

**1. GENERAL**

**1.1 Scope**

- .1 Test refrigerant piping.
- .2 Test chilled water piping.
- .3 Performance testing of equipment.
- .4 Manufacturer's start-up of equipment.

**1.2 Quality Assurance**

- .1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.
- .2 Test procedures in accordance with the current applicable portions of ASME, ASHRAE, and other recognised test codes as far as field conditions permit.
- .3 Perform tests on site to the satisfaction of the Contract Administrator.
- .4 Piping, fixtures or equipment shall not be concealed or covered until inspected and approved by the Engineer. Provide ample written notice (two working days) to the Contract Administrator before tests.
- .5 Co-ordinate with Contract Administrator at start of project, those tests that will require witnessing by the Consultant.
- .6 Use factory trained representatives and submit manufacturer's check sheets for starting the following specialty equipment.
  - .1 Air handling units
  - .2 Air Cooled Condensing Units
- .7 Prior to starting, testing, balancing, adjusting and cleaning processes, verify with Contract Administrator any tests required to be witnessed. Provide sufficient notice to Contract Administrator prior to commencement of procedures.
- .8 Contract Administrator shall be allowed to witness any testing, adjusting, starting, balancing and cleaning procedures.
- .9 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.
- .10 Prior to starting equipment or systems, secure and review manufacturer's installation, operation and starting instructions. Read in conjunction with procedures defined herein.

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- .11 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.
- .12 Compare installations to published manufacturer's data and record discrepancies. Items proving detrimental to equipment performance shall be corrected prior to equipment starting.
- .13 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures. (Gas inspectors, boiler and pressure vessels inspections etc.)
- .14 All starting, testing procedures shall be in accordance with applicable portions of the latest, current ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM and ASPE codes and standards.
- .15 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the reading and tests.
- .16 Assume all liabilities associated with starting, testing and balancing procedures.

### 1.3 Submittals

- .1 Obtain certificates of approval, acceptance, and comply with current rules and regulations from authorities having jurisdiction and include in Operating and Maintenance Manuals.
- .2 Perform tests as specified and upon completion of mechanical installation. Provide certification of tests with detailed data as required. Itemise each test as to time performed and personnel responsible. Include in Operating and Maintenance Manuals.

### 1.4 Liability

- .1 Take charge of plant during tests, assume responsibility for damages in event of injury to personnel, building or equipment and bear costs for liability, repairs, and restoration in this connection.

## 2. PRODUCTS

Not Applicable.

## 3. EXECUTION

### 3.1 Pressure Tests

- .1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of

- accuracy. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.
- .2 Carry out tests for eight-hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.
  - .3 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.
  - .4 When using water as test medium for system not using water, evacuate and dehydrate the piping and certify the lines are dry. Use agency specialising in this type of work.
  - .5 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.
  - .6 Water piping: test to 1 ½ times maximum working pressure or 1033 kPa (150 psi), whichever is greater.

### **3.2 General**

- .1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.
- .2 Meet with Division 16 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly co-ordinated prior to the commencement of each particular testing procedure. Establish all necessary manpower requirements.
- .3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.
- .4 Confirm voltages and operating amperages at full load.
- .5 Failure to follow instruction pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

### **3.3 Procedures**

- .1 Procedures shall be identified in the following five (5) distinct phases:
  - .1 Pre-Starting: Visual inspection.
  - .2 Starting: Actual starting procedure.

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- .3 Post-Starting: Operational testing adjusting or balancing, and equipment run-in phase.
  - .4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.
  - .5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.
- .2 Check specified and shop drawing data against installed data.
  - .3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

**END OF SECTION**