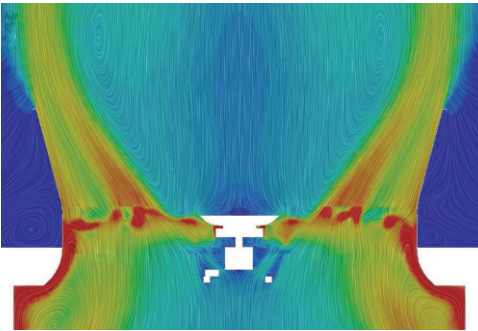




## Engineering Excellence in Velocity Recovery Technology



### Setting the Industry Standard in Cooling Tower Fan Stack Performance



#### Why Leading Engineers Choose CTR Fan Stacks

Fan stack efficiency matters. CTR's innovative design transcends ordinary cooling tower performance. Through computational fluid dynamics (CFD), we optimize fan stack profiles to achieve unprecedented cooling tower efficiency improvements.

#### The Science Behind Our Success

The governing equation for the airflow through a cooling tower is the Bernoulli principle. The loss coefficient,  $K$ , at the exit of the fan stack is 1. Thus, the pressure drop at the stack exit is directly proportional to the square of the velocity.

Most cooling tower manufacturers won't push beyond 7° taper angles. CTR did. Through extensive testing and research, we've discovered that higher taper angles - specifically between 8° and 11° deliver superior performance.

$$\Delta P = 1/2 K V^2$$



#### Critical Design Constraints

In typical cooling tower installations, there are geometric limitations on the fan stacks that require the outlet diameter to be equal to or less than the inlet of the fan stack. For this reason, the optimal taper angle was determined to be between 8-11°, depending on stack height and tower geometry. This still allows CTR stacks to increase efficiency over a 7° taper angle while staying within the limits of the cooling tower.

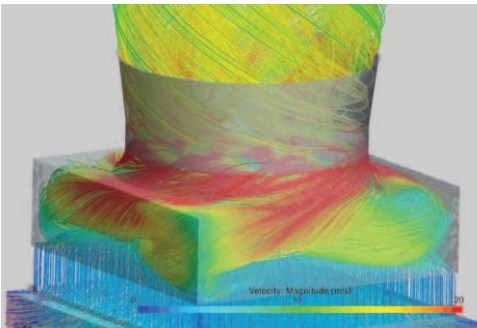


## Performance Benefits

Here's why our approach works:

- Our extensive CFD modeling demonstrates minimal air separation at taper angles up to 15°, with optimal performance at 11°
- Pressure loss is proportional to the square of the velocity
- By reducing velocity through increased fan stack exit area, we significantly decrease pressure loss
- **Here's a real-world example:**

On a typical 24' fan stack, upgrading from a 7° to 11° taper angle increases the cross-sectional area of the stack exit by 5%. This reduces pressure drop at this location by 10%, resulting in measurable increases in airflow and tower performance.



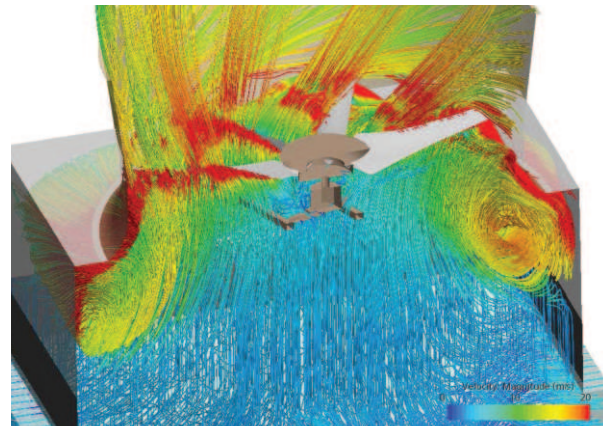
## Beyond Traditional Designs

Through advanced CFD analysis, we've identified the critical flow separation point above 15° and an optimal operating range between 8-11°. This results in improvements in pressure recovery characteristics, system efficiency, as well as increased airflow, and/or reduced power consumption.

## Engineering Support That Sets Us Apart

When you choose CTR, you get more than superior technology - you also get a partner committed to your success. Our engineering team provides:

- Detailed technical analysis
- Custom performance modelling
- Installation optimization
- Ongoing technical support
- Eliminates freeze damage risk



## Take the Next Step in Cooling Tower Efficiency

Don't let outdated technology limit your cooling tower's performance. Contact CTR today to learn how our advanced velocity recovery technology can transform your fan stack system's efficiency.

Call us, email us, or visit our website today!

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