

COOLING TECHNOLOGY INSTITUTE

Preparation For an Official CTI Thermal Performance, Plume Abatement, Or Drift Emission Test



February 2014

FOREWORD

PTG-156 (14)



Documents

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This document summarizes the best current state of knowledge regarding the specific subject. It represents a consensus of those individual members who have reviewed this document, its scope and provisions and is intended to aid all users or potential users of evaporative vapor condensers.

Approved by the CTI Executive Board.



This document has been revised and approved as part of CTI's Five Year Review Cycle. This document is again subject to review in 2019.

Approved by the
CTI Executive Board

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PTG-156 (14)

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Preparation for an Official CTI Thermal Performance, Plume Abatement, or Drift Emission Test

Part I - Scope and Purpose

1.0 Scope - This Bulletin covers test preparation for an official water cooling tower thermal performance test, plume abatement test or drift emissions test.

- Thermal performance tests are conducted in accordance with CTI Acceptance Test Code-105 (ATC-105).
- Plume abatement tests are performed in accordance with CTI Test Acceptance Code-150 (ATC-150).
- Drift emissions tests are conducted in accordance with CTI Acceptance Test Code-140 (ATC-140).

2.0 Purpose - The purpose of this Bulletin is to describe the action required to prepare for one or more of the above specified CTI tests. Pre-test and test activities are described to allow involved parties to adequately prepare for the test.

3.0 Impartial Testing Service - It is the intention of CTI to provide independent third-party testing services. This means that any situation in which the testing agency has a material or any other interest in the outcome of the test must be avoided. The CTI- Licensed Test Agency referred to in this document shall have no connection with the manufacturer, the tower purchaser, tower owner or the Cooling Technology Institute, other than a contractual agreement with the latter. For the purposes of this document, the CTI-Licensed Test Agency is hereinafter referred to as the CTI Test Representative.

Certain categories of business interests or activities may compromise the objectivity of an agency and are considered by CTI as inappropriate for an organization licensed to provide impartial testing services. When any portion of the revenues of a testing agency or any of its corporate parents or subsidiaries is derived from these interests or activities, this will preclude that organization from consideration. The following is a non-exclusive listing of these business categories or interests:

- a) The manufacture, repair, replacement or upgrade of cooling towers or cooling tower components.
- b) Operation or ownership of cooling towers related to primary income generating processes.

Part II - Introduction

1.0 Introduction - The CTI provides cooling tower thermal, plume abatement and drift performance testing programs as a service to cooling tower owner/operators and manufacturers. For these programs, calibrated test equipment is provided by the CTI Test Agency performing the test. The CTI representative collects the data, evaluates the data to determine if CTI code requirements are met, calculates the test result and ultimately prepares a test report. Thermal performance

tests are conducted in accordance with ATC-105. Plume abatement tests are performed in accordance with ATC-150. Drift emission tests are conducted in accordance with ATC-140.

2.0 Test Types and Test Objectives - This document addresses the preparation for CTI Thermal Performance, Plume Abatement, or Drift Emission Tests. These tests may be further subdivided by test objective. If the test is to be used to evaluate contractual performance guarantees, then the contractually responsible parties must be invited to attend. As such, contractual acceptance tests are typically witnessed by the tower purchaser and the tower manufacturer. If the test is used to benchmark the performance of an existing tower, the test is usually witnessed by the tower owner. In either case, all interested parties should agree upon the test objectives prior to the test and if necessary a pre-test meeting shall be held to resolve the test plans. Data collection for acceptance tests and benchmark tests are usually identical. The required measurement parameters, recommended test limits and frequency of readings are given in each applicable test code. Recommended test limits including stability requirements and maximum allowable deviations from the design specifications are provided for the measurement parameters and should be adhered to whenever possible. In practice, deviations from the recommended limits may be allowed if agreed upon by the parties to the test. In some cases, it may not be possible to conduct an acceptance test if the test parties do not agree to accept the deviation(s). For benchmark tests, supplementary measurements may be required in order to achieve the test objectives of the tower owner.

2.1 Thermal Performance Tests - Simply stated, thermal performance tests are conducted to determine the ability of the tower to cool water. Operating thermal parameters including inlet wet-bulb temperature, cold water temperature, hot water temperature, water flow rate and fan motor power are measured and compared against design specifications. These design values are usually presented as performance curves in the form of cold water temperature versus inlet wet-bulb temperature as specified in ATC-105. Alternately the design may be presented as a CTI characteristic curve.

Thermal tests may be used to determine contractual acceptance on new or modified towers or to evaluate the thermal performance of an older tower. Both tests are typically conducted in the same manner and with the same caliber of instrumentation.

2.1.1 Thermal Acceptance Test - The thermal acceptance test is conducted on new and rebuilt towers, usually within the first year of operation. This

test determines whether or not the cooling tower meets contractual thermal performance guarantees by the cooling tower manufacturer or rebuilder. For a contractual acceptance test, the cooling tower manufacturer or other contractually liable parties are invited to witness, whereas the manufacturer need not be invited to witness a thermal status test.

2.1.2 Thermal Status Test - The thermal status or benchmark performance test is typically conducted on cooling towers to establish existing thermal capability. This test quantifies existing thermal performance and may be used to evaluate thermal performance degradation which may have occurred since the tower was originally placed in service. This test is often performed when tower refurbishment is being considered, when there are problems with the system indicating the tower as a possible cause, or when an additional load will be put on the tower and new operating parameters are to be determined.

2.2 Plume Abatement Test - The plume abatement test is used to evaluate the exhaust plume visibility of a wet/dry or hybrid cooling tower at a specified thermal design condition. The test results are usually evaluated against a manufacturer's guaranteed set of fogging frequency curves. The plume abatement test incorporates all of the measurements of the thermal performance test, but is usually conducted in the colder months whereas the thermal performance test is usually conducted in the summer months. In addition to the normal thermal performance test parameters, the tower exhaust air flow rate, exit wet-bulb temperature and inlet and exit dry-bulb temperatures are also measured. The test may be used either for evaluation of contractual acceptance guarantees or for benchmarking purposes.

2.3 Drift Emission Tests - Drift emissions result from the water droplets that are entrained in the exhaust air stream that exit the tower. These droplets are different from condensation, in that the drift droplets contain the same chemical constituents as the circulating water. Drift emission tests are performed to measure the amount of chemically laden circulating water that exits the tower from individual cells or entire cooling towers. The mass emission rate can be used to evaluate contractual guarantees, establish drift emission benchmarks or for environmental studies.

Part III - Procedure to Obtain a Test

1.0 Procedure - An official list of CTI Licensed Testing Agencies may be obtained from the CTI office or the the CTI Website as listed below:

Cooling Technology Institute
P.O. Box 73383
Houston, Texas 77273
Phone: (281) 583-4087
Fax: (281) 537-1721
Internet Address: www.cti.org

This list will contain contact information as well as other information about the agencies. The Test purchaser has the option to request quotes from any or all of the CTI Licensed Testing Agencies. Purchase orders are placed directly with the chosen agency, who will directly bill the test purchaser. Sufficient lead time should be allowed when ordering tests to accommodate pretest preparations, allow the CTI Test Representative (and any contractually liable representatives e.g., the tower manufacturer) to make travel arrangements, and to assure choice of the preferred test date. Although a typical test requires only 1 to 3 days of on-site efforts, allowing ample lead time is highly recommended.

Pre-test information including this bulletin may be sent to the tower owner and/or manufacturer so the advance preparations such as installing water flow measuring taps, temperature measurement taps, and scaffolding may be completed as required. The CTI Test Representative will request relevant tower design information from the tower owner and/or manufacturer.

For a Thermal Performance or Plume Abatement Test, the CTI Representative will require the following information:

- Thermal Performance Curves / Characteristic Curve
- Water flow Measurement Locations (number and size of pipes)
- Tower Type [(counterflow / crossflow), (forced/induced draft)]
- Tower Manufacturer
- Air Inlet Size (height and number of open sides)
- Anticipated Heat Load
- Nominal Fan Motor Voltage and presence of variable speed drives
- Cold Water Measurement Location (pump or cold water grid)
- Make-up and blow-down locations

For thermal performance tests of closed circuit coolers, the CTI Representative will require the additional information:

- Circulating Fluid
- Thermodynamic Properties (specific gravity, specific heat)

In addition to the above information, the CTI Test Representative will require the following information for a Plume Abatement Test:

- Plume Abatement Curve and associated Thermal Design Point
- Stack Diameter
- Stack Height
- Fan Hub Diameter and proximity to the fan stack exit plane