CTI Thermal Certification Test Report
T43A-178-16A

2016 Annual Reverification Test
On the Bell Cooling Towers, Pvt., Ltd.
BCTI Series, Model BCTI-160X
1-cell, 4-Fan, Induced-draft, Counter-flow, Cooling Tower
Installed at Advent IT Park Customer Site
India

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

Test Date: July 26, 2016
Test No. T43A-178-16A

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

Summary

McHale and Associates, Inc. (McHale) have been designated by the Cooling Technology Institute (CTI) to conduct thermal certification tests as set forth in the CTI STD-201(15) certification standard. A CTI Annual Reverification Test was performed for Bell Cooling Towers, Pvt., Ltd. (Bell) on their BCTI Series, Model BCTI-160X, 1-cell, 4-fan, induced-draft, counter-flow, cooling tower. The test was conducted at the Advent IT Park customer site in India. The purpose of the CTI Annual Reverification Test is to verify the thermal performance as required to retain CTI Certification of the line of cooling towers. The work was performed by McHale as an independent contractor licensed by the CTI for STD-201 testing services.

The 2016 Annual Reverification Test was conducted on July 26, 2016, in accordance with the CTI Standard for Performance Rating of Evaporative Heat Rejection Equipment, STD-201RS(15). The test data were acquired in accordance with the CTI Acceptance Test Code for Water-Cooling Towers, ATC-105(00). 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 2016 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-160X cooling tower was operating at 111.2% of its published capability during the test on July 26, 2016, 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 retain 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-160X

July 26, 2016

Cooling Technology Institute

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

File No. TAN T43A-178-16A | Date July 26, 2016 | Time Period 14:04 - 15:04

odel No. 160X | Location Advent IT Park | TAN # TAN T43A-178-16A

Test Data

Hot Water, °F =	96.26	Cold Water, °F =	88.39	Wet Bulb, °F =	82.37
ower Flow, gpm =	2683.8	Makeup Flow,gpm =	N/A	Makeup Temp, °F =	N/A
Fan Power, Hp =	7.82	Pump Pressure, psi =	N/A	Barometer, in-Hg =	28.73
Fan Power, Hp =	8.50	Dry Bulb, °F =	91.20	Relative Humidity, % =	69.41

Calculated Values

Correction = 0.002966 * psi / Pump Efficiency:

tation = 0.00085 * Flow * Range

p Correction = (CWT + PC - MUT) * MUF / (Tower Flow - MUF)

= CWT + PC + MC

= HWT - CCWT

ch = CCWT - WBT

PC =	0.00	°F	
Evap =	N/A	gpm	
MC =	N/A	°F	
CCWT =	88.39	°F	
Range =	7.87	°F	
Approach =	6.02	°F	

Cataloged Water Flow for Wet Bulb = 82.0 °F

		7.50 Range	7.87 Range	10.00 Range
6.00	Approach	2480.00	2427.02	2122.00
6.02	Approach	2486.14	**2432.92**	2126.56
7.00	Approach	2787.00	2722.32	2350.00

Cataloged Water Flow for Wet Bulb = 83.0 °F

		7.50 Range	7.87 Range	10.00 Range
6.00	Approach	2552.00	2495.91	2173.00
6.02	Approach	2558.04	**2501.76**	2177.80
7.00	Approach	2854.00	2788.73	2413.00

Cataloged Water Flow for Wet Bulb = 82.37 °F 2458.39

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

Adjusted Test Flow (@ test barometer) = 2759.44

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

Barometric Factor = 1.009282

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

Adjusted Corrected Test Flow (@ standard barometer) = 2734.06

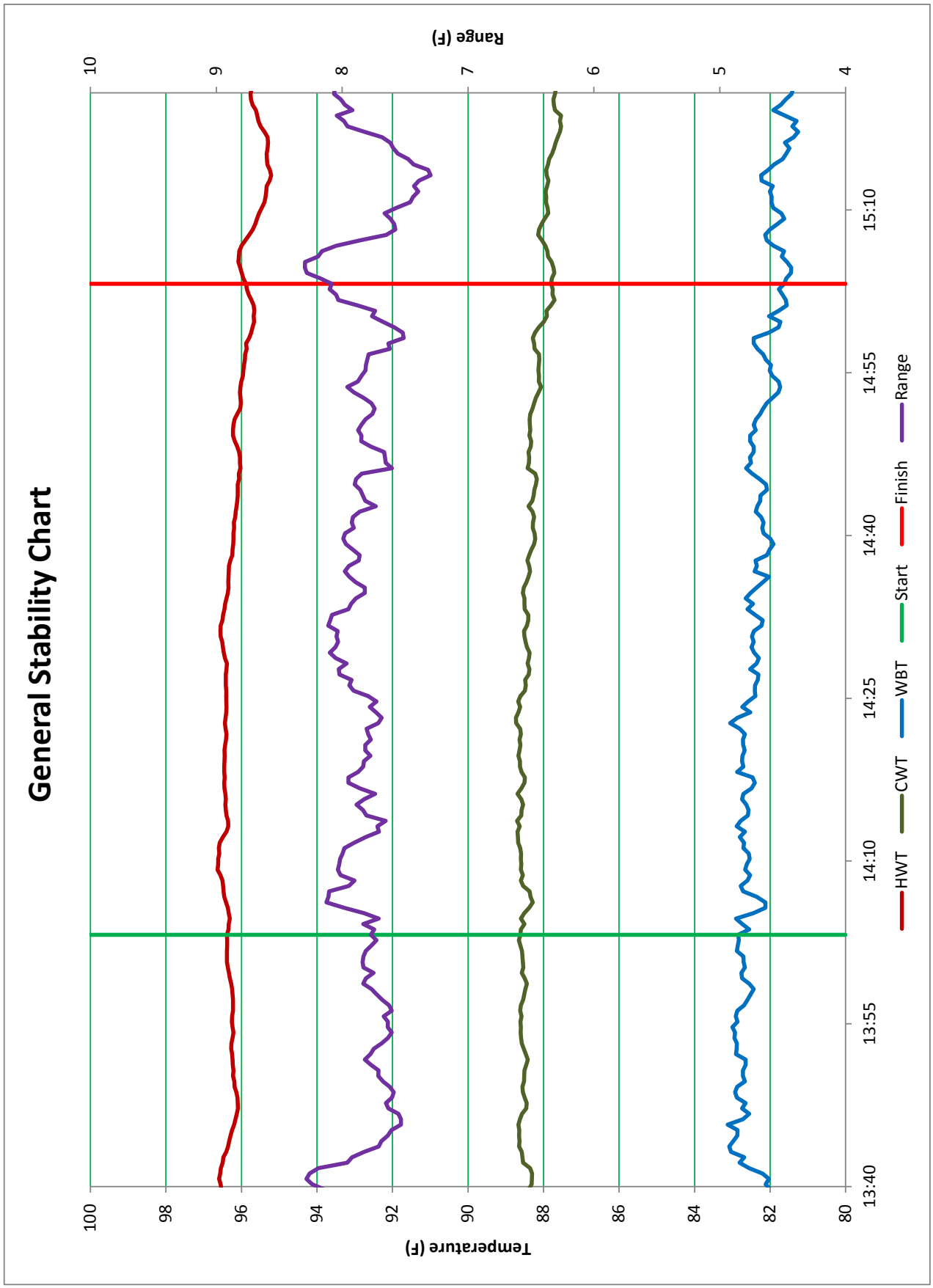
Capabilty = Adjusted Corrected Test Flow / Predicted Test Flow * 100

Percent Capability = 111.21 %

BCTI-160X Rating Table Excerpt

		Wet Bulb =	82
	Ranges	7.50	10.00
Approach =	6.00	2480	2122
Approach =	7.00	2787	2350

		Wet Bulb =	83
	Ranges	7.50	10.00
Approach =	6.00	2552	2173
Approach =	7.00	2854	2413


General Stability Chart
Temperature (F)
Range (F)
100
98
96
94
92
90
88
86
84
82
80
10
9
8
7
6
5
4
13:40
13:55
14:10
14:25
14:40
14:55
15:10
HWT
CWT
WBT
Start
Finish
Range

Annual Reverification Test

Bell Cooling Towers BCTI-160X

July 26, 2016

14:04-15:04

Data Summary

Description	Units	Nominal	Test Avg	201 Limits	Limit Check
Circulating Water Flow Rate	GPM	2,418.0	2,683.8	N/A	N/A
Hot Water Temperature	°F	100	96.26	<125	**Pass**
Cold Water Temperature*	°F	90	88.39	N/A	N/A
Wet Bulb Temperature	°F	83	82.37	50<WB<90	**Pass**
Cooling Range	°F	10	7.87	>4	**Pass**
Approach	°F	7	6.02	>5	**Pass**
Fan Motor Power	HP	34.0	31.30	±10%	**Pass**
Barometric Pressure	inHg	29.92	28.73	27<BP<31	**Pass**

*Corrected for pump influence and make-up as applicable

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Fan Power Data Sheet - IP

Location	At Starter	File No.	TAN T43A-178-16A
Barometric Pressure	28.73	TAN #	TAN T43A-178-16A
KW Instrument	Asset#24238	Date	July 25 2016
Model	Fluke 38	Time	13:00

Fan ID	Volt (1)	Volt (2)	Amp (1)	Amp (2)	KW (1)	KW (2)	KW Total	Motor Eff.	HP
A	395	394	13.90	14.70	5.40	1.60	7.000	0.850	7.98
B	385	393	13.60	13.70	5.20	1.20	6.400	0.850	7.29
C	398	396	14.70	15.60	5.60	1.40	7.000	0.850	7.98
D	398	396	15.10	15.40	5.90	1.60	7.500	0.850	8.55
Averages		394.4		14.6			6.975		

Motor Nameplate Data

Frame:	180MV	Voltage:	415	Manufacturer:	new India (NIEC)
RPM:	570	Amps:	18	Nominal Efficiency:	0.85
HP:	10	SF:		Power Factor:	

Line Loss Calculation

Data:

Wire Length	165	Wire Size	10
Average Amprere	14.59	Motor Eff.	0.850

Results:

KW - Total (avg.)	6.98	HP (measured)	7.95
KW (loss)	0.11	HP (loss)	0.13
KW (net)	6.87	Test HP (net)	7.82

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Water Flow Data Sheet

FILE NO. TAN T43A-178-16A DATE: July 25 2016

TAN# TAN T43A-178-16A

PITOT STYLE:	Simplex	PIPE IDENTITY:	Header
PITOT TYPE:	Standard	NOMINAL PIPE DIAMETER (in):	12in
SERIAL NUMBER:	CTI Cert #2	AVERAGE PIPE AREA (ft^2):	0.81013
DATE CALIBRATED:	March-2015	PITOT FLUID TYPE:	Water
PITOT COEFFICIENT:	0.7985	FLUID TEMPERATURE (°F):	93.7

		TAP:	Top	TAP:	Side
		TIME:	11:00pm	TIME:	11:00pm
		DIAMETER (in):	12 3/16	DIAMETER (in):	12 3/16
STATION NUMBER	RELATIVE LOCATION	LOCATION (in)	DEFLECTION d (in)	LOCATION (in)	DEFLECTION d (in)
1	0.0257	0 5/16	12 0/16	0 5/16	11 8/16
2	0.0817	1 0/16	15 5/16	1 0/16	15 13/16
3	0.1464	1 13/16	18 11/16	1 13/16	17 14/16
4	0.2261	2 12/16	20 0/16	2 12/16	20 5/16
5	0.3419	4 3/16	20 10/16	4 3/16	21 6/16
CP	0.5000	6 2/16	20 13/16	6 2/16	21 10/16
6	0.6581	8 0/16	19 14/16	8 0/16	20 14/16
7	0.7739	9 7/16	18 13/16	9 7/16	19 3/16
8	0.8536	10 6/16	16 3/16	10 6/16	15 11/16
9	0.9183	11 3/16	13 3/16	11 3/16	12 5/16
10	0.9743	11 14/16	10 3/16	11 14/16	5 6/16
		Diam 1 $\sum\sqrt{d}$	40.36	Diam 2 $\sum\sqrt{d}$	39.48
		Diam 1 Avg $\sqrt{d}$	4.036	Diam 2 Avg $\sqrt{d}$	3.948
			Pipe Average $\sqrt{d}$	3.9917	

FLOW, US GPM = 2,683.8