | Equipment or Area Served | | |  |  |
| 6 | Total Heating Capacity (MBH / lb/hr) | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit and adjoining ductwork sealed as per specifications. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 6 | Vacuum breakers provided at coil inlets and outlets. | | | YES | NO |
| 7 | Flexible pipe connection provided at condensate outlet of coil if required by the manufacturer’s installation instructions. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION* | | | | |
| 1 | Temperature sensor installed and calibration verified. | | | YES | NO |
| 2 | Steam valve actuator installed and operational. | | | YES | NO |
| 3 | Damper operator is readily accessible for inspection and service (integral face and bypass coils only). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and filled. | | | YES | NO |
| 2 | Bent or crushed fins combed out. | | | YES | NO |
| 3 | Dust and debris cleaned from unit casing and face. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS STARTUP* | | | | |
| 1 | Point-to-point connections of control wiring verified | | | YES | NO |
| 2 | Central system accurately represents conditions of unit. | | | YES | NO |
| 3 | Heating sequence of control verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 12 – Water Coils

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Coil Type / # Rows | | | **/** | **/** |
| 5 | Equipment or Area Served | | |  |  |
| 6 | Capacity / Flow (MBH / gpm) | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit and adjoining ductwork sealed as per specifications. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | 1-1/2" deep 18 gauge welded stainless steel drain pan provided for duct mounted or field erected AHU coils (chilled water and heat recovery coils only). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of AHU or ductwork. | | | YES | NO |
| 6 | Unit piped for counter flow arrangement. | | | YES | NO |
| 7 | Trap provided for condensate drain line and line run to nearest floor drain (chilled water coils ONLY). | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Sufficient clearance is provided around piping, fittings and valves to permit the application of full thickness insulation products as specified. | | |  |  |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping and/or pipe insulation when operated. | | | YES | NO |
| 12 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION* | | | | |
| 1 | Temperature sensor installed and calibration verified. | | | YES | NO |
| 2 | Water valve actuator installed and operational. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and filled. | | | YES | NO |
| 2 | Bent or crushed fins combed out. | | | YES | NO |
| 3 | Dust and debris cleaned from unit casing and face. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS STARTUP* | | | | |
| 1 | Point-to-point connections of control wiring verified | | | YES | NO |
| 2 | Central system accurately represents conditions of unit. | | | YES | NO |
| 3 | Heating or cooling sequence of control verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 13 – Modular Indoor Central-Station AHU

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 6 | Outside Air Flow (cfm) | | |  |  |
| 7 | Cooling Capacity (MBH / gpm) (if applicable) | | |  |  |
| 8 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 9 | Refrigerant Type (if applicable) | | |  |  |
| 10 | Cooling Coil # of Rows (if applicable) | | |  |  |
| 11 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 12 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 13 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | |  |  |
| 14 | Heating Coil # of Rows (if applicable) | | |  |  |
| 15 | Energy Recovery Wheel Type (if applicable) | | | **/** | **/** |
| 16 | Energy Recovery Capacity (MBH / gpm) (if applicable) | | |  |  |
| 17 | Energy Recovery Coil # of Rows (if applicable) | | |  |  |
| 18 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 19 | Exhaust Fan Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 20 | Energy Recovery Wheel Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 21 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| 22 | NEMA Nominal efficiency | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Concrete housekeeping pad or other support method is of sufficient height to accommodate condensate trap depth. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit sections attached per manufacturer instructions. | | | YES | NO |
| 9 | Unit is level and all sections plumb and square. | | | YES | NO |
| 10 | Cooling coil drain pan slopes correctly (if applicable). | | | YES | NO |
| 11 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 12 | Unit labeled and is easy to see. | | | YES | NO |
| 13 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *CHILLED WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Coil connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Unit piped for counter flow arrangement. | | | YES | NO |
| 8 | Trap provided for condensate drain line and line run to nearest floor drain. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *HOT WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 10 | Vacuum breakers provided at coil inlets and outlets. | | | YES | NO |
| 11 | Flexible pipe connection provided at unit bottom outlet of coil if required by the manufacturer’s installation instructions (face and bypass coils only). | | | YES | NO |
| 12 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 13 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 14 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *ENERGY RECOVERY WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | Motor NEMA Nominal Efficiency complies with the requirements of 23 05 13 | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| 7 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Safety items installed and verified (freezestat, high pressure, motor overload, etc.) | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Energy recovery wheel and motor lubricated and aligned (if applicable). | | | YES | NO |
| 4 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 5 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 6 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 7 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 8 | Energy recovery wheel seals have been adjusted according to manufacturer specifications | | | YES | NO |
| 9 | All bent or crushed fins have been combed out. | | | YES | NO |
| 10 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 11 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 12 | Final filters installed. | | | YES | NO |
| 13 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *M* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Heating optimum start sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 4 | Cooling optimum start sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 5 | Economizer sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 6 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 7 | Face and bypass heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 8 | CO2 reset sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 9 | Smoke damper interlock verified and acceptable. | | | YES | NO |
| 10 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 23 – Factory Fabricated Custom Air Handling Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 6 | Outside Air Flow (cfm) | | |  |  |
| 7 | Cooling Capacity (MBH / gpm) (if applicable) | | |  |  |
| 8 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 9 | Refrigerant Type (if applicable) | | |  |  |
| 10 | Cooling Coil # of Rows (if applicable) | | |  |  |
| 11 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 12 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 13 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | |  |  |
| 14 | Heating Coil # of Rows (if applicable) | | |  |  |
| 15 | Energy Recovery Wheel Type (if applicable) | | | **/** | **/** |
| 16 | Energy Recovery Capacity (MBH / gpm) (if applicable) | | |  |  |
| 17 | Energy Recovery Coil # of Rows (if applicable) | | |  |  |
| 18 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 19 | Exhaust Fan Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 20 | Energy Recovery Wheel Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 21 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| 22 | NEMA Nominal efficiency | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Concrete housekeeping pad or other support method is of sufficient height to accommodate condensate trap depth. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit sections attached per manufacturer instructions. | | | YES | NO |
| 9 | Unit is level and all sections plumb and square. | | | YES | NO |
| 10 | Cooling coil drain pan slopes correctly (if applicable). | | | YES | NO |
| 11 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 12 | Unit labeled and is easy to see. | | | YES | NO |
| 13 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *CHILLED WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Coil connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Unit piped for counter flow arrangement. | | | YES | NO |
| 8 | Trap provided for condensate drain line and line run to nearest floor drain. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *HOT WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| 14 | Valve tags attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 10 | Vacuum breakers provided at coil inlets and outlets. | | | YES | NO |
| 11 | Flexible pipe connection provided at unit bottom outlet of coil if required by the manufacturer’s installation instructions (face and bypass coils only). | | | YES | NO |
| 12 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 13 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 14 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *ENERGY RECOVERY WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | Motor NEMA Nominal Efficiency complies with the requirements of 23 05 13 | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| 7 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Safety items installed and verified (freezestat, high pressure, motor overload, etc.) | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Energy recovery wheel and motor lubricated and aligned (if applicable). | | | YES | NO |
| 4 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 5 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 6 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 7 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 8 | Energy recovery wheel seals have been adjusted according to manufacturer specifications | | | YES | NO |
| 9 | All bent or crushed fins have been combed out. | | | YES | NO |
| 10 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 11 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 12 | Final filters installed. | | | YES | NO |
| 13 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *M* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Heating optimum start sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 4 | Cooling optimum start sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 5 | Economizer sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 6 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 7 | Face and bypass heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 8 | CO2 reset sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 9 | Smoke damper interlock verified and acceptable. | | | YES | NO |
| 10 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 73 24 – Factory Fabricated Custom Laboratory Exhaust Energy Recovery Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 5 | Energy Recovery Capacity (MBH / gpm) (if applicable) | | |  |  |
| 6 | Energy Recovery Coil # of Rows (if applicable) | | |  |  |
| 7 | Exhaust Fan Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| 9 | NEMA Nominal efficiency | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Concrete housekeeping pad or other support method is of sufficient height to accommodate condensate trap depth. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit sections attached per manufacturer instructions. | | | YES | NO |
| 9 | Unit is level and all sections plumb and square. | | | YES | NO |
| 10 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| 12 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *ENERGY RECOVERY WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Sufficient clearance is provided between piping, fittings and valve to allow the application of full thickness pipe insulation. | | | YES | NO |
| 11 | Valve handles do not interfere with adjacent piping or pipe insulation when operated. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 3 | Flexible duct connections of proper material installed. | | | YES | NO |
| 4 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 5 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | Motor NEMA Nominal Efficiency complies with the requirements of 23 05 13 | | | YES | NO |
| 5 | All electrical connections are tight. | | | YES | NO |
| 6 | All electrical components are grounded. | | | YES | NO |
| 7 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Safety items installed and verified (freezestat, high pressure, motor overload, etc.) | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | All bent or crushed fins have been combed out. | | | YES | NO |
| 8 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | Sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Face and bypass heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

**CV-23 81 26 – Split System Ductless Air Conditioners**

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 5 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | |  |  |
| 6 | Compressor Type | | |  |  |
| 7 | Refrigerant Type | | |  |  |
| 8 | Fan Motor Speed / Power (rpm / hp) | | |  |  |
| 9 | Compressor Motor Power (hp) | | |  |  |
| 10 | # of Condenser Fans | | |  |  |
| 11 | Condenser Motor Speed / Power per Fan (rpm / hp) | | | **/** | **/** |
| 12 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Units are free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components/accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 3 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 4 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 5 | Outside Unit location is clear of trees, rubbish, dust, etc. to prevent fouling. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Units are level. | | | YES | NO |
| 9 | Cooling coil drain pan slopes correctly (if applicable). | | | YES | NO |
| 10 | Access ladder reaches grade level. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Trap provided for condensate drain line and line run to nearest floor drain. | | |  |  |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 7 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 8 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 2 | Control wiring between inside and outside units verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Local alarms and safeties wiring installed and operational. | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | System filled and charged with correct refrigerant and oil. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Fans and motors lubricated and aligned. | | | YES | NO |
| 4 | Filters cleaned and installed. | | | YES | NO |
| 5 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 6 | All bent or crushed fins have been combed out. | | | YES | NO |
| 7 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 8 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 9 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 4 | Local alarms tested and verified to generate general alarm at BAS head end. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| ***Group/***  ***Item*** | ***Date***  ***Found*** | ***Found***  ***By*** | ***Reason for Negative Response*** | ***Resolved*** | ***Date***  ***Resolved*** | ***Resolution*** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | ***YES / NO*** |  |  |
|  |  |  |  | ***YES / NO*** |  |  |
|  |  |  |  | ***YES / NO*** |  |  |
|  |  |  |  | ***YES / NO*** |  |  |
|  |  |  |  | ***YES / NO*** |  |  |

CV-23 82 00 – Cabinet Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (cfm) | | |  |  |
| 5 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 6 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 7 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | | **/** | **/** |
| 8 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 9 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs (if applicable). | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Unit installed a minimum of 6” above finished floor level for toilet and shower spaces (if applicable). | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| 7 | Construction filters installed. | | | YES | NO |
| 8 | Protective covering applied. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Drain valve, and vent line provided at coil. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | Motor rotation in the proper direction | | | YES | NO |
| 3 | All electrical connections are tight | | | YES | NO |
| 4 | All electrical components are grounded | | | YES | NO |
| 5 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 2 | Remote status wiring installed and communication verified. | | | YES | NO |
| 3 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 4 | Strap on aquastat installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Fan and motor lubricated and aligned. | | | YES | NO |
| 4 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 6 | Final filters installed. | | | YES | NO |
| 7 | Temperature setpoint for unit mounted thermostat set per contract documents (if applicable). | | | YES | NO |
| 8 | Unit access doors and cover can be opened and closed without damage to unit or wall/ceiling finish. | | | YES | NO |
| 9 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Remote start/stop from BAS verified and acceptable. | | | YES | NO |
| 2 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 3 | Aquastat setpoint set to 100ºF and operation verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Convectors

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 5 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 6 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | | **/** | **/** |
| 7 | Voltage / Phase / Frequency (V / - / Hz) (if applicable) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs (if applicable). | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Unit installed a minimum of 6” above finished floor level for toilet and shower spaces (if applicable). | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| 7 | Protective covering applied. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Drain valve, and vent line provided at coil. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL (if applicable)* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | All electrical connections are tight | | | YES | NO |
| 3 | All electrical components are grounded | | | YES | NO |
| 4 | Element inspected for damage prior to applying power. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Unit access doors and cover can be opened and closed without damage to unit or wall/ceiling finish. | | | YES | NO |
| 4 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 2 | Outside air lockout sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Fan Coil Units

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Cooling Capacity (MBH / gpm) (if applicable) | | |  |  |
| 6 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 7 | Refrigerant Type (if applicable) | | |  |  |
| 8 | Cooling Coil # of Rows (if applicable) | | |  |  |
| 9 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 10 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 11 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | |  |  |
| 12 | Heating Coil # of Rows (if applicable) | | |  |  |
| 13 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 14 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 3 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit is level. | | | YES | NO |
| 7 | Cooling coil drain pan slopes correctly (if applicable). | | | YES | NO |
| 8 | Shipping bolts have been removed. | | | YES | NO |
| 9 | Unit labeled and is easy to see. | | | YES | NO |
| 10 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *CHILLED WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Coil connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Trap provided for condensate drain line and line run to nearest floor drain. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *HOT WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 10 | Vacuum breakers provided at coil inlets and outlets. | | | YES | NO |
| 11 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS INSTALLATION* | | | | |
| 1 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 2 | Remote status wiring installed and communication verified. | | | YES | NO |
| 3 | Strap on aquastat installed and communication verified (CHW and HW coil applications ONLY). | | | YES | NO |
| 4 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fan and motor lubricated and aligned. | | | YES | NO |
| 3 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 4 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 5 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 6 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 7 | All bent or crushed fins have been combed out. | | | YES | NO |
| 8 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 9 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 10 | Final filters installed. | | | YES | NO |
| 11 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 4 | Aquastat setpoint set to and operation verified for each aquastat present (CHW and HW coil applications ONLY). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Fin Tube Radiation

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 5 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 6 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | | **/** | **/** |
| 7 | Total Enclosed Length (ft) | | |  |  |
| 8 | Element Length (ft) | | |  |  |
| 9 | Voltage / Phase / Frequency (V / - / Hz) (if applicable) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs (if applicable). | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Unit installed a minimum of 6” above finished floor level for toilet and shower spaces (if applicable). | | | YES | NO |
| 4 | Adequate clearance around unit for service. | | | YES | NO |
| 5 | All components accessible for maintenance. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| 7 | Protective covering applied. | | | YES | NO |
| 8 | Dirt guard gasket at mounting strip or caulk along top of mounting strip has been installed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Drain valve, and vent line provided at coil. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Access door provided in front of each valve, strainer, etc. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| 12 | Access door provided in front of each valve, strainer, trap, etc. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL (if applicable)* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | All electrical connections are tight | | | YES | NO |
| 3 | All electrical components are grounded | | | YES | NO |
| 4 | Element inspected for damage prior to applying power. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Unit access doors and cover can be opened and closed without damage to unit or wall/ceiling finish. | | | YES | NO |
| 4 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 2 | Outside air lockout sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Reheat Coils

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Equipment or Area Served | | |  |  |
| 5 | Capacity (cfm) | | |  |  |
| 6 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 7 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 8 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | | **/** | **/** |
| 9 | Pressure Drop Air / Water (in. wc / ft. wc). | | | **/** | **/** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Water openings are sealed with plastic plugs (if applicable). | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit supported independent of piping and ductwork as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Bent or crushed fins have been combed an unit is clean prior to finalization of ductwork. | | | YES | NO |
| 4 | Coil casings pitched in accordance with manufacturer's instructions. | | | YES | NO |
| 5 | Minimum straight ductwork lengths provided prior to and proceeding unit per manufacturer directions (electric coils ONLY). | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit labeled and is easy to see. | | | YES | NO |
| 9 | Access doors provided upstream and downstream of coil. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Units with multiple rows piped for counter flow arrangement. | | | YES | NO |
| 4 | Piping supported as required by specifications. | | | YES | NO |
| 5 | Piping is clean. | | | YES | NO |
| 6 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 7 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 8 | Drain valve, and vent line provided at coil. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL (if applicable)* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | All electrical connections are tight | | | YES | NO |
| 3 | All electrical components are grounded | | | YES | NO |
| 4 | Element inspected for damage prior to applying power. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION* | | | | |
| 1 | Discharge air temperature sensor installed and communication verified. | | | YES | NO |
| 2 | Thermostat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | **Response** |
| --- | --- | --- |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Unit Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (cfm) | | |  |  |
| 5 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 6 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 7 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | | **/** | **/** |
| 8 | Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 9 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | The water openings are sealed with plastic plugs (if applicable). | | | YES | NO |
| 3 | All components present. (Air flow diffusers, Fan blade guards, etc.) | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit suspended at height specified in contract documents as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit labeled and is easy to see. | | | YES | NO |
| 6 | Protective covering applied. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | Drain valve, and vent line provided at coil. | | | YES | NO |
| 8 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in an accessible location | | | YES | NO |
| 2 | Motor rotation in the proper direction | | | YES | NO |
| 3 | All electrical connections are tight | | | YES | NO |
| 4 | All electrical components are grounded | | | YES | NO |
| 5 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *CONTROLS INSTALLATION (if applicable)* | | | | |
| 1 | Thermostat wiring installed and communication verified. | | | YES | NO |
| 2 | Strap on aquastat installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *MECHANICAL STARTUP* | | | | |
| 1 | Protective coverings removed. | | | YES | NO |
| 2 | Unit is clean. | | | YES | NO |
| 3 | Fan and motor lubricated and aligned. | | | YES | NO |
| 4 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 5 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 6 | Temperature setpoint for unit mounted thermostat set per contract documents (if applicable). | | | YES | NO |
| 7 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *CONTROLS STARTUP (if applicable)* | | | | |
| 1 | Temperature control sequence verified and acceptable. | | | YES | NO |
| 2 | Aquastat setpoint set to 100ºF and operation verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 82 00 – Unit Ventilators

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Supply Air Flow / External Static Pressure (cfm / in W.C.) | | | **/** | **/** |
| 5 | Exhaust Air Flow / External Static Pressure (cfm / in W.C.) (if applicable) | | | **/** | **/** |
| 6 | Outside Air Flow (cfm) | | |  |  |
| 7 | Cooling Capacity (MBH / gpm) (if applicable) | | |  |  |
| 8 | Cooling Capacity (MBH) (if applicable) | | |  |  |
| 9 | Refrigerant Type (if applicable) | | |  |  |
| 10 | Cooling Coil # of Rows (if applicable) | | |  |  |
| 11 | Total Heating Capacity (kW) (if applicable) | | |  |  |
| 12 | Total Heating Capacity (MBH / gpm) (if applicable) | | | **/** | **/** |
| 13 | Total Heating Capacity (MBH / lb/hr) (if applicable) | | |  |  |
| 14 | Heating Coil # of Rows (if applicable) | | |  |  |
| 15 | Energy Recovery Wheel Type (if applicable) | | | **/** | **/** |
| 16 | Energy Recovery Capacity (MBH / gpm) (if applicable) | | |  |  |
| 17 | Supply Fan Motor Speed / Power (rpm / hp) | | | **/** | **/** |
| 18 | Exhaust Fan Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 19 | Energy Recovery Wheel Motor Speed / Power (rpm / hp) (if applicable) | | | **/** | **/** |
| 20 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | All openings are sealed with plastic plugs or sheeting. | | | YES | NO |
| 3 | All components present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Concrete housekeeping pad or other support method to accommodate weight of unit provided. | | | YES | NO |
| 2 | Concrete housekeeping pad or other support method is of sufficient height to accommodate condensate trap depth. | | | YES | NO |
| 3 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 4 | Unit is totally isolated (without rigid contact) from structure, ductwork or other stationary equipment or devices. | | | YES | NO |
| 5 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 6 | Adequate clearance around unit for service. | | | YES | NO |
| 7 | All components accessible for maintenance. | | | YES | NO |
| 8 | Unit is level. | | | YES | NO |
| 9 | Cooling coil drain pan slopes correctly (if applicable). | | | YES | NO |
| 10 | Shipping bolts have been removed and internal isolators have free movement. | | | YES | NO |
| 11 | Unit labeled and is easy to see. | | | YES | NO |
| 12 | Construction filters provided in unit per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *CHILLED WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Coil connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Trap provided for condensate drain line and line run to nearest floor drain. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *REFRIGERANT PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *HOT WATER PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of coil removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Separate air vent and drain valve provided for each coil header outside of unit or ductwork. | | | YES | NO |
| 6 | Unit connected to water supply and return piping using unions or flanges and isolation valves. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Unit piped for counter flow arrangement. | | | YES | NO |
| 9 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 10 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 11 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *STEAM PIPING (if applicable)* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbow provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 10 | Vacuum breakers provided at coil inlets and outlets. | | | YES | NO |
| 11 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 12 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 13 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *DUCTWORK* | | | | |
| 1 | Adequate locations available for testing and balancing of unit. | | | YES | NO |
| 2 | Outdoor and return air arrangement will not freeze coils, i.e. outdoor air and return air is adequately mixed before reaching coils (if applicable). | | | YES | NO |
| 3 | All dampers and sensors are accessible (access panels). | | | YES | NO |
| 4 | Flexible duct connections of proper material installed. | | | YES | NO |
| 5 | All dampers close tightly and stroke fully and easily. | | | YES | NO |
| 6 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | Each motor terminal box is connected with a minimum 12", maximum 36" piece of flexible conduit to a fixed junction box. | | | YES | NO |
| 3 | Motor rotation is in correct direction. | | | YES | NO |
| 4 | All electrical connections are tight. | | | YES | NO |
| 5 | All electrical components are grounded. | | | YES | NO |
| 6 | Element inspected for damage prior to applying power (if applicable). | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS INSTALLATION* | | | | |
| 1 | All sensors and actuators installed per contract documents and are calibrated. | | | YES | NO |
| 2 | Remote start and stop wiring installed and communication verified. | | | YES | NO |
| 3 | Remote status wiring installed and communication verified. | | | YES | NO |
| 4 | Remote alarm wiring installed and communication verified. | | | YES | NO |
| 5 | Safety items installed and verified (freezestat, etc.) | | | YES | NO |
| 6 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *K* | *MECHANICAL STARTUP* | | | | |
| 1 | Unit is clean. | | | YES | NO |
| 2 | Fans and motors lubricated and aligned. | | | YES | NO |
| 3 | Energy recovery wheel and motor lubricated and aligned (if applicable). | | | YES | NO |
| 4 | Angular mis-alignment of motor and unit shafts does not exceed 0.02 in per diameter of coupling hub (if applicable). | | | YES | NO |
| 5 | Belt sheaves have been properly aligned per the specifications (if applicable). | | | YES | NO |
| 6 | Fan belts have proper tension and are in good condition (if applicable). | | | YES | NO |
| 7 | Protective shrouds for fan and belts in place and secure. | | | YES | NO |
| 8 | Energy recovery wheel seals have been adjusted according to manufacturer specifications | | | YES | NO |
| 9 | All bent or crushed fins have been combed out. | | | YES | NO |
| 10 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 11 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| 12 | Final filters installed. | | | YES | NO |
| 13 | All damage to unit finish is repaired. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *L* | *CONTROLS STARTUP* | | | | |
| 1 | Cooling sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 2 | Heating sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 3 | Unoccupied sequence of control verified and acceptable (if applicable). | | | YES | NO |
| 4 | All safeties and alarms verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 84 13 – Electric Steam Humidifiers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Water Service Type | | |  |  |
| 5 | # of Dispersion Tubes | | |  |  |
| 6 | Dispersion Tube Length (in) | | |  |  |
| 7 | Steam Capacity (lb/hr / kW) | | | **/** | **/** |
| 8 | Voltage / Phase / Frequency (V / - / Hz) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components and accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION – STEAM GENERATOR* | | | | |
| 1 | Unit secured and supported as required by manufacturer and specifications. | | | YES | NO |
| 2 | Equipment location coordinated with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. | | | YES | NO |
| 3 | Adequate clearance around unit for service. | | | YES | NO |
| 4 | All components accessible for maintenance. | | | YES | NO |
| 5 | Unit is level. | | | YES | NO |
| 6 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *INSTALLATION – DISPERSION TUBE(S)* | | | | |
| 1 | Dispersion tube(s) is located at location specified in contract documents for proper absorption distance, but no less than 10’ from any elbow, duct mounted equipment, or diffuser. | | | YES | NO |
| 2 | Dispersion tube(s) oriented with distributor holes facing up and grid deflected slightly toward duct penetration. | | | YES | NO |
| 3 | Dispersion tube(s) supported and oriented per manufacturer and specification requirements. | | | YES | NO |
| 4 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *WATER PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Unit connected to water supply piping using unions or flanges and isolation valves. | | | YES | NO |
| 6 | Dielectric fittings installed to isolate dis-similar pipe materials. | | | YES | NO |
| 7 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 8 | Pressure regulating valve set to water pressure as recommended by manufacturer. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 10 | All valves and test ports are easily accessible. | | | YES | NO |
| 11 | Drain installed and piped to nearest drain rated for boiling water. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *STEAM PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed per manufacturer instructions. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Piping arranged for ease of unit removal. | | | YES | NO |
| 6 | Piping supported as required by specifications. | | | YES | NO |
| 7 | Piping is clean. | | | YES | NO |
| 8 | Piping properly checked and free of leaks. | | | YES | NO |
| 9 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *ELECTRICAL* | | | | |
| 1 | Local disconnect installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| 4 | Immersion element inspected for damage prior to applying power. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS INSTALLATION* | | | | |
| 1 | Fill float wiring installed and communication verified. | | | YES | NO |
| 2 | Humidistat wiring installed and communication verified. | | | YES | NO |
| 3 | Differential pressure switch wiring installed and communication verified. | | | YES | NO |
| 4 | High limit humidistat wiring installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and tank filled. | | | YES | NO |
| 2 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 3 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Humidification output programmed at local control panel. | | | YES | NO |
| 2 | Relative humidity reset schedule programmed and verified. | | | YES | NO |
| 3 | Humidification sequence verified and acceptable. | | | YES | NO |
| 4 | Humidification high limit safety verified and acceptable. | | | YES | NO |
| 5 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 84 13 – Evaporative Humidifiers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | Capacity (cfm / gal/day) | | | **/** | **/** |
| 5 | Voltage / Phase / Frequency (V / - / Hz) | | | **/ /** | **/ /** |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components and accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Unit secured as required by manufacturer and specifications. | | | YES | NO |
| 2 | Adequate clearance around unit for service. | | | YES | NO |
| 3 | All components accessible for maintenance. | | | YES | NO |
| 4 | Unit labeled and is easy to see. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Piping arranged for ease of unit removal. | | | YES | NO |
| 3 | Piping supported as required by specifications. | | | YES | NO |
| 4 | Piping is clean. | | | YES | NO |
| 5 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 6 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 7 | All valves and test ports are easily accessible. | | | YES | NO |
| 8 | Drain pipe installed, trapped, and piped to nearest drain. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *ELECTRICAL* | | | | |
| 1 | Receptacle installed in accessible and visible location. | | | YES | NO |
| 2 | All electrical connections are tight. | | | YES | NO |
| 3 | All electrical components are grounded. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *F* | *CONTROLS INSTALLATION* | | | | |
| 1 | Humidistat wiring installed and communication verified. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *G* | *MECHANICAL STARTUP* | | | | |
| 1 | Evaporator pad installed. | | | YES | NO |
| 2 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 3 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *H* | *CONTROLS STARTUP* | | | | |
| 1 | Humidification output programmed at unit. | | | YES | NO |
| 2 | Humidification sequence verified and acceptable. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

CV-23 84 13 – Steam Grid Humidifiers

**Equipment Identification/Tag: \_\_\_\_\_\_**

**Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group/Item** | **Group/Task Description** | | | **Submitted** | **Delivered** |
| *A* | *MODEL VERIFICATION* | | | | |
| 1 | Manufacturer | | |  |  |
| 2 | Model | | |  |  |
| 3 | Serial Number | | |  |  |
| 4 | # of Dispersion Grids | | |  |  |
| 5 | Dispersion Grid Length (in) | | |  |  |
| 6 | Steam Capacity (lb/hr / kW) | | |  |  |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *B* | *PHYSICAL CHECKS* | | | | |
| 1 | Unit is free from physical damage. | | | YES | NO |
| 2 | Openings are sealed with plastic plugs. | | | YES | NO |
| 3 | All components and accessories present. | | | YES | NO |
| 4 | Installation and startup manual provided. | | | YES | NO |
| 5 | Unit tags affixed. | | | YES | NO |
| 6 | Manufacturer’s ratings readable/accurate | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *C* | *INSTALLATION* | | | | |
| 1 | Dispersion grid(s) is located at location specified in contract documents for proper absorption distance, but no less than 10’ from any elbow, duct mounted equipment, or diffuser. | | | YES | NO |
| 2 | Dispersion grid(s) oriented with distributor holes facing up and grid deflected slightly toward duct penetration. | | | YES | NO |
| 3 | Dispersion grid(s) supported and oriented per manufacturer and specification requirements. | | | YES | NO |
| 4 | Ductwork is clean and free of debris. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *D* | *STEAM PIPING* | | | | |
| 1 | All piping components have been installed (in the correct order) as required by contract document or manufacturer. | | | YES | NO |
| 2 | Strainer and isolation valve installed. | | | YES | NO |
| 3 | Proper condensate trap installed. | | | YES | NO |
| 4 | Piping pitched for proper condensate flow. | | | YES | NO |
| 5 | Minimum of three elbows provided in branch line to unit prior to coil connections | | | YES | NO |
| 6 | Piping arranged for ease of unit removal. | | | YES | NO |
| 7 | Piping supported as required by specifications. | | | YES | NO |
| 8 | Piping is clean. | | | YES | NO |
| 9 | Individual trap and sufficient vertical condensate head provided for unit. | | | YES | NO |
| 10 | Piping and valves properly checked and free of leaks. | | | YES | NO |
| 11 | Piping insulation is complete and installed as per specifications. | | | YES | NO |
| 12 | All valves and test ports are easily accessible. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *E* | *CONTROLS INSTALLATION* | | | | |
| 1 | Humidistat wiring installed and communication verified. | | | YES | NO |
| 2 | Differential pressure switch wiring installed and communication verified. | | | YES | NO |
| 3 | High limit humidistat wiring installed and communication verified. | | | YES | NO |
| 4 | Condensate temperature switch installed and communication verified. | | | YES | NO |
| 5 | Test ports installed at all control sensors. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *I* | *MECHANICAL STARTUP* | | | | |
| 1 | System flushed and air purged through grid at full steam pressure. | | | YES | NO |
| 2 | System starts and runs without any unusual noise or vibration. | | | YES | NO |
| 3 | Manufacturer's startup checklist completed and attached. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

| **Group/Item** | **Group/Task Description** | | | **Response** | |
| --- | --- | --- | --- | --- | --- |
| *J* | *CONTROLS STARTUP* | | | | |
| 1 | Humidification output programmed at local control panel. | | | YES | NO |
| 2 | Relative humidity reset schedule programmed and verified. | | | YES | NO |
| 3 | Humidification sequence verified and acceptable. | | | YES | NO |
| 4 | Humidification high limit safety verified and acceptable. | | | YES | NO |
| 5 | Condensate temperature limit sequence verified and acceptable. | | | YES | NO |
| 6 | Control wiring labeled per specification requirements. | | | YES | NO |
| **❑ CHECKLIST GROUP COMPLETE** | | **INITIALS:** |  | **DATE:** |  |

**Negative Responses**

| **Group/**  **Item** | **Date**  **Found** | **Found**  **By** | **Reason for Negative Response** | **Resolved** | **Date**  **Resolved** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |
|  |  |  |  | **YES / NO** |  |  |

FUNCTIONAL PERFORMANCE TEST FORMS

Edit the individual functional performance test forms and provide additional test forms as needed to reflect the functional performance test requirements of assemblies, components, equipment and systems to be commissioned on this project. Include test forms with final review documents; no submission is required at preliminary review.

Edit to provide test forms unique to the specific test requirements of the project and remove the “SAMPLE” watermark. Edited or unedited test forms may be used in the bidding documents. Unedited test forms must be edited by the A/E at the time of shop drawing submittal and accompany the submittals when returned to the contractor prior to functional performance testing. Incorporate changes to the contract documents into the test forms prior to testing. This option is preferred for medium and large projects where there are many functional performance tests to be done.

FPT-23 05 14 - Variable Frequency Drives

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of a variable frequency drive.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Return “on” command to normal operation.
   5. Place unit into bypass mode via bypass circuit or starter.
   6. Command unit to “off”.
   7. Verify unit de-energizes.
   8. Return system to normal operation.
2. Speed Control – Differential Pressure (if applicable)
   1. Verify unit and associated motor are in occupied mode. If not override system into occupied mode.
   2. Verify differential pressure setpoint for associated system is set to [XX] psi.
   3. Record current differential pressure for associated system.
   4. Record current output capacity or frequency of unit.
   5. Override differential pressure setpoint to be 2 psi above current differential pressure.
   6. Verify output capacity or frequency of unit increases.
   7. Allow associated system to stabilize for 10 minutes.
   8. Return system to normal operation.
   9. Verify output capacity or frequency of unit decreases to original readings.
3. Speed Control – Static Pressure (if applicable)
   1. Verify unit and associated motor are in occupied mode. If not override system into occupied mode.
   2. Verify static pressure setpoint for associated system is set to [XX] psi.
   3. Record current static pressure for associated system.
   4. Record current output capacity or frequency of unit.
   5. Override static pressure setpoint to be 2 psi above current static pressure.
   6. Verify output capacity or frequency of unit increases.
   7. Allow associated system to stabilize for 10 minutes.
   8. Return system to normal operation.
   9. Verify output capacity or frequency of unit decreases to original readings.
4. Speed Control – Differential Temperature (if applicable)
   1. Verify unit and associated motor are in occupied mode. If not override system into occupied mode.
   2. Verify differential temperature setpoint for associated system is set to [XXºF].
   3. Record current differential temperature for associated system.
   4. Record current output capacity or frequency of unit.
   5. Override differential temperature setpoint to be 5º above current differential temperature.
   6. Verify output capacity or frequency of unit decreases.
   7. Allow associated system to stabilize for 10 minutes.
   8. Return system to normal operation.
   9. Verify output capacity or frequency of unit increases to original readings.
5. Speed Control – CHW Temperature (if applicable)
   1. Verify unit and associated motor are in occupied mode. If not override system into occupied mode.
   2. Verify CHW temperature setpoint for associated system is set to [XXºF].
   3. Record current CHW temperature for associated system.
   4. Record current output capacity or frequency of unit.
   5. Override CHW temperature setpoint to be 5º above current CHW temperature.
   6. Verify output capacity or frequency of unit increases.
   7. Allow associated system to stabilize for 10 minutes.
   8. Return system to normal operation.
   9. Verify output capacity or frequency of unit decreases to original readings.

**Results**

**Remote Start/Stop:**

Unit is energized and de-energized when commanded by BAS? YES NO

Unit is de-energized when commanded by BAS, when in bypass mode? YES NO

**Speed Control – Differential Pressure (if applicable):**

|  |  |
| --- | --- |
| Differential Pressure Setpoint: |  |
| Differential Pressure: |  |
| Unit Output Capacity or Frequency: | **Y / N** |
| Unit increases and decreases output capacity or frequency in response to decreases and increases of differential pressure, respectively? | **Y / N** |

**Speed Control – Static Pressure (if applicable):**

|  |  |
| --- | --- |
| Static Pressure Setpoint: |  |
| Static Pressure: |  |
| Unit Output Capacity or Frequency: | **Y / N** |
| Unit increases and decreases output capacity or frequency in response to decreases and increases of static pressure, respectively? | **Y / N** |

**Speed Control – Differential Temperature (if applicable):**

|  |  |
| --- | --- |
| Differential Temperature Setpoint: |  |
| Differential Temperature: |  |
| Unit Output Capacity or Frequency: | **Y / N** |
| Unit increases and decreases output capacity or frequency in response to increases and decreases of differential temperature, respectively? | **Y / N** |

**Speed Control – CHW Temperature (if applicable):**

|  |  |
| --- | --- |
| CHW Temperature Setpoint: |  |
| CHW Temperature: |  |
| Unit Output Capacity or Frequency: | **Y / N** |
| Unit increases and decreases output capacity or frequency in response to decreases and increases of CHW temperature, respectively? | **Y / N** |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, differential pressure setpoint, differential pressure, static pressure setpoint, static pressure, differential temperature setpoint, differential temperature, temperature setpoint, temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 05 93 – Testing, Adjusting and Balancing Verification Test

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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**Objectives**

This test is performed to verify the accuracy of the testing, adjusting and balancing completed for the facility.

**Instrumentation**

AABC or NEBB specified equipment with specified accuracies.

**Sampling Methodology**

1. Major equipment air flow (i.e. AHU’s, fans, etc.): Sample air flow performance of 100 % of all major equipment shown in the construction documents for all sample points indicated.
2. Major equipment water flow (i.e. AHU’s, Chillers, Boilers, pumps, etc.): Sample water flow performance of 100 % of all major equipment shown in the construction documents for all sample points indicated.
3. Terminal devices air flow (i.e. terminal units, fan coil units, grilles, etc.): Sample air flow performance of 10% of all terminal units shown in the construction documents, with at least one sample for each terminal type for all sample points indicated.
4. Terminal and balancing devices water flow (i.e. Fan Coils, Terminal Units, Balancing valves, etc.): Sample water flow performance of 10% of all terminal units and all balance valves shown in the construction documents, with at least one sample for each terminal or valve type for all sample points indicated.
5. Critical terminal devices for Labs and Vivariums (VAV boxes, air valves, etc.): Sample air flow performance of (50%)(100 %) of all Critical terminal devices shown in the construction documents for all sample points indicated.

Note: Fume hoods will be tested by the Contractor furnishing the fume hood when they conduct the ASHRAE 110 test and calibrate the fume hood monitor.

**Procedure**

For each of the sample points listed under the results section, re-test the point in accordance with the procedures detailed within specification section 23 05 93. Verify procedures utilized concur with these documents and record findings in the results section below. In addition, for each point tested record the measured value and verify the result is within 10% of the original value recorded and within the specified tolerances of the design setting for the point.

Sample 100% of Terminal devices if 20% of devices sampled fall outside of either specified tolerance range of the completed Testing, Adjusting and Balancing Verification Test Results Table found in form FPT – 23 05 93, located in section 01 91 01 or 01 91 02.

Sample 100% Lab and Vivarium devices if 20% of devices sampled fall outside of either specified tolerance range of the completed Testing, Adjusting and Balancing Verification Test Results Table found in form FPT – 23 05 93, located in section 01 91 01 or 01 91 02.

**Results**

| **Sample Point Name** | **Procedure Compliant** | **Design** | **T&B Report Final Reading** | **Commission Test** | **Tolerance**  **Within 10% of T & B Report Final Reading** | **Within Tolerance Specified in 23 05 93** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| AHU – CFM Min | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – CFM Max | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – CFM OA-Min | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – CFM OA-Max | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – CFM RA-Min | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – CFM RA-Max | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – GPM Coil | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| AHU – GPM Coil | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Fan – CFM | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Fan - ESP | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Grille – CFM | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Grille – CFM | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Offset – CFM-Pressurization | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Pump – GPM | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| Pump – GPM | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| VAV – CFM Min | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
| VAV – CFM Max | 􀂉 YES 􀂉 NO |  |  |  | 􀂉 YES 􀂉 NO | 􀂉 YES 􀂉 NO |  |
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Edit and expand Table to match sampling methodology and project Design.

Triple duty valves for pumps operated by VFD are 100% open? YES NO

Diffusers and grilles with adjustable throw patterns adjusted to match contract documents? YES NO

Final ductwork control static pressure setpoint recorded? YES NO

Final hydronic control differential pressure setpoint recorded? YES NO

VAV box “k” factors recorded YES NO

Pump impeller required trimming completed YES NO

**Conclusion**

Acceptable Criteria: All points listed are within listed tolerances of design and original recordings and were recorded in accordance with TAB plan and/or NEBB standards.

**Comments:**

**Observations:**

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Static Pressure Setpoint (VFD fans ONLY), Hydronic Loop Differential Setpoint (VFD pumps ONLY).

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 09 23 - BAS Communication/Calibration

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

**Procedure**

1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
   1. Disconnect relay contacts.
   2. Force alarm condition by running a diagnostic protocol on the local control panel.
   3. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

**Results**

**Status & Actuation Points:**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Temperature, Pressure, Humidity Sensors:**

| Point Name | BAS Value | Measured Value | Tolerance | Accepted |
| --- | --- | --- | --- | --- |
|  |  |  |  | ❑ YES ❑ NO |

**Alarms and Safeties**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Conclusion**

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

N/A

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 09 24 - BAS Communication/Calibration

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

**Procedure**

1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
   1. Disconnect relay contacts.
   2. Force alarm condition by running a diagnostic protocol on the local control panel.
   3. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

**Results**

**Status & Actuation Points:**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Temperature, Pressure, Humidity Sensors:**

| Point Name | BAS Value | Measured Value | Tolerance | Accepted |
| --- | --- | --- | --- | --- |
|  |  |  |  | ❑ YES ❑ NO |

**Alarms and Safeties**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Conclusion**

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

N/A

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 09 25 - BAS Communication/Calibration

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

**Procedure**

1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
   1. Disconnect relay contacts.
   2. Force alarm condition by running a diagnostic protocol on the local control panel.
   3. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

**Results**

**Status & Actuation Points:**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Temperature, Pressure, Humidity Sensors:**

| Point Name | BAS Value | Measured Value | Tolerance | Accepted |
| --- | --- | --- | --- | --- |
|  |  |  |  | ❑ YES ❑ NO |

**Alarms and Safeties**

| Point Name | Communication Verified | Notes |
| --- | --- | --- |
|  | ❑ YES ❑ NO |  |

**Conclusion**

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

N/A

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 12 13 - Facility Fuel Oil Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of facility fuel oil pumps.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Lead/Lag (if applicable)
   1. Have associated system or BAS call for lead pump to energize.
   2. Verify that lead pump is energized and that building automation system reflects unit is operational.
   3. De-energize pump via local disconnect switch.
   4. Verify lag pump is energized and alarm is generated at local control panel or BAS head end.
   5. Return system to normal operation.

**Results**

**Lead/Lag (if applicable):**

Lead pump is energized when commanded by BAS? YES NO

Lag pump is energized on lead pump failure and alarm is generated at BAS head end? YES NO

**Conclusion**

Acceptable Criteria: Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Pump run status

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 21 13 - Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of HVAC pumps.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Lead/Lag (if applicable)
   1. Have associated system or BAS call for lead pump to energize.
   2. Verify that lead pump is energized and that building automation system reflects unit is operational.
   3. De-energize pump via local disconnect switch.
   4. Verify lag pump is energized and alarm is generated at BAS head end.
   5. Return system to normal operation.
2. AHU Coil Circulation (if applicable)
   1. Verify mixed air enable temperature setpoint for pump is 45ºF.
   2. Record current mixed air temperature.
   3. Override mixed air enable temperature to be 10º above current mixed air temperature.
   4. Verify pump is energized and allow to stabilize for 10 minutes.
   5. Return system to normal operation.
   6. Verify pump de-energizes.
3. Tertiary Loop (if applicable)
   1. Verify tertiary loop differential pressure setpoint is 10 psig.
   2. Record current tertiary loop differential pressure.
   3. Override tertiary loop differential pressure setpoint to be 2 psig below current differential pressure.
   4. Verify pump bypass valve opens fully and pump is de-energized.
   5. Allow system to stabilize for 5 minutes.
   6. Override tertiary loop differential pressure setpoint to be 2 psig above current differential pressure.
   7. Verify pump bypass valve closes fully and pump is energized.
   8. Allow system to stabilize for 5 minutes.
   9. Return system to normal operation.

**Results**

**Lead/Lag (if applicable):**

Lead pump is energized when commanded by BAS? YES NO

Lag pump is energized on lead pump failure and alarm is generated at BAS head end? YES NO

**AHU Coil Circulation (if applicable):**

|  |  |
| --- | --- |
| Mixed air enable temperature setpoint for pump is 45ºF? | Y / N |
| Mixed Air Temperature: |  |
| Pump is energized when mixed air temperatures is below setpoint? | Y / N |
| Pump is de-energized when mixed air temperatures is above setpoint? |  |

**Tertiary Loop (if applicable):**

|  |  |
| --- | --- |
| Tertiary loop differential pressure setpoint is 10 psig? | Y / N |
| Tertiary Loop Differential Pressure: |  |
| Pump bypass valve opens fully and pump is de-energized when tertiary loop differential pressure is above setpoint? | Y / N |
| Pump bypass valve closes fully and pump is energized when tertiary loop differential pressure is below setpoint? |  |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at the BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Pump run status, MAT, tertiary loop differential pressure

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 22 23 - Condensate Pumps

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of condensate pumps.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Lead/Lag
   1. Verify unit is de-energized. If not override unit via local disconnect.
   2. Fill tank to level just past lead float. (if insufficient condensate is available it may be necessary to remove vent pipe and fill manually with make-up water)
   3. Energize unit.
   4. Verify pump energizes and pumps down tank until lead float is dis-engaged.
   5. De-energize unit.
   6. Fill tank to level just past lag float.
   7. Energize unit.
   8. Verify lead and lag pumps energize and pump down tank until lead float is dis-engaged.
   9. Return system to normal operation.
2. Alarms and Safeties
   1. Verify unit is de-energized. If not override unit via local disconnect.
   2. Fill tank to level just past alarm float. (if insufficient condensate is available it may be necessary to remove vent pipe and fill manually with make-up water)
   3. Verify alarm is generated at local control panel and BAS head end.
   4. Energize unit.
   5. Verify lead and lag pumps energize and pump down tank until lead float is dis-engaged.
   6. Return system to normal operation.

**Results**

**Lead/Lag**:

Lead pump is energized on actuation of lead float? YES NO

Lead and lag pumps work in concert on actuation of lead and lag floats? YES NO

**Alarms and Safeties:**

Actuation of alarm float generates alarm at local control panel and BAS head end? YES NO

**Conclusion**

Acceptable Criteria: Unit pump energize in concert with associated floats. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, pump(s) status

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 34 00 - HVAC Fans

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of HVAC fan with associated system.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences, except fans controlled exclusively by interlock and/or switch which are to be verified under construction verification.

**Procedure**

1. Remote Start/Stop
   1. Verify fan is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Return “on” command to normal operation.
   5. Verify unit is energized.
   6. Return system to normal operation.
2. Thermostatically Controlled (Exhaust Applications)
   1. Record temperature setpoint of system/zone.
   2. Record current temperature of system/zone.
   3. If fan is on, adjust temperature setpoint to be 10º above current system/zone temperature.
   4. Verify fan is de-energized and allow to stabilize for 10 minutes.
   5. Return system to normal operation.
   6. If fan is off, adjust temperature setpoint to be 10º below current system/zone temperature.
   7. Verify fan is de-energized and allow to stabilize for 10 minutes.
   8. Return system to normal operation.
3. Thermostatically Controlled (Supply Applications)
   1. Record temperature setpoint of system/zone.
   2. Record current temperature of system/zone.
   3. If fan is on, adjust temperature setpoint to be 10º below current system/zone temperature.
   4. Verify fan is de-energized and allow to stabilize for 10 minutes.
   5. Return system to normal operation.
   6. If fan is off, adjust temperature setpoint to be 10º above current system/zone temperature.
   7. Verify fan is de-energized and allow to stabilize for 10 minutes.
   8. Return system to normal operation.
4. Blade Pitch (Vaneaxial Fans ONLY)
   1. Verify fan is in occupied mode. If not override system into occupied mode.
   2. Record static pressure setpoint of system.
   3. Record current static pressure of system.
   4. Adjust static pressure setpoint to be 1 in. W.C. below current system pressure.
   5. Visually verify fan blades uniformly and smoothly close down and allow to stabilize for 10 minutes.
   6. Return system to normal operation.
   7. Visually verify fan blades uniformly and smoothly open.

**Results**

**Remote Start/Stop:**

Unit is energized and de-energized when commanded by building automation system? YES NO

**Thermostatically Controlled (Exhaust Applications):**

|  |  |
| --- | --- |
| Initial Temperature Setpoint: |  |
| System/Zone Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Fan is energized or de-energized in response to increases and decreases of temperature setpoint? YES NO

**Thermostatically Controlled (Supply Applications):**

|  |  |
| --- | --- |
| Initial Temperature Setpoint: |  |
| System/Zone Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Fan is energized or de-energized in response to increases and decreases of temperature setpoint? YES NO

**Blade Pitch (Vaneaxial Fans ONLY):**

|  |  |
| --- | --- |
| Initial Static Pressure Setpoint: |  |
| System Static Pressure: |  |
| Adjusted Static Pressure Setpoint: |  |

Blades pitch closed in responses to a decreased static pressure setpoint in a uniform and smooth motion? YES NO

Blades pitch open in responses to an increased static pressure setpoint in a uniform and smooth motion? YES NO

**Conclusion**

Acceptable Criteria: Unit is energized when called upon by BAS. Unit is energized and de-energized in response to fluctuations in system or zone temperatures. Unit blades pitch closed and open uniformly and smoothly in response to fluctuations in system static pressure (vaneaxial fans ONLY).

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Fan run status, system/zone temperature, system static pressure, blade pitch

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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|  |  |  |

FPT-23 36 00 - Air Terminal

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the air terminal unit to maintain space temperatures.

**Instrumentatio**n

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of the total units present. However, areas specified as critical in nature are to be tested at a rate of all sequences for 100% of total unit presents.

**Procedure**

1. Cooling/Heating
   1. Steady State Operation
      1. Verify system is in occupied mode. If not override system into occupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record space temperature and setpoint temperature.
   2. Heating Step Change
      1. Adjust the temperature setpoint 10° higher than the current space temperatures so the space goes into the heating mode.
      2. Record space temperature, system temperature, and setpoint temperature.
      3. Verify that unit damper modulates to minimum.
      4. Return system to normal operation.
   3. Heating Step Change w/ Re-Heat Coil (if applicable)
      1. Adjust the temperature setpoint 10° higher than the current space temperatures so the space goes into the heating mode.
      2. Record space temperature, system temperature, and setpoint temperature.
      3. Verify that unit damper modulates to minimum and hot water/steam valve modulates open or electric coil is energized after damper has reached minimum position.
      4. Return system to normal operation.
   4. Cooling Step Change
      1. Adjust the temperature setpoint 10° lower than the current space temperatures so the space goes into the cooling mode.
      2. Record space temperature and setpoint temperature.
      3. Verify that the unit damper modulates open to maximum.
      4. Return system to normal operation.
   5. Cooling Step Change w/ Re-Heat Coil (if applicable)
      1. Adjust the temperature setpoint 10° lower than the current space temperatures so the space goes into the cooling mode.
      2. Record space temperature and setpoint temperature.
      3. Verify that the hot water/steam valve modulates closed or electric coil de-energizes and damper modulates open to maximum after valve has closed or coil is de-energized.
      4. Return system to normal operation.
2. Unoccupied Cooling/Heating (if applicable)
   1. Steady State Operation
      1. Verify system is in unoccupied mode. If not override system into unoccupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record space temperature and setpoint temperature.
   2. Heating Step Change
      1. Adjust the temperature setpoint 10° higher than the current space temperatures so the space goes into the heating mode.
      2. Record space temperature, system temperature, and setpoint temperature.
      3. Verify that unit damper modulates to minimum.
      4. Return system to normal operation.
   3. Heating Step Change w/ Re-Heat Coil (if applicable)
      1. Adjust the temperature setpoint 10° higher than the current space temperatures so the space goes into the heating mode.
      2. Record space temperature, system temperature, and setpoint temperature.
      3. Verify that unit damper modulates to minimum and hot water/steam valve modulates open or electric coil is energized after damper has reached minimum position.
      4. Return system to normal operation.
   4. Cooling Step Change
      1. Adjust the temperature setpoint 10° lower than the current space temperatures so the space goes into the cooling mode.
      2. Record space temperature and setpoint temperature.
      3. Verify that the unit damper modulates open to maximum.
      4. Return system to normal operation.
   5. Cooling Step Change w/ Re-Heat Coil (if applicable)
      1. Adjust the temperature setpoint 10° lower than the current space temperatures so the space goes into the cooling mode.
      2. Record space temperature and setpoint temperature.
      3. Verify that the hot water/steam valve modulates closed or electric coil de-energizes and damper modulates open to maximum after valve has closed or coil is de-energized.
      4. Return system to normal operation.
3. Occupancy Override (occupancy controlled applications ONLY)
   1. Manual Override (Thermostat Switch)
      1. Verify system is in unoccupied mode. If not override system into unoccupied mode.
      2. Allow the unit to stabilize for a minimum of 15 minutes.
      3. Depress manual override at space and verify unit status changes to occupied.
      4. Record occupancy override duration at BAS.
      5. Return system to normal operation.
   2. Occupancy Sensor
      1. Verify system is in unoccupied mode. If not override system into unoccupied mode.
      2. Verify minimum airflow setpoint is 0 cfm.
      3. Allow the unit to stabilize for a minimum of 15 minutes.
      4. Enter space and verify unit status changes to occupied.
      5. Record occupancy override duration at BAS.
      6. Return system to normal operation.
4. Constant Volume (if applicable)
   1. Steady State Operation
      1. Verify system is in occupied mode. If not override system into occupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record space temperature, setpoint temperature, air flow and air flow setpoint.
   2. Heating Step Change w/ Re-Heat Coil (if applicable)
      1. Adjust the temperature setpoint 10° higher than the current space temperatures so the space goes into the heating mode.
      2. Record space temperature, setpoint temperature, air flow and air flow setpoint.
      3. Verify hot water/steam valve modulates open or electric coil is energized.
      4. Return system to normal operation.
   3. Air Flow Step Change
      1. Adjust the air flow setpoint 100 cfm lower than the current air flow.
      2. Record air flow and air flow setpoint.
      3. Verify that damper modulates closed to maintain air flow.
      4. Return system to normal operation.
5. Fume Hood Tracking (air valve applications ONLY)
   1. Steady State Operation
      1. Verify system is in occupied mode. If not override system into occupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record air flow and air flow setpoint.
   2. Sash Closed
      1. Close sash at associated fume hood.
      2. Record air flow and air flow setpoint.
      3. Verify that damper modulates closed to minimum position.
      4. Return system to normal operation.
   3. Sash Open
      1. Open sash fully at associated fume hood.
      2. Record air flow and air flow setpoint.
      3. Verify that damper modulates open to maximum position.
      4. Return system to normal operation.
6. Exhaust/Return Air Flow Tracking (if applicable)
   1. Steady State Operation
      1. Verify system is in occupied mode. If not override system into occupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record supply air flow, exhaust/return air flow, air flow offset setpoint (relative to supply) and exhaust/return air flow setpoint.
   2. Air Flow Step Change
      1. Override supply air flow setpoint to be 100 cfm above current supply air flow.
      2. Record supply air flow, exhaust/return air flow, and exhaust/return air flow setpoint.
      3. Verify that damper modulates open to achieve elevated air flow requirements.
      4. Return system to normal operation.
7. Supply Air Flow Tracking (air valve applications ONLY)
   1. Steady State Operation
      1. Verify system is in occupied mode. If not override system into occupied mode.
      2. Allow the unit to operate at its current condition and stabilize for a minimum of 15 minutes.
      3. Record the following values:
         1. Total exhaust air flow
         2. Air flow offset setpoint (relative to exhaust)
         3. Supply air flow setpoint
         4. Supply air flow
         5. Space temperature
         6. Setpoint temperature
   2. Air Flow Step Change
      1. Override total exhaust air flow by opening all associated fume hoods within space.
      2. Record the following values:
         1. Total exhaust air flow
         2. Supply air flow setpoint
         3. Supply air flow
         4. Space temperature
         5. Setpoint temperature
      3. Verify that damper modulates open to achieve elevated air flow requirements and that hot water/steam valve modulates open or electric coil is energized.
      4. Return system to normal operation.
8. Differential Pressure Reset
   1. Verify system is in occupied mode. If not override system into occupied mode.
   2. Override unit into differential pressure reset mode.
   3. Verify damper closes fully.
   4. Return system to normal operation.

**Results**

**Cooling/Heating:**

| **Unit #** | **Mode** | **Setpoint**  **Temp. °F** | **Space**  **Temp. °F** | **Discharge**  **Temp. °F** | **Damper**  **Status** | **Valve/Coil**  **Status** | **Approved** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Steady |  |  |  |  |  | Y / N |
| Heat |  |  |  |  |  | Y / N |
| Cool |  |  |  |  |  | Y / N |

**Unoccupied Cooling/Heating (if applicable):**

| **Unit #** | **Mode** | **Setpoint**  **Temp. °F** | **Space**  **Temp. °F** | **Discharge**  **Temp. °F** | **Damper**  **Status** | **Valve/Coil**  **Status** | **Approved** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Steady |  |  |  |  |  | Y / N |
| Heat |  |  |  |  |  | Y / N |
| Cool |  |  |  |  |  | Y / N |

**Occupancy Override (occupancy controlled applications ONLY):**

*Manual Override (Thermostat Switch)*

| **Unit #** | **Override**  **Duration, min** | **Approved** |
| --- | --- | --- |
|  |  | Y / N |

*Occupancy Sensor*

| **Unit #** | **Override**  **Duration, min** | **Min**  **Air Flow, cfm** | **Approved** |
| --- | --- | --- | --- |
|  |  |  | Y / N |

**Constant Volume (if applicable):**

| **Unit #** | **Mode** | **Setpoint**  **Temp.**  **°F** | **Space**  **Temp.**  **°F** | **Setpoint**  **Air Flow**  **cfm** | **Air Flow**  **cfm** | **Discharge**  **Temp. °F** | **Damper**  **Status** | **Valve/Coil**  **Status** | **Approved** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Steady |  |  |  |  |  |  |  | Y / N |
| Heat |  |  |  |  |  |  |  | Y / N |
| Air |  |  |  |  |  |  |  | Y / N |

**Fume Hood Tracking (air valve applications ONLY):**

| **Unit #** | **Sash**  **Position** | **Setpoint**  **Air Flow**  **cfm** | **Air Flow**  **cfm** | **Damper**  **Status** | **Approved** |
| --- | --- | --- | --- | --- | --- |
|  | Steady |  |  |  | Y / N |
| Close |  |  |  | Y / N |
| Open |  |  |  | Y / N |

**Exhaust/Return Air Flow Tracking (if applicable):**

| **Unit #** | **Mode** | **Supply**  **Air Flow**  **cfm** | **Setpoint**  **Offset**  **cfm** | **Setpoint**  **Exhaust/Return**  **Air Flow**  **cfm** | **Exhaust/Return**  **Air Flow**  **cfm** | **Damper**  **Status** | **Approved** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Steady |  |  |  |  |  | Y / N |
| Air |  |  |  |  |  | Y / N |

**Supply Air Flow Tracking (air valve applications ONLY):**

| **Unit #** |  | |  | |  | |
| --- | --- | --- | --- | --- | --- | --- |
| **Steady** | **Air** | **Steady** | **Air** | **Steady** | **Air** |
| Total Exhaust Air Flow, cfm |  |  |  |  |  |  |
| Offset Setpoint, cfm |  |  |  |  |  |  |
| Supply Air Flow Setpoint, cfm |  |  |  |  |  |  |
| Supply Air Flow, cfm |  |  |  |  |  |  |
| Space Temperature Setpoint, °F |  |  |  |  |  |  |
| Space Temperature, °F |  |  |  |  |  |  |
| Discharge Temperature, °F |  |  |  |  |  |  |
| Damper Status |  |  |  |  |  |  |
| Valve/Coil Status |  |  |  |  |  |  |
| Approved | **Y / N** | **Y / N** | **Y / N** | **Y / N** | **Y / N** | **Y / N** |

**Differential Pressure Reset:**

Unit damper closes fully in recognition of differential pressure reset call? YES NO

Differential pressure reset call is not a global command for all units in one air distribution system? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. All sequences comply with stated sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Space temperature, space temperature setpoint, damper position, HW/steam valve position, re-heat coil status, unit discharge temperature, air flow, air flow setpoint, sash position, air flow offset setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
|  |  |  |
|  |  |  |
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|  |  |  |
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FPT-23 52 00 - Boilers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the boiler to provide heating water or steam for the facility.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Hot Water Temperature Reset
   1. Verify boilers are in occupied mode. If not override system into occupied mode.
   2. Record outside air temperature and hot water supply temperature.
   3. Override outside air temperature to be 10º above current outside air temperature.
   4. Verify hot water temperature decreases with override proportionally.
   5. Override outside air temperature to be 10º below current outside air temperature.
   6. Verify hot water temperature increases with override proportionally.
   7. Return outside air temperature to normal operation.
2. Staging Up
   1. Override hot water temperature set point to be 15º above current reading.
   2. Verify lead boiler circulation pump energizes and lead boiler fires at low fire.
   3. Record the hot water supply and return temperatures, as well as the time lead boiler started.
   4. Lower the delay time between all stages to a maximum of 3 minutes.
   5. Verify lead boiler modulates to high fire after three minutes at low fire setting.
   6. Record the hot water supply and return temperatures.
   7. Verify lag boiler circulation pump energizes and lag boiler fires at low fire after lead boiler has been under operation at high fire for 3 minutes.
   8. Record the hot water supply and return temperatures.
   9. Verify lag boiler modulates to high fire after three minutes at low fire setting.
   10. Record the hot water supply and return temperatures.
   11. Repeat steps g to j for each additional lag boiler present.
   12. Verify lead and lag boilers continue to operate until hot water temperature set point is achieved and record time.
3. Staging Down
   1. With all boilers firing, lower hot water temperature set point to be 15º below current reading.
   2. Record the hot water supply and return temperatures, as well as the time test started.
   3. Verify lag boiler(s) modulates to low fire after 3 minutes at new setpoint.
   4. Record the hot water supply and return temperatures.
   5. Verify lag boiler(s) shuts down after operation at low fire for 3 minutes.
   6. Verify lag boiler(s) circulation pump de-energizes thirty seconds after lag boiler(s) has shut down.
   7. Record the hot water supply and return temperatures.
   8. Verify lead boiler modulates to low fire after 3 minutes has passed since last lag boiler(s) shut down.
   9. Record the hot water supply and return temperatures.
   10. Verify lead boiler shuts down after operation at low fire for 3 minutes.
   11. Verify lead boiler circulation pump de-energizes thirty seconds after lead boiler has shut down.
   12. Record time of lead boiler shut down.
   13. Return system and settings to normal mode and original set points.
4. Minimum Boiler Flow (primary pumping systems ONLY)
   1. Override hot water temperature set point to be 5º above current reading.
   2. Verify one boiler pump energizes and boiler fires at low fire.
   3. Override all control valves to close in hot water system. For 3-way valves ensure valves are set to bypass coil.
   4. Verify boiler has minimum flow per manufacturer requirements.
   5. Override all 3-way valves to coil.
   6. Verify boiler has minimum flow per manufacturer requirements.
   7. Override all control valves to close in hot water system. For 3-way valves ensure valves are set to bypass coil.
   8. Shut down ON boiler via local disconnect.
   9. Verify lag boiler pump energizes and lag boiler fires at low fire.
   10. Verify boiler has minimum flow per manufacturer requirements.
   11. Override all 3-way valves to coil.
   12. Verify boiler has minimum flow per manufacturer requirements.
   13. Override all control valves to close in hot water system. For 3-way valves ensure valves are set to bypass coil.
   14. Shut down ON boiler via local disconnect.
   15. Repeat steps ix through xiv for each lag boiler.
   16. Return system to normal operation and conditions.
5. Unoccupied Mode
   1. Change the current time to be in unoccupied mode.
   2. Verify all connected loads to hot water system are also in unoccupied mode and not operational.
   3. Override boilers and pump to normal.
   4. Verify boilers and pumps do not come ON.
   5. Manually start one load served by the hot water system.
   6. Verify boilers and pumps are energized.
   7. Manually shut down the energized air handling unit from step e.
   8. Verify boilers and pumps shut down in accordance with proper cool down and minimum run times for boilers.
   9. Return system to and equipment to normal operations and occupied mode.
6. Alarms and Safeties
   1. With lead boiler ON in occupied mode (adjust hot water temperature set point if necessary), manually shut OFF boiler via disconnect.
   2. Verify lag boiler energizes and alarm is generated at local control panel and/or BAS head end.
   3. Repeat steps a and b for each lag boiler.
   4. Return all boilers to normal operating conditions.
   5. With lead boiler ON in occupied mode (adjust hot water temperature set point if necessary), shut down circulation pump for boiler via disconnect.
   6. Verify low flow alarm is initiated at local control panel and/or BAS head end and boiler shuts down.
   7. Repeat steps e and f for each lag boiler.
   8. Return all boilers to normal operating conditions.
   9. With lead boiler ON in occupied mode (adjust hot water temperature set point if necessary), lower high temperature limit set point to be below current hot water temperature reading.
   10. Verify boiler shuts down and alarm is initiated at local control panel and/or BAS head end and boiler shuts down.
   11. Repeat steps i and j for each lag boiler.
   12. Return all boilers to normal operating conditions.
   13. With lead boiler ON in occupied mode (adjust hot water temperature set point if necessary), jump or remove wires or close gas valve, as appropriate, to simulate an unsafe gas condition.
   14. Verify boiler shuts down and alarm is initiated at local control panel and/or BAS head end and boiler shuts down.
   15. Repeat steps m and n for each lag boiler.
   16. Return all boilers to normal operating conditions.
   17. With lead boiler ON in occupied mode (adjust hot water temperature set point if necessary), locate and trip EPO (Emergency Power Off) switch.
   18. Verify boiler goes into emergency shutdown operations, an audible alarm is sounded in room, and an alarm is initiated at local control panel and/or BAS head end.
   19. Return all boilers to normal operating conditions.
7. *STEAM*
   1. *Repeat all procedures listed for hot water boiler applications. Modify tests to accommodate regulation and monitoring of steam pressure in lieu of hot water temperature and ensure a high pressure limit alarm sequence is included within the Alarms and Safeties tests.*
8. *FULLY MODULATING BURNERS*
9. *Repeat all procedures listed for hot water boiler applications. Modify tests to accommodate fully modulating burners by adapting stage steps to coincide with boiler management system capacity percentages provided by manufacturer.*

**Results**

**Hot Water Temperature Reset:**

|  |  |
| --- | --- |
| Outside Air Temperature #1: |  |
| Heating Water Setpoint #1: |  |
| Outside Air Temperature #2: |  |
| Heating Water Setpoint #2: |  |

Hot water temperature setpoint adjusts proportionally with increases/decreases with outside air temperature? YES NO

**Staging Up:**

|  |  |
| --- | --- |
| Starting HWS Temperature: |  |
| Starting HWR Temperature: |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Boiler Tag |  |  |  |  |  |  |
| Time Boiler Started: |  |  |  |  |  |  |
| HWR Temperature at Low Fire Start: |  |  |  |  |  |  |
| HWS Temperature at High Fire Start: |  |  |  |  |  |  |

|  |  |
| --- | --- |
| Time Setpoint Reached: |  |

**Staging Down:**

|  |  |
| --- | --- |
| Starting HWS Temperature: |  |
| Starting HWR Temperature: |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Boiler Tag: |  |  |  |  |  |  |
| HWR Temperature at Low Fire Start: |  |  |  |  |  |  |
| HWS Temperature at Boiler Shut Down: |  |  |  |  |  |  |
| Time Boiler Shut Down: |  |  |  |  |  |  |

|  |  |
| --- | --- |
| Time All Boilers Shut Down: |  |

Boiler circulation pumps do not de-energize until 30 seconds after associated boiler has shut down?

YES NO

**Minimum Boiler Flow (primary pumping systems ONLY):**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Boiler Tag: |  |  |  |  |  |  |
| Boiler maintains minimum flow with all loads bypassed or isolated? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| Boiler maintains minimum flow with all 2-way valved loads isolated and all 3-way valved loads open to load? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |

**Unoccupied Mode:**

Boilers do not fire when placed into unoccupied mode? YES NO

Boilers fire when load is sensed on hot water system during unoccupied mode? YES NO

**Alarms and Safeties:**

| Boiler Tag: |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lead/lag operation for boiler is operational and acceptable? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| Low flow alarm sequence is operational and acceptable? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| High temperature limit sequence is operational and acceptable? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| Flame failure sequence is operational and acceptable? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |
| EPO switch sequence is operational and acceptable? | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO | YES  NO |

***STEAM***

*Identical results to be recorded as specified for hot water applications. Modify results table to accommodate monitoring and recording of steam supply pressure and set points in lieu of hot water temperature.*

***FULLY MODULATING BURNERS***

*Identical results to be recorded as specified for hot water applications. Modify results tables to include capacity percentages for staging of burners and HWS and HWR temperatures and times at transfer to each stage.*

**Conclusion**

Acceptable Criteria: Hot water temperature reset schedule adjusts hot water temperature setpoint in proportion to outside air temperature per contract documents. Boiler staging and firing corresponds to designated heating sequence for facility with minimal hunting. Whereas minimal hunting corresponds to hot water temperature readings differ from hot water temperature set point by no more than ±2º. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and/or BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Boiler status, HWS temperature, HWR temperature, HWS setpoint, pump status, outside air temperature.

***STEAM***

*Boiler status, steam pressure, steam pressure setpoint, outside air temperature.*

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 53 00 - Deaerator Assemblies

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of deaerator assemblies.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Deaerator Heating
   1. Verify associated boiler is in unoccupied mode. If not override boiler into unoccupied mode.
   2. Record temperature of make-up and condensate water to surge tank.
   3. Open drain line for surge tank and drain tank until tank is 1/3 full.
   4. Verify that make-up water valve opens and tank begins to fill.
   5. Verify steam valve to surge tank modulates open and temperature of tank begins to rise.
   6. Allow tank to fill and system to stabilize for 15 minutes.
   7. Verify deaerator water temperature at surge tank is [XXXºF].
   8. Return system to normal operation.
2. Deaerator Level Control
   1. Verify associated boiler is in unoccupied mode. If not override boiler into unoccupied mode.
   2. Open drain line for deaerator tank and drain tank until tank is 1/3 full.
   3. Verify that lead transfer pump is energized and tank begins to fill.
   4. Allow tank to fill and system to stabilize for 15 minutes.
   5. Verify transfer pump de-energizes.
   6. Return system to normal operation.
3. Boiler Start/Stop
   1. Verify associated boiler is in occupied mode. If not override boiler into occupied mode.
   2. Override steam discharge pressure setpoint of boiler to be 5 psig above current pressure.
   3. Verify lead feed pump energizes.
   4. De-energize unit via local disconnect (ensure unit is only de-energized for less than 5 minutes).
   5. Verify alarm is generated at local control panel and at BAS head end.
   6. Return unit to normal operation.
   7. Return steam discharge pressure setpoint of boiler to normal operation.
   8. Allow system to stabilize (~15 minutes).
   9. Verify lead feed pump is de-energized.
   10. Return system to normal operation.
4. Alarms and Safeties
   1. PUMP FAILURE tested under Boiler Start/Stop procedure.
   2. Manually override steam valve to 25% open.
   3. Verify alarm is generated at local control panel and/or BAS head end once deaerator water temperature exceeds [XXXºF].
   4. Return system to normal operation.

**Results**

**Deaerator Heating:**

Steam valve modulates to maintain deaerator water temperature at surge tank at [XXXºF]? YES NO

**Deaerator Level Control:**

Lead transfer pump energizes and de-energizes in concert with deaerator tank levels? YES NO

**Boiler Start/Stop:**

Lead feed pump is energized and de-energized when commanded by associated boiler? YES NO

Alarm is generated at local control panel and at BAS head end on recognition of pump failure? YES NO

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Pump failure | N/A | Y / N |
| High temperature | [XXXºF] | Y / N |

**Conclusion**

Acceptable Criteria: Unit is energized when called upon by associated boiler. Deaerator heating sequence complies with stated sequence. Deaerator level control sequence complies with stated sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and/or BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, transfer pump(s) status, feed pump(s) status, boiler status, valve position, deaerator water temperature, deaerator tank level

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 53 00 - Feedwater Pump Assemblies

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of feedwater pump assemblies.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Boiler Start/Stop
   1. Verify associated boiler is in occupied mode. If not override boiler into occupied mode.
   2. Override steam discharge pressure setpoint of boiler to be 5 psig above current pressure.
   3. Verify unit energizes.
   4. De-energize unit via local disconnect (ensure unit is only de-energized for less than 5 minutes).
   5. Verify alarm is generated at local control panel and at BAS head end.
   6. Return unit to normal operation.
   7. Return steam discharge pressure setpoint of boiler to normal operation.
   8. Allow system to stabilize (~15 minutes).
   9. Verify unit is de-energized.
   10. Return system to normal operation.
2. Feedwater Pre-Heat
   1. Verify associated boiler is in unoccupied mode. If not override boiler into unoccupied mode.
   2. Record temperature of make-up and condensate water to unit.
   3. Open drain line for receiver tank and drain tank until tank is 1/3 full.
   4. Verify that make-up water valve opens and tank begins to fill.
   5. Verify steam pre-heat valve to receiver tank modulates open and temperature of tank begins to rise.
   6. Allow tank to fill and system to stabilize for 15 minutes.
   7. Verify feedwater temperature at receiver tank is 200ºF.
   8. Return system to normal operation.
3. Alarms and Safeties
   1. PUMP FAILURE tested under Boiler Start/Stop procedure.
   2. Manually override steam pre-heat valve to 25% open.
   3. Verify alarm is generated at local control panel and/or BAS head end once feedwater temperature exceeds 212ºF.
   4. Return system to normal operation.

**Results**

**Boiler Start/Stop:**

Unit is energized and de-energized when commanded by associated boiler? YES NO

Alarm is generated at local control panel and at BAS head end on recognition of pump failure? YES NO

**Feedwater Pre-Heat:**

Steam pre-heat valve modulates to maintain feedwater temperature at receiver tank at 200ºF? YES NO

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Pump failure | N/A | Y / N |
| High temperature | 212ºF | Y / N |

**Conclusion**

Acceptable Criteria: Unit is energized when called upon by associated boiler. Feedwater pre-heat sequence complies with stated sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and/or BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, pump(s) status, boiler status, valve position, feedwater temperature

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 54 00 - Gas Fired Furnaces

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the gas fried furnace to maintain space temperatures.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify space temperature setpoint for cooling is [XXoF].
   3. Verify space temperature setpoint for heating is [XXoF].
   4. Record space temperature.
   5. Override space temperature setpoint to be 5o above current space temperature.
   6. Verify burner fires to maintain space temperature.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Return space temperature setpoint to normal operation.
   9. Verify refrigerant coil and remote condensing unit energize to maintain space temperature.
   10. Allow unit to stabilize at setpoint for 10 minutes.
   11. Return system to normal operation.
2. Unoccupied Mode
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
   3. Override unoccupied heating space temperature setpoint to be 10o above current space temperature (ensure cooling setpoint is at least 10o above override value).
   4. Verify unit energizes and burner fires to maintain space temperature.
   5. Return unoccupied heating space temperature setpoint to normal operation.
   6. Override unoccupied cooling space temperature setpoint to be 10o below current space space (ensure heating setpoint is at least 10o below override value).
   7. Verify unit energizes refrigerant coil and remote condensing unit energize to maintain space temperature.
   8. Return system to normal operation.
3. Alarms and Safeties:
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Disconnect power to vent exhauster or vent pressure switch to simulate a blocked vent.
   3. Override space temperature setpoint to be 5o above current space temperature.
   4. Verify burner does not fire.
   5. Return system to normal operation.

**Results**

**Cooling / Heating:**

|  |  |
| --- | --- |
| Space temperature setpoint for cooling is [XXoF]? | Y / N |
| Space temperature setpoint for heating is [XXoF]? | Y / N |
| Space Temperature: |  |
| Burner fires to maintain space temperature (±1oF) on call for heating? | Y / N |
| Refrigerant coil and remote condensing unit energize to maintain space temperature (±1oF) on call for cooling? | Y / N |

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space Temperature: |  |
| Unit energizes and burner fires to maintain space temperature under call for heating? | Y / N |
| Unit energizes and refrigerant coil and remote condensing unit energize to maintain space temperature under call for cooling? | Y / N |

**Alarms and Safeties:**

Burner does not fire on call for heating when vent pressure switch fails? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, space temperature, space temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 55 00 - Direct Fired MUA Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the MAU to maintain discharge temperatures to supply air distribution systems for the facility or maintain space temperature, as well as evaluate the functionality of the integral sequences related to this primary service.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and supply dampers close fully.
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Return “on” command to normal operation.
   7. Visually verify all associated fire/smoke dampers have opened.
   8. Visually verify that outside air and supply dampers open fully.
   9. Verify unit is energized and all devices return to normal operation.
2. Heating – Discharge Air Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify discharge air temperature setpoint is [XXoF].
   3. Record discharge air temperature.
   4. Verify burner lockout setpoint is [XXoF].
   5. Record outside air temperature.
   6. Override burner lockout setpoint to be 5o below current outside air temperature.
   7. Override discharge air temperature setpoint to be 5o above current discharge temperature.
   8. Override system into occupied mode.
   9. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner does not fire (sequence must be in order stated).
   10. Allow system to stabilize for 10 minutes.
   11. Override system into unoccupied mode.
   12. Override burner lockout setpoint to be 5o above current outside air temperature.
   13. Override system into occupied mode.
   14. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner fires (sequence must be in order stated).
   15. Allow system to stabilize for 10 minutes.
   16. Override discharge air temperature setpoint to be 10o above current discharge temperature.
   17. Verify gas valve modulates open to maintain discharge temperature without hunting or overshooting.
   18. Return system to normal operation.
3. Heating – Space Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify space temperature setpoint is [XXoF].
   3. Record space temperature.
   4. Verify burner lockout setpoint is [XXoF].
   5. Record outside air temperature.
   6. Override burner lockout setpoint to be 5o below current outside air temperature.
   7. Override space temperature setpoint to be 5o above current discharge temperature.
   8. Override system into occupied mode.
   9. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner does not fire (sequence must be in order stated).
   10. Allow system to stabilize for 10 minutes.
   11. Override system into unoccupied mode.
   12. Override burner lockout setpoint to be 5o above current outside air temperature.
   13. Override system into occupied mode.
   14. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner fires (sequence must be in order stated).
   15. Allow system to stabilize for 10 minutes.
   16. Override space temperature setpoint to be 10o above current discharge temperature.
   17. Verify gas valve modulates open to maintain discharge temperature without hunting or overshooting.
   18. Return system to normal operation.
4. Unoccupied Mode – Discharge Air Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Locate space with lowest temperature and record current space temperature of that space.
   4. Override unoccupied space temperature setpoint to be 10o above selected space (adjust burner lockout setpoint if needed).
   5. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner fires (sequence must be in order stated).
   6. Return system to normal operation.
5. Unoccupied Mode – Space Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Override unoccupied space temperature setpoint to be 10o above space temperature(adjust burner lockout setpoint if needed).
   4. Verify outside air and supply dampers open fully and are proven, fan is energized and proven, and burner fires (sequence must be in order stated).
   5. Return system to normal operation.
6. Alarms and Safeties
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Record freezestat setpoint.
   3. Disconnect freezestat to simulate a freezing condition.
   4. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   5. Record supply high temperature limit setpoint.
   6. Override supply high temperature limit setpoint to be set below current discharge air temperature.
   7. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   8. Return system to normal operation.
   9. Record supply low temperature limit setpoint.
   10. Override supply low temperature limit setpoint to be set above current discharge air temperature.
   11. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   12. Return system to normal operation.
   13. Record gas high limit setpoint.
   14. Override gas high limit pressure switch to be set below current gas pressure reading.
   15. Verify that gas valve closes and alarm is initiated local control panel and at BAS head end.
   16. Return system to normal operation (gas high limit switch may need to be reset manually).
   17. Record gas low limit setpoint.
   18. Override gas low limit pressure switch to be set above current gas pressure reading.
   19. Verify that gas valve closes and alarm is initiated local control panel and at BAS head end.
   20. Return system to normal operation.
   21. Disconnect fire alarm relay to simulate a fire condition (ensure occupants and local authorities have been notified prior to this test).
   22. Verify that unit is de-energized and alarm is initiated at BAS head end.
   23. Verify that all associated fire/smoke dampers are closed and signal from these dampers is initiated at BAS head end.
   24. Return system to normal operation.
   25. Record filter monitor alarm setpoint.
   26. Override filter monitor alarm setpoint to be 0.5 psig below current differential pressure across filter rack.
   27. Verify alarm is initiated at local control panel and BAS head end.
   28. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and supply dampers close fully when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize unit by BAS? YES NO

**Heating – Discharge Air Temperature (if applicable):**

|  |  |
| --- | --- |
| Discharge air temperature setpoint is [XXºF]? | Y / N |
| Discharge Air Temperature: |  |
| Burner lockout temperature setpoint is [XXºF]? | Y / N |
| Outside Air Temperature: |  |
| When outside air temperature exceeds burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner does not fire? | Y / N |
| When outside air temperature does not exceed burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner fires? | Y / N |
| On additional call for heating gas valve modulates open? | Y / N |

**Heating – Space Temperature (if applicable):**

|  |  |
| --- | --- |
| Space temperature setpoint is [XXºF]? | Y / N |
| Space Temperature: |  |
| Burner lockout temperature setpoint is [XXºF]? | Y / N |
| Outside Air Temperature: |  |
| When outside air temperature exceeds burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner does not fire? | Y / N |
| When outside air temperature does not exceed burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner fires? | Y / N |
| On additional call for heating gas valve modulates open? | Y / N |

**Unoccupied Mode – Discharge Air Temperature (if applicable):**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is [XXºF]? | Y / N |
| Space #: |  |
| Space Temperature: |  |
| Unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner fires to maintain discharge air temperature? | Y / N |

**Unoccupied Mode – Space Temperature (if applicable):**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is [XXºF]? | Y / N |
| Space Temperature: |  |
| Unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, fan is energized and proven, burner fires to maintain space temperature? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Freezestat |  | Y / N |
| Supply high temperature limit |  | Y / N |
| Supply low temperature limit |  | Y / N |
| Gas high pressure limit |  | Y / N |
| Gas low pressure limit |  | Y / N |
| Fire alarm | N/A | Y / N |
| Filter monitor |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, fan status, burner status, OAT, SAT, OA damper position, SA damper position, gas valve position, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 55 00 - Gas Fired Unit Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the unit heater to maintain the setpoint temperature for the space.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Heating Unoccupied
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes after delay of [X] minutes.
   6. Return system to normal operation
   7. Verify unit remains energized for [X] minute(s) prior to de-energizing.
2. Heating Occupied
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes after delay of [X] minutes.
   6. Return system to normal operation.
3. Alarms and Safeties
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   3. Disconnect lead to combustion air pressure switch.
   4. Verify alarm is generated at BAS head end and unit de-energizes.
   5. Return combustion air pressure switch to normal operation.
   6. Disconnect lead to vent pressure switch.
   7. Verify alarm is generated at BAS head end and unit de-energizes.
   8. Return vent pressure switch to normal operation.
   9. Record high temperature limit setpoint.
   10. Adjust the high temperature limit setpoint to be 5o lower than the current discharge air temperature of the unit.
   11. Verify alarm is generated at BAS head end and unit de-energizes.
   12. Return system to normal operation.

**Results**

**Heating Unoccupied (if applicable):**

|  |  |
| --- | --- |
| Unoccupied Space Temperature Setpoint: |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |
| Unit is energized in response to increases of temperature setpoint? | Y / N |
| Energization Time Delay: |  |
| De-Energization Time Delay: |  |

**Heating Occupied:**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |
| Unit is energized in response to increases of temperature setpoint? | Y / N |
| Energization Time Delay: |  |
| De-Energization Time Delay: |  |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Combustion air pressure | N/A | Y / N |
| Vent pressure | N/A | Y / N |
| High temperature limit | [XXXºF] | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit energizes and de-energizes per stated heating sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit run status, space temperature

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 55 00 - Indirect Fired MUA Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the MAU to maintain discharge temperatures to supply air distribution systems for the facility or maintain space temperature, as well as evaluate the functionality of the integral sequences related to this primary service.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes and vent exhauster remains operational for a period of [X] seconds.
   4. Visually verify that outside air and supply dampers close fully.
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Return “on” command to normal operation.
   7. Visually verify all associated fire/smoke dampers have opened.
   8. Visually verify that outside air and supply dampers open fully.
   9. Verify that vent exhauster energizes for a period of [X] seconds prior to unit energizing.
   10. Return system to normal operation.
2. Heating – Discharge Air Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify discharge air temperature setpoint is [XXoF].
   3. Record discharge air temperature.
   4. Verify burner lockout setpoint is [XXoF].
   5. Record outside air temperature.
   6. Override burner lockout setpoint to be 5o below current outside air temperature.
   7. Override discharge air temperature setpoint to be 5o above current discharge temperature.
   8. Override system into occupied mode.
   9. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner does not fire (sequence must be in order stated).
   10. Allow system to stabilize for 10 minutes.
   11. Override system into unoccupied mode.
   12. Verify vent exhauster remains operational for a period of [X] seconds after unit is de-energized.
   13. Override burner lockout setpoint to be 5o above current outside air temperature.
   14. Override system into occupied mode.
   15. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner fires (sequence must be in order stated).
   16. Allow system to stabilize for 10 minutes.
   17. Override discharge air temperature setpoint to be 10o above current discharge temperature.
   18. Verify gas valve modulates open to maintain discharge temperature without hunting or overshooting.
   19. Return system to normal operation.
3. Heating – Space Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify space temperature setpoint is [XXoF].
   3. Record space temperature.
   4. Verify burner lockout setpoint is [XXoF].
   5. Record outside air temperature.
   6. Override burner lockout setpoint to be 5o below current outside air temperature.
   7. Override space temperature setpoint to be 5o above current discharge temperature.
   8. Override system into occupied mode.
   9. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner does not fire (sequence must be in order stated).
   10. Allow system to stabilize for 10 minutes.
   11. Override system into unoccupied mode.
   12. Verify vent exhauster remains operational for a period of [X] seconds after unit is de-energized.
   13. Override burner lockout setpoint to be 5o above current outside air temperature.
   14. Override system into occupied mode.
   15. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner fires (sequence must be in order stated).
   16. Allow system to stabilize for 10 minutes.
   17. Override space temperature setpoint to be 10o above current discharge temperature.
   18. Verify gas valve modulates open to maintain discharge temperature without hunting or overshooting.
   19. Return system to normal operation.
4. Unoccupied Mode – Discharge Air Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Locate space with lowest temperature and record current space temperature of that space.
   4. Override unoccupied space temperature setpoint to be 10o above selected space (adjust burner lockout setpoint if needed).
   5. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner fires (sequence must be in order stated).
   6. Return system to normal operation.
5. Unoccupied Mode – Space Temperature (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Override unoccupied space temperature setpoint to be 10o above space temperature(adjust burner lockout setpoint if needed).
   4. Verify outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, and burner fires (sequence must be in order stated).
   5. Return system to normal operation.
6. Alarms and Safeties
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Adjust the discharge air or space temperature setpoint to be 10oF above the current temperature.
   3. Disconnect lead to combustion air pressure switch.
   4. Verify alarm is generated at local control panel and BAS head end, and unit de-energizes.
   5. Return combustion air pressure switch to normal operation.
   6. Disconnect lead to vent pressure switch.
   7. Verify alarm is generated at local control panel and BAS head end, and unit de-energizes.
   8. Return vent pressure switch to normal operation.
   9. Record freezestat setpoint.
   10. Disconnect freezestat to simulate a freezing condition.
   11. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   12. Record supply high temperature limit setpoint.
   13. Override supply high temperature limit setpoint to be set below current discharge air temperature.
   14. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   15. Return system to normal operation.
   16. Record supply low temperature limit setpoint.
   17. Override supply low temperature limit setpoint to be set above current discharge air temperature.
   18. Verify unit is de-energized and alarm is generated at local control panel and BAS head end.
   19. Return system to normal operation.
   20. Record gas high limit setpoint.
   21. Override gas high limit pressure switch to be set below current gas pressure reading.
   22. Verify that gas valve closes and alarm is initiated local control panel and at BAS head end.
   23. Return system to normal operation (gas high limit switch may need to be reset manually).
   24. Record gas low limit setpoint.
   25. Override gas low limit pressure switch to be set above current gas pressure reading.
   26. Verify that gas valve closes and alarm is initiated local control panel and at BAS head end.
   27. Return system to normal operation.
   28. Disconnect fire alarm relay to simulate a fire condition (ensure occupants and local authorities have been notified prior to this test).
   29. Verify that unit is de-energized and alarm is initiated at BAS head end.
   30. Verify that all associated fire/smoke dampers are closed and signal from these dampers is initiated at BAS head end.
   31. Return system to normal operation.
   32. Record filter monitor alarm setpoint.
   33. Override filter monitor alarm setpoint to be 0.5 psig below current differential pressure across filter rack.
   34. Verify alarm is initiated at local control panel and BAS head end.
   35. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and supply dampers close fully when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize unit by BAS? YES NO

**Heating – Discharge Air Temperature (if applicable):**

|  |  |
| --- | --- |
| Discharge air temperature setpoint is [XXºF]? | Y / N |
| Discharge Air Temperature: |  |
| Burner lockout temperature setpoint is [XXºF]? | Y / N |
| Outside Air Temperature: |  |
| When outside air temperature exceeds burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner does not fire? | Y / N |
| When outside air temperature does not exceed burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner fires? | Y / N |
| On additional call for heating gas valve modulates open? | Y / N |

**Heating – Space Temperature (if applicable):**

|  |  |
| --- | --- |
| Space temperature setpoint is [XXºF]? | Y / N |
| Space Temperature: |  |
| Burner lockout temperature setpoint is [XXºF]? | Y / N |
| Outside Air Temperature: |  |
| When outside air temperature exceeds burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner does not fire? | Y / N |
| When outside air temperature does not exceed burner lockout unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner fires? | Y / N |
| On additional call for heating gas valve modulates open? | Y / N |

**Unoccupied Mode – Discharge Air Temperature (if applicable):**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is [XXºF]? | Y / N |
| Space #: |  |
| Space Temperature: |  |
| Unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner fires to maintain discharge air temperature? | Y / N |

**Unoccupied Mode – Space Temperature (if applicable):**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is [XXºF]? | Y / N |
| Space Temperature: |  |
| Unit heating sequence corresponds to the following sequence in the order stated; outside air and supply dampers open fully and are proven, vent exhauster energizes and runs for [X] seconds, fan is energized and proven, burner fires to maintain space temperature? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Combustion air pressure | N/A | Y / N |
| Vent pressure | N/A | Y / N |
| Freezestat |  | Y / N |
| Supply high temperature limit |  | Y / N |
| Supply low temperature limit |  | Y / N |
| Gas high pressure limit |  | Y / N |
| Gas low pressure limit |  | Y / N |
| Fire alarm | N/A | Y / N |
| Filter monitor |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel and BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, fan status, burner status, OAT, SAT, OA damper position, SA damper position, gas valve position, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 55 00 - Infra-Red Heating Devices

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Test Duration

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the infra-red heating device to maintain the setpoint temperature for the space.

Instrumentation

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Heating
   1. Verify unit is in energized.
   2. Verify that the space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the space temperature setpoint to be 10oF above the current temperature.
   5. Verify that vent exhauster energizes for a period of [X] seconds prior to flame ignition.
   6. Verify the burner energizes.
   7. Return system to normal operation.
2. Alarms and Safeties
   1. Verify unit is energized.
   2. Adjust the space temperature setpoint to be 10oF above the current temperature.
   3. Disconnect lead to vent differential airflow switch.
   4. Verify alarm is generated at local control panel and unit de-energizes.
   5. Return system to normal operation.
   6. Isolate gas to unit via local isolation valve to simulate a flame failure.
   7. Verify alarm is generated at local control panel and unit de-energizes.
   8. Return system to normal operation.

**Results**

**Heating Occupied:**

|  |  |
| --- | --- |
| Space Temperature Setpoint: |  |
| Space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |
| Vent Exhaust Pre-Purge Period: |  |
| Burner is energized in response to increases of temperature setpoint following pre-purge by vent exhauster? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Vent differential airflow | N/A | Y / N |
| Flame failure | N/A | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit energizes and de-energizes per stated heating sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at local control panel.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit run status, space temperature

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 57 00 - Heat Exchangers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the heat exchanger to provide heating water from steam.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Heat Exchange – General (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify secondary supply water temperature setpoint is [XXXºF].
   3. Record secondary supply water temperature.
   4. Override secondary supply water temperature setpoint to be 10º above current supply water temperature.
   5. Verify primary control valve modulates open to maintain secondary supply water temperature.
   6. Return system to normal operation.
2. Heat Exchange – Converter (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify hot water loop pumps feeding unit are energized.
   3. Record hot water supply temperature setpoint.
   4. Override outside air temperature to 10ºF.
   5. Record outside air and hot water supply temperatures.
   6. Verify hot water supply temperature setpoint resets to 180ºF.
   7. Verify steam valve(s) modulates open to maintain hot water supply temperature.
   8. Override outside air temperature to 60ºF.
   9. Verify hot water supply temperature setpoint resets to 140ºF.
   10. Verify steam valve(s) modulates closed to maintain hot water supply temperature.
   11. Return system to normal operation.
3. Heat Exchange – Steam to Steam Humidification (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Produce call for humidification from associated humidification grid (if necessary override humidification setpoint at grid).
   3. Verify steam valve opens, make-up water valve opens, and that humidity levels increase at commanded grid.
   4. Return system to normal operation.
4. Alarms and Safeties (if applicable)
   1. Converter Applications ONLY
   2. Verify unit is in occupied mode. If not override system into occupied mode.
   3. Verify hot water high temperature alarm setpoint is set to 200ºF.
   4. Verify hot water high temperature critical alarm setpoint is set to 210ºF.
   5. Record current hot water supply temperature.
   6. Override hot water high temperature alarm setpoint to be 2º below current hot water supply temperature.
   7. Verify alarm is generated at BAS head end.
   8. Return hot water high temperature alarm setpoint to normal operation.
   9. Override hot water high temperature critical alarm setpoint to be 2º below current hot water supply temperature.
   10. Verify steam valve closes and alarm is generated at BAS head end.
   11. Return system to normal operation.
   12. Steam to Steam Humidification Applications ONLY
   13. Verify unit is in occupied mode. If not override system into occupied mode.
   14. Disconnect low level switch.
   15. Verify alarm is generated at BAS head end.
   16. Return system to normal operation.

**Results**

**Heat Exchange – General (if applicable):**

|  |  |
| --- | --- |
| Secondary supply loop temperature setpoint is [XXXºF]? | Y / N |
| Secondary Supply Water Temperature: |  |
| Primary control valve modulates open to maintain secondary supply water temperature? | Y / N |

**Heat Exchange – Converter (if applicable):**

|  |  |
| --- | --- |
| Hot Water Supply Temperature Setpoint: |  |
| Outside Air Temperature: |  |
| Hot Water Supply Temperature: |  |
| Hot water supply temperature setpoint resets linearly from 140ºF to 180ºF for outside air temperatures of 10ºF to 60ºF, respectively? | Y / N |
| Original hot water supply temperature setpoint falls on linear temperature reset schedule above? | Y / N |
| Steam valve(s) modulates to maintain hot water supply temperature? | Y / N |

**Heat Exchange – Steam to Steam Humidification (if applicable):**

|  |  |
| --- | --- |
| Associated Humidification Grid: |  |
| Steam valve and make-up water valves modulate in concert upon recognition of a humidification call? | Y / N |

**Alarms and Safeties (if applicable):**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Hot water high temperature alarm | 200ºF | Y / N |
| Hot water high temperature critical alarm | 210ºF | Y / N |
| Low level |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Primary supply water temperature, primary return water temperature, secondary supply water temperature, secondary supply water temperature setpoint, secondary return water temperature, OA temperature, primary valve position

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 62 13 - Air-Cooled Chillers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of the air-cooled chillers to provide chilled water for the facility.

Instrumentation

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Procedure**

1. Lead/Lag
   1. Have associated system or BAS call for lead chiller to energize.
   2. Verify the following occurs in the order shown;
      1. Associated chilled water pump is energized.
      2. Lead chiller is energized and that BAS reflects unit is operational.
   3. Record tag of lead chiller.
   4. Override system to unoccupied mode.
   5. Verify lead chiller de-energizes after minimum chiller run time of 30 minutes has passed.
   6. After lead chiller has de-energized disconnect power to lead chiller via local disconnect.
   7. Override system to occupied mode.
   8. Verify lag identical start sequence for lead chiller is initiated for lag chiller and alarm is generated at BAS head end.
   9. Return system to normal operation.
   10. Override system to unoccupied mode.
   11. Verify chiller enable setpoint is 57ºF.
   12. Record current outside air temperature.
   13. Override chiller enable setpoint to be 5º below current outside air temperature.
   14. Override system to occupied mode.
   15. Verify neither lead nor lag chiller are energized.
   16. Return system to normal operation.
2. Chilled Water Temperature Reset
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Record chilled water supply temperature setpoint.
   3. Record outside air and chilled water supply temperatures.
   4. Override outside air temperature to be [XXºF].
   5. Verify chilled water supply temperature setpoint resets to [XXºF].
   6. Verify unit cycles down to maintain chilled water supply temperature.
   7. Override outside air temperature to be [XXºF].
   8. Verify chilled water supply temperature setpoint resets to [XXºF].
   9. Verify unit cycles up to maintain chilled water supply temperature.
   10. Return system to normal operation.
3. Chiller Sequencing – Secondary CHW Capacity (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable percentage is 90% of lead chiller rated capacity (Btu).
   6. Verify lead chiller limiting setpoint is 80%.
   7. Verify lag chiller is enabled once measured secondary chilled water capacity exceeds lag chiller enable percentage, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated capacity (Btu).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable percentage is 80% of lead chiller rated capacity (Btu).
   15. Verify lag chiller is disabled once measured secondary chilled water capacity falls below lag chiller disable percentage, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
4. Chiller Sequencing – Secondary CHW Flow (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary water flow percentage 20% greater than rated lead chiller flow.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow.
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
5. Chiller Sequencing – Secondary CHW Flow-Bridge (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary water flow exceeding primary chilled water flow by 20% of rated lead chiller flow.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow.
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
6. Chiller Sequencing –CHW Temperatures (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary supply water temperature 2º greater than primary supply water temperature.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lead chiller excess flow being equal to or greater than 20% as calculated as follows:
       1. (((Secondary CHW Return Temp.)-(Primary CHW Return Temp.))/((( Secondary CHW Return Temp.)-(Primary CHW Supply Temp.)) \* (Qty. of Chillers Enabled))) \* 100 = % of Primary CHW Excess Flow
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Record the following at lag chiller disable point:
       1. Secondary CHW return temperature
       2. Primary CHW return temperature
       3. Primary CHW supply temperature
       4. # of chillers enabled (prior to lag chiller disable)
       5. Calculated primary CHW excess flow %
   17. Return system to normal operation.

**Results**

**Lead/Lag:**

|  |  |
| --- | --- |
| Lead or lag chiller energize sequence complies to the following; CHW pump energized, CHW flow proven, unit energized? | Y / N |
| Lead Chiller |  |
| Minimum run time is set to 30 minutes for each chiller and units de-energize after this period has passed with no cooling demand? | Y / N |
| Chiller enable setpoint is 57ºF? | Y / N |
| Chillers are only energized when outside air temperature exceeds chiller enable setpoint? | Y / N |

**Chilled Water Temperature Reset:**

|  |  |
| --- | --- |
| Chilled Water Supply Temperature Setpoint: |  |
| Outside Air Temperature: |  |
| Chilled Water Supply Temperature: |  |
| Hot water supply temperature setpoint resets linearly from [XXºF] to [XXºF] for outside air temperatures of [XXºF] to [XXºF], respectively? | Y / N |
| Original chilled water supply temperature setpoint falls on linear temperature reset schedule above? | Y / N |
| Unit cycles to maintain chilled water supply temperature? | Y / N |

**Chiller Sequencing – Secondary CHW Capacity:**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint is equal to 90% of lead chiller rated capacity? | Y / N |
| Lag Chiller Enable Setpoint (Btu): |  |
| Lead chiller limiting setpoint is equal to 80% of rated capacity? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and both conditions of lag chiller enable are met? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated capacity prior to lag chiller being energized? | Y / N |
| Lag chiller cycles to maintain chilled water temperature with lead chiller held at 80% of rated capacity? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated capacity (Btu)? | Y / N |
| Lead Chiller Release Setpoint (Btu): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint is equal to 80 % of lead chiller rate dcapacity? | Y / N |
| Lag Chiller Disable Setpoint (Btu): |  |
| Lag chiller is disabled after measured capacity of secondary chilled water falls below lag chiller disable setpoint? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing – Secondary CHW Flow:**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary water flow percentage 20% greater than rated lead chiller flow? | Y / N |
| Lag Chiller Enable Setpoint (A / gpm): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow? | Y / N |
| Lag Chiller Disable Setpoint (gpm): |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing – Secondary CHW Flow (if applicable):**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary water flow exceeds primary water flow by 20% greater than rated lead chiller flow? | Y / N |
| Lag Chiller Enable Setpoint (A / gpm): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow? | Y / N |
| Lag Chiller Disable Setpoint (gpm): |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing –CHW Temperatures (if applicable):**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary supply water temperature 2º greater than primary supply water temperature? | Y / N |
| Lag Chiller Enable Setpoint (A / ΔºF): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lead chiller excess flow being equal to or greater than 20% as calculated by listed formula? | Y / N |
| Secondary CHW Return Temperature: |  |
| Primary CHW Return Temperature: |  |
| Primary CHW Supply Temperature: |  |
| # of Chillers Enabled (Prior to Lag Chiller Disabled): |  |
| Calculated % of Excess Primary CHW Flow: |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles to maintain chilled water temperature exclusively? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, CHW pump status, primary CHW supply temperature, primary CHW return temperature, secondary CHW supply temperature, secondary CHW return temperature, OAT, primary CHW flow, secondary CHW flow, primary CHW capacity, secondary CHW capacity, unit demand

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 64 15 - Water Cooled Chillers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of the water cooled chillers to provide chilled water for the facility.

Instrumentation

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Procedure**

1. Lead/Lag
   1. Have associated system or BAS call for lead chiller to energize.
   2. Verify the following occurs in the order shown;
      1. Associated chilled water pump is energized.
      2. Lead chiller is energized and that BAS reflects unit is operational.
      3. Associated condenser pump is energized.
   3. Record tag of lead chiller.
   4. Override system to unoccupied mode.
   5. Verify lead chiller de-energizes after minimum chiller run time of 30 minutes has passed.
   6. After lead chiller has de-energized disconnect power to lead chiller via local disconnect.
   7. Override system to occupied mode.
   8. Verify lag identical start sequence for lead chiller is initiated for lag chiller and alarm is generated at BAS head end.
   9. Return system to normal operation.
   10. Override system to unoccupied mode.
   11. Verify chiller enable setpoint is 57ºF.
   12. Record current outside air temperature.
   13. Override chiller enable setpoint to be 5º below current outside air temperature.
   14. Override system to occupied mode.
   15. Verify neither lead nor lag chiller are energized.
   16. Return system to normal operation.
2. Chilled Water Temperature Reset
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Record chilled water supply temperature setpoint.
   3. Record outside air and chilled water supply temperatures.
   4. Override outside air temperature to be [XXºF].
   5. Verify chilled water supply temperature setpoint resets to [XXºF].
   6. Verify unit cycles or modulates down to maintain chilled water supply temperature.
   7. Override outside air temperature to be [XXºF].
   8. Verify chilled water supply temperature setpoint resets to [XXºF].
   9. Verify unit cycles or modulates up to maintain chilled water supply temperature.
   10. Return system to normal operation.
3. Chiller Sequencing – Secondary CHW Capacity (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable percentage is 90% of lead chiller rated capacity (Btu).
   6. Verify lead chiller limiting setpoint is 80%.
   7. Verify lag chiller is enabled once measured secondary chilled water capacity exceeds lag chiller enable percentage, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated capacity (Btu).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle or modulate in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable percentage is 80% of lead chiller rated capacity (Btu).
   15. Verify lag chiller is disabled once measured secondary chilled water capacity falls below lag chiller disable percentage, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
4. Chiller Sequencing – Secondary CHW Flow (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary water flow percentage 20% greater than rated lead chiller flow.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle or modulate in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow.
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
5. Chiller Sequencing – Secondary CHW Flow-Bridge (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary water flow exceeding primary chilled water flow by 20% of rated lead chiller flow.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle or modulate in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow.
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Return system to normal operation.
6. Chiller Sequencing –CHW Temperatures (if applicable):
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Provide false loading on chilled water system by commanding all attached coils open fully with associated heating capabilities commanded on at 100% output.
   3. Verify lead chiller is energized.
   4. Allow lead chiller to run until minimum lead sequence run time of 30 minutes has passed.
   5. Verify lag chiller enable setpoint consists of 80% of lead chiller rated demand (A) and secondary supply water temperature 2º greater than primary supply water temperature.
   6. Verify lead chiller limiting setpoint is 80% of rated demand (A).
   7. Verify lag chiller is enabled once both enable parameters have been met, and lead chiller capacity is limited to 80% of rated capacity.
   8. Verify lag chiller cycles or ramps up to meet chilled water temperature setpoint.
   9. Allow system to stabilize for 15 minutes.
   10. Verify lead chiller limit release setpoint is 70% of lag chiller rated demand (A).
   11. Verify lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and that lead and lag chiller cycle or modulate in concert to maintain chilled water temperature.
   12. Return all attached coils and associated heating capabilities to normal operation.
   13. Verify lag chiller cycles or ramps down to meet chilled water temperature setpoint.
   14. Verify lag chiller disable setpoint is condition of lead chiller excess flow being equal to or greater than 20% as calculated as follows:
       1. (((Secondary CHW Return Temp.)-(Primary CHW Return Temp.))/((( Secondary CHW Return Temp.)-(Primary CHW Supply Temp.)) \* (Qty. of Chillers Enabled))) \* 100 = % of Primary CHW Excess Flow
   15. Verify lag chiller is disabled once lag chiller disable setpoint condition is met, and lead chiller capacity limits is lifted.
   16. Record the following at lag chiller disable point:
       1. Secondary CHW return temperature
       2. Primary CHW return temperature
       3. Primary CHW supply temperature
       4. # of chillers enabled (prior to lag chiller disable)
       5. Calculated primary CHW excess flow %
   17. Return system to normal operation.

**Results**

**Lead/Lag:**

|  |  |
| --- | --- |
| Lead or lag chiller energize sequence complies to the following; CHW pump energized, CHW flow proven, unit energized, condenser water pump energized and flow proven? | Y / N |
| Lead Chiller |  |
| Minimum run time is set to 30 minutes for each chiller and units de-energize after this period has passed with no cooling demand? | Y / N |
| Chiller enable setpoint is 57ºF? | Y / N |
| Chillers are only energized when outside air temperature exceeds chiller enable setpoint? | Y / N |

**Chilled Water Temperature Reset:**

|  |  |
| --- | --- |
| Chilled Water Supply Temperature Setpoint: |  |
| Outside Air Temperature: |  |
| Chilled Water Supply Temperature: |  |
| Hot water supply temperature setpoint resets linearly from [XXºF] to [XXºF] for outside air temperatures of [XXºF] to [XXºF], respectively? | Y / N |
| Original chilled water supply temperature setpoint falls on linear temperature reset schedule above? | Y / N |
| Unit cycles or modulates to maintain chilled water supply temperature? | Y / N |

**Chiller Sequencing – Secondary CHW Capacity:**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint is equal to 90% of lead chiller rated capacity? | Y / N |
| Lag Chiller Enable Setpoint (Btu): |  |
| Lead chiller limiting setpoint is equal to 80% of rated capacity? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and both conditions of lag chiller enable are met? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated capacity prior to lag chiller being energized? | Y / N |
| Lag chiller cycles or modulates to maintain chilled water temperature with lead chiller held at 80% of rated capacity? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated capacity (Btu)? | Y / N |
| Lead Chiller Release Setpoint (Btu): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle or modulate in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint is equal to 80 % of lead chiller rate dcapacity? | Y / N |
| Lag Chiller Disable Setpoint (Btu): |  |
| Lag chiller is disabled after measured capacity of secondary chilled water falls below lag chiller disable setpoint? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles or modulates to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing – Secondary CHW Flow:**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary water flow percentage 20% greater than rated lead chiller flow? | Y / N |
| Lag Chiller Enable Setpoint (A / gpm): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles or modulates to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle or modulate in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow? | Y / N |
| Lag Chiller Disable Setpoint (gpm): |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles or modulates to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing – Secondary CHW Flow (if applicable):**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary water flow exceeds primary water flow by 20% greater than rated lead chiller flow? | Y / N |
| Lag Chiller Enable Setpoint (A / gpm): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles or modulates to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle or modulate in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lag chiller flow +10% of lead chiller flow being equal to or greater than secondary chilled water flow? | Y / N |
| Lag Chiller Disable Setpoint (gpm): |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles or modulates to maintain chilled water temperature exclusively? | Y / N |

**Chiller Sequencing –CHW Temperatures (if applicable):**

|  |  |
| --- | --- |
| Minimum run time for lead chiller is 30 minutes? | Y / N |
| Lag chiller enable setpoint consists of two portions as follows; 80% of lead chiller rated demand (A) and secondary supply water temperature 2º greater than primary supply water temperature? | Y / N |
| Lag Chiller Enable Setpoint (A / ΔºF): | / |
| Lead chiller limiting setpoint is equal to 80% of rated demand? | Y / N |
| Lag chiller is enabled only after minimum run time for lead chiller has expired and measured capacity of secondary chilled water exceeds lag chiller enable setpoint? | Y / N |
| On call for lag chiller to energize, lead chiller is limited to 80% of rated demand (A) prior to lag chiller being energized? | Y / N |
| Lag chiller cycles or modulates to maintain chilled water temperature with lead chiller held at 80% of rated demand (A)? | Y / N |
| Lead chiller limit release setpoint is 70% of lag chiller rated demand (A)? | Y / N |
| Lead Chiller Release Setpoint (A): |  |
| Lead chiller demand limit is released once lead chiller limit release setpoint is exceeded, and lead and lag chillers cycle or modulate in concert to maintain chilled water temperature? | Y / N |
| Lag chiller disable setpoint consists of conditions as follows: lead chiller excess flow being equal to or greater than 20% as calculated by listed formula? | Y / N |
| Secondary CHW Return Temperature: |  |
| Primary CHW Return Temperature: |  |
| Primary CHW Supply Temperature: |  |
| # of Chillers Enabled (Prior to Lag Chiller Disabled): |  |
| Calculated % of Excess Primary CHW Flow: |  |
| Lag chiller is disabled after conditions of lag chiller disable are met? | Y / N |
| On call for lag chiller to de-energize, lead chiller limit is lifted and lead chiller cycles or modulates to maintain chilled water temperature exclusively? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, CHW pump status, condenser pump status, primary CHW supply temperature, primary CHW return temperature, secondary CHW supply temperature, secondary CHW return temperature, OAT, primary CHW flow, secondary CHW flow, primary CHW capacity, secondary CHW capacity, unit demand, condenser supply water temperature, condenser return water temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 65 00 - Cooling Towers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the cooling tower to transfer heat effectively.

Instrumentation

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Normal Operation – Outside Air Wetbulb (if applicable)
   1. Verify minimum condenser water supply temperature setpoint is 70ºF.
   2. Verify condenser water supply to outside air wetbulb temperature differential is 8ºF.
   3. Record condenser water supply temperature setpoint.
   4. Record outside air wetbulb temperature.
   5. Override associated chiller to energize and override chilled water supply temperature setpoint to be 10º below current temperature (ensure adjusted supply temperature setpoint will not create a freezing condition at chiller). (if necessary override chiller lockout).
   6. Verify associated condenser pump is energized.
   7. Record condenser water supply temperature.
   8. Override minimum condenser water supply temperature setpoint to be 5º above current condenser water supply temperature.
   9. Verify that condenser water bypass valve is modulates to maintain supply water temperature.
   10. Return minimum condenser water supply temperature setpoint to normal operation.
   11. Override minimum condenser water supply temperature setpoint to be 5º below current condenser water supply temperature. (if necessary create full load at chiller by operating at 100% OA, opening all HW/steam coil valves, or other feasible means)
   12. Verify condenser water bypass valve closes and lead fan is energized and fan speed modulates to maintain supply water temperature.
   13. Override condenser water temperature setpoint to be 5º above current condenser water supply temperature.
   14. Verify lead fan speed increases to 55%, lag fan is energized at 55% fan speed after 15 minutes of lead fan at or above 55% speed, and both fans work in concert (identical speeds) to maintain supply water temperature.
   15. Return system to normal operation.
2. Normal Operation – Return Water (if applicable)
   1. Verify minimum condenser water supply temperature setpoint is 70ºF.
   2. Verify condenser water supply to condenser water return temperature differential is 20ºF.
   3. Record condenser water supply temperature setpoint.
   4. Record outside air wetbulb temperature.
   5. Override associated chiller to energize and override chilled water supply temperature setpoint to be 10º below current temperature (ensure adjusted supply temperature setpoint will not create a freezing condition at chiller). (if necessary override chiller lockout).
   6. Verify associated condenser pump is energized.
   7. Record condenser water supply temperature.
   8. Override minimum condenser water supply temperature setpoint to be 5º above current condenser water supply temperature.
   9. Verify that condenser water bypass valve is modulates to maintain supply water temperature.
   10. Return minimum condenser water supply temperature setpoint to normal operation.
   11. Override minimum condenser water supply temperature setpoint to be 5º below current condenser water supply temperature. (if necessary create full load at chiller by operating at 100% OA, opening all HW/steam coil valves, or other feasible means)
   12. Verify condenser water bypass valve closes and lead fan is energized and fan speed modulates to maintain supply water temperature.
   13. Override condenser water temperature setpoint to be 5º above current condenser water supply temperature.
   14. Verify lead fan speed increases to 55%, lag fan is energized at 55% fan speed after 15 minutes of lead fan at or above 55% speed, and both fans work in concert (identical speeds) to maintain supply water temperature.
   15. Return system to normal operation.
3. Electric Basin Heater
   1. Verify basin heater temperature setpoint is [XXºF].
   2. Record current basin water temperature.
   3. Override basin heater temperature setpoint to be 5º above current basin water temperature.
   4. Verify heater is energized.
   5. Return system to normal operation.
   6. Disconnect low water cutoff switch.
   7. Verify alarm is generated at BAS head end.
   8. Override basin heater temperature setpoint to be 5º above current basin water temperature.
   9. Verify heater does not energize.

**Results**

**Normal Operation – Outside Air Wetbulb (if applicable):**

|  |  |
| --- | --- |
| Minimum condenser water supply temperature setpoint is 70ºF? | Y / N |
| Condenser water supply to outside air wetbulb temperature differential is 8ºF? | Y / N |
| Condenser Water Supply Temperature Setpoint: |  |
| Outside Air Wetbulb Temperature: |  |
| Condenser water supply temperature setpoint is equal to outside air wetbulb temperature plus condenser water supply to outside air wetbulb temperature differential, but no less than 70ºF? | Y / N |
| Condenser pump is energized in conjunction with energization of associated chiller? | Y / N |
| Condenser Water Supply Temperature: |  |
| Condenser water bypass valve modulates to maintain supply water temperature when condenser water supply temperature falls below minimum condenser water supply temperature setpoint? | Y / N |
| Condenser water bypass valve closes and lead fan is energized and fan speed modulates to maintain supply water temperature when condenser water temperature exceeds minimum condenser water supply temperature setpoint by more than 2º? | Y / N |
| Lag fan is energized and speed controlled in concert with lead fan speed after lead fan has operated at or above 55% speed for more than 15 minutes? | Y / N |

**Normal Operation – Return Water (if applicable):**

|  |  |
| --- | --- |
| Minimum condenser water supply temperature setpoint is 70ºF? | Y / N |
| Condenser water supply to return water temperature differential is 20ºF? | Y / N |
| Condenser Water Supply Temperature Setpoint: |  |
| Outside Air Wetbulb Temperature: |  |
| Condenser water supply temperature setpoint is equal to outside air wetbulb temperature plus condenser water supply to outside air wetbulb temperature differential, but no less than 70ºF? | Y / N |
| Condenser pump is energized in conjunction with energization of associated chiller? | Y / N |
| Condenser Water Supply Temperature: |  |
| Condenser water bypass valve modulates to maintain supply water temperature when condenser water supply temperature falls below minimum condenser water supply temperature setpoint? | Y / N |
| Condenser water bypass valve closes and lead fan is energized and fan speed modulates to maintain supply water temperature when condenser water temperature exceeds minimum condenser water supply temperature setpoint by more than 2º? | Y / N |
| Lag fan is energized and speed controlled in concert with lead fan speed after lead fan has operated at or above 55% speed for more than 15 minutes? | Y / N |

**Electric Basin Heater:**

|  |  |
| --- | --- |
| Basin heater temperature setpoint is [XXºF]? | Y / N |
| Basin Water Temperature: |  |
| Heater is energized on recognition of basin water temperatures below setpoint? | Y / N |
| Alarm is generated at BAS head end and heater does nto energize on recognition of low water cutoff? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, chiller status, OA wetbulb, condenser water supply temperature, condenser water supply temperature setpoint, condenser water return temperature, lead fan status, lead fan speed, lag fan status, lag fan speed

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

FPT-23 72 00 – Air-to-Air Heat Exchangers-Fixed Plate

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of air-to air heat exchangers with fixed plates.

Instrumentation

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

*To be defined by A/E and commissioning provider at completion of construction documents.*

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and exhaust dampers close fully.
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Return “on” command to normal operation.
   7. Verify all associated fire/smoke dampers have opened.
   8. Verify unit is energized and all devices return to normal operation.
2. Economizer Mode
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer enable range is between [XXoF] and [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o above the lower end of the economizer enable range.
   5. Verify bypass damper for both the exhaust and outside air streams open fully, and both streams to heat exchanger are isolated.
   6. Override outside air temperature to be 5o above the higher end of the economizer enable range.
   7. Verify bypass damper for both the exhaust and outside air streams close fully, and both streams to heat exchanger are opened.
   8. Return system to normal operation.
3. Maintenance Mode
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Enable maintenance mode.
   3. Verify bypass damper for both the exhaust and outside air streams open fully.
   4. Return system to normal operation.
4. Washdown Mode
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Enable washdown mode.
   3. Visually verify washdown valve opens and nozzles spray heat exchanger surface
   4. Return system to normal operation.
5. Pre-Heat Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify pre-heat enable setpoint is [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o below the pre-heat enable setpoint range.
   5. Verify electric coil is energized.
   6. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and exhaust dampers close fully when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize unit by BAS? YES NO

**Economizer Mode:**

|  |  |
| --- | --- |
| Economizer enable range is between [XXoF] and [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Exhaust and outside airstreams isolated and bypass dampers open fully when outside air temperatures fall within the economizer enable range? | Y / N |

**Maintenance Mode:**

Bypass dampers open fully for exhaust and outside airstreams on recognition of call for maintenance mode? YES NO

**Washdown Mode:**

Washdown valve opens fully and heat exchanger surface is washed fully on recognition of call for washdown mode? YES NO

**Pre-Heat Mode (if applicable):**

|  |  |
| --- | --- |
| Pre-heat enable setpoint is [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Electric coil is energized when outside air temperatures fall below frost protection setpoint? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, exhaust fan status, supply fan status, electric coil status, RAT, OAT, SAT, OA damper position, EA damper position, washdown valve position

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

FPT-23 72 00 - Air-to-Air Heat Exchangers-Heat Pipe

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of air-to air heat exchangers with heat pipes.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and exhaust dampers close fully.
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Return “on” command to normal operation.
   7. Verify all associated fire/smoke dampers have opened.
   8. Verify unit is energized and all devices return to normal operation.
2. Economizer Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer enable range is between [XXoF] and [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o above the lower end of the economizer enable range.
   5. Verify bypass damper for both the exhaust and outside air streams open fully, and both streams to heat pipe are isolated.
   6. Override outside air temperature to be 5o above the higher end of the economizer enable range.
   7. Verify bypass damper for both the exhaust and outside air streams close fully, and both streams to heat pipe are opened.
   8. Return system to normal operation.
3. Pre-Heat Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify pre-heat enable setpoint is [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o below the pre-heat enable setpoint range.
   5. Verify electric coil is energized.
   6. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and exhaust dampers close fully when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize unit by BAS? YES NO

**Economizer Mode (if applicable):**

|  |  |
| --- | --- |
| Economizer enable range is between [XXoF] and [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Exhaust and outside airstreams isolated and bypass dampers open fully when outside air temperatures fall within the economizer enable range? | Y / N |

**Pre-Heat Mode (if applicable):**

|  |  |
| --- | --- |
| Pre-heat enable setpoint is [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Electric coil is energized when outside air temperatures fall below frost protection setpoint? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, exhaust fan status, supply fan status, electric coil status, RAT, OAT, SAT, OA damper position, EA damper position

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 72 00 - Air-to-Air Heat Exchangers-Rotary Wheel

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the functionality of energy recovery wheel units.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and exhaust dampers close fully.
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Return “on” command to normal operation.
   7. Verify all associated fire/smoke dampers have opened.
   8. Verify unit is energized and all devices return to normal operation.
2. Economizer Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer enable range is between [XXoF] and [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o below the lower end of the economizer enable range.
   5. Verify wheel rotates freely and continuously.
   6. Override outside air temperature to be 5o above the lower end of the economizer enable range.
   7. Verify wheel stops and jogs, rotates 1/2 rotation, once every [XX] minutes (do not perform next step until one jog cycle has been observed).
   8. Override outside air temperature to be 5o above the higher end of the economizer enable range.
   9. Verify wheel rotates freely and continuously.
   10. Return system to normal operation.
3. Frost Protection Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify frost protection setpoint is [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o below the frost protection setpoint range.
   5. Verify wheel stops and jogs, rotates 1/2 rotation, once every [XX] minutes (do not perform next step until one jog cycle has been observed).
   6. Return system to normal operation.
4. Pre-Heat Mode (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify pre-heat enable setpoint is [XXoF].
   3. Record current outside air temperature.
   4. Override outside air temperature to be 5o below the pre-heat enable setpoint range.
   5. Verify electric coil is energized and wheel continues to rotate freely and continuously.
   6. Return system to normal operation.
5. Alarms and Safeties
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Disconnect power to energy recovery wheel (wheel motor ONLY) via local disconnect.
   3. Verify alarm is generated at BAS head end.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and exhaust dampers close fully when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize unit by BAS? YES NO

**Economizer Mode (if applicable):**

|  |  |
| --- | --- |
| Economizer enable range is between [XXoF] and [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Wheel is de-energized when outside air temperatures fall within the economizer enable range? | Y / N |
| Wheel is jogged (1/2 rotation) every [XX] minutes when outside air temperatures fall within the economizer enable range? | Y / N |

**Frost Protection Mode (if applicable):**

|  |  |
| --- | --- |
| Frost protection enable setpoint is [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Wheel is de-energized when outside air temperatures fall below frost protection setpoint? | Y / N |
| Wheel is jogged (1/2 rotation) every [XX] minutes when outside air temperatures fall below frost protection setpoint? | Y / N |

**Pre-Heat Mode (if applicable):**

|  |  |
| --- | --- |
| Pre-heat enable setpoint is [XXoF]? | Y / N |
| Outside Air Temperature: |  |
| Electric coil is energized when outside air temperatures fall below frost protection setpoint? | Y / N |

**Alarms and Safeties:**

Alarm is generated at BAS head end on recognition of wheel rotation failure? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, exhaust fan status, supply fan status, wheel status, electric coil status, RAT, OAT, SAT, OA damper position, EA damper position

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 73 13 - Air Handling Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the AHU to maintain discharge temperatures to supply air distribution systems for the facility, as well as evaluate the functionality of the integral sequences related to this primary service.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and exhaust dampers close fully and return air damper opens fully (for 100% outside air applications verify dampers close fully).
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Visually verify that chilled water valve is closed (if applicable).
   7. Override discharge temperature setpoint to be 10o above current temperature.
   8. Verify hot water or steam valve modulates open to maintain discharge temperature.
   9. Return discharge temperature setpoint to normal operation.
   10. Disconnect lead to freezestat.
   11. Verify hot water or steam valve modulates fully open and freeze alarm is generated at BAS head end.
   12. Return freezestat to normal operation.
   13. Return “on” command to normal operation.
   14. Verify all associated fire/smoke dampers have opened.
   15. Verify unit is energized and all devices return to normal operation.
2. Economizer Mode – Dry Bulb (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer switchover sepoint is 68oF.
   3. Record current outside air temperature.
   4. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override economizer switchover sepoint to be 10o above current outside air temperature.
   5. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   6. Verify outside air and relief dampers open fully and return air damper closes fully.
   7. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   8. Return system to normal operation.
   9. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   10. Verify outside air and relief dampers open fully and return air damper closes fully.
   11. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   12. Return system to normal operation.
3. Economizer Mode – Floating Dry Bulb (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer differential sepoint is 4oF.
   3. Record current outside and return air temperatures.
   4. If unit is currently operating in a cooling mode and outside air temperature is above return air temperature -4oF verify outside, return and relief dampers are at minimum outside air ventilation positions.
   5. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override return air temperature to be 10o above current outside air temperature.
   6. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   7. Verify outside air and relief dampers open fully and return air damper closes fully.
   8. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   9. Return system to normal operation.
   10. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   11. Verify outside air and relief dampers open fully and return air damper closes fully.
   12. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   13. Return system to normal operation.
4. Economizer Mode – Fixed Enthalpy (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer switchover sepoint is 28 Btu/lb of dry air.
   3. Calculate current outside air enthalpy.
   4. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override economizer switchover sepoint to be 5 Btu/lb above current outside air enthalpy.
   5. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   6. Verify outside air and relief dampers open fully and return air damper closes fully.
   7. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   8. Return system to normal operation.
   9. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   10. Verify outside air and relief dampers open fully and return air damper closes fully.
   11. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   12. Return system to normal operation.
5. Economizer Mode – Differential Enthalpy (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer differential sepoint is 1 Btu/lb of dry air.
   3. Record current outside and return air enthalpies.
   4. If unit is currently operating in a cooling mode and outside air enthalpy is above return air enthalpy -1 Btu/lb verify outside, return and relief dampers are at minimum outside air ventilation positions.
   5. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override return air enthalpy to be 5 Btu/lb above current outside air enthalpy.
   6. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   7. Verify outside air and relief dampers open fully and return air damper closes fully.
   8. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   9. Return system to normal operation.
   10. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   11. Verify outside air and relief dampers open fully and return air damper closes fully.
   12. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   13. Return system to normal operation.
6. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify discharge air temperature setpoint is 55oF.
   3. Record discharge air temperature.
   4. Override discharge air temperature setpoint to be 5o above current discharge temperature.
   5. Verify outside, return and relief dampers modulate to minimum outside air ventilation positions.
   6. Verify hot water or steam valve modulates open to maintain discharge temperature without hunting or overshooting.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Disable economizer mode for unit.
   9. Return discharge air temperature setpoint to normal operation.
   10. Verify chilled water valve modulates or refrigerant circuits energize to maintain discharge temperature without hunting or overshooting.
   11. Allow unit to stabilize at setpoint for 10 minutes.
   12. Override outside air temperature to be 50oF.
   13. Verify chilled water valve closes or refrigerant circuits de-energize.
   14. Return system to normal operation.
7. Face and Bypass
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify heating coil lockout temperature setpoint is 50ºF.
   3. Record outside air temperature.
   4. Override outside air temperature to be 5º above heating coil lockout temperature setpoint.
   5. Verify hot water or steam valve closes.
   6. Return outside air temperature to normal operation.
   7. Verify heating sequence switchover setpoint is 40ºF.
   8. Record mixed air temperature.
   9. Override discharge air temperature setpoint to be 5º above current discharge air temperature.
   10. Override heating sequence switchover setpoint to be 5º below current mixed air temperature.
   11. Verify hot water or steam valve and dampers modulate in concert to maintain discharge air temperature.
   12. Override heating sequence switchover setpoint to be 5º above current mixed air temperature.
   13. Verify hot water or steam valve opens fully and dampers modulate to maintain discharge air temperature.
   14. Return system to normal operation.
   15. Override system into unoccupied mode and allow to stabilize for 10 minutes.
   16. Verify coil mixed air start-up temperature setpoint is 53ºF.
   17. Record current mixed air temperature.
   18. Override coil mixed air start-up temperature setpoint to be 5º above current mixed air temperature.
   19. Override system into occupied mode.
   20. Verify unit energizes and hot water or steam valve opens fully and dampers modulate maintain mixed air start-up temperature.
   21. Allow unit to stabilize for 15 minutes.
   22. Verify coil control is transferred to typical heating sequence of control.
   23. Return system to normal operation.
8. CO2 Reset – Volume Matching (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
   3. Record CO2 return air level.
   4. Record CO2 outside air level (for differential reset applications ONLY).
   5. Override return air CO2 level to be 150 ppm below return air reset setpoint.
   6. Visually verify minimum outside air damper modulates to minimum position.
   7. Override return air CO2 level to be 150 ppm above return air reset setpoint.
   8. Visually verify minimum outside air damper modulates to maximum position.
   9. Override return air CO2 level to be 1850 ppm.
   10. Verify CO2 alarm is generated at BAS head end.
   11. Return system to normal operation.
9. CO2 Reset – Minimum Outside Air Damper Differential Pressure (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
   3. Record CO2 return air level.
   4. Record CO2 outside air level (for differential reset applications ONLY).
   5. Record minimum outside air damper differential pressure setpoint.
   6. Override return air CO2 level to be 150 ppm below return air reset setpoint.
   7. Visually verify relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint.
   8. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.).
   9. Verify relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence.
   10. Return system to normal operation.
   11. Override return air CO2 level to be 150 ppm above return air reset setpoint.
   12. Visually verify relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint.
   13. Override return air CO2 level to be 1850 ppm.
   14. Verify CO2 alarm is generated at BAS head end.
   15. Return system to normal operation.
10. CO2 Reset – Minimum Outside Air Flow (if applicable)
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
    3. Record CO2 return air level.
    4. Record CO2 outside air level (for differential reset applications ONLY).
    5. Record minimum outside air flow setpoint.
    6. Record maximum outside air flow setpoint.
    7. Override return air CO2 level to be 150 ppm below return air reset setpoint.
    8. Visually verify minimum outside air damper modulates to maintain minimum outside air flow setpoint.
    9. Override minimum outside air flow setpoint to be equal to maximum outside air flow setpoint plus 500 cfm.
    10. Verify return air damper closes to 50% open and relief damper opens fully.
    11. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.).
    12. Verify relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence.
    13. Return system to normal operation.
    14. Override return air CO2 level to be 150 ppm above return air reset setpoint.
    15. Visually verify minimum outside air damper modulates to maintain maximum outside air flow setpoint.
    16. Override return air CO2 level to be 1850 ppm.
    17. Verify CO2 alarm is generated at BAS head end.
    18. Return system to normal operation.
11. CO2 Reset – Full Outside Air Flow (if applicable)
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
    3. Record CO2 return air level.
    4. Record CO2 outside air level (for differential reset applications ONLY).
    5. Record minimum outside air flow setpoint.
    6. Record maximum outside air flow setpoint.
    7. Override return air CO2 level to be 150 ppm below return air reset setpoint.
    8. Visually verify outside air damper modulates to maintain minimum outside air flow setpoint.
    9. Override return air CO2 level to be 150 ppm above return air reset setpoint.
    10. Visually verify outside air damper modulates to maintain maximum outside air flow setpoint.
    11. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.). Ensure call for cooling will not result in outside air damper being commanded to more than 50% open.
    12. Record current outside air flow.
    13. Override maximum outside air flow setpoint to be 500 cfm above current outside air flow.
    14. Verify outside, return and relief dampers modulate to maintain increased outside air flow setpoint.
    15. Override return air CO2 level to be 1850 ppm.
    16. Verify CO2 alarm is generated at BAS head end.
    17. Return system to normal operation.
12. Cooling / Heating Optimum Start
    1. Given these sequences are based upon algorithms testing of this procedures is best suited by reviewing trends specifically designed to analyze the functionality of the algorithm. Therefore, the test procedures will be to have Contractor provide seven (7) days of trending of points noted below at five (5) minute intervals with date and time as X axis:
       1. Unit status
       2. Zone temperature (critical zone as noted by contract documents)
       3. Occupied zone temperature setpoint (critical zone as noted by contract documents)
       4. Outside air temperature
13. Unoccupied Mode
    1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
    2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
    3. Locate space with lowest temperature and record current space temperature of that space.
    4. Override unoccupied heating space temperature setpoint to be 10o above selected space (ensure cooling setpoint is at least 10o above override value).
    5. Verify outside and relief air dampers close and return air damper opens to 100%.
    6. Verify unit energizes and hot water or steam valve modulates to maintain discharge temperature.
    7. Return unoccupied heating space temperature setpoint to normal operation.
    8. Override unoccupied cooling space temperature setpoint to be 10o below selected space (ensure heating setpoint is at least 10o below override value).
    9. Verify unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain discharge temperature.
    10. Return system to normal operation.
14. Alarms and Safeties
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Record freezestat setpoint.
    3. Disconnect freezestat to simulate a freezing condition.
    4. Verify unit is de-energized and alarm is generated at BAS head end.
    5. Record supply high limit setpoint.
    6. Override supply high limit pressure switch to be set below current static pressure reading.
    7. Verify that unit shuts down and alarm is initiated at BAS head end.
    8. Return system to normal operation.
    9. Record supply low limit setpoint.
    10. Override supply low limit pressure switch to be set above current static pressure reading.
    11. Verify that unit shuts down and alarm is initiated at BAS head end.
    12. Return system to normal operation.
    13. Record return high limit setpoint.
    14. Override return high limit pressure switch to be set below current static pressure reading.
    15. Verify that unit shuts down and alarm is initiated at BAS head end.
    16. Return system to normal operation.
    17. Record return low limit setpoint.
    18. Override return low limit pressure switch to be set above current static pressure reading.
    19. Verify that unit shuts down and alarm is initiated at BAS head end.
    20. Return system to normal operation.
    21. Disconnect fire alarm relay to simulate a fire condition (ensure occupants and local authorities have been notified prior to this test).
    22. Verify that unit shuts down and alarm is initiated at BAS head end.
    23. Verify that all associated fire/smoke dampers are closed and signal from these dampers is initiated at BAS head end.
    24. Return system to normal operation.
    25. De-energize supply fan via local disconnect.
    26. Verify that return fan de-energizes and alarm is initiated at BAS head end.
    27. Return system to normal operation.
    28. Repeat Steps y-aa for return fan.
    29. Record filter monitor alarm setpoint.
    30. Override filter monitor alarm setpoint to be 0.5 psig below current differential pressure across filter rack.
    31. Verify alarm is initiated at BAS head end.
    32. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and exhaust dampers close fully and return air damper opens fully (for 100% outside air

applications verify dampers close fully) when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

Chilled water valve closes (if applicable) when unit is de-energized? YES NO

Hot water or steam valve modulates to maintain discharge temperature when unit is de-energized? YES NO

On recognition of simulated freezestat trip hot water or steam valve modulates fully open and

freeze alarm is generated at BAS head end when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize when unit by BAS? YES NO

**Economizer Mode – Dry Bulb (if applicable):**

|  |  |
| --- | --- |
| Economizer switchover sepoint is 68oF? | Y / N |
| Outside Air Temperature: |  |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Floating Dry Bulb (if applicable):**

|  |  |
| --- | --- |
| Economizer differential sepoint is 4oF? | Y / N |
| Outside Air Temperature: |  |
| Return Air Temperature: |  |
| Outside, relief and return air dampers maintain minimum ventilation positions when outside air temperature exceeds current return air temperature -4oF? | Y / N |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Fixed Enthalpy (if applicable):**

|  |  |
| --- | --- |
| Economizer switchover sepoint is 28 Btu/lb? | Y / N |
| Outside Air Enthalpy: |  |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Differential Enthalpy (if applicable):**

|  |  |
| --- | --- |
| Economizer differential sepoint is 1 Btu/lb? | Y / N |
| Outside Air Enthalpy: |  |
| Return Air Enthalpy: |  |
| Outside, relief and return air dampers maintain minimum ventilation positions when outside air enthalpy exceeds current return air enthalpy -1 Btu/lb? | Y / N |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Cooling / Heating:**

|  |  |
| --- | --- |
| Heating coil lockout temperature setpoint is 50ºF? | Y / N |
| Outside Air Temperature: |  |
| Hot water or steam valve closes when outside air temperature exceeds heating coil lockout temperature setpoint? | Y / N |
| Hot water or steam valve modulates to maintain discharge temperature (±1oF) with no hunting or overshooting on call for heating? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized to maintain discharge temperature (±1oF) with no hunting or overshooting on call for cooling? | Y / N |
| Chilled water or refrigerant coil is locked out when outside air temperatures fall below 50oF? | Y / N |

**Face and Bypass:**

|  |  |
| --- | --- |
| Discharge air temperature sepoint is 55oF? | Y / N |
| Discharge Air Temperature: |  |
| Outside, relief and return air dampers modulate to minimum ventilation positions on call for heating? | Y / N |
| Heating sequence switchover setpoint is 40ºF? | Y / N |
| Mixed Air Temperature: |  |
| Hot water or steam valve and dampers modulate in concert to maintain discharge air temperature when mixed air temperature is above heating sequence switchover setpoint? | Y / N |
| Hot water or steam valve opens fully and dampers modulate to maintain discharge air temperature when mixed air temperature is below heating sequence switchover setpoint? | Y / N |
| Coil mixed air start-up temperature setpoint is 53ºF? | Y / N |
| Upon start-up unit energizes and hot water or steam valve opens fully and dampers modulate maintain mixed air start-up temperature for a period of 15 minutes? | Y / N |

**CO2 Reset – Volume Matching (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Minimum outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Minimum Outside Air Damper Differential Pressure (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Damper Differential Pressure Setpoint: |  |
| Relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint on recognition of decreased CO2 return air levels? | Y / N |
| Relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence when economizer mode is active? | Y / N |
| Relief and return air dampers modulate to maintain maximum outside air damper differential pressure setpoint on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Minimum Outside Air Flow (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Flow: |  |
| Maximum Outside Air Flow: |  |
| Minimum outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Return air damper closes to 50% open and relief damper opens fully on recognition that outside air flow setpoint is not met with minimum outside damper at 100% open? | Y / N |
| Relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence when economizer mode is active? | Y / N |
| Minimum outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Full Outside Air Flow (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Flow Setpoint: |  |
| Maximum Outside Air Flow Setpoint: |  |
| Outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| Outside Air Flow: |  |
| Outside, return and relief air dampers modulate to maintain outside air flow setpoint regardless of economizer mode being active? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**Cooling / Heating Optimum Start:**

Trends show unit achieves occupied zone temperature setpoint within ±1oF no more than

30 minutes prior to scheduled start of occupied period? YES NO

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space #: |  |
| Space Temperature: |  |
| Unit energizes, outside and relief air dampers close and return air damper opens to 100%, and hot water or steam valve modulates to maintain discharge temperature under call for heating? | Y / N |
| Unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain discharge temperature under call for cooling? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Freezestat |  | Y / N |
| Supply high limit |  | Y / N |
| Supply low limit |  | Y / N |
| Return high limit |  | Y / N |
| Return low limit |  | Y / N |
| Fire alarm | N/A | Y / N |
| Supply fan failure |  | Y / N |
| Return fan failure |  | Y / N |
| Filter monitor |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, return fan status, supply fan status, RAT, OAT, SAT, OA damper position, RA damper position, Relief damper position, heating valve position, CHW valve position, refrigerant circuit status, OA enthalpy, RA enthalpy, MAT, CO2 RA, CO2 OA, OA flow, minimum OA flow, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

FPT-23 73 23 - Factory Fabricated Custom Air Handling Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the Custom AHU to maintain discharge temperatures to supply air distribution systems for the facility, as well as evaluate the functionality of the integral sequences related to this primary service.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Visually verify that outside air and exhaust dampers close fully and return air damper opens fully (for 100% outside air applications verify dampers close fully).
   5. Visually verify all associated fire/smoke dampers have closed.
   6. Visually verify that chilled water valve is closed (if applicable).
   7. Override discharge temperature setpoint to be 10o above current temperature.
   8. Verify hot water or steam valve modulates open to maintain discharge temperature.
   9. Return discharge temperature setpoint to normal operation.
   10. Disconnect lead to freezestat.
   11. Verify hot water or steam valve modulates fully open and freeze alarm is generated at BAS head end.
   12. Return freezestat to normal operation.
   13. Return “on” command to normal operation.
   14. Verify all associated fire/smoke dampers have opened.
   15. Verify unit is energized and all devices return to normal operation.
2. Economizer Mode – Dry Bulb (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer switchover sepoint is 68oF.
   3. Record current outside air temperature.
   4. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override economizer switchover sepoint to be 10o above current outside air temperature.
   5. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   6. Verify outside air and relief dampers open fully and return air damper closes fully.
   7. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   8. Return system to normal operation.
   9. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   10. Verify outside air and relief dampers open fully and return air damper closes fully.
   11. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   12. Return system to normal operation.
3. Economizer Mode – Floating Dry Bulb (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer differential sepoint is 4oF.
   3. Record current outside and return air temperatures.
   4. If unit is currently operating in a cooling mode and outside air temperature is above return air temperature -4oF verify outside, return and relief dampers are at minimum outside air ventilation positions.
   5. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override return air temperature to be 10o above current outside air temperature.
   6. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   7. Verify outside air and relief dampers open fully and return air damper closes fully.
   8. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   9. Return system to normal operation.
   10. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   11. Verify outside air and relief dampers open fully and return air damper closes fully.
   12. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   13. Return system to normal operation.
4. Economizer Mode – Fixed Enthalpy (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer switchover sepoint is 28 Btu/lb of dry air.
   3. Calculate current outside air enthalpy.
   4. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override economizer switchover sepoint to be 5 Btu/lb above current outside air enthalpy.
   5. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   6. Verify outside air and relief dampers open fully and return air damper closes fully.
   7. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   8. Return system to normal operation.
   9. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   10. Verify outside air and relief dampers open fully and return air damper closes fully.
   11. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   12. Return system to normal operation.
5. Economizer Mode – Differential Enthalpy (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify economizer differential sepoint is 1 Btu/lb of dry air.
   3. Record current outside and return air enthalpies.
   4. If unit is currently operating in a cooling mode and outside air enthalpy is above return air enthalpy -1 Btu/lb verify outside, return and relief dampers are at minimum outside air ventilation positions.
   5. If unit is currently operating in a cooling mode verify outside, relief and return air dampers modulate to maintain discharge air temperature. If necessary, override return air enthalpy to be 5 Btu/lb above current outside air enthalpy.
   6. Simulate a false heat load on the unit by overriding hot water or steam valve to 100% open (or other feasible means).
   7. Verify outside air and relief dampers open fully and return air damper closes fully.
   8. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   9. Return system to normal operation.
   10. If unit is currently operating in a heating mode, override hot water or steam valve to 100% open (or provide other supplementary heat to unit) and override discharge air temperature to be 10o below current temperature (ensure cooling coil lockout has been jumped or disabled).
   11. Verify outside air and relief dampers open fully and return air damper closes fully.
   12. Verify chilled water valve modulates open or refrigerant circuit is energized upon further call for cooling.
   13. Return system to normal operation.
6. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify discharge air temperature setpoint is 55oF.
   3. Record discharge air temperature.
   4. Override discharge air temperature setpoint to be 5o above current discharge temperature.
   5. Verify outside, return and relief dampers modulate to minimum outside air ventilation positions.
   6. Verify hot water or steam valve modulates open to maintain discharge temperature without hunting or overshooting.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Disable economizer mode for unit.
   9. Return discharge air temperature setpoint to normal operation.
   10. Verify chilled water valve modulates or refrigerant circuits energize to maintain discharge temperature without hunting or overshooting.
   11. Allow unit to stabilize at setpoint for 10 minutes.
   12. Override outside air temperature to be 50oF.
   13. Verify chilled water valve closes or refrigerant circuits de-energize.
   14. Return system to normal operation.
7. Face and Bypass
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify heating coil lockout temperature setpoint is 50ºF.
   3. Record outside air temperature.
   4. Override outside air temperature to be 5º above heating coil lockout temperature setpoint.
   5. Verify hot water or steam valve closes.
   6. Return outside air temperature to normal operation.
   7. Verify heating sequence switchover setpoint is 40ºF.
   8. Record mixed air temperature.
   9. Override discharge air temperature setpoint to be 5º above current discharge air temperature.
   10. Override heating sequence switchover setpoint to be 5º below current mixed air temperature.
   11. Verify hot water or steam valve and dampers modulate in concert to maintain discharge air temperature.
   12. Override heating sequence switchover setpoint to be 5º above current mixed air temperature.
   13. Verify hot water or steam valve opens fully and dampers modulate to maintain discharge air temperature.
   14. Return system to normal operation.
   15. Override system into unoccupied mode and allow to stabilize for 10 minutes.
   16. Verify coil mixed air start-up temperature setpoint is 53ºF.
   17. Record current mixed air temperature.
   18. Override coil mixed air start-up temperature setpoint to be 5º above current mixed air temperature.
   19. Override system into occupied mode.
   20. Verify unit energizes and hot water or steam valve opens fully and dampers modulate maintain mixed air start-up temperature.
   21. Allow unit to stabilize for 15 minutes.
   22. Verify coil control is transferred to typical heating sequence of control.
   23. Return system to normal operation.
8. CO2 Reset – Volume Matching (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
   3. Record CO2 return air level.
   4. Record CO2 outside air level (for differential reset applications ONLY).
   5. Override return air CO2 level to be 150 ppm below return air reset setpoint.
   6. Visually verify minimum outside air damper modulates to minimum position.
   7. Override return air CO2 level to be 150 ppm above return air reset setpoint.
   8. Visually verify minimum outside air damper modulates to maximum position.
   9. Override return air CO2 level to be 1850 ppm.
   10. Verify CO2 alarm is generated at BAS head end.
   11. Return system to normal operation.
9. CO2 Reset – Minimum Outside Air Damper Differential Pressure (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
   3. Record CO2 return air level.
   4. Record CO2 outside air level (for differential reset applications ONLY).
   5. Record minimum outside air damper differential pressure setpoint.
   6. Override return air CO2 level to be 150 ppm below return air reset setpoint.
   7. Visually verify relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint.
   8. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.).
   9. Verify relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence.
   10. Return system to normal operation.
   11. Override return air CO2 level to be 150 ppm above return air reset setpoint.
   12. Visually verify relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint.
   13. Override return air CO2 level to be 1850 ppm.
   14. Verify CO2 alarm is generated at BAS head end.
   15. Return system to normal operation.
10. CO2 Reset – Minimum Outside Air Flow (if applicable)
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
    3. Record CO2 return air level.
    4. Record CO2 outside air level (for differential reset applications ONLY).
    5. Record minimum outside air flow setpoint.
    6. Record maximum outside air flow setpoint.
    7. Override return air CO2 level to be 150 ppm below return air reset setpoint.
    8. Visually verify minimum outside air damper modulates to maintain minimum outside air flow setpoint.
    9. Override minimum outside air flow setpoint to be equal to maximum outside air flow setpoint plus 500 cfm.
    10. Verify return air damper closes to 50% open and relief damper opens fully.
    11. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.).
    12. Verify relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence.
    13. Return system to normal operation.
    14. Override return air CO2 level to be 150 ppm above return air reset setpoint.
    15. Visually verify minimum outside air damper modulates to maintain maximum outside air flow setpoint.
    16. Override return air CO2 level to be 1850 ppm.
    17. Verify CO2 alarm is generated at BAS head end.
    18. Return system to normal operation.
11. CO2 Reset – Full Outside Air Flow (if applicable)
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Verify CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level.
    3. Record CO2 return air level.
    4. Record CO2 outside air level (for differential reset applications ONLY).
    5. Record minimum outside air flow setpoint.
    6. Record maximum outside air flow setpoint.
    7. Override return air CO2 level to be 150 ppm below return air reset setpoint.
    8. Visually verify outside air damper modulates to maintain minimum outside air flow setpoint.
    9. Override return air CO2 level to be 150 ppm above return air reset setpoint.
    10. Visually verify outside air damper modulates to maintain maximum outside air flow setpoint.
    11. Override system to produce call for cooling under economizer conditions (this may require overriding outside air temperature, discharge temperature, etc.). Ensure call for cooling will not result in outside air damper being commanded to more than 50% open.
    12. Record current outside air flow.
    13. Override maximum outside air flow setpoint to be 500 cfm above current outside air flow.
    14. Verify outside, return and relief dampers modulate to maintain increased outside air flow setpoint.
    15. Override return air CO2 level to be 1850 ppm.
    16. Verify CO2 alarm is generated at BAS head end.
    17. Return system to normal operation.
12. Cooling / Heating Optimum Start
    1. Given these sequences are based upon algorithms testing of this procedures is best suited by reviewing trends specifically designed to analyze the functionality of the algorithm. Therefore, the test procedures will be to have Contractor provide seven (7) days of trending of points noted below at five (5) minute intervals with date and time as X axis:
       1. Unit status
       2. Zone temperature (critical zone as noted by contract documents)
       3. Occupied zone temperature setpoint (critical zone as noted by contract documents)
       4. Outside air temperature
13. Unoccupied Mode
    1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
    2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
    3. Locate space with lowest temperature and record current space temperature of that space.
    4. Override unoccupied heating space temperature setpoint to be 10o above selected space (ensure cooling setpoint is at least 10o above override value).
    5. Verify outside and relief air dampers close and return air damper opens to 100%.
    6. Verify unit energizes and hot water or steam valve modulates to maintain discharge temperature.
    7. Return unoccupied heating space temperature setpoint to normal operation.
    8. Override unoccupied cooling space temperature setpoint to be 10o below selected space (ensure heating setpoint is at least 10o below override value).
    9. Verify unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain discharge temperature.
    10. Return system to normal operation.
14. Alarms and Safeties
    1. Verify unit is in occupied mode. If not override system into occupied mode.
    2. Record freezestat setpoint.
    3. Disconnect freezestat to simulate a freezing condition.
    4. Verify unit is de-energized and alarm is generated at BAS head end.
    5. Record supply high limit setpoint.
    6. Override supply high limit pressure switch to be set below current static pressure reading.
    7. Verify that unit shuts down and alarm is initiated at BAS head end.
    8. Return system to normal operation.
    9. Record supply low limit setpoint.
    10. Override supply low limit pressure switch to be set above current static pressure reading.
    11. Verify that unit shuts down and alarm is initiated at BAS head end.
    12. Return system to normal operation.
    13. Record return high limit setpoint.
    14. Override return high limit pressure switch to be set below current static pressure reading.
    15. Verify that unit shuts down and alarm is initiated at BAS head end.
    16. Return system to normal operation.
    17. Record return low limit setpoint.
    18. Override return low limit pressure switch to be set above current static pressure reading.
    19. Verify that unit shuts down and alarm is initiated at BAS head end.
    20. Return system to normal operation.
    21. Disconnect fire alarm relay to simulate a fire condition (ensure occupants and local authorities have been notified prior to this test).
    22. Verify that unit shuts down and alarm is initiated at BAS head end.
    23. Verify that all associated fire/smoke dampers are closed and signal from these dampers is initiated at BAS head end.
    24. Return system to normal operation.
    25. De-energize supply fan via local disconnect.
    26. Verify that return fan de-energizes and alarm is initiated at BAS head end.
    27. Return system to normal operation.
    28. Repeat Steps y-aa for return fan.
    29. Record filter monitor alarm setpoint.
    30. Override filter monitor alarm setpoint to be 0.5 psig below current differential pressure across filter rack.
    31. Verify alarm is initiated at BAS head end.
    32. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

Outside air and exhaust dampers close fully and return air damper opens fully (for 100% outside air

applications verify dampers close fully) when unit is de-energized? YES NO

All associated fire/smoke dampers close when unit is de-energized? YES NO

Chilled water valve closes (if applicable) when unit is de-energized? YES NO

Hot water or steam valve modulates to maintain discharge temperature when unit is de-energized? YES NO

On recognition of simulated freezestat trip hot water or steam valve modulates fully open and

freeze alarm is generated at BAS head end when unit is de-energized? YES NO

All associated fire/smoke dampers open and are proven open on call to energize when unit by BAS? YES NO

**Economizer Mode – Dry Bulb (if applicable):**

|  |  |
| --- | --- |
| Economizer switchover sepoint is 68oF? | Y / N |
| Outside Air Temperature: |  |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Floating Dry Bulb (if applicable):**

|  |  |
| --- | --- |
| Economizer differential sepoint is 4oF? | Y / N |
| Outside Air Temperature: |  |
| Return Air Temperature: |  |
| Outside, relief and return air dampers maintain minimum ventilation positions when outside air temperature exceeds current return air temperature -4oF? | Y / N |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Fixed Enthalpy (if applicable):**

|  |  |
| --- | --- |
| Economizer switchover sepoint is 28 Btu/lb? | Y / N |
| Outside Air Enthalpy: |  |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Economizer Mode – Differential Enthalpy (if applicable):**

|  |  |
| --- | --- |
| Economizer differential sepoint is 1 Btu/lb? | Y / N |
| Outside Air Enthalpy: |  |
| Return Air Enthalpy: |  |
| Outside, relief and return air dampers maintain minimum ventilation positions when outside air enthalpy exceeds current return air enthalpy -1 Btu/lb? | Y / N |
| Outside, relief and return air dampers modulate in concert to maintain discharge air temperature? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized in economizer mode only after outside air damper has been commanded to 100% and cooling demand remains? | Y / N |

**Cooling / Heating:**

|  |  |
| --- | --- |
| Heating coil lockout temperature setpoint is 50ºF? | Y / N |
| Outside Air Temperature: |  |
| Hot water or steam valve closes when outside air temperature exceeds heating coil lockout temperature setpoint? | Y / N |
| Hot water or steam valve modulates to maintain discharge temperature (±1oF) with no hunting or overshooting on call for heating? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized to maintain discharge temperature (±1oF) with no hunting or overshooting on call for cooling? | Y / N |
| Chilled water or refrigerant coil is locked out when outside air temperatures fall below 50oF? | Y / N |

**Face and Bypass:**

|  |  |
| --- | --- |
| Discharge air temperature sepoint is 55oF? | Y / N |
| Discharge Air Temperature: |  |
| Outside, relief and return air dampers modulate to minimum ventilation positions on call for heating? | Y / N |
| Heating sequence switchover setpoint is 40ºF? | Y / N |
| Mixed Air Temperature: |  |
| Hot water or steam valve and dampers modulate in concert to maintain discharge air temperature when mixed air temperature is above heating sequence switchover setpoint? | Y / N |
| Hot water or steam valve opens fully and dampers modulate to maintain discharge air temperature when mixed air temperature is below heating sequence switchover setpoint? | Y / N |
| Coil mixed air start-up temperature setpoint is 53ºF? | Y / N |
| Upon start-up unit energizes and hot water or steam valve opens fully and dampers modulate maintain mixed air start-up temperature for a period of 15 minutes? | Y / N |

**CO2 Reset – Volume Matching (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Minimum outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Minimum Outside Air Damper Differential Pressure (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Damper Differential Pressure Setpoint: |  |
| Relief and return air dampers modulate to maintain minimum outside air damper differential pressure setpoint on recognition of decreased CO2 return air levels? | Y / N |
| Relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence when economizer mode is active? | Y / N |
| Relief and return air dampers modulate to maintain maximum outside air damper differential pressure setpoint on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Minimum Outside Air Flow (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Flow: |  |
| Maximum Outside Air Flow: |  |
| Minimum outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Return air damper closes to 50% open and relief damper opens fully on recognition that outside air flow setpoint is not met with minimum outside damper at 100% open? | Y / N |
| Relief and return air dampers are released from CO2 reset control and modulate according to economizer sequence when economizer mode is active? | Y / N |
| Minimum outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**CO2 Reset – Full Outside Air Flow (if applicable):**

|  |  |
| --- | --- |
| CO2 return air reset setpoint is 900 ppm or 450 ppm above outside air CO2 level? | Y / N |
| CO2 Return Air Level: |  |
| CO2 Outside Air Level (for differential reset applications ONLY): |  |
| Minimum Outside Air Flow Setpoint: |  |
| Maximum Outside Air Flow Setpoint: |  |
| Outside air damper modulates to minimum position on recognition of decreased CO2 return air levels? | Y / N |
| Outside air damper modulates to maximum position on recognition of increased CO2 return air levels? | Y / N |
| Outside Air Flow: |  |
| Outside, return and relief air dampers modulate to maintain outside air flow setpoint regardless of economizer mode being active? | Y / N |
| CO2 alarm generated at BAS head end when CO2 return air levels exceed 1800 ppm? | Y / N |

**Cooling / Heating Optimum Start:**

Trends show unit achieves occupied zone temperature setpoint within ±1oF no more

than 30 minutes prior to scheduled start of occupied period? YES NO

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space #: |  |
| Space Temperature: |  |
| Unit energizes, outside and relief air dampers close and return air damper opens to 100%, and hot water or steam valve modulates to maintain discharge temperature under call for heating? | Y / N |
| Unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain discharge temperature under call for cooling? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Freezestat |  | Y / N |
| Supply high limit |  | Y / N |
| Supply low limit |  | Y / N |
| Return high limit |  | Y / N |
| Return low limit |  | Y / N |
| Fire alarm | N/A | Y / N |
| Supply fan failure |  | Y / N |
| Return fan failure |  | Y / N |
| Filter monitor |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, return fan status, supply fan status, RAT, OAT, SAT, OA damper position, RA damper position, Relief damper position, heating valve position, CHW valve position, refrigerant circuit status, OA enthalpy, RA enthalpy, MAT, CO2 RA, CO2 OA, OA flow, minimum OA flow, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 73 24 - Factory Fabricated Custom Laboratory Exhaust Energy Recovery Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

Modify per specific application and installation.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

Modify per specific application and installation.

**Results**

Modify per specific application and installation.

**Alarms and Safeties:**

Modify per specific application and installation.

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |
|  |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Modify per specific application and installation.

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 81 26 – Split System Ductless Air Conditioners

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
|  | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the fan coil units to maintain space temperatures.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Return “on” command to normal operation.
   5. Verify unit is energized and all devices return to normal operation.
2. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify space temperature setpoint for cooling is [XXoF].
   3. Verify space temperature setpoint for heating is [XXoF].
   4. Record space temperature.
   5. Override space temperature setpoint to be 5o above current space temperature.
   6. Verify hot water or steam valve modulates open or electric coil is energized to maintain space temperature without hunting or overshooting.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Return space temperature setpoint to normal operation.
   9. Verify chilled water valve modulates or refrigerant circuits energize to maintain space temperature without hunting or overshooting.
   10. Allow unit to stabilize at setpoint for 10 minutes.
   11. Return system to normal operation.
3. Unoccupied Mode
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
   3. Override unoccupied heating space temperature setpoint to be 10o above current space temperature (ensure cooling setpoint is at least 10o above override value).
   4. Verify unit energizes and hot water or steam valve modulates or electric coil is energized to maintain space temperature.
   5. Return unoccupied heating space temperature setpoint to normal operation.
   6. Override unoccupied cooling space temperature setpoint to be 10o below current space space (ensure heating setpoint is at least 10o below override value).
   7. Verify unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain space temperature.
   8. Return system to normal operation.
4. Fan Control (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Adjust the occupied space temperature setpoint to be 10oF below the current temperature.
   3. Verify unit is energized and condensing unit is operating.
   4. Return system to normal operation.
   5. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   6. Verify unit is energized and condensing unit is operating.
   7. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

**Cooling / Heating:**

|  |  |
| --- | --- |
| Space temperature setpoint for cooling is [XXoF]? | Y / N |
| Space temperature setpoint for heating is [XXoF]? | Y / N |
| Space Temperature: |  |
| Unit operates to maintain space temperature (±1oF) with no hunting or overshooting on call for heating? | Y / N |
| Refrigerant circuit is energized to maintain space temperature (±1oF) with no hunting or overshooting on call for cooling? | Y / N |

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space Temperature: |  |
| Unit operates to maintain space temperature under call for heating? | Y / N |
| Refrigerant circuits work in concert to maintain space temperature under call for cooling? | Y / N |

**Fan Control (if applicable):**

|  |  |
| --- | --- |
| Space Temperature: |  |
| Adjusted Space Temperature Setpoint: |  |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full. Unit fan is energized and de-energized per stated fan control sequence.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, refrigerant circuit status, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Cabinet Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the cabinet heater to maintain the setpoint temperature for the space.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Remote Start/Stop (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Return “on” command to normal operation.
   5. Verify unit is energized.
   6. Return system to normal operation.
2. Heating Unoccupied (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
3. Heating Occupied (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
4. Heating – Local Thermostat (if applicable)
   1. Verify that the space temperature setpoint is [XXoF].
   2. Record current space temperature.
   3. Adjust the space temperature setpoint to be 10oF above the current temperature.
   4. Verify the unit energizes.
   5. Return system to normal operation.
5. Fan Control (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that aquastat setpoint is 100oF.
   3. Record current temperature of hot water loop.
   4. Adjust the aquastat setpoint to be 10oF above the current loop temperature.
   5. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   6. Verify unit is energized and flow to coil, but fan does not energize.
   7. Return system to normal operation.
   8. Verify fan energizes.
   9. Return system to normal operation.

**Results**

**Remote Start/Stop (if applicable):**

Unit is energized and de-energized when commanded by building automation system? YES NO

|  |  |
| --- | --- |
| **Unoccupied Space Temperature Setpoint:** |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is

visually found to open? YES NO

**Heating Occupied (if applicable):**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is

visually found to open? YES NO

**Heating – Local Thermostat (if applicable):**

|  |  |
| --- | --- |
| Space Temperature Setpoint: |  |
| Space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is

visually found to open? YES NO

**Fan Control (if applicable):**

|  |  |
| --- | --- |
| Aquastat Setpoint: |  |
| Aquastat setpoint complies with contract documents? | Y / N |
| Loop Temperature: |  |
| Adjusted Aquastat Setpoint: |  |
| Space Temperature: |  |
| Adjusted Space Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint, control valve is

visually found to open, but fan does NOT energize at increased aquastat setpoint? YES NO

Fan is energized when aquastat setpoint is lowered to original setpoint and unit is energized? YES NO

**Conclusion**

Acceptable Criteria: Unit is energized when called upon by BAS. All setpoints comply with contract documents. Unit energizes and de-energizes per stated heating sequence. Unit fan is energized and de-energized per stated fan control sequence.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit run status, space temperature, valve position, loop temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Convectors & Fin Tube Radiation

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the convector and/or fin tube to maintain the setpoint temperature for the space.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units/areas present.

**Procedure**

1. Heating Unoccupied
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
2. Heating Occupied
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
3. Heating w/ Re-Heat Coils Unoccupied (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the control valve opens or electric coil energizes for unit.
   6. Verify that re-heat coil is not energized or coil control valve is not opened.
   7. Return system to normal operation.
4. Heating w/ Re-Heat Coils Occupied (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the control valve opens or electric coil energizes for unit simultaneously with the energization of the electric re-heat coil or opening of the control valve for the re-heat coil.
   6. Return system to normal operation.
5. Outside Air Lockout
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the outside air temperature lockout setpoint is [XXoF].
   3. Record outside air temperature.
   4. Adjust the outside air temperature lockout setpoint to be 10oF above the current outside air temperature.
   5. Adjust the occupied space temperature setpoint to be 10oF above the current space temperature.
   6. Verify that the control valve remains closed or electric coil does not energize.
   7. Return system to normal operation.

**Results**

**Heating Unoccupied:**

|  |  |
| --- | --- |
| Unoccupied Space Temperature Setpoint: |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

**Heating Occupied:**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

**Heating w/ Re-Heat Coil Unoccupied (if applicable):**

|  |  |
| --- | --- |
| Unoccupied Space Temperature Setpoint: |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

Re-heat coil control valve is not opened or re-heat electric coil is not energized in response to

increases of temperature setpoint? YES NO

**Heating w/ Re-Heat Coil Occupied (if applicable):**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

Re-heat coil control valve is opened or re-heat electric coil is energized simultaneously with unit

control valve or electric coil in response to increases of temperature setpoint? YES NO

**Outside Air Lockout:**

|  |  |
| --- | --- |
| Outside Air Temperature Lockout Setpoint: |  |
| Outside air temperature lockout setpoint complies with contract documents? | Y / N |
| Outside Air Temperature: |  |
| Adjusted Outside Air Temperature Lockout Setpoint: |  |

Unit control valve remains closed or electric coil does not energize in response to increases

of temperature setpoint when outside air temperature exceeds lockout setpoint? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit control valve cycles or coil is energized per stated heating sequence. Unit control valve does not open or coil is not energized when outside air temperature exceeds lockout setpoint.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, space temperature, unit valve position, loop temperature, re-heat coil valve position, re-heat coil status, outside air temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Fan Coil Units

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the fan coil units to maintain space temperatures.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Return “on” command to normal operation.
   5. Verify unit is energized and all devices return to normal operation.
2. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify space temperature setpoint for cooling is [XXoF].
   3. Verify space temperature setpoint for heating is [XXoF].
   4. Record space temperature.
   5. Override space temperature setpoint to be 5o above current space temperature.
   6. Verify hot water or steam valve modulates open or electric coil is energized to maintain space temperature without hunting or overshooting.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Return space temperature setpoint to normal operation.
   9. Verify chilled water valve modulates or refrigerant circuits energize to maintain space temperature without hunting or overshooting.
   10. Allow unit to stabilize at setpoint for 10 minutes.
   11. Return system to normal operation.
3. Unoccupied Mode
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
   3. Override unoccupied heating space temperature setpoint to be 10o above current space temperature (ensure cooling setpoint is at least 10o above override value).
   4. Verify unit energizes and hot water or steam valve modulates or electric coil is energized to maintain space temperature.
   5. Return unoccupied heating space temperature setpoint to normal operation.
   6. Override unoccupied cooling space temperature setpoint to be 10o below current space space (ensure heating setpoint is at least 10o below override value).
   7. Verify unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain space temperature.
   8. Return system to normal operation.
4. Fan Control (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that chilled water coil aquastat setpoint is 60oF.
   3. Record current temperature of chilled water loop.
   4. Adjust the aquastat setpoint to be 10oF below the current loop temperature.
   5. Adjust the occupied space temperature setpoint to be 10oF below the current temperature.
   6. Verify unit is energized and flow to chilled water coil, but fan does not energize.
   7. Return system to normal operation.
   8. Verify that hot water coil aquastat setpoint is 100oF.
   9. Record current temperature of hot water loop.
   10. Adjust the aquastat setpoint to be 10oF above the current loop temperature.
   11. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   12. Verify unit is energized and flow to hot water coil, but fan does not energize.
   13. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

On recognition of simulated freezestat trip hot water or steam valve modulates fully open

and freeze alarm is generated at BAS head end when unit is de-energized? YES NO

**Cooling / Heating:**

|  |  |
| --- | --- |
| Space temperature setpoint for cooling is [XXoF]? | Y / N |
| Space temperature setpoint for heating is [XXoF]? | Y / N |
| Space Temperature: |  |
| Hot water or steam valve modulates or electric coil is energized to maintain space temperature (±1oF) with no hunting or overshooting on call for heating? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized to maintain space temperature (±1oF) with no hunting or overshooting on call for cooling? | Y / N |

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space Temperature: |  |
| Unit energizes and hot water or steam valve modulates or electric coil is energized to maintain space temperature under call for heating? | Y / N |
| Unit energizes and chilled water valve or refrigerant circuits work in concert to maintain space temperature under call for cooling? | Y / N |

**Fan Control (if applicable):**

|  |  |
| --- | --- |
| Chilled Water Coil Aquastat Setpoint: |  |
| Aquastat setpoint complies with contract documents? | Y / N |
| Chilled Water Loop Temperature: |  |
| Adjusted Aquastat Setpoint: |  |
| Space Temperature: |  |
| Adjusted Space Temperature Setpoint: |  |

Unit is energized in response to decreases of temperature setpoint, chilled water control

valve is visually found to open, but fan does NOT energize at decreased aquastat setpoint? YES NO

Fan is energized when aquastat setpoint is increased to original setpoint and unit is energized? YES NO

|  |  |
| --- | --- |
| **Hot Water Coil Aquastat Setpoint:** |  |
| Aquastat setpoint complies with contract documents? | Y / N |
| Hot Water Loop Temperature: |  |
| Adjusted Aquastat Setpoint: |  |
| Space Temperature: |  |
| Adjusted Space Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint, hot water control valve

is visually found to open, but fan does NOT energize at increased aquastat setpoint? YES NO

Fan is energized when aquastat setpoint is decreased to original setpoint and unit is energized? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full. Unit fan is energized and de-energized per stated fan control sequence.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, heating valve position, CHW valve position, refrigerant circuit status, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Reheat Coils

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
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**Objectives**

This test is performed to investigate the ability of the re-heat coil to maintain the setpoint temperature for the space.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Heating Unoccupied
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
2. Heating Occupied
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.

**Results**

**Heating Unoccupied:**

|  |  |
| --- | --- |
| Unoccupied Space Temperature Setpoint: |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

**Heating Occupied:**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit control valve is opened or electric coil energized in response to increases of temperature setpoint? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit control valve cycles or coil is energized per stated heating sequence.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, space temperature, valve position, loop temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Unit Heaters

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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|  | |  | |  |  |
| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the unit heater to maintain the setpoint temperature for the space.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| Instrument | Accuracy | Measurement |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All sequences for a minimum of 20% of total units present.

**Procedure**

1. Heating Unoccupied (if applicable)
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the unoccupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
2. Heating Occupied (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that the occupied space temperature setpoint is [XXoF].
   3. Record current space temperature.
   4. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   5. Verify the unit energizes.
   6. Return system to normal operation.
3. Heating – Local Thermostat (if applicable)
   1. Verify that the space temperature setpoint is [XXoF].
   2. Record current space temperature.
   3. Adjust the space temperature setpoint to be 10oF above the current temperature.
   4. Verify the unit energizes.
   5. Return system to normal operation.
4. Fan Control (if applicable)
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify that aquastat setpoint is 100oF.
   3. Record current temperature of hot water loop.
   4. Adjust the aquastat setpoint to be 10oF above the current loop temperature.
   5. Adjust the occupied space temperature setpoint to be 10oF above the current temperature.
   6. Verify unit is energized and flow to coil, but fan does not energize.
   7. Return system to normal operation.
   8. Verify fan energizes.
   9. Return system to normal operation.

**Results**

**Heating Unoccupied (if applicable):**

|  |  |
| --- | --- |
| Unoccupied Space Temperature Setpoint: |  |
| Unoccupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is visually found to open? YES NO

**Heating Occupied (if applicable):**

|  |  |
| --- | --- |
| Occupied Space Temperature Setpoint: |  |
| Occupied space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is visually found to open? YES NO

**Heating – Local Thermostat (if applicable):**

|  |  |
| --- | --- |
| Space Temperature Setpoint: |  |
| Space temperature setpoint complies with contract documents? | Y / N |
| Space Temperature: |  |
| Adjusted Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint and control valve is visually found to open? YES NO

**Fan Control (if applicable):**

|  |  |
| --- | --- |
| Aquastat Setpoint: |  |
| Aquastat setpoint complies with contract documents? | Y / N |
| Loop Temperature: |  |
| Adjusted Aquastat Setpoint: |  |
| Space Temperature: |  |
| Adjusted Space Temperature Setpoint: |  |

Unit is energized in response to increases of temperature setpoint, control valve is visually found to

open, but fan does NOT energize at increased aquastat setpoint? YES NO

Fan is energized when aquastat setpoint is lowered to original setpoint and unit is energized? YES NO

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit energizes and de-energizes per stated heating sequence. Unit fan is energized and de-energized per stated fan control sequence.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit run status, space temperature, valve position, loop temperature

**Witnesses**

| **Name** |  | **Signature** |
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FPT-23 82 00 - Unit Ventilators

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the unit ventilator to maintain space temperatures, as well as evaluate the functionality of the integral sequences related to this primary service.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Remote Start/Stop
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Override “on” command to “off”.
   3. Verify unit de-energizes.
   4. Disconnect lead to freezestat.
   5. Verify hot water or steam valve modulates fully open or electric coil is energized and freeze alarm is generated at BAS head end.
   6. Return freezestat to normal operation.
   7. Return “on” command to normal operation.
   8. Verify unit is energized and all devices return to normal operation.
2. Cooling / Heating
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Verify space temperature setpoint for cooling is [XXoF].
   3. Verify space temperature setpoint for heating is [XXoF].
   4. Record space temperature.
   5. Override space temperature setpoint to be 5o above current space temperature.
   6. Verify hot water or steam valve modulates open or electric coil is energized to maintain space temperature without hunting or overshooting.
   7. Allow unit to stabilize at new setpoint for 10 minutes.
   8. Return space temperature setpoint to normal operation.
   9. Verify chilled water valve modulates or refrigerant circuits energize to maintain space temperature without hunting or overshooting.
   10. Allow unit to stabilize at setpoint for 10 minutes.
   11. Return system to normal operation.
3. Unoccupied Mode
   1. Verify unit is in unoccupied mode. If not override system into unoccupied mode.
   2. Verify that the unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling.
   3. Override unoccupied heating space temperature setpoint to be 10o above current space temperature (ensure cooling setpoint is at least 10o above override value).
   4. Verify unit energizes and hot water or steam valve modulates or electric coil is energized to maintain space temperature.
   5. Return unoccupied heating space temperature setpoint to normal operation.
   6. Override unoccupied cooling space temperature setpoint to be 10o below current space space (ensure heating setpoint is at least 10o below override value).
   7. Verify unit energizes and economizer and/or chilled water valve or refrigerant circuits work in concert to maintain space temperature.
   8. Return system to normal operation.
4. Alarms and Safeties
   1. Verify unit is in occupied mode. If not override system into occupied mode.
   2. Record freezestat setpoint.
   3. Disconnect freezestat to simulate a freezing condition.
   4. Verify unit is de-energized and alarm is generated at BAS head end.
   5. Disconnect fire alarm relay to simulate a fire condition (ensure occupants and local authorities have been notified prior to this test).
   6. Verify that unit shuts down and alarm is initiated at BAS head end.
   7. Record filter monitor alarm setpoint.
   8. Override filter monitor alarm setpoint to be 0.5 psig below current differential pressure across filter rack.
   9. Verify alarm is initiated at BAS head end.
   10. Return system to normal operation.

**Results**

**Remote Start/Stop:**

Unit is energized when commanded by BAS? YES NO

On recognition of simulated freezestat trip hot water or steam valve modulates fully open

and freeze alarm is generated at BAS head end when unit is de-energized? YES NO

**Cooling / Heating:**

|  |  |
| --- | --- |
| Space temperature setpoint for cooling is [XXoF]? | Y / N |
| Space temperature setpoint for heating is [XXoF]? | Y / N |
| Space Temperature: |  |
| Hot water or steam valve modulates or electric coil is energized to maintain space temperature (±1oF) with no hunting or overshooting on call for heating? | Y / N |
| Chilled water valve modulates or refrigerant circuit is energized to maintain space temperature (±1oF) with no hunting or overshooting on call for cooling? | Y / N |

**Unoccupied Mode:**

|  |  |
| --- | --- |
| Unoccupied space temperature setpoint is 60oF for heating and 84oF for cooling? | Y / N |
| Space Temperature: |  |
| Unit energizes and hot water or steam valve modulates or electric coil is energized to maintain space temperature under call for heating? | Y / N |
| Unit energizes and chilled water valve or refrigerant circuits work in concert to maintain space temperature under call for cooling? | Y / N |

**Alarms and Safeties:**

|  |  |  |
| --- | --- | --- |
|  | *SETPOINT* | *APPROVED* |
| Freezestat |  | Y / N |
| Fire alarm | N/A | Y / N |
| Filter monitor |  | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Unit complies with all stated sequences in full.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, heating valve position, CHW valve position, refrigerant circuit status, zone temperature, zone temperature setpoint

**Witnesses**

| **Name** |  | **Signature** |
| --- | --- | --- |
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FPT-23 84 13 - Humidifiers

**Equipment Identification/Tag: \_\_\_\_\_\_\_**

**Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Test Duration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: |  | Start Time: |  | End Time |  |
|  |  |  |  |  |  |
| Estimated Duration: | |  |  |  |  |
| Cx Provider(s): | |  | |  |  |
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| Applicable Equipment: | |  | | | |
|  | |  | | | |

**Objectives**

This test is performed to investigate the ability of the humidifier to provide humidification to the supply air distribution for the facility.

**Instrumentation**

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Accuracy** | **Measurement** |
| N/A | N/A | N/A |

**Stated Sequence**

To be defined by A/E and commissioning provider at completion of construction documents.

**Sampling Set**

All units and all sequences.

**Procedure**

1. Humidification – Steam Grid (if applicable)
   1. Verify associated AHU and unit are in occupied mode. If not override system into occupied mode.
   2. Record relative humidity setpoint.
   3. Record outside air temperature and return or space relative humidity.
   4. Override outside air temperature to 50ºF.
   5. Verify relative humidity setpoint resets to 35%RH.
   6. Verify steam valve modulates open to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   7. Allow system to stabilize for 10 minutes.
   8. Override outside air temperature to 0ºF.
   9. Verify relative humidity setpoint resets to 20%RH.
   10. Verify steam valve modulates closed to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   11. Override relative humidity setpoint to be 10% above current relative humidity.
   12. Verify steam valve begins to modulate open to maintain relative humidity and override outside air temperature to be 51ºF.
   13. Verify steam valve closes.
   14. Return outside air temperature to normal operation.
   15. Verify steam valve begins to modulate open to maintain relative humidity and override AHU to open chilled water valve or energize a refrigerant circuit.
   16. Verify steam valve closes.
   17. Return AHU to normal operation.
   18. Verify steam valve begins to modulate open to maintain relative humidity and disconnect power to AHU via local disconnect.
   19. Verify steam valve closes.
   20. Return system to normal operation.
   21. Verify humidity high limit setpoint is to 90%RH.
   22. Override relative humidity setpoint to be 10% above current relative humidity.
   23. Override humidity high limit setpoint to be 5% above current duct relative humidity.
   24. Allow steam valve to respond to humidification call.
   25. Verify steam valve closes when lowered humidity high limit is achieved and alarm is generated at BAS head end.
   26. Return system to normal operation.
   27. Verify condensate temperature limit setpoint is 205ºF.
   28. Disconnect condensate temperature switch to simulate a below temperature condition.
   29. Override relative humidity setpoint to be 10% above current relative humidity.
   30. Verify steam valve remains closed.
   31. Return system to normal operation.
2. Humidification – Electric Steam (if applicable)
   1. Verify associated AHU and unit are in occupied mode. If not override system into occupied mode.
   2. Record relative humidity setpoint.
   3. Record outside air temperature and return or space relative humidity.
   4. Override outside air temperature to 50ºF.
   5. Verify relative humidity setpoint resets to 35%RH.
   6. Verify unit energizes to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   7. Allow system to stabilize for 10 minutes.
   8. Override outside air temperature to 0ºF.
   9. Verify relative humidity setpoint resets to 20%RH.
   10. Verify unit de-energizes to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   11. Override relative humidity setpoint to be 10% above current relative humidity.
   12. Verify unit energizes to maintain relative humidity and override outside air temperature to be 51ºF.
   13. Verify unit de-energizes.
   14. Return outside air temperature to normal operation.
   15. Verify unit energizes to maintain relative humidity and override AHU to open chilled water valve or energize a refrigerant circuit.
   16. Verify unit de-energizes.
   17. Return AHU to normal operation.
   18. Verify unit energizes to maintain relative humidity and disconnect power to AHU via local disconnect.
   19. Verify unit de-energizes.
   20. Return system to normal operation.
   21. Verify humidity high limit setpoint is to 90%RH.
   22. Override relative humidity setpoint to be 10% above current relative humidity.
   23. Override humidity high limit setpoint to be 5% above current duct relative humidity.
   24. Allow unit to respond to humidification call.
   25. Verify unit de-energizes when lowered humidity high limit is achieved and alarm is generated at BAS head end.
   26. Return system to normal operation.
   27. Return system to normal operation.
3. Humidification – Evaporative (if applicable)
   1. Verify associated AHU and unit are in occupied mode. If not override system into occupied mode.
   2. Record relative humidity setpoint.
   3. Record outside air temperature and return or space relative humidity.
   4. Override outside air temperature to 50ºF.
   5. Verify relative humidity setpoint resets to 35%RH.
   6. Visually verify water valve modulates open and unit energizes to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   7. Allow system to stabilize for 10 minutes.
   8. Override outside air temperature to 0ºF.
   9. Verify relative humidity setpoint resets to 20%RH.
   10. Visually verify water valve modulates closed and unit de-energizes to maintain relative humidity. (if necessary override setpoint above current return or space relative humidity to observe this function)
   11. Return system to normal operation.

**Results**

**Humidification – Steam Grid (if applicable):**

|  |  |
| --- | --- |
| Relative Humidity Setpoint: |  |
| Outside Air Temperature: |  |
| Return or Space Relative Humidity: |  |
| Relative humidity setpoint resets linearly from 20%RH to 35%RH for outside air temperatures of 0ºF to 50ºF, respectively? | Y / N |
| Original relative humidity setpoint falls on linear temperature reset schedule above? | Y / N |
| Steam valve modulates to maintain relative humidity? | Y / N |
| Humidification sequence is locked out under the following conditions: |  |
| Outside air temperature >50ºF  Active status of mechanical cooling at associated AHU  Associated AHU is de-energized | Y / N  Y / N  Y / N |
| Humidity high limit setpoint is 90%RH? | Y / N |
| Steam valve closes and alarm is generated at BAS head end when humidity high limit is surpassed? | Y / N |
| Condensate temperature limit setpoint is 205ºF? | Y / N |
| Humidification sequence is locked if condensate temperature limit is not surpassed? | Y / N |

**Humidification – Electric Steam (if applicable):**

|  |  |
| --- | --- |
| Relative Humidity Setpoint: |  |
| Outside Air Temperature: |  |
| Return or Space Relative Humidity: |  |
| Relative humidity setpoint resets linearly from 20%RH to 35%RH for outside air temperatures of 0ºF to 50ºF, respectively? | Y / N |
| Original relative humidity setpoint falls on linear temperature reset schedule above? | Y / N |
| Unit energizes and de-energizes to maintain relative humidity? | Y / N |
| Humidification sequence is locked out under the following conditions: |  |
| Outside air temperature >50ºF  Active status of mechanical cooling at associated AHU  Associated AHU is de-energized | Y / N  Y / N  Y / N |
| Humidity high limit setpoint is 90%RH? | Y / N |
| Unit de-energizes and alarm is generated at BAS head end when humidity high limit is surpassed? | Y / N |

**Humidification – Evaporative (if applicable):**

|  |  |
| --- | --- |
| Relative Humidity Setpoint: |  |
| Outside Air Temperature: |  |
| Return or Space Relative Humidity: |  |
| Relative humidity setpoint resets linearly from 20%RH to 35%RH for outside air temperatures of 0ºF to 50ºF, respectively? | Y / N |
| Original relative humidity setpoint falls on linear temperature reset schedule above? | Y / N |
| Water valve modulates and unit energizes/de-energizes to maintain relative humidity? | Y / N |

**Conclusion**

Acceptable Criteria: All setpoints comply with contract documents. Relative Humidity reset schedule adjusts relative humidity setpoint in proportion to outside air temperature per contract documents. Humidification sequence complies with stated sequence. All alarm and safeties operate per specified sequence and initiate appropriate alarm conditions at BAS head end.

Comments:

Observations:

Final Status: ❑ Accepted ❑ Not Accepted

**Relevant Trend Data**

Unit status, AHU status, OAT, RH setpoint, RH

**Witnesses**

| **Name** |  | **Signature** |
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