

Fan Cylinders



The Importance of Fan Cylinders

The fan cylinder does far more than protect operating personnel from a rotating fan. It is a vital link in the chain of critical components that contribute to the overall efficiency of the cooling tower. When correctly designed, manufactured and applied, it assures that the fan will be capable of moving the maximum amount of air through the tower at the minimum required horsepower. Poorly designed or utilized, it contributes virtually nothing to the fan's capability and, in some cases, can be more of a hindrance than a help.

Critical Fan Cylinder Characteristics

Several physical characteristics of the fan cylinder will affect the delivery of air to—and through—the fan. They include:

- The fan deck floor opening which is, of course, the entry point for air flow into the cylinder. On industrial wood towers, this opening is usually cut in the field and there is a natural tendency on the part of the erector to cut the opening too small. The result is a protrusion of the fan deck into the fan cylinder opening disrupting the smooth flow of air at a critical point of entry. Specify a 1" maximum protrusion of the fan deck into the fan opening.
- An eased air inlet occurs when the diameter of the fan cylinder below the fan gradually decreases (an elliptical curve) as it approaches the elevation of the fan. To be effective, the vertical distance over which this transition occurs should be no less than 15% of the fan diameter. This assures full area, low turbulent airflow through the cylinder, maximizing air loading near the tips of the fan blades where most of the work of the fan is done. Without this eased inlet, eddies will form at the point of air entry and will continue up the walls of the cylinder forcing the maximum airflow to occur inboard of the fan tips which will significantly reduce fan efficiency. Specify an eased inlet fan cylinder with the operating fan tip track center line at least 15% of the fan diameter above the cylinder entrance. (for a 28' fan, a tip track of 4.2' above the fan deck would be correct).
- Fan tip clearance also affects air flow and fan efficiency. Fan tips should operate as close to the fan cylinder wall as prudent design will allow. Moreover, the tip clearance must be consistent around the fan's circumference. Uneven tip clearance not only disrupts the airflow, but can also induce fan vibration. In establishing fan tip clearance, the knowledgeable designer must also take into account the fan cylinder distortions that may occur under wind load or other external forces. Specify a fan and cylinder design for a fan tip clearance of 0.5% of the fan diameter. Specify a fan cylinder design that allows adjustment to $\pm 30\%$ of the average tip clearance.



Critical Fan Cylinder Characteristics

- Velocity recovery, particularly in large fan cylinders, is vital to overall fan efficiency. It is accomplished by a gradual increase in the diameter of the fan cylinder above the fan. This reduces the throughput velocity of the air — relieving the fan of the unproductive work required to maintain an unnecessarily high level of kinetic energy in the exiting air stream. Specify a maximum flare angle of 12° for recovery cylinders. Specify a maximum assumed velocity recovery of 75% of the difference in average velocity pressure, unless scale model data for the exact fan and cylinder system can be submitted.
- Structurally strong, and dimensionally stable fan cylinders that are capable of resisting wind loads, must be securely attached to the tower structure. The design of the fan cylinder and its anchorage must be rigid enough to withstand high wind loads without deflecting and contacting the blade tips of a rotating fan. Specify fan cylinder and floor anchorage design that limit deflections to less than the fan tip clearance at 30 psf minimum wind loads.
- Maintenance access within the fan cylinder and drive shaft guard. Specify a removable access hatch of sufficient size to allow removal of all mechanical equipment components, and an OSHA approved coupling guard to shroud that portion of the drive shaft that extends outside the fan cylinder.



The Marley Difference

Marley cooling tower fan cylinders have been designed and manufactured since the 1930s. This experience, plus considerable modeling and full scale testing, has led to the development of several new fan cylinder designs for a variety of tower types and fan sizes. One such development resulted in the Reflex™ velocity recovery cylinder utilized for

10' diameter and larger fans. The exact shape (eased inlet, tip clearance, velocity recovery, etc.) of Marley fan cylinders are used to establish performance ratings of all Marley fans. This contributes to the certainty that the performance you pay for is the performance you'll get in a Marley product — guaranteed.

How to Specify

Include in your specification language comparable to the following:

"Fan deck protrusion into the fan opening shall be a maximum of 1". The fan cylinder shall have an eased inlet with the operating fan tip track center line at least 15% of the fan diameter above the cylinder entrance. Fan tip clearance shall be 0.5% of the fan diameter and fan cylinder shall allow adjustment to ± 30% of the average tip clearance. Velocity recovery fan cylinders shall have a maximum flare angle of 12° with a maximum assumed velocity recovery of 75% of the difference in average velocity

pressure. Fan cylinder floor anchorage design shall limit deflections to less than the fan tip clearance at 30 psf minimum wind loads. Fan cylinder shall have an access hatch of sufficient size to allow removal of all mechanical equipment components, and an OSHA approved coupling guard to shroud that portion of the drive shaft that extends outside the fan cylinder."

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