Crossflow Performance

Systems Approach

All components used in Marley crossflow cooling towers have been rigorously tested at SPX's industry leading Research and Development Center as a system, in the configurations in which they are actually used. There are no mix and match combinations of components which haven't been tested as a system.

Fan Efficiency

Multi-segment fiberglass fan cylinders on cooling towers are difficult to correctly position concentric with the fan, and do not stay completely round during high wind loads or when the sun heats up one side on very hot days. As a result, fan cylinders are normally designed to leave acceptably safe clearance between blade tips and cylinder sides to avoid contact and damage.

Typical fan performance data used by some manufacturers reflect fan performance data in ideal operating conditions — almost no blade tip clearance, tall idealized eased inlets, and very large plenums. This type of data indicates far better fan efficiency than is possible at realistic blade tip clearances, actual cooling tower eased inlets, and plenums that occur in real world cooling towers. Peak fan efficiency varies with the fan used and the tower operating point. Based on our experience in scale modeling of complete cooling tower fan systems along with field testing, peak fan efficiency does not exceed about 82% for any of the fans currently used on cooling towers.

Ask for the impact on guaranteed cold water temperature with a more realistic fan efficiency, and evaluate the difference on the bids. Specify a maximum acceptable fan efficiency of 82%.

Crossflow Drift Eliminators

Eliminators must be tested for drift reduction and air side pressure drop in the arrangement used in actual tower design. Crossflow oriented eliminators have different pressure drop and drift rates than counterflow eliminators. Eliminator performance is tested in real crossflow systems, including such factors as distance from fill to eliminators and drain board and seal details.

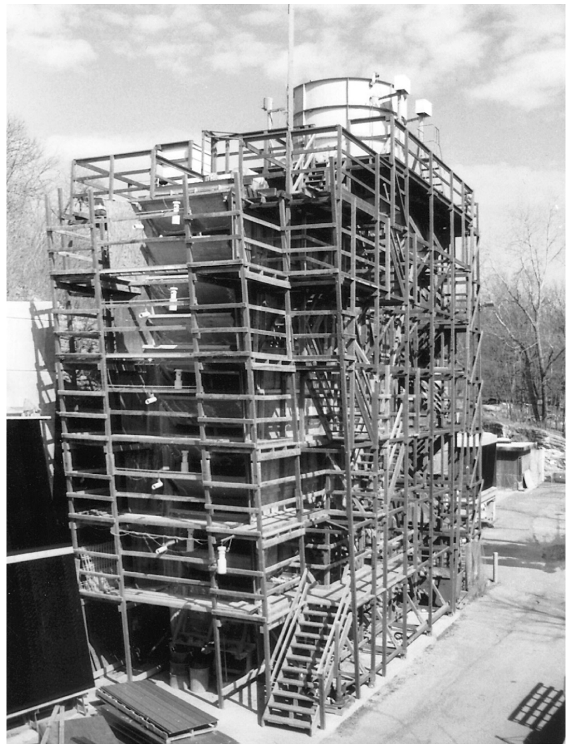
The Marley XCEL® TU crossflow cellular drift eliminator discharges air at an angle of 42° to 55° with respect to the horizontal — the exact angle depends on the specific slope of the tower frame. This directional change incorporated into the XCEL three-pass eliminator acts as a turning vane to induce discharge air flow through a gentle turn from the horizontal toward the vertical. Other drift eliminator manufacturers overlook this fact and do not include turning vanes on their cellular eliminators which factors into either increased fan horsepower by as much as 25%, or reduced thermal performance. XCEL does not create this kind of penalty.

Specify that drift eliminators used in large crossflow towers provide a discharge angle (as defined by the angle of the last section of the eliminator itself) of at least 42° from the horizontal when installed. Otherwise, unnecessary and costly turning losses will occur in the plenum.

Low drift rate is the primary goal of eliminator design, and we typically guarantee drift rates as low as .002 % of the total gpm measured accurately. We guarantee drift rates as low as .0005%! Marley pioneered development of the CTI endorsed Hot Bead Isokinetic Drift Measurement (HBIK) method. Specify pressure drop data and CTI endorsed HBIK drift data for the eliminator when installed in crossflow towers.

Closed Loop Design

In the 90 plus years Marley cooling towers have been built, over 100 other cooling tower companies have come and gone. During that time, we have carefully monitored cooling tower testing and customer feedback. Our approach to cooling tower performance is to develop data and prediction methods on an increasingly larger scale as we move a design toward production. Towers that can be tested full scale are tested full scale, finished form. Towers that are too large to fit in our laboratory have components tested as parts of full-scale towers. Prediction methods for whole tower applications are developed by building scale models to create mathematical models, and then validating the math models by full-scale, real tower prototype testing. Our tower acceptance testing history — the best in the industry — provides the feedback to close the loop in fine tuning our designs and testing methods.



Five-story industrial size crossflow test cell

Crossflow Fill

Since 1940 — when the crossflow doubleflow cooling tower design was patented by Marley — a wealth of knowledge has been gained on crossflow fill design and thermal performance. The thermal performance characteristics of a crossflow fill change with fill height, and each fill has a different sensitivity to increased fill height.

At the SPX R&D Center, every crossflow fill is tested at various heights up to full industrial tower size to determine the proper application at a desired fill height. Specify that the vendor be able to provide fill data from a test cell greater than or equal to the height proposed or can reasonably extrapolate from multiple fill height tests.

Third-Party Testing

Experience has shown that cookbook combinations of laboratory component data do not yield expected results in full scale performance. This is due in part to many of the preceding factors listed. In order to develop valid cooling tower performance prediction, experience in field testing a variety of tower configurations is essential. Specify a minimum of 5 successful independent third party tests conducted by CTI certified testing agencies as a requirement to bid. Require full independent test history of the product line with the technical data. Use the relative number of successful tests to support bidders with larger towers (when comparing relative thermal performance capability) in the evaluation of bids.

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