

# Cooling Tower Performance Curves

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## Introduction

The ambient air and loading performance plots show the output characteristics of a 1000-kW cooling tower under various ambient conditions and heat loads, respectively. The cooling tower has the following specifications:

Feature	Rating
Capacity	1000 kW
Hot Water Temperature (HWT)	38.0 °C
Cold Water Temperature (CWT)	32.8 °C
Design Wet Bulb Temperature	29.73 °C
Approach	3.07 C°
Range	5.2 C°
Water flow rate	46.0 kg/s
Evaporation Loss	0.78%
Air flow rate	22.8 kg/s
Exhaust relative humidity	95%
Fan diameter	2.2 m
Water flow limits	20% - 120%

Whereas in the exhaust air speed plots, the largest unit per fan diameter is shown. These are the units attaining the highest exhaust speeds in their respective category.

## Control Modes

Two control modes specify the performance of the cooling tower:

<b>Flow-limited pump control</b>	This control maintains the HWT at nominal values, except when the water flow limits are reached.
<b>Continuous speed fan control</b>	This control maintains the exhaust temperature equal to the HWT by adjusting the air flow over a continuous speed band.

## List of plots

Figure 1 – Exhaust dry bulb temperature vs. ambient conditions

Figure 2 – Exhaust humidity ratio vs. ambient conditions

Figure 3 – Air mass flow vs. ambient conditions

Figure 4 – Exhaust dry bulb temperature vs. loading

Figure 5 – Exhaust humidity ratio vs. loading

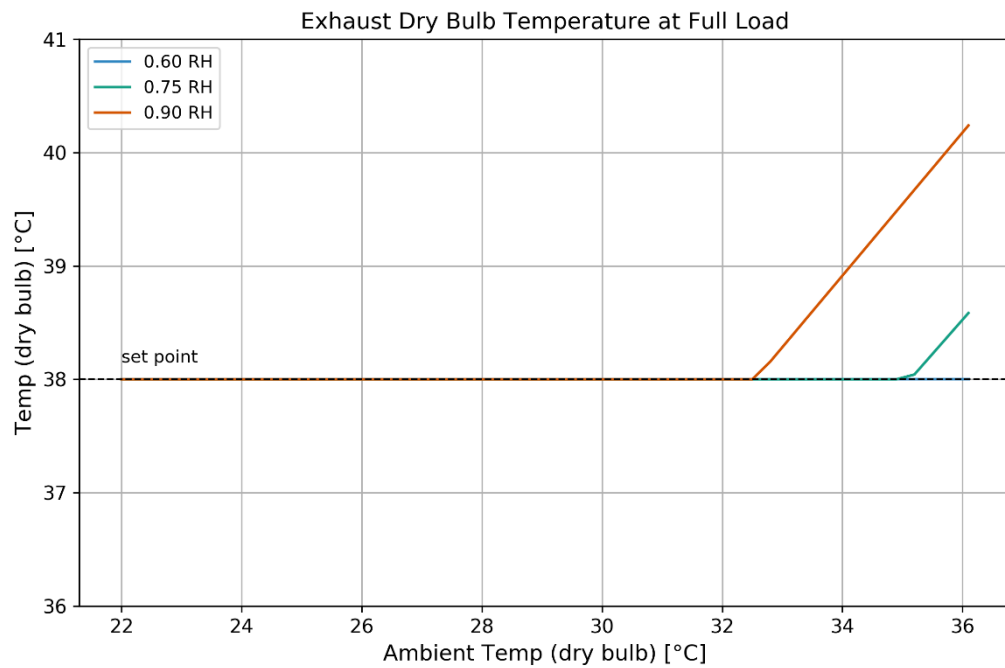
Figure 6 – Air mass flow vs. loading

Figure 7 – Exhaust air speed of largest unit per fan diameter, mean ambient conditions

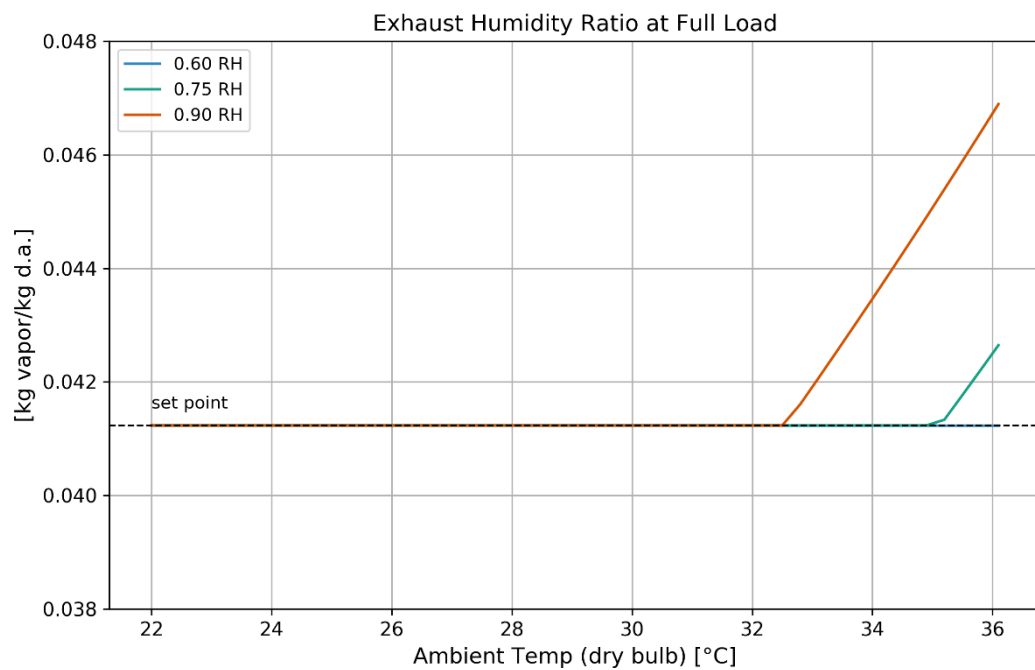
Figure 8 – Exhaust air speed of largest unit per fan diameter, hot and humid conditions

# 1 Ambient Air Performance

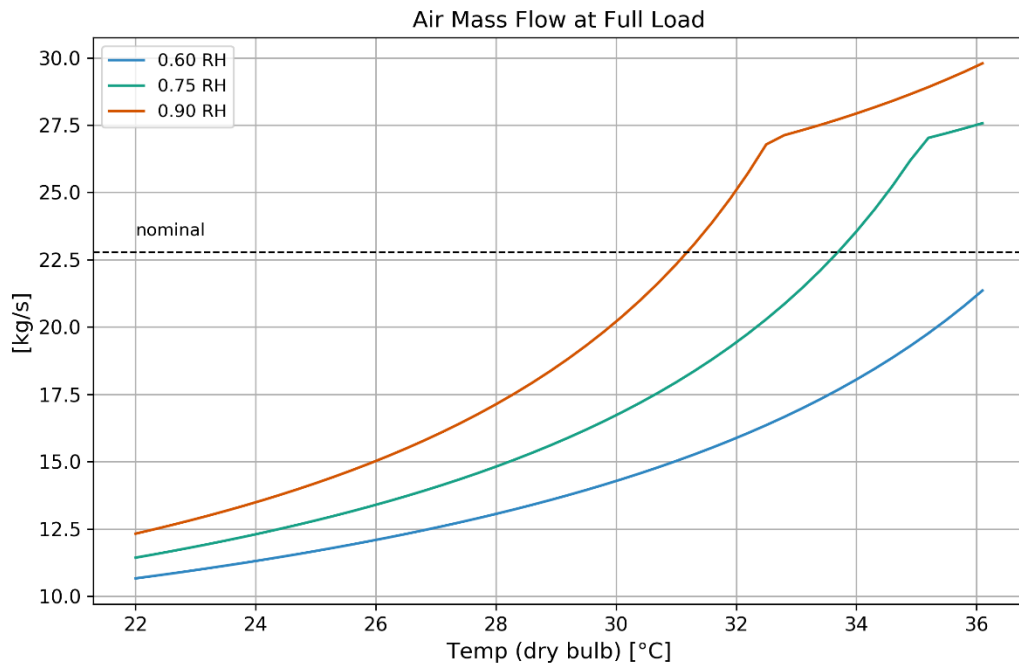
The ambient air performance curves are derived at full load operation, with varying ambient dry bulb temperatures and relative humidity.



**Figure 1** Exhaust dry bulb temperature vs. ambient conditions



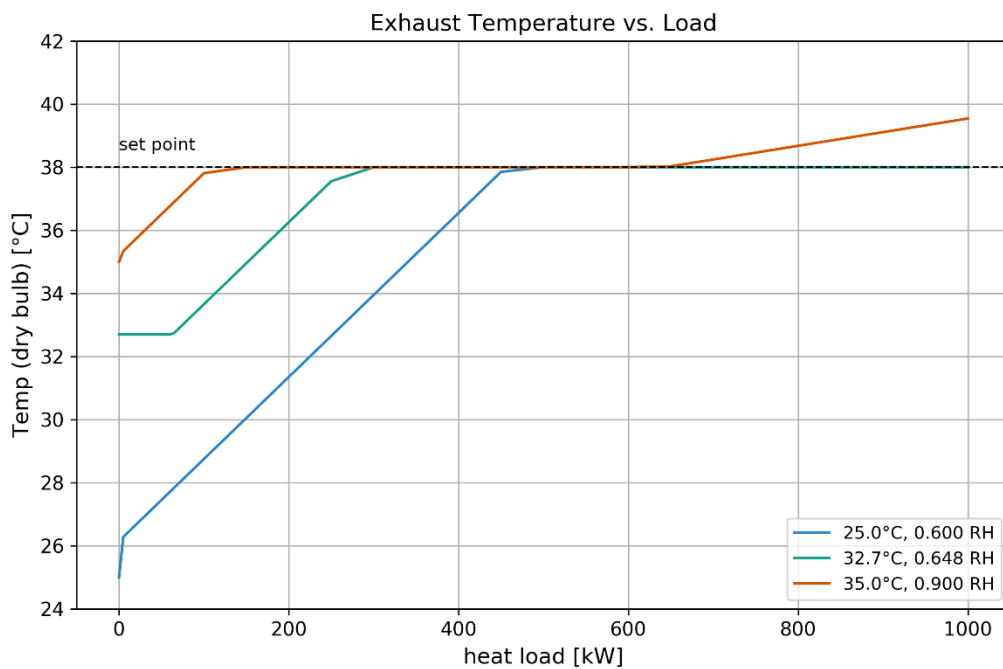
**Figure 2** Exhaust humidity ratio vs. ambient conditions



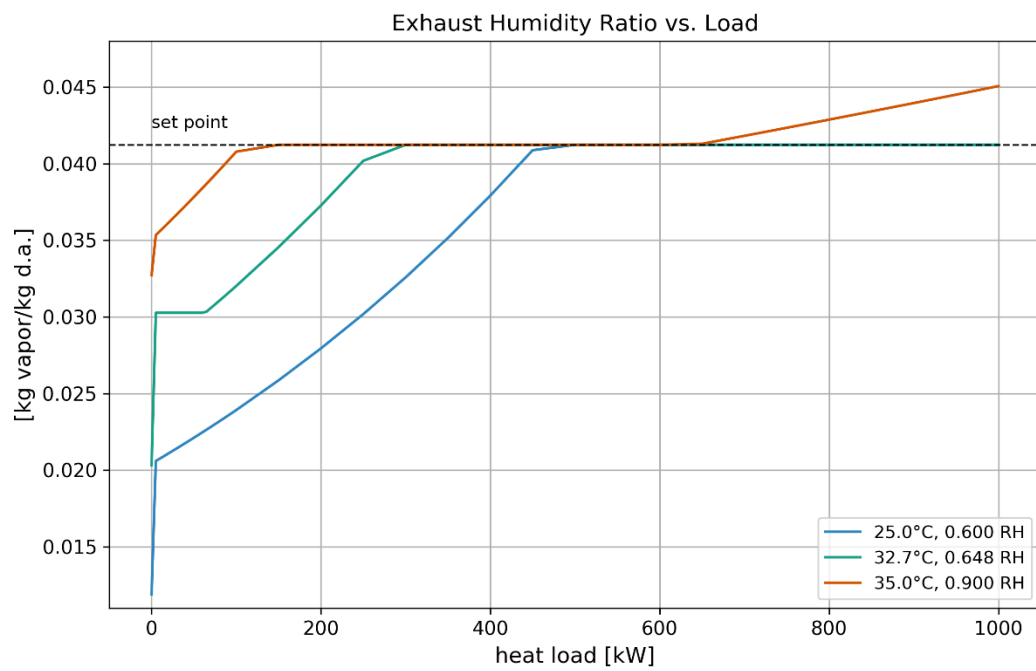
**Figure 3** Air mass flow vs. ambient conditions

## 2 Loading Performance

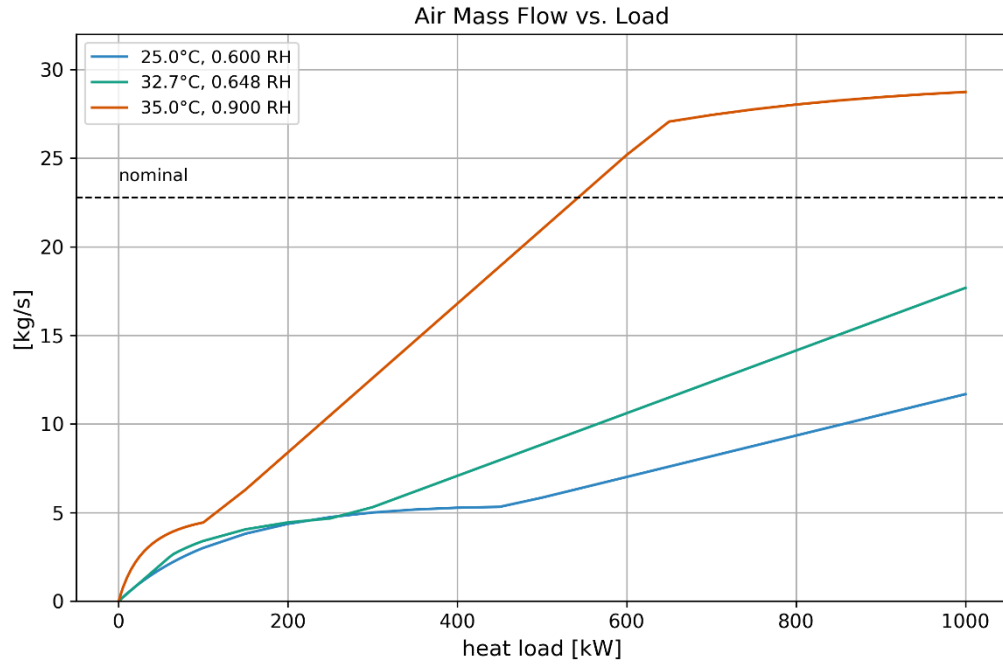
The loading curves plot the cooling tower performance at different load levels at three representative ambient air conditions: a) cool and dry; b) mean conditions; and c) hot and humid. These conditions progressively limit the extent that evaporative cooling can be done, impeding tower performance.



**Figure 4** Exhaust dry bulb temperature vs. load



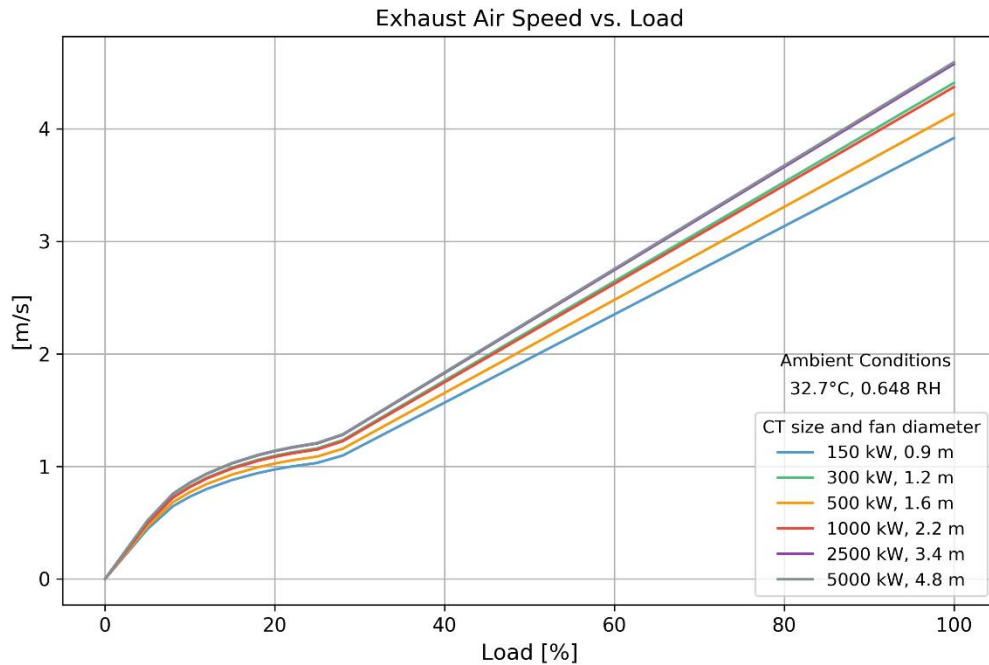
**Figure 5** Exhaust humidity ratio vs. load



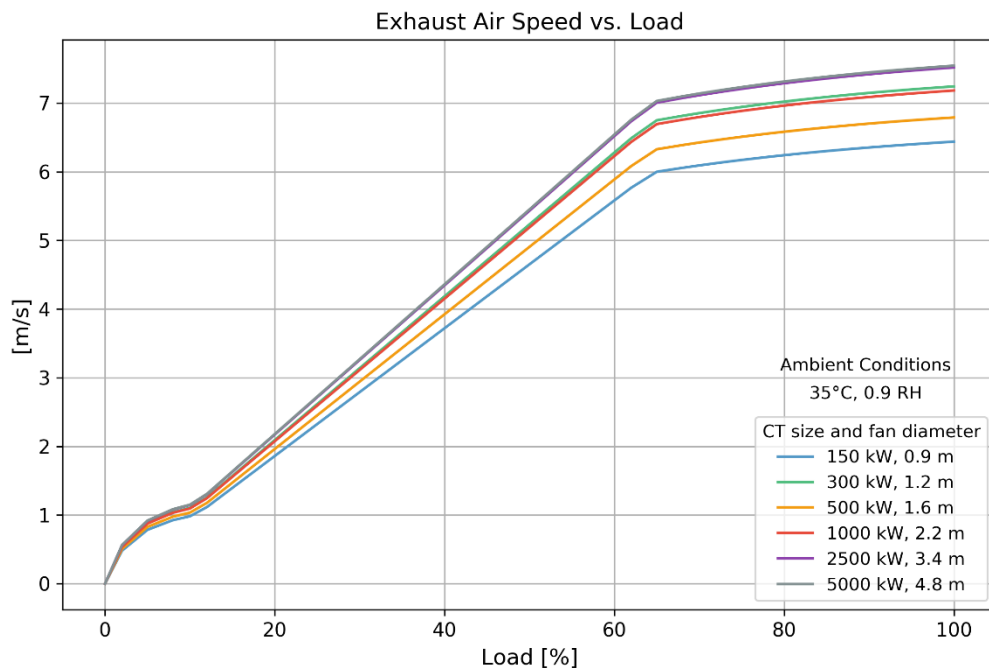
**Figure 6** Air mass flow vs. load

### 3 Exhaust Air Speed

The exhaust air speed plots are shown for the largest cooling tower at the given fan size, under two representative ambient conditions: a) mean; and b) hot and humid.



**Figure 7** Exhaust air speed of largest unit per fan diameter, mean conditions



**Figure 8** Exhaust air speed of largest unit per fan diameter, hot and humid conditions