

## **SECTION 7 – INSPECTION AND TESTING**

### **7-01 GENERAL**

The Contractor shall submit to the Engineer, one month prior to the date of commencement of the tests, three (3) copies of the complete test procedure. The procedure, method and points of measurement as well as the method of calculation shall be approved by the Engineer before any test is carried. Three (3) copies of the test results shall be furnished to the Engineer for his approval.

The Contractor shall supply all necessary testing instruments, and carryout any test of any kind on a piece of equipment, apparatus part of system or on a complete system if the Engineer requests such a test for determining specified or guaranteed data, as given in the Specifications or in the Schedule of Equipment. Necessary skilled staff shall be provided by Contractor.

Any damage resulting from the test shall be repaired and/or damaged material replaced with intimation to the Engineer, all to the satisfaction of the Engineer, and at no extra cost to the Employer. Skilled staff shall be provided by the Contractor.

In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommenced after the adjustment or repairs have been completed.

All testing, balancing and final adjustment shall be in accordance with the provision of the applicable ASHRAE Standards, or other approved relevant standards.

The Contractor shall test a piece of equipment, apparatus, parts of system or a complete system in accordance with method and Schedule of Tests provided by the Engineer to determine Specified or Guaranteed data, given in the Specifications, Schedule of Equipment and Contractor's Data Sheets.

### **7-02 PRELIMINARY TESTS**

#### **7-02.1 General**

All equipment shall be tested to determine the Specified and guaranteed data, and conformance to specified requirements, when operated independent of overall HVAC System, for noise, vibration, electrical data, air flow rates, temperatures, pressure and capacities.

#### **7-02.2 Equipment**

All HVAC equipment shall be inspected for proper operation, noise and vibration. Tests shall be carried out with readings of temperature, pressure, RPM, amperage, voltage, flow rates, etc. to determine the Specified data.

#### **7-02.3 Electrical Equipment**

All electrical equipment shall be cleaned and adjusted on site before application of power. The following tests shall be carried out :

1. Wire and cable continuity tests
2. Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using 500 volts megger. The megger reading shall not be less than one meg. ohm.
3. Earth resistance between metallic conduit systems and earth must not exceed half (1/2) ohm.
4. Phasing out and phase rotation tests.
5. Operating tests on all protective relays to prove their correct operation before energising the main equipment.
6. Operating tests on all starters, circuit breakers, etc.

#### **7-03 PERFORMANCE TESTS**

All HVAC equipment shall be tested for performance after successful completion of Commissioning Tests to determine the specified and Guaranteed Data at specified operating conditions as shown in Equipment Schedule and Specifications. These tests shall be carried out during appropriate seasons when the Design Outside Conditions are met or approximated and when the building is fully sealed with glazing and door shutters. These performance tests shall continue for one month during summer and one month during winter.

The test data shall not deviate by more than five percent (5%) from the Guaranteed capacity data.

Suction and discharge pressures for each Cu-unit shall be checked and recorded.

Temperature readings shall be taken for the entering and leaving air for each A.C. unit. Should any part of the apparatus or system fail to meet the specification requirements, it shall be adjusted, repaired or replaced to the satisfaction of the Engineer by the Contractor at his own cost. The complete Commissioning Test shall then be repeated.

The date of commencement of the above said tests shall be subject to agreement with the Engineer.

#### **7-04 RELIABILITY TRIAL TEST**

After completing the above Preliminary Tests, adjustments, Commissioning Tests and Performance Tests, the Contractor shall carry out Reliability Trail Test for the whole system.

The trial tests for summer shall last for a period of 15 consecutive days during which time the whole of the system shall operate continuously without adjustment or repair to the satisfaction of the Engineer.

Should any part of the apparatus or system fail to operate continuously as specified, it shall be adjusted, repaired or replaced to the satisfaction of the Engineer and the Reliability Trial Test shall be repeated for another 15 consecutive days.

#### 7-05 **MEASUREMENT AND PAYMENT**

##### **Measurement:**

Measurement of acceptably completed works of this item will be made in the unit of LOT/JOB, acceptably furnished and where required installed, tested and commissioned.

##### **Payment:**

Payment will be made for acceptable measured number of respective items on the basis of lumpsum price per LOT/JOB quoted against the respective item in the Bill of Quantities, and shall constitute full compensation for all the works related to these item.