



**STAR**  
COOLING TOWERS

# Series 6000 Crossflow Cooling Towers



## COOLING TOWER TECHNOLOGY EXPERTS SINCE 1951

POWER | PETROCHEMICAL | REFINING

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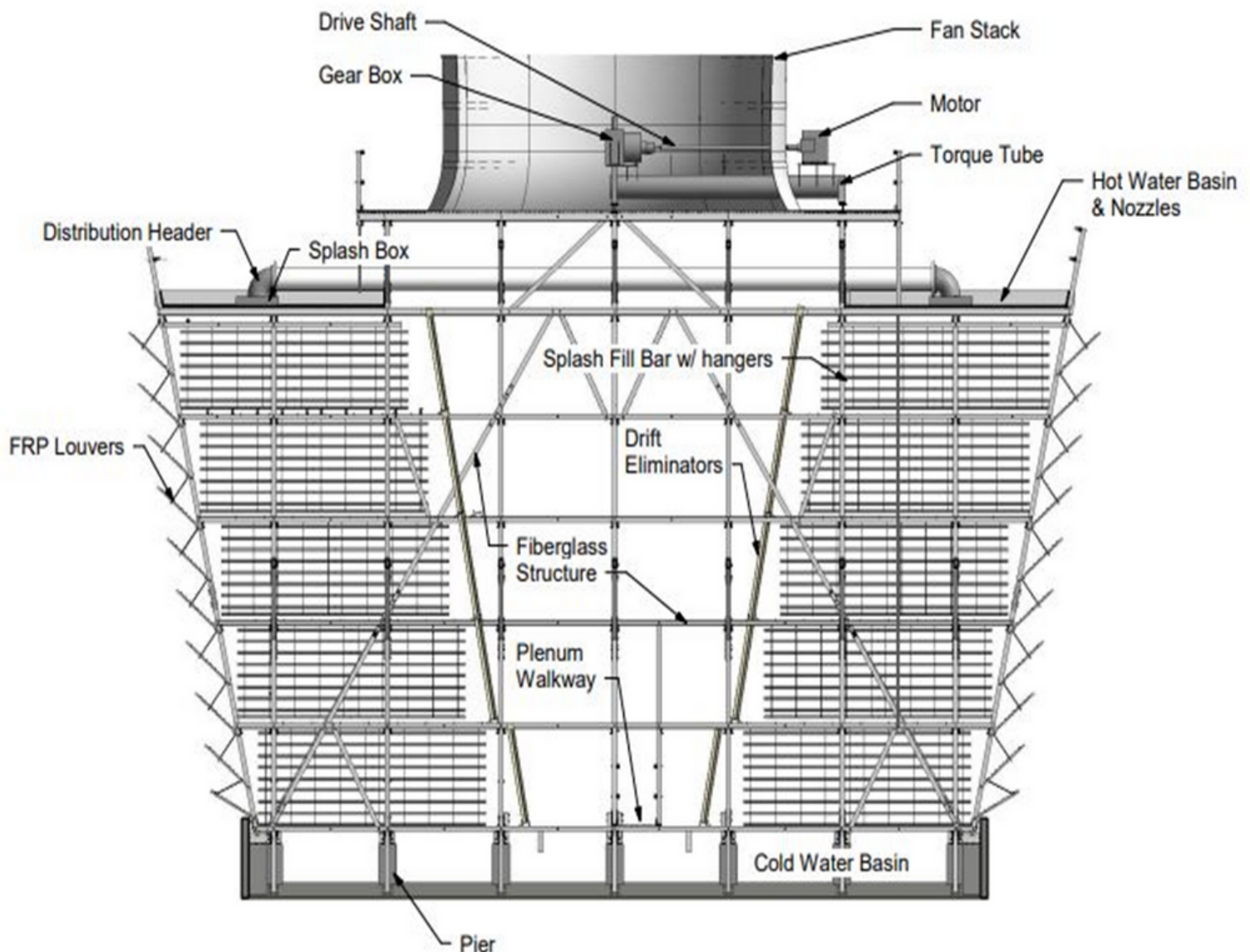
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# STAR

COOLING TOWERS

## Series 6000 Crossflow Cooling Towers





**Star Cooling Towers** supplies a wide range of cooling tower products and services to utilities, process, and industrial customers.

They have come to rely on Star Cooling towers' reputation for quality, value, and super customer service. They know Star Cooling Towers consistently lives up to its own high standards on every job.

## SERVICES

EXPERIENCED ENGINEERING AND DESIGN

PRE-ENGINEERED AND CUSTOM DESIGNS

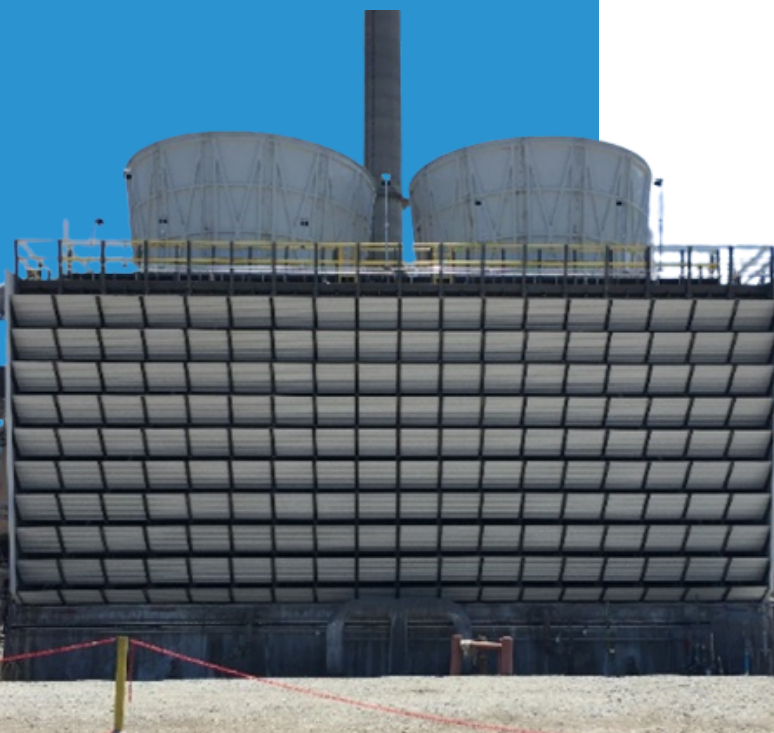
INNOVATIVE DESIGNS USING LATEST COOLING TOWER TECHNOLOGIES

FULL-TIME CONSTRUCTION STAFF

OUTSTANDING SAFETY PERFORMANCE

## ENGINEERED BY EXPERTS

Our experienced engineering and design group can offer you the best value option for your particular cooling tower application, whether it is one of our pre-engineered cooling towers or a custom-designed solution. Many fill options to fit your application.





## UPGRADE TO A PREMIUM PULTRUDED FIBERGLASS TOWER

The Series 6000 is constructed from premium quality fiberglass. Owners and operators accustomed to wooden-structure cooling towers from decades past can upgrade to this modern high-performance fiberglass version. Upgrading to fiberglass means avoiding the environmental issues that come with wood preservatives, including arsenic and other toxic chemicals. Better yet, fiberglass is impervious to water intrusion that leads to the eventual rot and decay of wood cooling towers and is resistant to chemical attack.



## CELL EXTENSIONS OR NEW APPLICATIONS

The Series 6000 is ideal for cell extensions or expansion projects, as well as new cooling tower applications. The Series 6000 uses the latest available heat transfer and drift eliminator technologies, and the same high-quality materials STAR has been known for since its founding in 1951.



## NON-CORROSIVE CONSTRUCTION COMPONENTS

- FRP structural components
- Rigid FRP fan deck and fan stacks
- FRP blade louvers standard
- Type 304 stainless steel hardware standard





## STAR MODEL SXF PULTRUDED FIBERGLASS

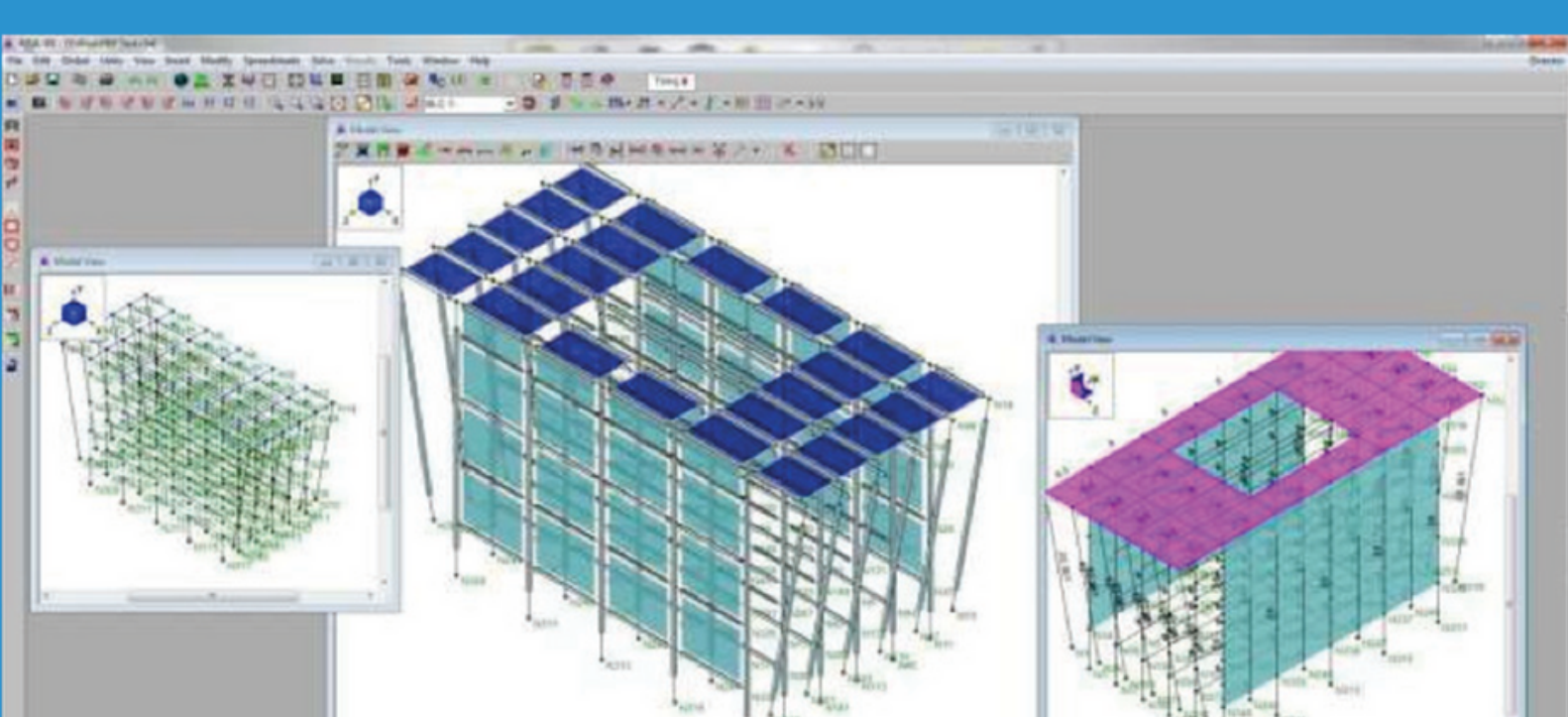
### PERFORMANCE BENEFITS

- Aesthetically pleasing design
- Energy efficient
- Quiet operation
- Reliable year-round performance
- Extended service life
- Environmentally friendly

### OPTIMIZED DESIGN

- All-fiberglass structures can be designed for specific seismic and wind conditions per the International Building Code or ASCE-7
- Motor located outside saturated airstream
- Positive shut-off flow control valves for optimal flow control
- Superior crossflow fill media
- Designed to outlive the facility it serves





## FINITE ELEMENT ANALYSIS FOR WOOD & FRP STRUCTURAL DESIGNS



## REVIT + AUTOCAD 3D DESIGN AND VISUALIZATION SOFTWARE

You can count on Star Cooling Towers' experience in cooling tower engineering, design, manufacturing, repair, and construction.

Our team will work with you through the design, budgeting, planning, and installation of your project to make sure you get the best job for the best value.

- Project planning and budget preparation
- Thermal performance testing
- Cooling tower optimization and upgrades
- Temporary cooling towers





The construction of new wood and fiberglass cooling towers using a “bent line” technique provides a safer, and much faster erection of the framework.

The prefabricated transverse bent lines are assembled on the ground near the cooling tower basin. STAR utilizes a specially designed 48’ long spreader bar incorporating cable rollers that allow the horizontal hoisting of the bent line. Once clear of the bent stack, the rollers allow the bent line to rotate to a vertical position for final placement. This process is repeated one bent at a time while also installing the longitudinal tie-ins until the entire framework is complete





# FIBERGLASS STRUCTURAL FRAMING



Design wind loading is in accordance with ASCE 7 for the wind velocity and exposure for the new cooling tower location. Pultruded polyester resin structural fiberglass shapes for columns, braces, joists, and ties are in accordance with CTI Standard-137 “Fiberglass Pultruded Structural Products” and CTI Guideline ESG-152 Structural Design of FRP Components”.

Structural joints consist of joint connectors properly fitted and thru-bolted to the structural members. Structural columns will extend to the basin floor or piers and shall be fully grouted if necessary to assure proper bearing surface. All diagonal braces will be anchored to the basin floor. All perimeter columns which do not have a diagonal brace extending outside the tower footprint will also be anchored.

Columns shall be standard 3 ½” square tube unless required larger as determined by design loading. Horizontal support beams shall be 3 ½” channel or 5 ½” channel as necessary per the span and loading requirements. Diagonal wind bracing shall be a minimum 3 ½ ” square tube unless required larger.



## Hardware

All bolts, nuts, washers, and fasteners will be 304 series stainless steel. Structural connectors will be 304 series stainless steel.

## Casing

The tower is cased with a nominal 12 oz. fiberglass reinforced plastic (FRP) panels, extending from the top of the air inlet upwards to the fan deck level. All joints and connector locations are sealed to prevent water leakage. Prefabricated finish corner roll strips are used on all corners. The casing is secured with stainless steel screws with neoprene-backed stainless steel washers.

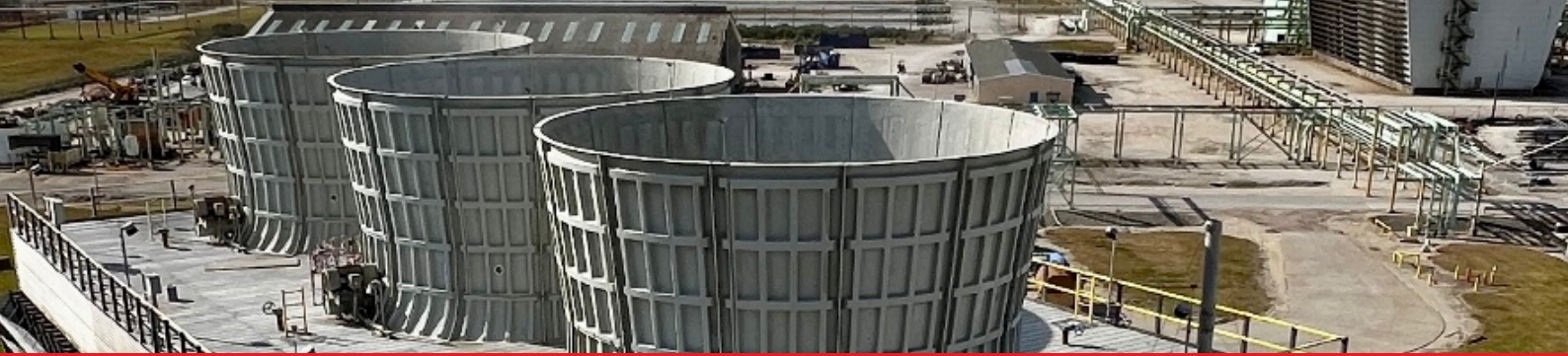
## Louvers

Louvers on the air inlets are comprised of 12 oz./SF FRP casing material for the louver panels, 4" fiberglass channel bottom louver supports, and polypropylene upper diagonal support arms. All hardware will be stainless steel (grade to match tower structure).

## Cell Partitions

Double-wall partitions between cells are provided in the transverse direction when two or more cells form the full cooling tower. Fiberglass cladding will be secured to one side of the column bent line using SST screws with neoprene-backed stainless steel washers. Panels will be hung horizontally starting at the bottom of the fan deck and extending down to 1'-0" below the basin curb elevation. Notching around structural members shall be neat and clean leaving gaps less than 1/2".





### **FANDECK (FRP)**

The deck is constructed of 24" wide overlapping pultruded FRP profiles fastened to the deck framing members. The deck is designed for a 60 PSF loading as specified by the CTI. The deck shall have a non-skid top surface.



### **SPLASH FILL - PVC**

The heat exchanger system consist of fill bars, 50 mil nominal thickness. The fill bars are extruded profile manufactured from PVC with UV inhibitor as an additive. The fill is oriented parallel to the airflow and installed on 8" vertical by 8" horizontal centers. The fill bars are held on 14 ga. PVC coated galvanized steel fill hangers, or optional 304 series stainless steel fill hangers. Each fill bar is secured at 1 hanger to prevent movement of the fill bars. The fill hangers are installed on pultruded FRP hanger supports. The fill bars are fire rated.



### **DRIFT ELIMINATORS - PVC**

The drift eliminators are comprised of three-pass sinusoidal wavy sheets of polyvinyl chloride (PVC) assembled in solvent welded or mechanically attached packs. The packs are 5 ½" thick x 1'-0" wide x 6'-0" long. The drift eliminator packs are supported on PVC drain boards located approximately 18" from the end of the fill media, covering the full height on both sides of each cell. The purpose of the drift eliminators is to reduce the circulating water losses, due to carry-over, to the specified percentage of the circulating water flow



# HOT WATER DISTRIBUTION BASINS



Hot water basins on crossflow cooling towers play a large role in the overall performance. The components of the hot water basins are designed to work together to evenly distribute water across the fill. A properly maintained and balanced hot water basin will allow the cooling tower to achieve its maximum cooling potential. The hot water basin deck is constructed of 24" wide overlapping pultruded FRP profiles fastened to the deck framing members. The deck is designed for a 60 PSF loading as specified by the CTI. The deck shall have a non-skid top surface.

Star Cooling Towers Precision-Flo water distribution nozzle is a non-clogging nozzle designed specifically for all crossflow cooling tower applications. It provides excellent flow characteristics by utilizing a one-piece design with a single support distribution plate. This produces a uniform distribution pattern helping to enhance the cooling tower's thermal performance. Our FRP water distribution box is designed, engineered, and manufactured of strong lightweight, non-corrosive fiberglass reinforced plastic. It is perfect for most crossflow cooling tower applications and comes in various sizes and heights based on specifications. It helps deliver a uniform of water from the flow control valves into the hot water basin of the cooling tower which is essential for optimum thermal performance.



## ■ MECHANICAL EQUIPMENT ■

Each mechanical drive package shall consist of a right angle speed reducer connected to an electric motor via a floating driveshaft. An axial flow fan is mounted on the output shaft of the speed reducer. The fan and motor are mounted on a galvanized steel support frame attached to the tower structure. The motor and gear are shimmed for proper alignment and the driveshaft shall be properly aligned per the manufacturer's recommendations. The following describes each of these major components in more detail:

### **FAN ASSEMBLIES**

The fans are selected for smooth, vibration-free operation. Each fan shall employ manually adjustable, fiberglass blades attached to a galvanized steel hub. Each blade shall be statically balanced at the factory against a master. The blades shall be secured to the hub with hot-dip galvanized hardware.

### **GEAR REDUCERS**

The right angle, single and double reduction, and spiral-bevel gear reducers shall be designed in accordance with AGMA standards and CTI Bulletin STD-111. The speed reducers are sized with a minimum service factor (S.F.) of 2.0 based on the motor nameplate horsepower. The bearings shall be lubricated by a positive splash slinger system.

### **DRIVESHAFTS**

Each drive shall include a composite fiber, single-piece driveshaft connected by flexible, self-aligning couplings to the motor and to the gear reducer. Each driveshaft and coupling set shall be sized for a minimum service factor of 2.0 based on the motor nameplate rating. The coupling hubs shall be keyed to the shafts, and the shaft assembly shall be dynamically balanced. Coupling hubs and hardware shall be 316 stainless steel.

### **MOTORS**

Each fan motor is suitable for use with a VFD, 1800 RPM, 3/60/460, 1.15 SF, IEEE841E

### **VIBRATION SWITCHES**

Each drive shall be provided with a vibration switch equipped with a single-pole, double throw snap switch as manufactured by F.W. Murphy, Inc., or equal, unless otherwise specified. The switch will be mounted on the mechanical support frame outside the fan stack air stream near the motor.

### **LUBE OIL PIPING**

The gearbox lube oil piping consists of 304 stainless steel piping for the oil drain, fill and vent lines running from the reducers to outside of the fan stacks. The gearbox oil level for standing and operating conditions shall be marked on the sight glass located outside of the fan stack near the fill and drain plugs.





### **FANSTACKS**

The fan stacks shall be of the velocity recovery design and shall be constructed of heavy ribbed fiberglass panels bolted together with 316 stainless steel hardware. An access panel shall be provided for removal of mechanical equipment on stacks 10 feet high and taller. A full radius inlet bell is provided for smooth airflow into the fan. The stack shall be designed for a wind load of 40 PSF.



### **PLENUM WALKWAY**

A fiberglass walkway complete with FRP handrails is provided the entire length of the cooling tower. Access doors located at each end wall leads to the plenum walkway, providing easy access to the plenum.



### **ACCESS TO THE FAN DECK**

The fan deck is accessed by a FRP stairway and FRP escape ladder with FRP cage. An FRP handrail system shall be provided around the full perimeter of the fan deck.







# STAR

COOLING TOWERS

**DESIGN, CONSTRUCTION, REPAIR, & UPGRADES SINCE 1951**

## The Integrity of Service and Technology



### Outstanding Customer Service

The Star Performance Plus program is designed to offer you complete support for the proper maintenance, operation, and optimization of your new cooling tower.

The result is consistent thermal performance, reduced unplanned maintenance, and emergency downtime, and overall maintenance cost reduction.

- Cooling tower start-up & training services
- Performance testing
- Annual inspection services
- Maintenance planning & budgeting
- Scheduled maintenance services
- Emergency response plans & implementation

### OEM Replacement Parts

Our large selection of quality OEM (Original Equipment Manufacturer) replacement parts are compatible with most models and manufacturers of cooling towers, and they offer a high-quality, reliable, low-cost alternative to expensive original equipment parts.

Call us today for more details on how we can be your best value cooling tower supplier.

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