

Cooling Tower Reconstruction

Extend tower lifespan by restoring thermal performance and structural integrity

After many years of operation, cooling towers may require more than routine maintenance and component replacement to achieve the thermal performance necessary to support plant processes. In addition to achieving proper thermal performance, plants also must address the permanence of the cooling tower. Replacement of heat transfer media or other spot repairs in an older cooling tower will boost cooling capacity in the short term, but unless structural integrity also is addressed, there will be no improvement in the longevity or structural stability of the cooling tower.

Unlike small patchwork repairs, a successful cooling tower reconstruction project can demonstrate returns in both cooling capacity and structural integrity, thus extending the lifetime of the cooling tower. With these goals in mind, how can plant operators plan and execute a successful reconstruction project and avoid potential reconstruction pitfalls? The following review of industry best practices, from planning to execution, will help ensure successful cooling tower reconstruction.

Determine Suitability of Cooling Tower Reconstruction

Occasionally, user requirements are limited to what might be termed professional maintenance. For example, the owner may want the cooling tower restored to operational dependability by replacing specific components rather than auditing the entire tower's performance and reconstructing as necessary. In these cases, where the required restoration is relatively minor, and improving the cooling capacity of the cooling tower is not critical, competent specialists in the field of maintenance and repair normally will be satisfactory.

Usually, however, the cooling tower's structural, mechanical and operational integrity are a concern. In these situations, capital investment to reconstruct the cooling tower can



Capital investment to restore a cooling tower's structural, mechanical and operational integrity can yield substantial short and long-term benefits.

yield substantial and almost immediate returns if the latest cooling tower technological developments are implemented. If reconstruction is specified, seek advice from representatives of companies with experience in the design, manufacture and construction of cooling towers.

Prepare for Cooling Tower Reconstruction

Regardless of what types of repair work are to be done, 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 and trip hazards. 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 (LOTO), personal protective equipment (PPE) and fall protection.

The scope of work for any reconstruction project should be defined by the findings and recommendations of an experienced cooling tower professional. Whether the tower reconstruction company is preselected based on prior experience, or the contract is awarded on the basis of competitive bidding, any reconstruction effort should begin with an inspection of the cooling tower by each of the bidders.

A thorough inspection should identify:

- 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

Although inspections will involve some cost, they are essential to the process. The results of the inspection will assist the parties in determining the scope of reconstruction.



Plant operators benefit from working with service providers that maintain stock of replacement components. Ready access to components helps ensure the cooling tower is back online quickly if a mechanical failure occurs.

After soliciting multiple bids and completing the cooling tower's inspection, plant operators must be selective in choosing a reconstruction company. Here are some questions to consider when evaluating service providers:

- Are you confident their scope is comprehensive enough to achieve the goals of the project?
- Are the bids you are comparing truly apples-to-apples when considering price and scope?
- What is each company's history and reputation in meeting outage schedules and completing projects on time and within budget?
- What is their overall quality of workmanship?
- How does their safety record compare to other bidders?

- Do they have an understanding of your required goals?
- Are they able to provide a temporary cooling solution (if needed)?
- Which manufacturer's fill, nozzles, drift eliminators, fans, speed reducers and other components will be utilized. Are they designed to work well together?
- Who is responsible for overall warranty?
- Do they offer maintenance services?

As the purchaser of reconstruction services, plant operators bear the responsibility of identifying the supplier that will best fulfill the project's needs, based on the above questions. They also should obtain multiple references from each supplier to confirm their reputation in the industry.

After the inspection and selection of a service provider, the decision making continues. The operator then must outline what reconstruction is needed to achieve plant objectives without losing sight of capital budget plans. It can be key at this point to listen to various industry leaders for guidance because there may be new solutions that meet multiple demands of the project. For example, if a cooling tower's fill is clogged or damaged beyond repair, there may be an opportunity to replace it 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). In other cases, where the integrity of the fill is sufficient and additional thermal performance is not sought, simply cleaning the fill may meet project goals.

Reconstruction also presents an excellent opportunity to upgrade the structural components of the cooling tower. Replacing wood with fiberglass-reinforced plastic (FRP) is a good choice when the lifespan of the cooling tower is a top priority. For example, during reconstruction of a wood crossflow cooling tower at a coal-powered baseload plant, one cooling tower owner chose to make structural upgrades. He replaced a hot water deck, deck supports, walkways, crossflow pipe-saddle supports and structural splice plates, changing from wood to FRP. The same owner/operator also changed the steel riser support beam from carbon steel to stainless steel.



Any reconstruction effort should begin with an inspection of the cooling tower by an experienced cooling tower service provider. The scope of work should be defined by their findings and recommendations.

Pretest the Cooling Tower

Even if a plant operator can produce the original design specifications of the cooling tower, additional steps must be taken to assess the success of a reconstruction project. Age and physical deterioration take their toll on the cooling tower's capacity. A performance test prior to reconstruction gives the plant operator a starting point to establish goals for capacity improvement as well as 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 accuracy of a cooling tower can be determined. Because specialized instrumentation is required to determine precise water flow rates, air rates and temperatures, however, full-scale performance testing may require an outside agency's assistance. Some cooling tower companies have the trained personnel and instrumentation required to establish the cooling tower's performance level. CTI can assist plant operators with identifying a reputable cooling tower testing agency to perform the recommended performance testing. The test may be costly, but it will yield critically important knowledge by helping to establish the level of performance improvement and determine whether or not the supplier's guarantee has been met.

Outline a Future Maintenance Schedule

As reconstruction ends and the tower's lifecycle advances, plant operators will benefit from working with service providers that maintain stock of replacement components.

Should a mechanical failure occur, ready access to components will ensure the cooling tower is back online quickly and unplanned outages, which could extend for weeks or months, are avoided.

After reconstruction work is complete, plant operators should ask suppliers for detailed recommendations on scope and timing of maintenance for the newly reconstructed cooling tower. At a minimum, every cell of the cooling tower should receive an annual professional inspection of gearboxes, gearbox oil and seals, drive shafts, distribution water basins, fan cylinders, fans, fan-tip clearance and pitch, fill, distribution piping and nozzles, ladders and other safety components. In doing so, operators protect the capital investment value of the cooling tower reconstruction and extend service life.



Reconstruction presents an opportunity to upgrade the structural components of the cooling tower. Replacing wood with fiberglass reinforced plastic (FRP) helps extend the lifespan of the cooling tower.

Considering the heavy demands placed on the cooling towers at many plants, proactive maintenance is essential to 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. They reinforce the importance of proper inspections, testing and repairs. Some cooling tower reconstruction companies provide proactive maintenance services, so operators can establish supplier relationships that extend from reconstruction to ongoing maintenance.

Minor repairs and component replacements sometimes are not enough to address component and structural integrity challenges. Plant operators must pursue long-term cooling objectives such as improved safety measures and proven inspection techniques. Carefully selecting suppliers, identifying a clear scope of work, arranging pre- and post-reconstruction testing, and planning for future maintenance are key steps. They help ensure that your cooling tower can successfully be reconstructed with quick returns in cooling capacity, structural integrity and increased longevity.

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