

## **COOLING TOWER PERFORMANCE TESTING PROCEDURE**

### **SCOPE:**

Acceptance test procedure shall cover the determination of thermal capability and Verification of all guarantee of the cooling tower (s) supplied for the project.

### **PURPOSE:**

The purpose of this test procedure is to describe instrumentation and procedures for testing and performance evaluation of cooling towers.

### **CODES:**

The cooling tower test is conducted in reference with CTI Code ATC 105(00), Schedule II Performance curve method & mutually agreed conditions between client and cooling tower supplier.

### **CONDITION OF TEST:**

1. Test shall be conducted by accredited representative of contractor and owner. The contractor shall be given permission to inspect the tower in advance and ready it for test. The readings recorded at site shall be made in duplicate and shall be signed by the representatives of contractor and owner.
2. The guaranteed performance of the equipments shall be demonstrated by the Contactor after evaluating the P.G. Test. Should the results of the test deviates from the guaranteed values the contractor shall be given opportunity to modify the equipment as required to enable it to meet the guarantees. In such cases the cost of modification, including labor, materials and cost of additional testing shall be born by contractor.
3. A maximum tolerance of 0.5 Deg C in the cold water temperature shall however be allowed to take care of design and instrument inaccuracies.

### **GENERAL CONDITIONS:**

#### **A. Condition of equipment**

1. At the time of test, the tower shall be in good operating condition. Tower may be inspected and repaired, (if necessary) by the contractor, before the test to Ensure following.
2. Water distribution system shall be essentially clear and free from foreign Materials, which may impede the normal water flow.
3. Mechanical equipments shall be in good working condition, with fans adjusted for proper rotation and specified horse power loading.
4. Fills shall be essentially free from foreign materials such as oil, tar, scale or Algae.

5. Drift eliminator shall be essentially clear and free of algae and other deposits, which may impede normal air flow.
6. Water level in the cold water basin shall be at normal operating level and shall be maintained substantially constant during the test.
7. The water quality shall be as close as possible to its specifications. The Maximum TDS (Total Dissolved Solids) shall be +/- 10%.

## **B. Operating Conditions**

1. The test shall be conducted within the following limitations.
2. Every effort shall be made to run the test under design conditions or as close to design conditions as possible.

The following variations from design condition shall not be exceeded.

|                           |             |                     |
|---------------------------|-------------|---------------------|
| a. Wet bulb temp.         | ± 8.5 Deg C |                     |
| b. Range                  | ± 20 %      |                     |
| c. Circulating water flow | ± 10 %      |                     |
| d. Heat Load              | ± 20 %      |                     |
| e. Fan power consumption  | ± 10 %      |                     |
| f. Average wind velocity  | 4.5 m/s     | (10miles per hour)  |
| g. one minute duration    | 7.0 m/s     | (15 miles per hour) |

## **C. Duration of Test**

After reaching steady state conditions the duration of test run shall not be less than one hour.

For mechanical –draft towers, duration of the test run shall be not less than one hour .if thermal leg time is greater than five minutes, the time test period shall be at least one hour plus thermal lag

#### D. Frequency of Test

Test readings shall be taken as per following schedule.

| Sl. No. | Measurements                      | No. of Readings (min.) | Unit           |
|---------|-----------------------------------|------------------------|----------------|
| 1       | Wet Bulb Temperature*             | 12 Nos.                | Degree Celsius |
| 2       | Cold Water Temperature*           | 12Nos.                 | Degree Celsius |
| 3       | Hot Water Temperature*            | 12 Nos.                | Degree Celsius |
| 4       | Circulating Water Flow**          | 3Nos.                  | Cum/Hr         |
| 5       | Power Consumption by Fan Motor*** | 1 Nos.                 | KW             |

\* Or recording (Data logging)

\*\* single center point readings for comparison with full transverse reading (in case of pitot tube) to verify that the flow has not changed by the allowable limit

In case Pitot tube can't be used then the water Flow rate will be taken from Annubar / Ultra sonic Flow Meter on acceptance from client

\*\*\* If applicable

#### E. Constancy of Test condition

For a valid test verifications in the test condition shall be within the following limits.

- Circulating water flow not varies by more than 2%.
- Heat load shall not vary by more than 5%.
- Range shall not vary by more than 5%.
- WBT 1 Deg C per Hour.
- DBT 3 Deg C per Hour.

## F. Test Instruments and their locations

### 1. Water flow measurements:

Water flow measurements can be made any of the following means.

- Pitot tube.
- Orifice plate.
- Venturi meter/ UFM's.
- Weir
- Measurement of flow through single nozzle.

By measuring pump parameters or by pump manufacturer curves.

### 2. Wet bulb temperature measurements:

The measurement of inlet WBT is required for the testing of all types of cooling towers covered by this code.

WBT measurements shall be made by mechanically aspirated Psychrometer or by sling psychrometer.

At each time four successive readings shall be made at four different stations located within 1.5 m of the air intake(s). Average of these four readings will give a final reading for that time.

### 3. Water temperature measurements:

Water temperature measurements shall be made by resistance Thermometer or mercury in glass thermometers the indicator of which shall not be guaranteed in increments of not more than 0.1 Deg

- a. Hot circulating water temperature measurements shall be made tower riser or at outlet of tower riser on top of the tower.
- b. Cold Circulating water temperature measurement shall be made in cold water basin.

### 4. Power input measurements:

In case of electrical motors power input shall be determined by Measurement of voltage, current and power factor. The measurement shall be made at motor terminal, proper de-rating for motor efficiency, power factor to be considered in calculation.

## G. Report of Result.

Recorded data during test will be co-related with performance with performance Curves of cooling tower and report will be submitted in a month