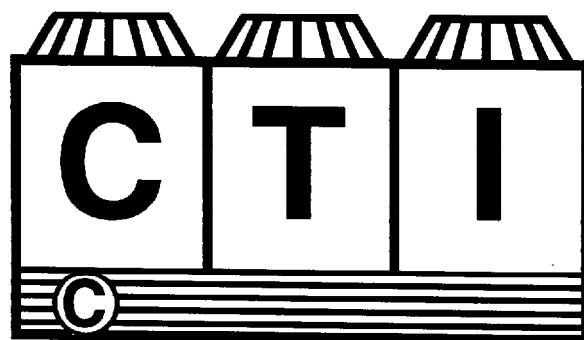


COOLING TOWER INSTITUTE

STD-201

STANDARD FOR THE CERTIFICATION OF WATER-COOLING TOWER THERMAL PERFORMANCE



November 1996

CTI Standard STD-201 (96)

CTI CODE TOWER

STANDARD SPECIFICATIONS

FOREWORD

In the interest of obtaining uniform standards in the cooling tower industry, the Cooling Tower Institute has developed a series of individual Standards. Those standards applicable to the tower, taken together, constitute a specification for a **CTI CODE TOWER**. Adherence to these standards is strictly on a voluntary basis. Any manufacturer may use them in whole or in part but their existence does not in any respect preclude any party who has approved of the standard from manufacturing or selling a water-cooling tower not conforming to the standard. However, when reference to this CTI Code Tower Standard Specification is made in proposals, contracts, labels, invoices or advertising literature, the provisions of the standard are enforceable through usual legal channels as part of the sales contract.

Services of the Cooling Tower Institute may be arranged to assist any and all users and manufacturers of water-cooling towers in the application of these Standard Specifications.

Printed copies of all **CTI CODE TOWER** Standard Specifications are available at nominal cost.

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Approved by the CTI Executive Board
Supersedes CTI Standard STD-201
dated October 1996
dated October 1991

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CTI Standard STD-201 (96)

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STANDARD FOR THE CERTIFICATION OF WATER-COOLING TOWER THERMAL PERFORMANCE

1.0 PURPOSE

1.1 This Standard sets forth a program whereby the Cooling Tower Institute will certify that all models of a line of water cooling towers offered for sale by a specific Manufacturer will perform thermally in accordance with the Manufacturer's published ratings, as limited in Paragraph 2.8.

2.0 SCOPE

2.1 This Standard applies to Mechanical Draft Water Cooling Towers where thermal capacity is selected from published ratings.

2.2 This certification program shall be administered by a CTI Certification Administrator who shall be appointed by and serve at the discretion of the CTI Board of Directors.

2.3 The term "published ratings," as used in this Standard, pertains to the cooling tower thermal performance ratings (presented in printed form or as computer output) available upon request, to contractors, distributors, consultants, engineers, and owners for selecting equipment for applications. Such ratings shall be sufficient in scope to permit cooling tower selections and test evaluations over the full range of certified operating conditions claimed by the Manufacturer (see Paragraphs 2.5 and 2.8).

2.4 The term "Line," as used in this Standard, applies to a Manufacturer's grouping of cooling towers, all of which are of consistent design in that they employ the same design configuration (induced draft crossflow, forced draft counterflow, etc.), and the same fan type (propeller or centrifugal), plus any other optional design or application considerations (such as range of capacities) as the Manufacturer may employ, and for which the Manufacturer issues a unique catalog or other sales literature providing a physical description and dimensions for all models and a selection procedure.

2.5 The range of certified thermal operating conditions shall not extend beyond:

Wet Bulb Temperatures:	15.5°C to 29.5°C (60°F to 85°F)
Maximum Process Fluid Temperature:	51.7°C (125°F)
Minimum Range:	2.2°C (4°F)
Minimum Approach:	2.8°C (5°F)

The Manufacturer may set more restrictive limits if desired. Conversely, if the Manufacturer's published ratings are more extensive than the limits set forth above, the limits of certification shall be clearly defined and noted in the published ratings.

2.6 Compliance with this Standard requires all models of the cooling tower line to be certified.

2.7 Compliance with this Standard requires initial qualification testing and annual reverification testing of individual cooling tower models selected from the line by the CTI Certification Administrator.

2.8 Certified ratings are established on the basis of entering wet bulb temperature for towers located in a free and unobstructed environment and circulating fresh water over the fill or heat exchanger. The Manufacturer shall make available published criteria defining a free and unobstructed environment and, in the case of closed circuit towers, clearly identify in published literature the Process Fluids included under the certification.

2.9 Certifications issued by the CTI in accordance with the provisions of this Standard shall apply only to the exact products described in the approved certification report as maintained by the CTI Certification Administrator. Certification shall also apply to multiple cell arrangements of certified models provided the physical configuration and airflow through each cell remains unaltered.

2.10 When optional accessories available from a manufacturer affect the airflow rate through the tower and compensation must be made in the selection, the certification is no longer applicable unless certified as a separate model. This fact shall be clearly specified in all published literature and submittal documents pertaining to the certified line.

2.11 The Manufacturer of a line of cooling towers certified under the provisions of this Standard shall not make any implication that the certification applies to any other line of cooling towers or products not duly certified under the provisions of this Standard.

3.0 OPERATION OF PROGRAM

3.1 The Manufacturer requesting certification of a line of cooling towers shall submit an application for certification to the CTI Certification Administrator.

3.2 Included in the Manufacturer's application shall be:

- (a) A general description of the cooling tower line to be certified, including catalogs if available.
- (b) A copy of the "published ratings" for each cooling tower model comprising the line.
- (c) A Physical Data Sheet (see Appendix A) for each cooling tower model comprising the line.

3.3 The CTI Certification Administrator shall evaluate the data submitted for reasonableness and consistency. Based upon this re-

view, he shall select one cooling tower model from the line for the Initial Qualifying Test.

3.4 If, in the judgment of the CTI Certification Administrator, evaluation of certification data submitted by the Manufacturer for the results of the Initial Qualifying Test so warrant, he may require qualifying tests on additional models.

3.5 The CTI Certification Administrator shall advise the Manufacturer in writing of the unit(s) selected for the Initial Qualifying Test(s) and provide the current CTI Schedule of Fees for both the certified CTI Testing Agency and the services of the CTI Certification Administrator. If the selected model is unavailable, an alternative model may be selected by the Certification Administrator. The Certification Administrator may require that the originally selected model be made available and tested within one year of the issuance of certification of that line, or the model must be withdrawn from the line.

3.6 The Manufacturer shall submit a Purchase Order (or signed proposal), to the CTI for the testing and administrative fees and specify when and where the initial qualification test(s) will be conducted.

3.7 All tests prescribed by this Standard shall be conducted by the certified CTI Testing Agency. Original test data shall be retained by the CTI Certification Administrator and a copy given to the Manufacturer.

3.8 To substantiate the Manufacturer's published thermal ratings, cooling towers tested under the provisions of this Standard must demonstrate a thermal performance capability (as defined in Paragraph 5.2) of 100%. The test tolerance on individual tests shall be $\pm 5\%$.

3.9 In the event a cooling tower tested under any of the provisions of this Standard, including Initial Qualifying Tests, fails to demonstrate a thermal performance capability of at least 95%, it shall be considered a test failure and the provisions of Paragraph 7.5 shall apply.

3.10 If the evaluation of the certification data submitted by the Manufacturer and the results of the Initial Qualifying Test(s) are satisfactory to the CTI Certification Administrator, and the testing and administrative fees have been paid by the Manufacturer, a formal letter of acceptance (Appendix B) shall be sent to the Manufacturer advising him of the unique Certification Validation Number for the certified line and authorizing him to use the CTI Certification Logo in published literature pertaining to the certified line and to affix a CTI Certification Label to each certified tower sold. A copy of the letter of acceptance shall be retained on file by the CTI Certification Administrator.

3.11 The Manufacturer shall affix a permanent Serial Number and the CTI Certification Label displaying the appropriate validation number to each tower sold as certified. The CTI Certification Label shall conform to the wording in the sample label in Appendix D.

3.12 The manufacturer of a line of certified towers may make

design or rating changes to the line at any time. However, in making changes which affect any of the physical data of record (Appendix A), the ratings of one or more models comprising the line, or when adding new models to the line, he shall submit to the CTI Certification Administrator:

- (a) A description of the exact changes proposed, including any additions or modifications to the ratings and/or the Data of record described in Appendix A.
- (b) The approximate date on which the changes are to be implemented.

Within 20 working days after the receipt of these data, the CTI Certification Administrator shall, at his discretion, either:

- (1) Issue a formal acceptance of the change (using the format of Appendix C) based solely on his examination of the data.
- (2) Require testing of one or more cooling tower models selected by the CTI Certification Administrator to verify the certified performance, which test(s) shall be treated as an additional qualifying test.

3.13 To demonstrate compliance with published ratings on an ongoing basis, an annual reverification test shall be conducted, at the Manufacturer's expense, on one cooling tower model selected by the CTI Certification Administrator from each certified line. In the event any such unit fails to pass an annual reverification test (see Paragraph 3.9), the procedure of Paragraph 7.5 shall apply.

3.14 The procedures set forth in the preceding paragraphs of this section shall be followed for each and every line of cooling towers certified by the Cooling Tower Institute (CTI).

3.15 All data submitted by the Manufacturer of a certified cooling tower line and all test reports shall be kept permanently on file by the CTI Certification Administrator. Such files shall be held in strictest confidence by the CTI Certification Administrator and shall not be copied or distributed to any other parties, including the CTI Board of Directors, without the explicit, written authorization of the Manufacturer.

3.16 The CTI shall publish annually a listing of all current certified cooling tower lines. This list shall include the name of the Manufacturer and identification of the cooling tower line. Additionally, since there may be changes over the course of the year to the number of program participants, the number of cooling tower lines certified, or the certified ratings of any particular certified line of towers, the CTI Certification Administrator shall supply, upon request, to any interested party, the current status of any participant or any cooling tower model and will provide such changes for publication in routinely printed CTI Journals.

4.0 TESTING PROCEDURES

4.1 All cooling tower performance tests prescribed by this Standard may be conducted in either a laboratory or in the field and shall conform to the provisions of the latest version of the CTI Test

Code ATC-105, except as hereinafter provided.

4.2 Each tower shall be tested with all standard appurtenances such as fan screens, inlet screens, motor and belt guards, and velocity recovery stacks (as applicable) properly installed.

4.3 Certification tests shall be conducted on towers with the design process fluid at a design flow rate of no less than 60% or more than 140% of the midpoint of the published flow rate limits for the cooling tower model and process fluid being tested. At least one Initial Qualifying Test shall be conducted for each process fluid to be included in the certification.

4.4 During certification tests, the tower shall be operating within the Manufacturer's recommended limits of hot water basin head/nozzle spray pressure. Additionally, for closed circuit towers, the measured "clean tube" pressure drop of the process fluid across the heat exchanger shall not exceed 115% of the rated value for that fluid at the measured flow.

4.5 Certification tests shall be conducted at a thermal operating condition encompassed by the limits of certification (Paragraph 2.4) or the Manufacturer's published selection/rating procedure, whichever is more restrictive.

4.6 Certification tests shall be conducted with the cooling tower under test operating within 10% of the rated fan motor output power.

4.7 Certification tests shall be conducted at barometric pressures between 91.4 kPa [27" Hg] and 105 kPa [31" Hg] and corrected to Standard Barometric Pressure using Equation 1 below:

$$C_{SBP} = \left(\frac{C_{TBP}}{1 + (K_1)(BP_{Std} - BP_T)} \right) \quad (\text{Eqn. 1})$$

Where: C_{SBP} = Tower Capability adjusted to Standard Barometric Pressure.

C_{TBP} = Tower Capability at Test Barometric Pressure.

K_1 = Constant equal to 0.0023 for SI and 0.0078 for IP.

BP_{Std} = Standard Barometric Pressure equal to 101.325 kPa for SI and 29.92 in Hg for IP.

BP_T = Test Barometric Pressure in kPa (in Hg).

(Note: this equation is valid only for the limits stated above and should not be extrapolated)

4.8 Test Instrumentation

- (a) Remote reading temperature sensors and data acquisition system or mercury-in-glass thermometers, owned by the CTI or its certified testing agency, calibrated to an accuracy of $\pm 0.05^\circ\text{C}$ ($\pm 0.10^\circ\text{F}$) or better against instrumentation traceable to the National Institute of Standards and

Technology, shall be used to obtain the hot water, cold water and wet-bulb temperatures. The instrumentation shall be checked for calibration by the CTI Testing Agency prior to and after each tower test series. All instrumentation systems and calibrations shall be maintained by the CTI Testing Agency.

- (b) Psychrometer used to measure wet bulb temperatures shall be as designed by the CTI and be maintained by the CTI Testing Agency.
- (c) An appropriately sized Pitot tube or Venturi meter, approved by the Certification Administrator, which is owned by CTI or the certified Testing Agency shall be the primary device for measurement of the process fluid flow rate. Flow measurement devices shall be calibrated by a recognized hydraulics laboratory.
- (d) A mercury manometer or calibrated pressure differential meter/transducer, approved by the Certification Administrator and owned by the CTI or the certified Testing Agency, shall be used to measure the pressure differential of the process fluid across the heat exchanger.

4.9 The Manufacturer may observe but not participate in reading and recording of official test data.

4.10 The models selected for testing, as prescribed by this Standard, will preferably be production towers; however, if prototypes are tested, as soon as practicable random production towers shall be dimensional and component checked by the CTI Certification Administrator or his designee to verify conformance with the prototypes and the Physical Data Sheets of record.

5.0 EVALUATION OF TESTS

5.1 For each test, the Manufacturer's "published ratings" shall be used to determine the predicted flow rate for the tower in L/s (gpm) at the measured test thermal conditions and design fan motor output power.

5.2 The thermal performance capability of the tower shall be determined by the Performance Curve Method in the latest edition of ATC-105.

5.3 The thermal conditions for any test must be sufficiently inside the boundaries of the "published ratings" to allow the methodology of Paragraph 5.1 and 5.2 above.

6.0 COMPLAINT PROCEDURES

6.1 Complaints regarding non-compliance with this Standard can be submitted to the CTI Certification Administrator by program participants or by customers who have purchased a cooling tower certified under this program.

6.2 Complaints of non-compliance shall be submitted with twenty-four months after shipment of the tower from the Manufacturer. The tower in question shall have been in service for not less than one month or more than twelve months.