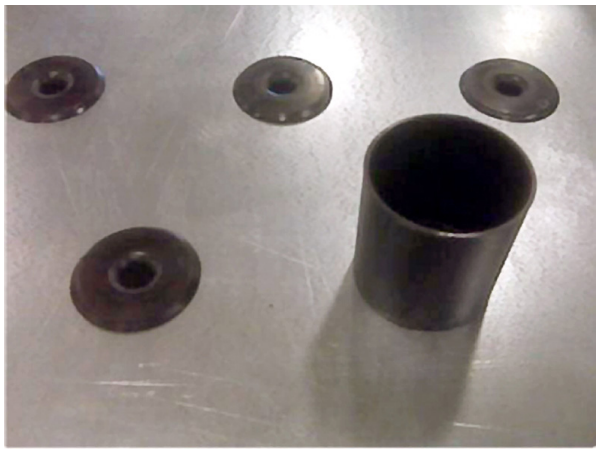
MARLEY®

Variflow nozzle cup



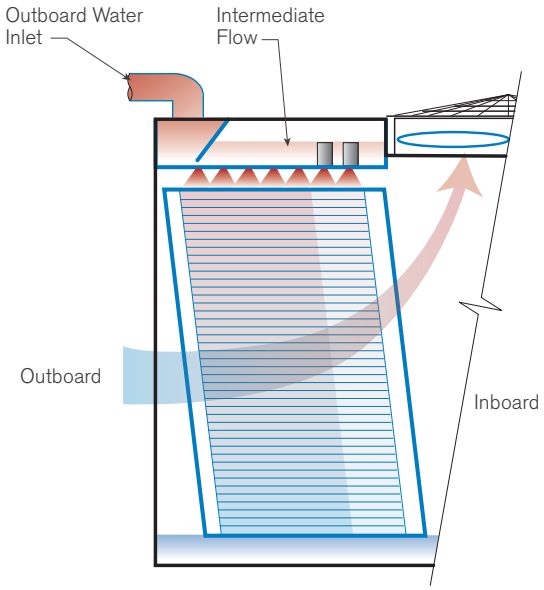
Simple modifications to Marley crossflow cooling towers permit variance in the flow rate over a wide range by varying the number of nozzles that are active as a function of the flow rate.

Installing Variflow™ nozzle cups can effectively divide the hot water distribution basin into outboard and an inboard sections. This allows the cooling tower to manage variations in flow automatically, ensuring that adequate head over the active nozzles is maintained. Most importantly, uniform air-side pressure drop is maintained across the fill.

Variflow nozzle cups enables the ability to:

- Maintain uniform air-water contact for maximum efficiency
- Provide consistent off-design performance
- Minimize drift
- Minimize risk of icing in freezing weather

The following graphic illustrates intermediate flow condition of an NC® crossflow cooling tower with Variflow nozzle cups. With less water over the cooling tower, the lower flow rate results in less head over the nozzles – the water depth decreases. As the depth decreases, the nozzle cups begin to restrict flow to the nozzles on the inboard side of the basin. Since cups are installed along the full length of the basin, the water flow rate is uniformly reduced along the inboard portion of the fill.



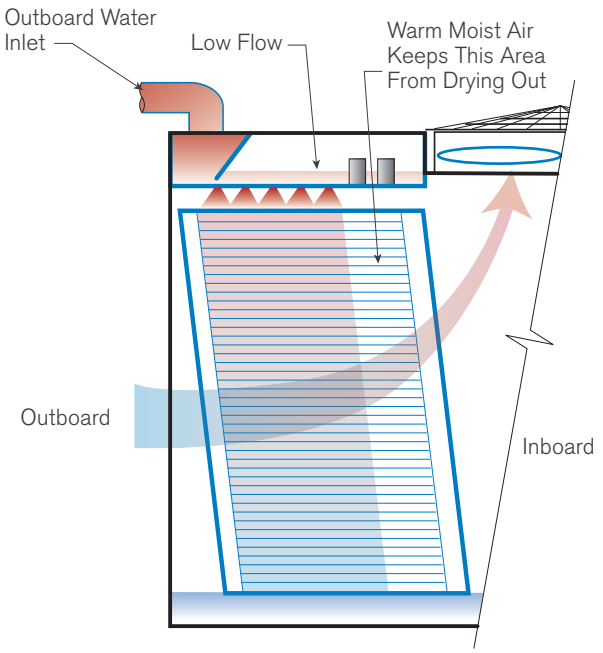
Intermediate Flow

Variflow nozzle cup

Note that uniform water depth across the entire outboard portion of the hot water basin is within the design operating range of the nozzles providing predictable water flow uniformly distributed across the full length of the air inlet opening. The air side pressure drop through this portion of the fill is uniform.

In addition, lower water flow through the cupped nozzles means less water flowing into the inboard portion of the fill. Even if this reduced flow rate results in less-than-minimum head over the nozzle resulting in unpredictable flow through individual nozzles in this area, this area of unpredictable flow is still uniformly distributed along the entire length of the fill section.

Reducing the flow to the minimum flow rate as in the following graphic results in the head in the basin dropping further and the cups becoming fully active. This completely cuts off water flow to the nozzles on the inboard side of the basin. The nozzles at the rear of the basin are now dry.



Low Flow

The inboard portion of the fill, however, is not dry. Since airflow in a crossflow cooling tower is horizontal across the flow of the falling water in the fill, there is still a tendency of the airflow to pull the water back into that section of the fill. Further, the air picked up moisture as a result of passing through the outboard section of fill and is now saturated.

Saturated air results in the fill, drift eliminators and plenum structure remaining wet. There is no scale formation in either the drift eliminators or the cooling tower plenum on a cooling tower in normal operation. The fill is not flooded but is wet so there is no alternate wetting and drying taking place at the rear of the fill or in the eliminators or plenum.

Water depth in the outboard portion of the basin is at the proper head, so flow through the nozzles remains predictable at all times. Although there is still some water on the inboard portion of the fill as a result of the horizontal airflow through the front of the fill, some loss of effectiveness in the rear portion of the fill during very low-flow conditions only occurs at extremely low total heat loads relative to the cooling tower capacity, minimizing the effect.

Most importantly, uniform air side pressure drop across the fill occurs so the fan maximizes its intended function of cooling the water. No air bypasses the fill, it is all put to effective use.

When the process the cooling towers is serving is operating at reduced load, Variflow nozzle cups help provide consistent off-design performance and increased energy saving when operating cooling towers with lower fan speeds.

Variflow nozzles can be easily added to existing NC, Quadraflow®, AV and Aquatower® cooling towers and specified as an option on new installations. To learn more about how variable flow can save energy cost see *Marley Technical Report TR-14* "Variable Flow Over Cooling Towers for Energy Savings" available at spxcooling.com.

SPX COOLING TECHNOLOGIES, INC.
7401 WEST 129 STREET
OVERLAND PARK, KS 66213 USA
913 664 7400 | spxcooling@spx.com
spxcooling.com

SP-VF | ISSUED 12/2016