

Supplement — 2.1E Update

the fluid at this minimum speed, then the fan will cycle between off and minimum speed. It is possible that the tower fan may reach a "critical speed" as the airflow is reduced. This is because the static pressure capability of the fan will drop as the square of the speed. The static pressure drop of the tower, however, may not fall off as the square of the airflow, as air flowing through falling water does not obey the ideal fan laws. As a result, the fan may enter a "surge region" if the speed is sufficiently low. For specific applications, the tower manufacturer should be consulted.

TWR-PUMP-HEAD	is the pressure head in the tower water circulation loop. This head is used together with the fluid flowrate, impeller efficiency and motor efficiency to determine the power consumption of the condenser pump.
TWR-IMPELLER-EFF	specifies the impeller efficiency of the tower circulation pump.
TWR-MOTOR-EFF	specifies the efficiency of the tower pump motor.
DIRECT-COOL-MODE	accepts a code-word that defines the direct cooling control scheme, if any. In either direct cooling mode, the tower will attempt to control to the DC-TWR-WTR-SETPT. The default for this keyword varies according to mode.
NOT-AVAILABLE	the default
STRAINER-CYCLE	allows cooling tower water to be passed directly (or through a heat exchanger) into the chilled water loop.
THERMO-CYCLE	simulates the use of compression chillers as heat exchangers without electric input into the compressor.
DC-MAX-OAT	specifies the maximum outdoor drybulb temperature for which direct cooling is allowed. Above this temperature, direct cooling is terminated, regardless of whether it could be effective.
DC-MAX-CHILL-WTR-T	specifies the maximum chilled water temperature for which direct cooling is allowed, either strainer cycle or thermo cycle. For strainer cycle systems, this temperature is the maximum allowable temperature leaving the tower. Above this temperature, direct cooling will be terminated. If a heat exchanger is used (not directly modeled by the program), this temperature is the temperature leaving the tower and entering the heat exchanger. As such, its value should be lower than when no heat exchanger is used. For thermo-cycle systems, this temperature is the temperature leaving the chiller. Thermo-cycle cooling will be terminated when the chiller(s) cannot satisfy the load while maintaining this temperature. (The CHILL-WTR-T and CHILL-WTR-THROTTLE are ignored

during direct cooling.)

DC—TWR—WTR—SETPT

is the leaving tower water temperature which the controller will attempt to maintain when using direct cooling. For a STRAINER—CYCLE, the default is 45°F. The tower will attempt to maintain this temperature. If the temperature floats above the DC—MAX—CHILL—WTR—T, then direct cooling will be terminated. For a THERMO—CYCLE, the default is 40°F. The tower will control to this temperature, and the chiller will control to the DC—MAX—CHILL—WTR—T.

DIRECT—COOL—SCH

accepts a u-name of a schedule. When the hourly value specified in the schedule is 1.0, direct cooling is allowed. When the value is 0.0, direct cooling is not allowed.

DIRECT—COOL—KW

specifies the electrical input to direct cooling auxiliary equipment. The default varies according to the direct cooling mode. If DIRECT—COOL—MODE = THERMO—CYCLE, you should specify DIRECT—COOL—KW as kW/ton of operating capacity for the period during which the compression chillers are operating in this mode. The chiller electrical input is assumed to be DIRECT—COOL—KW multiplied by the operating capacity and the fraction of the hour the chiller ran. If DIRECT—COOL—MODE = STRAINER—CYCLE, you should specify DIRECT—COOL—KW as the electrical input to the condenser water pumps (and other added equipment), calculated as kW/ton of SYSTEMS peak cooling load. Usually, this value is zero as the chilled water pumps are assumed to provide all motive energy. If a heat exchanger is used to isolate the tower from the chilled water loop, then this value should be non-zero to model the condenser pumping energy. In this case, the condenser water pumping energy is calculated using the value of DIRECT—COOL—KW as the kW per ton of the design SYSTEMS load. (Fluid flow to the tower is assumed to be the design chilled water flowrate). For both modes of direct cooling, THERMO—CYCLE and STRAINER—CYCLE, the chilled water pumps are assumed to run as usual.

The following two keywords are repeated here as the meaning of CHILL—WTR—THROTTLE is expanded:

CHILL—WTR—T

specifies the chilled water temperature at the middle of the throttling range for chillers. The default is 44°F.

CHILL—WTR—THROTTLE

is the throttling range of the temperature controller on the chiller. The default is 2.5°F. A positive value for this keyword causes the chilled water temperature setpoint to drop as the load drops. This release of the program can now accept a negative value for this keyword. When negative, the chilled water setpoint *rises* as the load *drops*. This approximates some of the