

Part 1 General

1.1 INTENT

- .1 Inspect, start and test each piece of mechanical equipment. Verify that equipment has been properly installed and is operating at a level which meets specified requirements.

1.2 RELATED SECTIONS

- .1 Starting Equipment and Systems: Division 01.
- .2 Contractor Start-Up Report Forms: Division 01.
- .3 Common Work Results for HVAC: Section 23 05 00.
- .4 Operation and Maintenance Manuals: Division 01.
- .5 General Mechanical Starting and Testing Requirements: Section 23 08 13.
- .6 Balancing and Adjusting of Mechanical Equipment and Systems: Section 23 08 83.
- .7 Commissioning: Division 01.

1.3 FACTORY TRAINED REPRESENTATIVES

- .1 Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.

Part 2 Products – Not Used

Part 3 Execution

3.1 FUEL FIRED EQUIPMENT - SERVICE WATER HEATERS

- .1 Pre-Starting:
 - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.
 - .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
 - .1 Heater is level on housekeeping base.
 - .2 Flue and chimney installed without visible damage.

- .3 No visible damage to heater jacket.
- .4 No visible damage to refractory or combustion chamber.
- .5 Check PRVs for correct operation and specified relief pressure. Adjust as required.
- .6 Clearances have been provided and piping is flanged for easy removal and servicing.
- .7 Labels are clearly visible.
- .8 Heater, burner and flue completely clean and free of construction debris.
- .9 Burner blower rotates in correct direction.
- .10 Controls completed.
- .11 Tank has dielectric unions on piping connections.
- .3 Verify that chemical sterilization of piping system is completed.
- .4 Ensure circulation pump is operational.
- .5 Check for proper operation of pressure reducing valve on gas train, including venting.
- .2 Starting:
 - .1 Ensure pilot is operating.
 - .2 Ensure tank is full of water, vented and flushed.
 - .3 Ensure thermostat is set at 50°C.
 - .4 Start as recommended by manufacturer.
 - .5 Fill out start-up sheets and attach copy with Mechanical Sub-Contractor Start-Up Report.
 - .6 Check and record performance of all factory provided protection devices, and firing sequences.
 - .7 Run-in as recommended or required by manufacturer.
- .3 Post-Starting:
 - .1 Measure gas pressure on manifold.
 - .2 Measure combustion air temperature at inlet to burner.

- .3 Measure flue gas temperature at boiler discharge.
- .4 Perform flue gas analysis. Measure and record flue gas CO₂ and O₂ concentration.
- .5 Measure natural flue draft.
- .6 Adjust heater combustion efficiency (%) to that specified, or advertised by manufacturer if latter is higher.
- .7 Fill tank with cold domestic water and determine tank recovery time.
- .4 Pre-Interim Acceptance:
 - .1 Drain tank, refill and vent.

3.2 FLUID HANDLING EQUIPMENT - PUMPS

- .1 Pre-Starting:
 - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.
 - .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
 - .1 Pump is level.
 - .2 Isolation valves, strainers, check valve, pressure gauges, by-pass filter and flow meter are installed properly.
 - .3 Pump suction has sufficient length of straight run piping.
 - .4 Air has been completely bled off piping system.
 - .5 Expansion tank is charged and on-line.
 - .6 Strainers have clean screens in place.
 - .7 Where specified for large pumps, check pump base vibration isolation and flexible connections on water pipes are properly installed.
 - .8 Nameplate is readily visible.
 - .9 Check clearance space is adequate for pump servicing and removal.
- .2 Starting:
 - .1 Start as recommended by manufacturer.

- .2 Fill out start-up sheets and attach copy with Mechanical Sub-Contractor Start-Up Report.
- .3 Check impeller is rotating in correct direction.
- .3 Post Starting:
 - .1 Run-in pumps for minimum 12 continuous hours.
 - .2 Ensure flows through parallel pumps are equally balanced.
 - .3 Ensure mechanical seals do not leak, or packing gland type seals are wetted.
 - .4 Check pump NPSH - net positive suction head.
 - .5 Where vibration isolation is specified, check for correct static deflection of unit vibration isolators, and that start up and shut down deflection is within resilience limits of isolators and flexible connections.
 - .6 Verify that motor has sufficient air flow through casing to provide cooling.
- .4 Pre-Interim Acceptance:
 - .1 Clean strainers.
 - .2 Replace shaft seals if pump has been used to degrease system.

3.3 FLUID HANDLING EQUIPMENT - COILS

- .1 Pre-Starting:
 - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations.
 - .2 Complete manufacturer's installation and start-up check sheets and include following items on check sheets:
 - .1 Pipe connections have been correctly made for counter current heat exchange between air and fluid.
 - .2 Clearances have been provided and piping is flanged for easy removal and servicing.
 - .3 Coil air vent and drain valve and deadleg drain valves have been provided.
 - .4 Coil is sloped to ensure complete drain down.
 - .5 Pressure and temperature tappings, Pete's plugs, have been provided.
 - .6 Fins inspected and combed straight as required.

- .7 Cooling coil drain pan and trapped drain line installed correctly.
- .8 Labels are clearly visible
- .9 Control valve piping is connected for correct flow through valve body and for required fail safe action of valve.
- .2 Starting:
 - .1 Check operation of cooling coil condensate drain with supply fan at maximum air flow. Ensure that condensate will drain away against maximum suction pressure of supply fan. Check for and eliminate condensate carry over at maximum air velocity.
 - .3 Post-Starting: refer to Section 23 08 83 - Balancing and Adjusting of Mechanical Equipment and Systems.
 - .4 Pre-Interim Acceptance: not applicable.

3.4 FLUID HANDLING EQUIPMENT - MISCELLANEOUS

- .1 Gauges and Thermometers:
 - .1 Confirm all gauges and thermometers can be read from the floor level and are installed as recommended by manufacturer.
 - .2 Calibrate.
- .2 Verify following equipment is installed as recommended by manufacturer. Fill out manufacturer's start-up sheets:
 - .1 PRVs.
 - .2 Strainers.
 - .3 Check valves.
 - .4 Balancing valves.
 - .5 Backflow preventers.
 - .6 Vacuum breakers.

3.5 AIR HANDLING EQUIPMENT – HEAT RECOVERY VENTILATOR

- .1 Pre-Starting:
 - .1 Check that installation is as drawn and specified and in accordance with manufacturer's recommendations.

- .2 Complete manufacturer's installation and start-up check sheets including following:
 - .1 Fresh, Exhaust and Recirculation air motorized dampers, operation and size.
 - .2 Filters.
 - .3 Check that fan base vibration isolation and flexible connections to ductwork are properly installed.
 - .4 Special features, access doors, liners, labels.
- .2 Lubricate bearings on fans as recommended by manufacturer. Ensure fan wheels rotate in correct direction without binding. Adjust belts to proper alignment and tension.
- .3 Vacuum clean air systems.
- .4 Ensure temporary filters are installed. **Never** operate system without filters installed.
- .5 Ensure all balancing and fire dampers are open and ductwork is complete.
- .6 Ensure all coils are in operation.
- .7 On parallel fan systems ensure backdraft dampers are installed.
- .8 Ensure electrical connections are complete and system disconnects are within sight of unit.
- .9 Ensure controls are operational.
- .10 Ensure inlet and discharge duct geometry is correct.
- .2 Starting:
 - .1 Follow manufacturer's recommendations.
- .3 Post-Starting:
 - .1 Start fan and check for vibration free operation.
 - .2 Check for correct static deflection of unit vibration isolators, and that start-up and shut down deflection is within resilience limits.
 - .3 Run for one day and check filters, and coils for bypass. Seal as required.
 - .4 Check that bearings are not overheating.

- .4 Pre-Interim Acceptance:
 - .1 Replace temporary filters with permanent filters.
 - .2 Vacuum clean heating and cooling coils.
 - .3 Lubricate bearings.
 - .4 Check belts for tension and wear.

3.6 AIR HANDLING EQUIPMENT - MISCELLANEOUS

- .1 Refer to Section 23 08 83.

3.7 MISCELLANEOUS EQUIPMENT - TANKS

- .1 Pre-Starting:
 - .1 Verify that installation is as drawn and specified and in accordance with manufacturer's recommendations. Check following:
 - .1 Tank is level on housekeeping base.
 - .2 No visible damage to vessel.
 - .3 Check PRVs for correct operation and specified relief pressure. Adjust as required.
 - .4 Clearances have been provided and piping is flanged for easy removal and servicing.
 - .5 Labels are clearly visible.
 - .6 Controls, gauges, alarm devices, etc. are operational.
 - .7 Access ports/manholes provided.
 - .8 Piping sizes - inlet/outlet are correct.
 - .9 Lining is intact and not damaged.
 - .10 Tank has dielectric unions on piping connections.
- .2 Starting: not applicable.

- .3 Post-Starting:
 - .1 Verify operation of:
 - .1 Drain line.
 - .2 Make-up line if applicable.
 - .3 Gauge glass.
 - .4 Diaphragm if applicable.
 - .4 Pre-Interim Acceptable: not applicable.

3.8 MISCELLANEOUS EQUIPMENT - FIRE EXTINGUISHERS

- .1 Check the number, make, model and capacity of each portable fire extinguisher.
- .2 Check the pressure drop on each extinguisher over 20 day period. Replace units losing charge.
- .3 Check that all cabinets are clean and door latch functions correctly.

END OF SECTION