CTI Thermal Certification Test Report
T43A-128-23A

2023 Annual Reverification Test
On the Bell Cooling Towers, Pvt., Ltd.
BCTI Series, Model BCTI-100XE
1-cell, Induced-draft, Counter-flow, Cooling Tower
Installed at a Customer Site in Delhi
India

For Bell Cooling Towers, Pvt., Ltd.
136 Charmwood Plaza
Eros Garden, Surajkund Road
Faridabad (Haryana) 102009
India

Test Date: June 21, 2022
CTI Test No.: T43A-128-23A

Prepared by: Michael G. Womack, P.E.
CTI Thermal Certification Administrator
c/o CleanAir Engineering

Summary

Cooling Tower Test Associates, Inc. (CTTA) has been designated by the Cooling Technology Institute (CTI) to conduct thermal certification tests as set forth in the CTI STD-201(21) certification standard. A CTI Annual Reverification Test was performed for Bell Cooling Towers, Pvt., Ltd. (Bell) on their BCTI Series, Model BCTI-100XE, 1-cell, induced-draft, counter-flow, cooling tower. The test was conducted at a customer site in Delhi, India. The purpose of the CTI Annual Reverification Test is to verify the thermal performance as required to maintain CTI Certification of the line of cooling towers. The work was performed by CTTA as an independent contractor licensed by the CTI for STD-201 testing services.

The 2023 Annual Reverification Test was conducted on June 21, 2022, in accordance with the CTI Standard for Performance Rating of Evaporative Heat Rejection Equipment, STD-201RS(21). The test data were acquired in accordance with the CTI Acceptance Test Code for Water-Cooling Towers, ATC-105(19). All thermal parameters were measured with precision platinum RTD temperature probes and recorded using a data acquisition system consisting of a multi-channel data logger interfaced with a laptop computer. The circulating water flow was measured using a hydraulic pitot tube with an air-over-water manometer. Fan motor power was measured with a clamp-on digital kilowatt meter. Following the test, the computer system was used to average the test data, assist with selection of time periods for analysis, and calculate the test results.

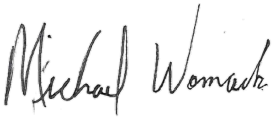
The test results were calculated for one time period selected during the Annual Reverification Test by using the manufacturer's expanded rating tables and the methods of analysis as specified in the CTI STD-201 certification standard. The data indicate that the Bell BCTI Series, model BCTI-100XE cooling tower was operating at 98.6% of its published capacity during the test on June 21, 2022, which exceeds the 95% minimum allowed by the CTI STD-201.

Therefore, the Bell BCTI Series line of cooling towers has fulfilled the testing requirement to maintain its thermal certification as per CTI STD-201.

The CTI STD-201 Certification requires the successful completion of a CTI Annual Reverification Test on a different model each year to remain in effect in the subsequent year.

Clean Air Engineering, Inc.
Thermal Certification Administration Services

Prepared by:



Michael G. Womack, P.E.
CTI Certification Administrator

Test on Model BCTI-100XE

June 21, 2022

Cooling Technology Institute

Test Calculations (IP Units: °F, gpm & in-Hg)

File No.	C043	Date	6/21/2022	Time Period	12:15-13:15
Model No.	BCTI-100XE	Location	Field in Delhi	TAN #	T43A-128-23A

Test Data

Hot Water, °F =	85.14	Cold Water, °F =	78.18	Wet Bulb, °F =	73.05
Tower Flow, gpm =	1146.6	Makeup Flow,gpm =	N/A	Makeup Temp, °F =	N/A
Test Fan Power, Hp =	21.80	Pump Pressure, psi =	N/A	Barometer, in-Hg =	28.55
Rated Fan Power, Hp =	24.80	Dry Bulb, °F =	80.00	Relative Humidity, % =	72.52
	12.1%				

Calculated Values

Pump Correction = 0.002966 * psi / Pump Efficiency: PC = 0.00 °F

Evaportation = 0.00085 * Flow * Range Evap = N/A gpm

Makeup Correction = (CWT + PC - MUT) * MUF / (Tower Flow - MUF) MC = N/A °F

CCWT = CWT + PC + MC CCWT = 78.18 °F

Range = HWT - CCWT Range = 6.96 °F

Approach = CCWT - WBT Approach = 5.14 °F

Cataloged Water Flow for Wet Bulb = 74.0 °F

		6.00 Range	6.96 Range	7.50 Range
5.00	Approach	1311.15	1204.98	1145.76
5.14	Approach	1336.21	**1227.26**	1166.48
6.00	Approach	1496.15	1369.43	1298.75

Cataloged Water Flow for Wet Bulb = 75.0 °F

		6.00 Range	6.96 Range	7.50 Range
5.00	Approach	1341.48	1232.26	1171.34
5.14	Approach	1367.09	**1255.06**	1192.56
6.00	Approach	1530.52	1400.54	1328.04

Cataloged Water Flow for Wet Bulb = 73.05 °F **1200.75**

Adjusted Test Flow = Test Flow * [Fan Power (design) / Fan Power (test)] $^{(1/3)}$

Adjusted Test Flow (@ test barometer) = 1196.97

Barometric Factor {Inches Mercury} = 1 + (0.0078 *(BPstd - BPtst))

Barometric Factor = 1.010686

Adjusted Corrected Test Flow (with BP correction) = Adjusted Test Flow / Barometric Factor

Adjusted Corrected Test Flow (@ standard barometer) = 1184.32

Percent Capabilty = Adjusted Corrected Test Flow / Predicted Test Flow * 100

Percent Capability = 98.63 %

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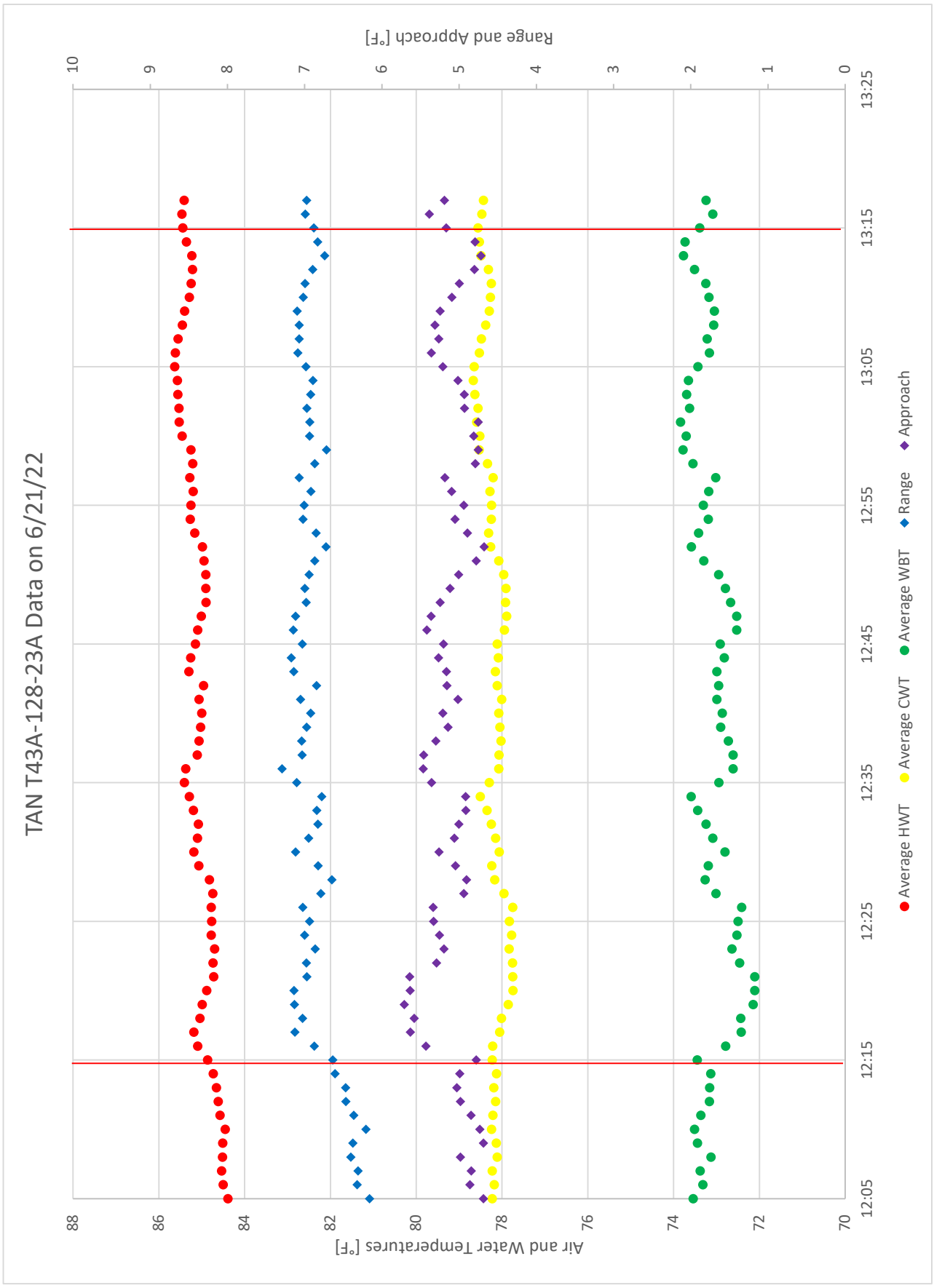
BCTI-100XE Rating Table Excerpt

		Wet Bulb =	74
	Ranges	6.00	7.50
Approach =	5.00	1311.15	1145.76
Approach =	6.00	1496.147	1298.745

		Wet Bulb =	75
	Ranges	6.00	7.50
Approach =	5.00	1341.478	1171.335
Approach =	6.00	1530.518	1328.04

Table Values: BCTI-XEmatrixRerated29Sep2022.xls


TAN T43A-128-23A Data on 6/21/22
Air and Water Temperatures [°F]
Range and Approach [°F]
88
86
84
82
80
78
76
74
72
70
10
9
8
7
6
5
4
3
2
1
0
12:05
12:15
12:25
12:35
12:45
12:55
13:05
13:15
13:25
Average HWT
Average CWT
Average WBT
Range
Approach

Cooling Tower Test Associates, inc.
Hourly Data Summary - Test Run 1

TAN:	T43A-128-23A
Manufacturer:	Bell
Model:	BCTI-100XE

Test Date:	6/21/2022
Start Time:	12:15
End Time:	13:15

Channel	Description	Average	Deg / Hr	Std. Deviation
101	HWT1	85.15	0.59	0.25
102	HWT2	85.14	0.59	0.25
103	CWT1	78.19	0.60	0.26
104	CWT2	78.18	0.59	0.25
105	WBT1	73.26	1.43	0.59
106	WBT2	73.57	1.30	0.50
107	WBT3	72.83	0.62	0.44
108	WBT4	72.53	0.79	0.46

Description	Average	Deg / Hr	Std. Deviation
Average HWT:	85.14	0.59	0.25
Average CWT:	78.18	0.60	0.25
Average WBT:	73.05	1.04	0.46
Range:	6.96	-0.01	0.15
Approach:	5.14	-0.44	0.27

Stability of Range	
Slope / Average	-0.09%
Maximum Deviation From Average	4.76%

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Fan Power Data Sheet - IP

Location	Field in Delhi	File No.	C043
Barometric Pressure	28.55	TAN #	T43A-128-23A
KW Instrument	D	Date	6/21/2022
Tower Model	BCTI-100XE	Time	10:30

Fan ID	Volt (1)	Volt (2)	Amp (1)	Amp (2)	KW (1)	KW (2)	KW Total	Motor Eff.	HP
Fan 1 & 2	402	398	25.52	20.15	9.590	1.200	10.790	0.780	11.28
Fan 3 & 4	398	401	25.35	18.87	9.39	1.16	10.550	0.780	11.03
Averages		399.8		22.5		Average:	10.670	Sum:	22.313

Motor Nameplate Data

Frame:	Voltage:	Manufacturer:	
RPM:	Amps:	Nominal Efficiency:	0.78
HP:	SF:	Power Factor:	

Line Loss Calculation

Data:

Wire Length	500	Wire Size	8
Average Amprere	22.47	Motor Eff.	0.780

Results:

KW - Total (avg.)	10.67	HP (measured)	22.31
KW (loss)	0.49	HP (loss)	0.51
KW (net)	10.18	Test HP (net)	21.80

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Water Flow Data Sheet

FILE NO. C043 DATE: 06/21/22

TAN# T43A-128-23A

PITOT STYLE:	Elliptical	PIPE IDENTITY:	Hot Water Riser
PITOT TYPE:	Standard	NOMINAL PIPE DIAMETER (in):	11
SERIAL NUMBER:	18001	AVERAGE PIPE AREA (ft^2):	0.58709
DATE CALIBRATED:	February-2021	PITOT FLUID TYPE:	Water
PITOT COEFFICIENT:	0.7564	FLUID TEMPERATURE (°F):	85.1

		TAP:	Side 1	TAP:	Side 2
		TIME:	12:10	TIME:	12:25
		DIAMETER (in):	10 3/8	DIAMETER (in):	10 3/8
STATION NUMBER	RELATIVE LOCATION	LOCATION (in)	DEFLECTION d (in)	LOCATION (in)	DEFLECTION d (in)
1	0.0257	0 4/16	7 5/16	0 4/16	7 13/16
2	0.0817	0 14/16	8 2/16	0 14/16	8 9/16
3	0.1464	1 8/16	8 4/16	1 8/16	8 10/16
4	0.2261	2 6/16	8 6/16	2 6/16	8 5/16
5	0.3419	3 9/16	7 12/16	3 9/16	7 7/16
CP	0.5000	5 3/16	6 5/16	5 3/16	6 8/16
6	0.6581	6 13/16	5 5/16	6 13/16	5 12/16
7	0.7739	8 0/16	4 9/16	8 0/16	5 12/16
8	0.8536	8 14/16	4 5/16	8 14/16	5 6/16
9	0.9183	9 8/16	3 15/16	9 8/16	4 9/16
10	0.9743	10 2/16	2 12/16	10 2/16	3 10/16
		Diam 1 $\sum\sqrt{d}$	24.26	Diam 2 $\sum\sqrt{d}$	25.42
		Diam 1 Avg $\sqrt{d}$	2.426	Diam 2 Avg $\sqrt{d}$	2.542
			Pipe Average $\sqrt{d}$	2.4844	

FLOW, US GPM = 1,146.6