

C. E. Shepherd Company, L. P.

## GLOSSARY

### Cooling Tower Terms

## Glossary

### — A —

**Air Flow**—total amount of dry air and associated water vapor flowing through the tower, measured in cubic feet per minute at the exhaust from the tower and converted to standard air, which has a density of 0.075 lb. per cu ft.

**Air Horsepower**—the measure of useful power required to move a given air rate against a given resistance. The ratio of air horsepower to fan input horsepower is the measure of fan efficiency.

**Air Inlet**—opening in cooling tower through which air enters a tower. On Induced Draft Towers, the air inlet is commonly called the louvered face.

**Ambient**—the atmosphere that is adjacent to but not affected by the cooling tower. Generally, this means upwind of the tower and the other areas where other heat producing equipment is located which supplies extraneous sources of heat to the air coming to the tower.

**Ambient Dew Point**—the ambient temperature in °F when dew begins to be deposited.

**Ambient Wet-Bulb Temperature**—the wet-bulb temperature which is measured in accordance with the definition of ambient. Readings are obtained by means of a mechanically aspirated psychrometer.

**Approach**—the difference between the cold water temperature in °F and the ambient or inlet wet-bulb temperature in °F.

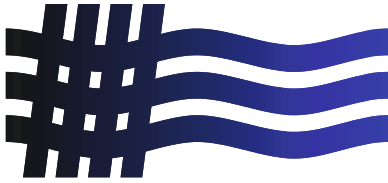
### — B —

**Basin**—see *Cold Water Basin* and *Distribution Basin*.

**Basin Sump**—see *Sump*.

**BHP**—(abbr.)—see *Brake Horsepower*.

**Blowdown**—water discharged from the system to control concentration of salts or other impurities in the circulating water.



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**Blower**—a squirrel-cage type of air moving device usually applied for operation at higher than normal static pressures or for the sound control reasons.

**Brake Horsepower (BHP)**—the actual power output of an engine or a motor.

**British Thermal Unit (Btu)**—the quantity of heat required to raise the temperature of one lb. of water 1°F.

— C —

**Capacity**—see *Thermal Capacity*.

**Cell**—the smallest tower subdivision which can function as an independent unit with regard to air and water flow; it is bounded on exterior walls or partitions. Each cell may have one or more fans or stacks and one or more distribution systems.

**Cell Dimensions**—(a) Width: dimension perpendicular to tower longitudinal axis and usually at right angles to the louver area; (b) Length: dimension parallel to longitudinal axis and the plane where louvers are usually placed; (c) Height: distance from basin curb to top of fan deck but not including fan stack. Nominal width and length are measured from and to the column centerlines.

**Circulating Water Rate**—quantity of hot water entering the tower.

**Cold Water Basin**—a device underlying the tower to receive the cold water from the tower and direct its flow to the suction line or sump.

**Cold Water Temperature (CWT)**—temperature of the water entering the cold water basin before addition of make-up or removal of blowdown.

**Cooling Range**—see *Range*.

**Counterflow Tower**—one in which air, drawn in through the louvers (induced draft) or forced in (forced draft) at the base by the fan, flows upward through the fill material and interfaces counter currently with the falling hot water.

**Crossflow Tower**—one in which air, drawn on forced in through the air intakes by the fan, flows horizontally across the fill section and interfaces perpendicularly with the falling hot water.

**CWT**—(abbr.) see *Cold Water Temperature*.



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**Cylinder**—see *Fan Stack*.

#### — D —

**DBT**—(abbr.)—see *Dry-Bulb Temperature*.

**Design Conditions**—defined as the hot water temperature (HWT), cold water temperature (CWT), gallons per minute and wet-bulb temperature (WBT) in Mechanical Draft Towers. In Natural Draft Towers; HWT, CWT, gpm, WBT plus either dry bulb temperature (DBT) or relative humidity (RH).

**Discharge Stack**—a walled enclosure extending upward above the eliminators to direct exhaust air vertically away from fans in a forced draft tower. See *Fan Stack* for operation of Induced Draft Towers.

**Distribution Basin**—a shallow pan-shape basin used to distribute hot water over the tower fill.

**Distribution Nozzle**—see *Nozzle* and next entry.

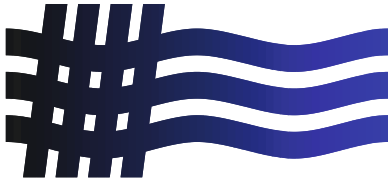
**Distribution System**—those parts of a tower, beginning with the inlet connection, which distribute the hot circulating water within the tower to the points where it contact the air. In a Counterflow Tower, this includes the header, laterals, and distribution nozzles. In a Crossflow Tower, the system includes the header or manifold, valves, distribution box, basin pan, and nozzles.

**Double-Flow Water Cooling Tower**—a Crossflow Tower with two fill sections and one plenum chamber which is common to both.

**Downspout**—a short vertically placed pipe or nozzle used in a gravity distribution system to divert water from a flume or lateral to a splasher.

**Drift**—water lost from the tower as liquid droplets entrained in the exhaust air. It is independent of water lost by evaporation. Units may be in lbs./hr or percentage of circulating water flow. Drift eliminators control this loss from the tower.

**Drift Eliminators**—an assembly constructed of wood, plastic, cement asbestos board, steel, or other material which serves to remove entrained moisture from the discharged air.



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**Driver**—primary drive for the fan drive assembly. It may be an electric motor, gas engine, steam turbine, hydraulic motor, or other power source.

**Drive Shaft**—a device including couplings for transmitting torque from the driver to the speed reducer.

**Dry-Bulb Temperature**—the temperature of the inlet or ambient air adjacent to the cooling tower as measured by a dry-bulb thermometer.

#### — E —

**Effective Volume**—see *Net Effective Volume*.

**Eliminator**—see *Drift Eliminator*.

**Eliminator Baffle**—see *Eliminator Board*.

**Eliminator Blade**—see *Eliminator Board*.

**Eliminator Board**—the smallest component in a wood drift eliminator assembly that is usually installed in a fixed position at an angle to the direction of airflow. Also known as Eliminator Baffle (Blade).

**End Wall**—the wall on the end of the tower structure.

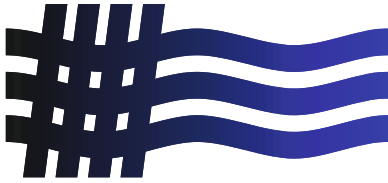
**Entering Air**—air from the atmosphere surrounding the cooling tower that enters through the louvers on an Induced Draft Tower or is discharged into the tower by a fan on a Forced Draft Tower.

**Entering Wet-Bulb Temperature**—average wet-bulb temperature of the entering air. Includes any effects of recirculation.

**Evaporation Loss**—water evaporated from the circulating water into the atmosphere by the cooling process.

**Exhaust Air**—the mixture of air and its associated vapor leaving the tower. See *Air Flow*.

**Exhaust Wet-Bulb Temperature**—average wet-bulb temperature of the air discharged from the tower.



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**Exit Basin Temperature**—temperature of the circulating water leaving the cold water basin. If blowdown is removed from or make-up added to the basin, the temperature will be affected accordingly.

#### — F —

**Fan**—a device for moving air in a Mechanical Draft Tower. The fan design may be either an axial flow propeller or centrifugal blower. The fan can be applied as induced draft or forced draft.

**Fan Deck**—the surface enclosing the top of an Induced Draft Tower. In a Counterflow Tower, the fan deck covers the entire top surface of the tower. In a Crossflow Tower, the open fan deck covers only the tower plenum area, leaving the distribution system exposed. An extended fan deck encloses the distribution system and covers the entire top surface of the tower.

**Fan Drive Assembly**—mechanical components furnishing power to the fan, usually consisting of driver, drive shaft, speed reducer, and supporting members.

**Fan Driver Input**—horsepower input to the driver. For 3-phase alternating current (ac) motors:

$$\text{hp} = \frac{\text{amps} \times \text{volts} \times 3 \times \text{Power Factor} \times \text{Efficiency}}{746}$$

**Fan Driver Output**—brake horsepower output of the driver to the drive shaft. Fan driver input x motor efficiency.

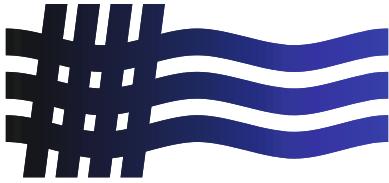
**Fan Guard**—a protective screen installed either at the inlet of a forced draft fan or at the exit of an induced draft fan.

**Fan Pitch**—the angle which a fan blade makes with the plane of rotation; degrees from horizontal.

**Fan Ring**—see **Fan Stack**.

**Fan Stack**—cylindrical or modified cylindrical structure in which the fan operates. Fan stacks are used on both induced draft and forced draft axial flow propeller fans. Also know as Cylinder.

**Fan Stack Height**—distance from top of fan deck to top of fan stack.



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**Fan Support**—see ***Mechanical Equipment Support***.

**Fill Bars**—the assembly of splash bars comprising the tower filling. Fill bars intercept the downward fall of water at regular intervals, forming splash surfaces which cause water drops to break into smaller droplets, and provide wetted surfaces for air-water contact.

**Fill-Deck**—the assembly of splash bars comprising the tower filling. See ***Fill Bars*** for description of operation in a Crossflow Tower.

**Fill Hanger**—support system in a Crossflow Tower for fill bars that hold fill in place.

**Fill Support**—see ***Deck Support***.

**Filling**—that part of a Crossflow, Counterflow, or Natural Draft Tower consisting of splash bars, vertical sheets of various configurations, or honeycomb assemblies, tile, or other materials, which are placed within the tower to affect heat and mass transfer between the circulating water and the air flowing through the tower.

**Flexible Shaft**—see ***Drive Shaft***.

**Float Valve**—a valve which is actuated by a float, generally used to control make-up water supply.

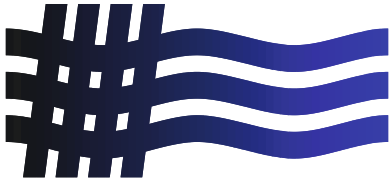
**Flow Control Valve**—a manually controlled valve generally located in the hot water supply line.

**Flume**—a trough which may be totally enclosed or open at the top. Flumes are sometimes used in cooling tower to distribute the hot water over the fill.

**Fogging**—a fog condition created when the exhaust air or plume from a cooling tower, which is essentially a saturated air-water vapor mixture warmer than the ambient air, become supersaturated so that part of the water vapor condenses into visible liquid droplets.

**Forced Draft Water Cooling Tower**—type of Mechanical Draft Tower in which one or more fans are located at the air inlet to force air into the tower.

**Foundation**—support material beneath the tower.



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#### — G —

**Gear Reducer**—a reduction gear, commonly used on fan drivers to reduce driver speed to fan speed requirements. Also known as Speed Reducer.

**GPM**—(abbr.)—gallons per minute.

#### — H —

**Handrail**—a horizontal or sloping rail placed along an access way or at the edge of a platform. Usually at 3'-6" above the walkway or floor. See ***Safety Handrail***.

**Header**—in a Counterflow Tower, the main pipe carrying hot water to a series of laterals for distribution over the fill material. In a Crossflow Tower, it is the main pipe carrying hot water to the distribution basin of each cell. See ***Manifold***.

**Heat Exchanger**—a device for transferring heat from one substance to another. Heat transfer can be by direct contact, as in a cooling tower, or indirect, as in a shell and tube condenser.

**Head Load**—heat removed from the circulating water within the tower. It may be calculated from the range and the circulating water flow. Unit: Btu/hr. = gpm x 500 x (HWT—CWT).

**Hot Water Temperature**—(HWT) - temperature in °Fahrenheit of circulating water entering the distribution system.

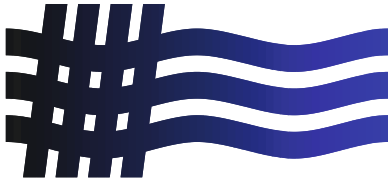
**Hyperbolic Tower**—a cooling tower of hyperbolic shape which depends on natural draft for air movement through the tower. Can be either Crossflow or Counterflow Tower. See ***Natural Draft Tower***.

#### — I —

**Induced Draft Water Cooling Tower**—type of Mechanical Draft Tower in which one or more fans are located in the air outlet to induce airflow through the air inlets.

**Inlet Air**—see ***Entering Air***.

**Inlet Wet-Bulb Temperature**—the average of the wet-bulb temperatures obtained from several stations located on both the windward and leeward sides of the tower.



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#### — J —

**Joist**—supports for fan decking.

#### — L —

**Lateral Header**—a pipe or flume distributing water from the distribution header to nozzles, or from other points of discharge to the filling area.

#### — M —

**Make-Up**—water added to the circulating water system to replace water lost from the system by evaporation, drift, blow-down, and leakage.

**Manifold**—the main header pipe in a Crossflow Tower. See **Header**.

**Mechanical Draft Water Cooling Tower**—a tower through which air movement is effected by one or more fans. There are two main types: Forced draft with fans located at the air inlet; Induced draft with fans located at the air exhaust.

**Motor Rated Horsepower**—horsepower rating inscribed on nameplate of the motor driving the fan. See **Rated Horsepower**. Unit: hp.

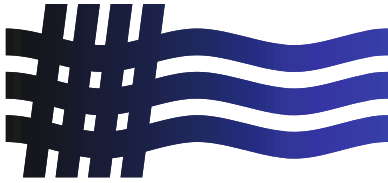
#### — N —

**Natural Draft Tower**—one, in which air movement through the tower is dependent upon atmospheric conditions, not induced by mechanical fans.

**Natural Draft Water Cooling Tower**—one in which air movement is dependent upon the difference in density between the entering air and internal air. As the heat of the water is transferred to the air passing through the tower, the warmed air tends to rise and draw in fresh air at the base of the tower. See **Hyperbolic Tower**.

**Nominal Tower Dimensions**—width and length measured from and to column centerline or walls; height measured from basin curb to top of fan deck (counterflow design) or to top of distribution basin (crossflow design). Unit: ft.





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**Nozzle**—a device for controlled distribution of water in a cooling tower. Nozzles are designed to deliver water in either a spray pattern by pressure or a solid stream by gravity flow.

#### — O —

**Overall Tower Dimensions**—(a) width: overall dimensions perpendicular to the tower's longitudinal axis; (b) length: overall dimension parallel to the air inlet louvers and the longitudinal axis; (c) total height: distance from basin curb to top of fan stack. Dimensions measured in feet.

#### — P —

**Packing**—see *Filling*.

**Partition**—an interior wall subdividing the tower into cells or into separate fan plenum areas.

**Pedestals**—used as a transition from the cross struts to the foundation of a Natural Draft Tower.

**Pitot Tube**—an instrument that operates on the principle of differential pressures. The primary use on cooling towers is the measurement of circulating water rate.

**Plenum**—the enclosed space between the eliminators and the fan stack in Induced Draft Towers or the enclosed space between the fan and the filling in Forced Draft Towers.

**Plume**—visible exhaust from a cooling tower. See *Fogging*.

**Power Factor**—the ratio of true power (watts) to the apparent power, as indicated by the product of amps x volts.

**Psychrometer**—an instrument used primarily to measure the wet-bulb temperatures. Either a sling or a mechanically aspirated type of psychrometer is acceptable provided the instrument is properly shielded from radiation and the air across the wick is limited to approximately 1,000 ft/min.



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#### — R —

**Range**—difference between the hot water temperature and the cold water temperature.  
Unit: °F. Also known as Cooling Range.

**Rated Horsepower**—nameplate horsepower of fan drivers other than electric motors.  
Unit: hp.

**Recirculation**—this term describes a condition in which a portion of the discharge air enters the tower along with the fresh air. The amount of recirculation is determined by tower design, tower placement, and atmospheric conditions. The effect is generally evaluated on the basis of the increase in the entering wet-bulb temperature compared to the ambient.

**Redistribution Basin**—an elevated basin installed between the hot and cold water basins in a Crossflow Tower to maintain correct water distribution throughout the entire height of the fill.

**Relative Humidity**—

**Riser**—piping which connects the circulating water supply line from the level of the base of the tower to the supply header of the tower inlet connection.

#### — S —

**Shell Diameter**—diameter of the shell in a Natural Draft Tower at the top of the curb, measured from inside of cross struts to inside of cross struts.

**Shell Height**—dimension from top of curb to top of the hyperbolic shell in a Natural Draft Tower.

**Single-Flow Water Cooling Tower**—a Crossflow Tower having a fill section on one side of the plenum chamber only.

**Speed Reducer**—see *Gear Reducer*.

**Splash Bar**—horizontal component of a fill deck which constitutes the principal splash surface.



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**Spray-Filled Water Cooling Tower**—a tower which has no fill, and water to air contact depends entirely on the break-up of the water by means of pressure spray nozzles.

**Spray Nozzle**—device used in a distribution system to break up the flow of the circulating water into droplets and effect uniform spreading of the water over the wetted area of the tower.

**Standard Air**—dry air having a density of 0.975 lbs/ft<sup>3</sup> at 70°F and 20.92" Hg.

**Static Pressure**—the pressure of a gas or fluid in a system as referred to a state of rest or lack of motion. Static pressure is equal to total pressure minus velocity pressure. Unit: lbs/in<sup>2</sup>.

**Sump**—lowest portion of the basin to which cold circulating water flows: usually the point of suction connection. Also known as basin pump.

**Supply Header**—portion of the water supply system from which riser or inlet connection receives the circulating water flow.

#### — T —

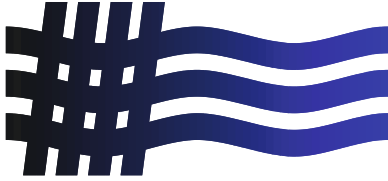
**Thermal Capacity**—the number of gallons per minute (gpm) a cooling tower will handle for a specified range, wet-bulb temperature, and approach. Also simply known as capacity.

**Total Pumping Head**—the total head of water measured above the basin curb, required to deliver the circulating water through the distribution system. See ***Tower Pumping Head***. Unit: FT.

**Tower Dimensions**—See ***Nominal*** or ***Overall Tower Dimensions***.

#### — U —

**Underflow Water Cooling Tower**—a Crossflow Tower with a forced draft fan located in a horizontal plane at the bottom of the plenum chamber. Air from the plenum travels horizontally through fill sections and discharges vertically at each end of the tower.



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#### — W —

**Water Cooling Tower**—an enclosed, steady-flow device for cooling water by evaporation through direct contact with air.

**Water Loading**—circulating water flow expressed in gallons per minute (gpm) per square foot of effective horizontal wetted area of the tower. Unit: gpm/ft<sup>2</sup>.

**Wet-Bulb Temperature** (WBT)—temperature indicated by a psychrometer. Also known as the thermodynamic wet-bulb temperature or the temperature of adiabatic saturation. Unit: °F.

**Wet-Dry Tower**—a wet (evaporative) cooling tower in combination with a dry (non-evaporative) heat exchanger system, used to reduce or abate cooling tower fog during cold