Understanding and Evaluating Cooling Tower Sound Levels Among Manufacturers

HVAC Systems and Sound

As populations in urban areas around the world continue to expand, the impact of sound from HVAC systems and industrial equipment has led municipalities to take increased measures to control and regulate sound levels. In order to provide equipment that meets these requirements, heat rejection equipment manufacturers have developed innovative solutions to address sound levels of their cooling towers, fluid coolers and other products. However, sound reduction research and the resulting technologies can contribute to higher equipment costs. In the absence of an industry standard for third-party sound verification (until 2026), some manufacturers chose to disseminate inaccurate, incomplete, unverified, and/or misleading equipment sound data. The purpose of this white paper is to aid the reader in distinguishing between accurate and misleading sound data, and outline solutions to manage cooling tower sound levels.

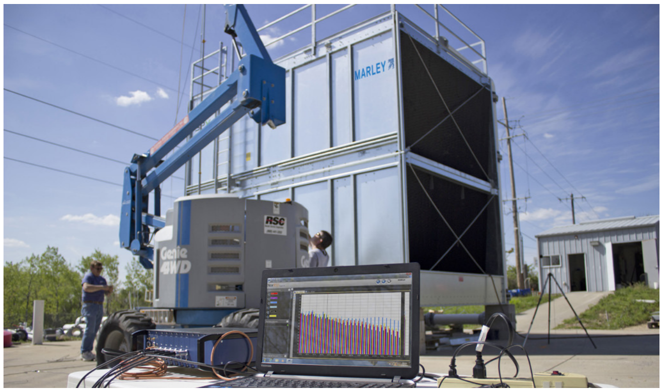
CTI Sound Certification Program

In early 2026, The Cooling Technology Institute (CTI) launched its new Sound Certification Program for heat rejection equipment, establishing a framework for manufacturers to independently certify their sound ratings. Defined in CTI STD 204, CTI Sound Certification verifies that a manufacturer's published 1.5 meter and 15 meter sound pressure levels align with independently measured performance data. Eligible equipment must also be thermally certified under CTI STD 201. By specifying and purchasing heat rejection equipment with CTI Sound Certification, owners/operators have assurance that the equipment's published thermal and sound performance has been independently verified.

SPX Cooling Technologies was a principal advocate for CTI Sound Certification during the program's nearly 10-year development, and was the first manufacturer to participate in the program. Multiple Marley® product lines are CTI Sound Certified. For a current listing of Certified products from all manufacturers, visit cti.org/certification-directory and filter for Certification Type = Sound.

CTI Code ATC-128

CTI's Acceptance Test Code (ATC) 128, *Measurement of Sound from Heat Rejection Equipment*, is the industry's recognized standard specifically for published sound data provided by manufacturers of factory assembled cooling towers and similar heat rejection equipment. This test code defines in detail how sound pressure data for heat rejection equipment is to be measured, and additionally, defines the method for calculating the sound power for the tower. It is important to specify that any sound data provided by a cooling tower manufacturer is wholly compliant with the latest revision of CTI ATC-128, Test Code and year (now March 2024), as this will help to establish a baseline



framework. Even more importantly, specify cooling products with CTI Sound Certification to ensure the accuracy of the manufacturers' published sound data.

Comparing Sound Data

When comparing sound data between manufacturers, cooling towers with similar configurations (crossflow/counterflow, induced/forced draft, model dimensions, fan diameter, fan speed and power) operating under similar conditions should result in very similar sound data. If the sound levels vary by 2dBA or less when measured with a precision sound instrument, this difference is essentially negligible. In other words, it is within typical measurement tolerance and an observer would be unlikely to perceive such a small sound variation. However, a deviation of 3dBA or more for comparable models is discernable and should be cause for further investigation.

In an effort to verify the reliability of published sound data, SPX Cooling Tech, LLC. compared independent tests of crossflow and counterflow cooling towers from other leading manufacturers. In several instances, the sound data generated by the independent, third-party agency was at least 5dBA higher than published values. This disparity proves the need for independent sound verification. For additional test information, please see "Proof in Performance – Certified Sound."

Checking Reliability of Sound Data

One method for checking the reliability of sound data is to consider the differences in sound pressure levels at 5ft vs 50ft when comparing data between any two manufacturers. If similar cooling towers from two different manufacturers have comparable sound pressure levels when a precision sound receiver is placed 5ft away from the source, then the sound pressure levels should also be comparable when the receiver is placed at a 50ft distance. Sound will attenuate exactly the same way over distance travelled from similar sources when the ambient conditions are also the same. For a 750 ton crossflow cooling tower, typical reductions from the air inlet and fan discharge from 5ft to 50ft should be less than 10dBA. However, on the cased-face side, the reduction is closer to 6dBA, as seen below in Figure 1. This is due to the cased-face side having much lower sound pressure levels than the air inlet or fan discharge sides. For a 350 ton counterflow cooling tower, the 5ft to 50ft reduction is closer to 12dBA, as shown in Figure 2.

Figure 1: SOUND PRESSURE LEVELS (SPL)

In Crossflow Induced-Draft Cooling Tower

Figure 2: SOUND PRESSURE LEVELS (SPL)

In Counterflow Induced-Draft Cooling Tower

Multicell Cooling Tower Considerations

When considering multicell installations, it is important to note that a two-cell tower does not necessarily result in a sound level that is double that of a single-cell tower of the same size. However, this contribution to the overall sound level of the equipment is still significant when adding additional cells and it must be considered. When sending specifications for sound level requirements to heat rejection equipment manufacturers, it is important to stipulate whether the requested sound data is for all cells operating or on a per-cell basis. When not clearly stated in the specification, per-cell data may be provided and incorrectly represent overall installation sound levels.

Fans and Their Effect on Sound

Fans are a significant contributor to the overall sound level of heat rejection equipment. Oversizing the equipment thermally, with the intention of allowing a variable frequency drive (VFD) to reduce fan speed during normal operation, is a common strategy for improving sound levels. A VFD impacts the equipment's noise level during periods of reduced load and/or reduced ambient temperature without compromising the system's ability to maintain a constant cold water temperature. This solution is relatively economical with a payback in reduced energy costs.

The theoretical reduction will be no greater than $50\log_{10}$ (new speed/old speed). For example, if fan speed is reduced to 50% of its original speed, sound reduction of up to 15dBA could result. However, it is important to note that the overall sound level of the equipment can only be reduced as low as the "fans off/water only" test data. In Figures 3 and 4 below, the sound pressure level for each cooling tower can only be reduced to a certain extent by slowing the fans down before the "fans off/water only" limit is reached and the actual sound pressure level begins to plateau. It is worth noting that fan noise makes a far greater contribution to the overall sound level in crossflow cooling towers than it does in counterflow cooling towers, so there is a greater opportunity for sound reduction when slowing the fan down in a crossflow cooling tower. When discussing options for slowing down a fan to reduce the overall sound level of a cooling tower, it is imperative to request the "fans off/water only" data from the manufacturer. It is physically impossible to achieve sound levels lower than this limit, unless options for splash and/or inlet attenuation are considered.

Figure 3 Sound Pressure Level Reduction for a Crossflow Induced-Draft Tower

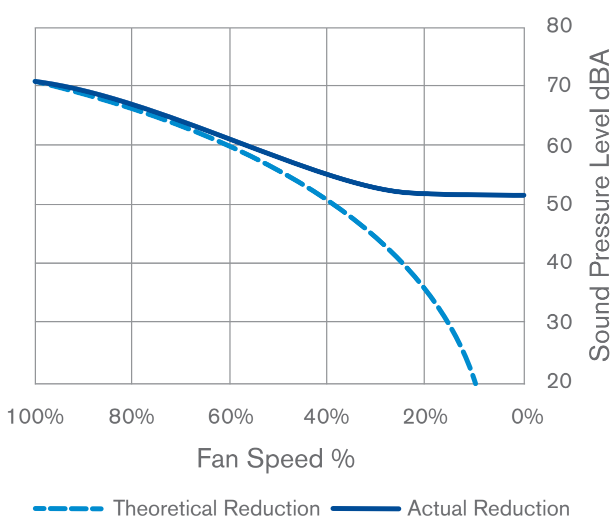
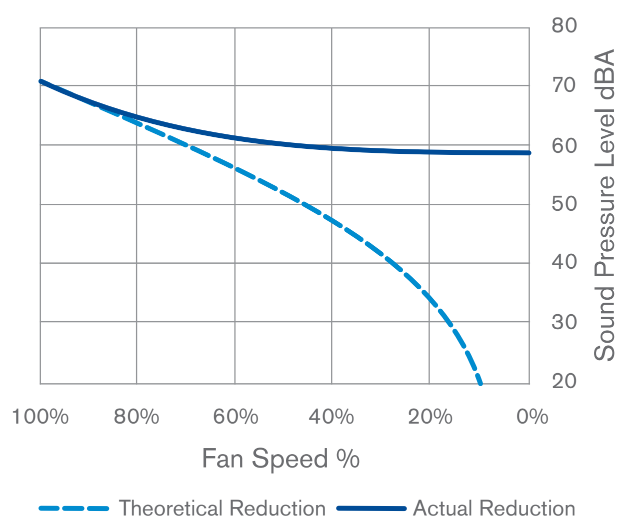
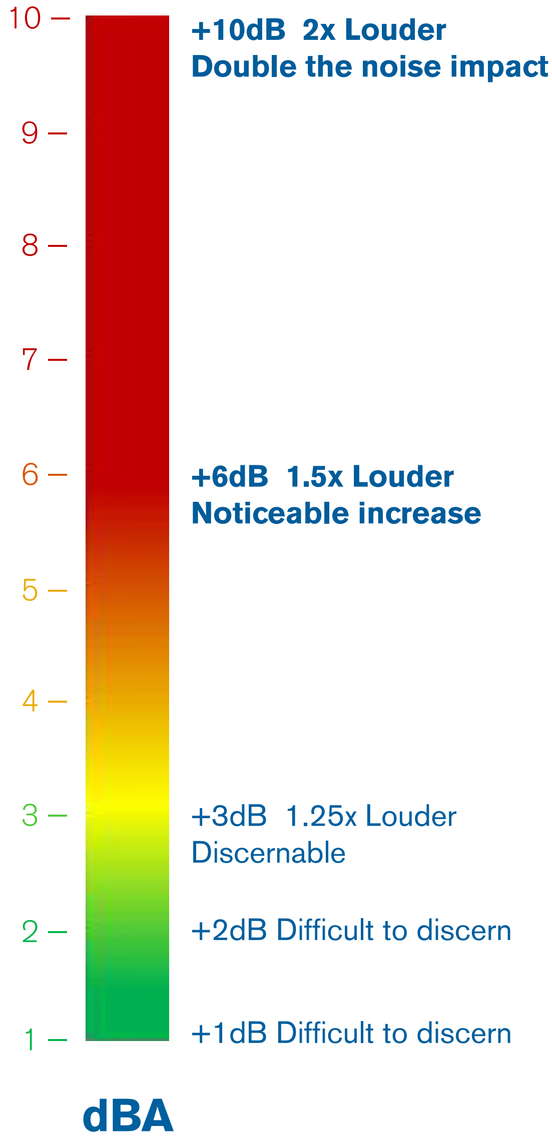


Figure 4 Sound Pressure Level Reduction for a Counterflow Induced-Draft Tower



Comparing Cooling Tower Sound Levels – Key Takeaways
Specify heat rejection products with CTI Sound Certification. Be cautious when evaluating uncertified sound data.
Heat rejection equipment with similar configurations operating under similar conditions should result in similar sound data.
If similar cooling towers have equivalent sound data at 5ft, the data should be comparable at 50ft.
For multi-cell installations, request sound data for all cells operating, rather than on a per-cell basis.
Oversizing equipment and allowing a VFD to slow the fan will only reduce sound levels as low as the “fans off/water only” data. Request this data from the cooling tower manufacturer.
Typical sound reduction methods and options are compared on page 5.



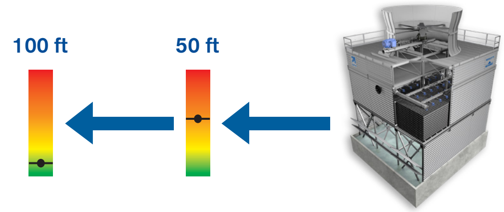
Applications Engineering - Sound Reduction Methods

Orientation

For crossflow and forced draft equipment, orient a cased-face side towards the receiver. In some instances, cased face(s) can be up to 12dBA quieter than the air inlet face(s).

Location

Move the cooling tower further away from the receiver. In the far field, there can be a reduction of approximately 6dBA for doubling the distance from source to receiver.

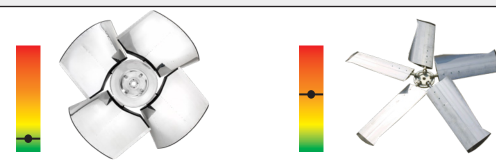


Oversize

Select heat rejection equipment with excess thermal capacity at design conditions. This strategy requires a VFD to reduce fan speed during normal operation. The equipment can achieve desired thermal conditions with reduced airflow and fan speed.

Fan Options

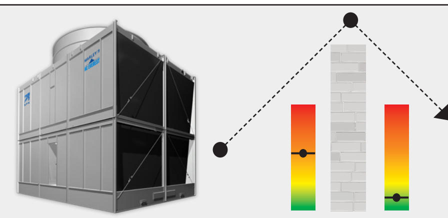
Opt for “quiet” or “ultra-quiet” fans, which have higher solidity and can often achieve comparable airflow at lower fan tip speed.



Ultra-Quiet Fan Standard Fan

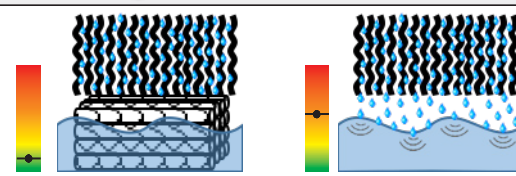
Barrier Walls

Solid or acoustic barrier walls can be installed between the equipment and receiver. Resulting sound reduction can be significant, but this will vary with wall location, size, and construction materials.



Splash Attenuation

For counterflow cooling towers, installing splash attenuation can reduce air inlet sound levels up to 5dBA with no thermal performance impact.



Splash Attenuation No Attenuation

Attenuation Baffles

Installing inlet and/or discharge attenuation can reduce sound levels 5dBA or more. Outlet attenuation will typically incur a performance derate, but inlet attenuation may have little to no impact on thermal performance.

Inlet Attenuation Discharge Attenuation

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