

Cooling Tower Reconstruction

BEST PRACTICES

Values and Pitfalls

After many years of operation, cooling towers may require more than small repair work and individual component replacement to return the thermal performance necessary to support plant processes. Above and beyond thermal performance is the need to address durability of the cooling tower. Replacement of the heat transfer media (“fill”) in an older cooling tower will boost cooling capacity short-term, but unless structural integrity is addressed, there will be no improvement in the longevity of the cooling tower. The structures of older cooling towers of wood construction, for example, have no doubt seen an inherent loss of strength depending on variables such as wood species and operating conditions. Spot repairs are an inexpensive approach to maintain operability; however they do not address the potential loss in the structural safety factor of the cooling tower. With proper guidance, a successful cooling tower reconstruction project can achieve returns in both cooling capacity and structural integrity, thus extending the life of the cooling tower.

With these goals in mind, how can you plan and execute a successful project, and avoid potential reconstruction pitfalls? Regardless of your experience with cooling tower reconstruction, a review of industry best practices will help ensure your success.

Know Your Intentions

Occasionally, user requirements are limited to what might be termed “professional maintenance”. That is to say, the owner wants the cooling tower restored to operational dependability by replacing specific components. Where the required restoration is relatively minor, and the cooling capacity of the cooling tower is considered non-critical, competent specialists in the field of maintenance and repair will normally be satisfactory.

Usually, however, the thermal capability of the cooling tower is of concern; as is structural, mechanical, and operational integrity. Capital investment to reconstruct the cooling tower can yield substantial and quick returns with the implementation of the latest technological developments in the industry. In these cases, it is recommended that you contact only those companies who design, manufacture, and construct cooling towers, or their authorized representatives.

Plan for Safety

Inspection and reconstruction personnel should be sufficiently trained in cooling tower access and should implement a full Job Safety Analysis (JSA) before accessing any cooling tower. Cooling towers have some inherent dangers such as high voltage power, fall hazards, trip hazards and areas for cuts, scrapes and bruises. JSAs should address all hazards that are specific to the cooling tower being inspected. The JSA should define appropriate mitigation plans for each hazard including items such as lockout/tagout, personal protective equipment, and fall protection.

Inspect your Cooling Tower.

The scope of work for your reconstruction project needs to be defined by the findings and recommendations of an experienced cooling tower professional. A thorough inspection should include the following:

- Deterioration in cooling tower structural elements
- Clogging or damage to fill
- Missing nozzles or leaking pipes
- Wear and corrosion of mechanical components
- Deterioration of ladders and guardrails
- Condition of drift eliminators and louvers

Whether you pre-select a company in which you have confidence, or award the contract on the basis of competitive bidding, the effort should begin with an inspection of your cooling tower by each of the bidders. Although such inspections will usually involve some cost to you, they are essential to the process. Only by inspecting the cooling tower can the successful bidder determine the full scope of work required. The results of the inspection will assist you in determining the advisability of attempted reconstruction.

Define Scope of Work

When combining your intentions with the results of the inspection, decisions must be made to achieve plant objectives without losing sight of capital budget plans. Listen to industry leaders for guidance, as there may be new solutions that meet multiple demands of the project. For example, if your fill is clogged or damaged beyond repair, there may be an opportunity to replace with higher-performing fill. A common reconstruction project where additional cooling capacity is sought involves replacing the original splash-fill with PVC film-fill where water quality allows. If the integrity of fill is sufficient, and additional thermal performance is not sought, simply cleaning the fill may meet project intentions.

Reconstruction also presents an excellent opportunity to upgrade the structural components of the cooling tower. Replacement of wood with FRP (fiberglass reinforced plastic) is an excellent choice when the lifespan of the cooling tower is a top priority. For example, during a reconstruction job to a wood crossflow cooling tower at a coal-powered baseload plant, a customer may choose to make structural upgrades such as:

- Hot water deck and deck supports from plywood to FRP
- Girts from wood to FRP
- Steel riser support beam from carbon steel to stainless steel
- Walkways from wood to FRP
- Crossflow pipe saddle supports from wood to FRP (for submerged wet material area)
- Structural splice plates from wood to FRP

Pre-test the Cooling Tower

It is not enough to know the original design performance of the cooling tower. Age and physical deterioration will undoubtedly have taken its toll on the cooling tower's capacity. A performance test prior to reconstruction gives the bidder a starting point to establish the promise of capacity improvement — and also a reference point for evaluating the final results. The Cooling Technology Institute (CTI) has a published thermal test code ATC-105 by which the performance of a cooling tower can be accurately determined. However, because rather specialized instrumentation is required to determine precise water flow rates, air rates and temperatures, full-scale performance testing may require the assistance of an outside agency. A reputable cooling tower company should have both the trained personnel and the instrumentation required to accurately establish the cooling tower's performance level. CTI can provide you with assistance in locating a reputable cooling tower testing agency to perform the recommended performance testing. The test will not be without cost, but will yield critical knowledge.



Wood Crossflow Cooling Tower Prior to Reconstruction



Post-Reconstruction Showing FRP Structural Enhancements

Be Selective

Choose the company which you feel knows most about your type of cooling tower, and from whose efforts you will gain the greatest benefit. Consider these questions when evaluating a bid:

- Are you confident their scope is comprehensive enough to achieve the goals of the project?
- Are the bids you are comparing truly an “apples-to-apples” when considering price and scope?
- What is their history and reputation in meeting outage schedules and completing projects on-time?
- How does their safety record compare with other bidders?
- Do they have your required goal in mind?
- Are they able to provide a temporary cooling solution (if needed)?
- Whose fill, nozzles, drift eliminators, fans, speed reducers, etc., will be utilized, and are those components capable of working well together?
- Where will the responsibility for overall warranty be?

As the purchaser of a service, it is your responsibility to seek satisfactory answers to these questions. Ask for multiple references from each supplier to be confident that the company you select has an excellent reputation in the industry.

Post-test the Cooling Tower

A performance test after the work has been completed establishes the level of performance improvement, and determines whether or not the guarantee has been met.

Outline Your Future Maintenance Schedule

Ask your supplier for recommendations on scope and timing of the maintenance required to prevent or reduce the degradation of your cooling tower. At a minimum, every cell of your cooling tower should receive an annual professional inspection of the following components:

- Gearboxes
- Gearbox oil and seals
- Driveshafts
- Distribution water basins
- Fan cylinders
- Fans, fan tip clearance and pitch
- Fill
- Distribution piping and nozzles
- Ladders and other safety components



In Conclusion

Also note that some cooling tower reconstruction companies can provide proactive maintenance services. Be sure to ask for a proposal in your bid. Considering the heavy demands placed on the cooling towers at your power plant, proactive maintenance is essential in extending the length of time between repairs and reconstruction. Recent collapses of aged cooling towers across the industry highlight the extreme risks associated with lack of maintenance, including lost revenue, extraordinary costs, and injury to personnel while emphasizing the importance of proper inspections, testing and repairs.

In conclusion, small repair work and component replacement are sometimes not enough to address durability and structural integrity issues. With detailed planning for ultimate objectives and safety, experienced inspection, clear scope of work, careful selection of suppliers, pre- and post-testing, and planning for future maintenance, cooling towers can be successfully reconstructed with returns in cooling capacity, structural integrity and longevity of the cooling tower.

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