SOUND EXPERTS

BLUE by nature
GREEN at heart

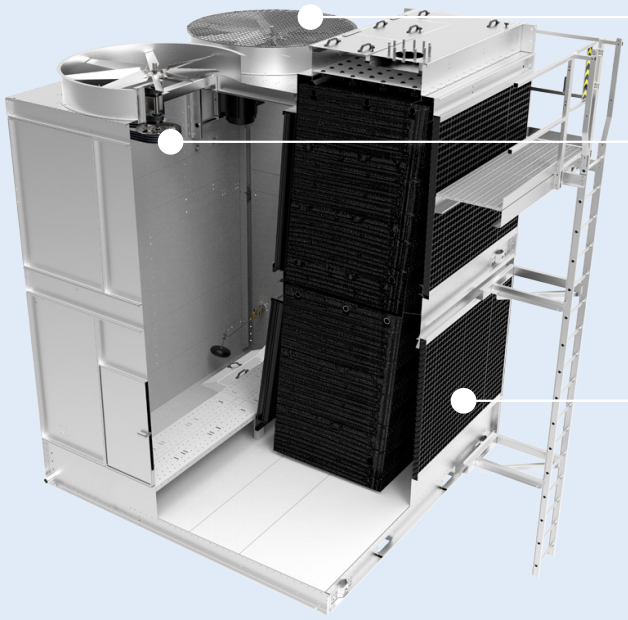
Your trusted expert and partner for sound-sensitive applications

BAC offers the most solutions to meet your stringent and challenging sound requirements, with experts in **product design, application engineering,** and **test support** to help you every step of the way. With industry-leading sound testing and modeling capabilities, BAC delivers reliable and trustworthy sound data compliant to the latest industry standards. The data are backed by our **Manufacturer's Sound Declaration** and **thousands of successful installations worldwide,** many of which have been evaluated by independent sound consultants.

SOUND SOLUTIONS FROM BAC

Different types of noise-reduction solutions can be combined to fit your needs. **Unit configurations** heavily influence **airborne, water** and **mechanical noise,** so component and design options allow for adjustment of the acoustic performance of the equipment while maintaining the thermal performance requirements.

Besides unit configuration, further sound reductions can be obtained by optimizing **operational control, sound attenuation** and **even elimination of certain noise sources.**



MINIMIZING AIRBORNE (FAN) NOISE

Fans are the major source of airborne noise, influenced by:

FAN TYPE
FAN ACOUSTICAL EFFICIENCY
AIR INLET/DISCHARGE LOCATIONS
FAN LOCATION
FAN SPEED

Fan type

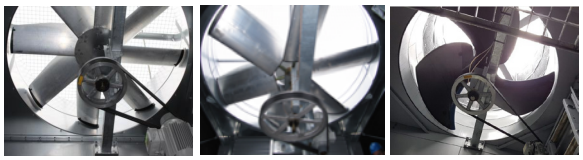
BAC offers three main types of fans: Axial, Radial and Centrifugal. They each offer specific advantages while minimizing sound emissions. BAC offers the most fan options of any manufacturer in the market.

	Fan Type	Primary Advantages	Additional Information
	Axial Fan	Highest energy efficiency	Lowest installation costs for medium to large sized applications
	Radial Fan	Low sound without attenuation combined with high energy efficiency	High static capability for indoor and ducted applications
	Centrifugal Fan	Lowest sound without attenuation	Highest static capability for indoor and ducted applications

Fan acoustical efficiency

Axial fans have different three designs based on the fan blade profile and pitch. Adjusting these factors will impact the acoustical performance.

Standard Fan | Low Sound Fan | Whisper Quiet Fan

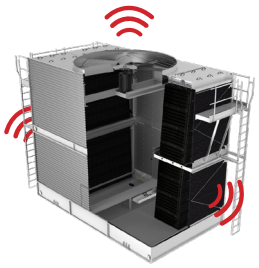


Air inlet/discharge & Fan location

Sound propagates mainly from the air inlet and discharge openings in the cooling tower, with the loudest section typically being the fan side. Cooling towers with **single or dual-sided air intakes have sides blocked by solid panels, minimizing noise** towards sound-sensitive areas. Towers with air intake on all four sides will propagate sound equally in all directions. **The fan location, being the source of the sound, can be at the top or the bottom of the unit, depending on where the site sensitivities are to sound.** BAC can design a solution to ensure that sound propagates to the least objectionable areas of your building.

Single inlet counterflow

Single inlet crossflow



Dual inlet crossflow

4-Sided inlet counterflow

Sound Propagation

BAC SOUND EXPERTS

Reducing fan speed while maintaining thermal performance

The sound pressure generated by the fan is directly proportional to the fan's rotational speed. Therefore, **one way to reduce the sound level is to reduce the fan speed.** However, reducing fan speed may also reduce thermal performance.

BAC's Extreme Efficiency (XE) models can reduce the fan speed thereby lowering sound, but without requiring a tradeoff between sound and thermal capacity. XE models reduce sound pressure levels by up to 4 dB, reduce fan power consumption by up to 25%, while maintaining the same unit thermal performance and footprint.

XE Models

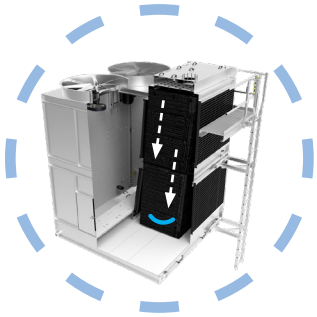
4 dB	25%	100%
SOUND REDUCTION	ENERGY REDUCTION	THERMAL PERFORMANCE

MINIMIZING FALLING WATER NOISE

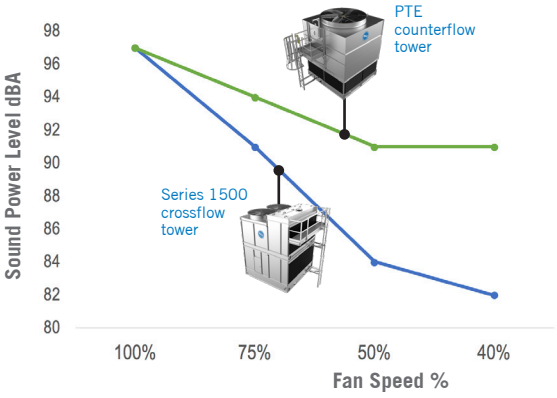
Falling water noise is caused when water cascades from the top of the tower to a collection basin at the bottom. There are three major types of flow configuration, generating varying levels of water noise.

Free falling water flow
Counterflow design

Intermediate water flow
DiamondClear® design



Guided water flow
Crossflow design



Crossflow units minimize the water noise by channeling the water through the fill to the basin. In Counterflow units, the water falls into the basin from a great height, often generating louder sound levels.

In this example, a Crossflow tower has lower sound power levels with reduced fan speed when compared to an equivalent Counterflow tower.

NOTE: This is based on 1500 kW (427 Tons) cooling capacity x 32°C/27°C (90°F/81°F) inlet/outlet water temperatures x Wet bulb temperatures: 21°C (70°F) at 100% speed, 18°C (64°F) at 75% speed, 8°C (46°F) at 50% speed, 0°C (32°F) at 40% speed

MINIMIZING MECHANICAL NOISE

There are three main types of fan-drive systems that transmit the rotational power of the motor to the fan. Of the three options, the gear-drive design has the highest potential for noise, is the most expensive to repair, and requires the most maintenance. BAC is the leader in the market for direct-drive systems, the lowest sound option of all fan-drive systems.

	Fan-Drive System Type	Primary Advantages	Additional Information
	Direct-Drive System (ENDURADRIVE® Fan System and EC Direct-Drive System)	Lowest sound option with no power transmission system, direct coupling of motor and fan eliminating sound source	Highest reliability and lowest maintenance costs
	Belt-Drive System	Lower sound option and more forgiving on noise from misalignment	Easy to maintain and repair, low down time and requires no special tools or skills to repair
	Gear-Drive System	Highest potential for noise, requires laser for alignment, most mechanical moving parts of all systems	Highest in maintenance and repair downs, longest down time when repair and maintenance is required

ACOUSTICAL OPTIONS/ACCESSORIES

Options to muffle or block sound propagation can be part of the cooling tower design, or it can be part of the overall building design.

Cooling tower design

Factory designed, tested and rated sound attenuation is available for both air intake and discharge. Additionally, water silencers are available for Counterflow cooling towers, as splashing noise in induced draft Counterflow cooling towers can be the dominant source of sound at short distances. In cases where additional sound reduction is required with allowance for reduced thermal capacity (e.g. night setback requirements), BAC products can all come equipped with variable speed frequency drives (VFD) or use variable speed motors to slow down the fan to achieve lower sound performance.

Building and site design

Barrier walls dampen the noise from evaporative cooling equipment and minimize sound transmission. Barrier walls can also conceal the equipment from view, to fulfill an architectural design element. Layout requirements should be taken into consideration during design to ensure that the unit has an adequate supply of fresh ambient air. BAC recommends working with an acoustical consultant in conjunction with your BAC representative to achieve the specified sound requirements while maintaining unit thermal performance.

Optimal sound results for your project

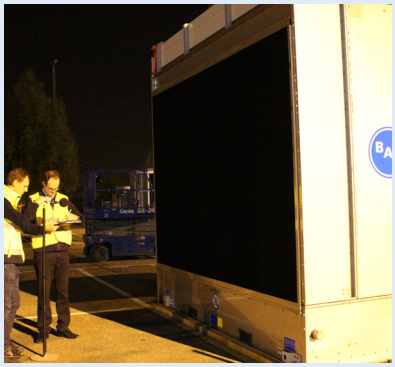
There are three sources of noise in cooling towers: Airborne, Falling Water and Mechanical. BAC offers component options and design flexibilty to reduce noise so that your site sound requirements are met without sacrificing the cooling performance you expect. Your BAC Representative can work with you to create an optimal sound product.

Read more on BAC's website

Consult your local BAC Representative

EXPERTISE YOU CAN TRUST AND RELY ON

For 60 years, BAC has led research and development efforts to minimize noisefor cooling towers. With our tate-of-the-art test capabilities in the Americas, Asia and Europe, we are able to combine **thermal and acoustic testing**, provide **reliable data** for a wide range of operating conditions using any test standards, and perform customized tests that mimic actual site conditions. This results in performance data that you can trust, backed by our Manufacturer's Sound Declaration to major test standards. We have the **industry's most experienced professionals** for sound design and our selection software is simple to use. To determine your most fitting sound solution, please visit our website or consult your local BAC Representative today.



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