

Wood Design Standards

What Standards Govern the Design of Wood Cooling Tower Structures?

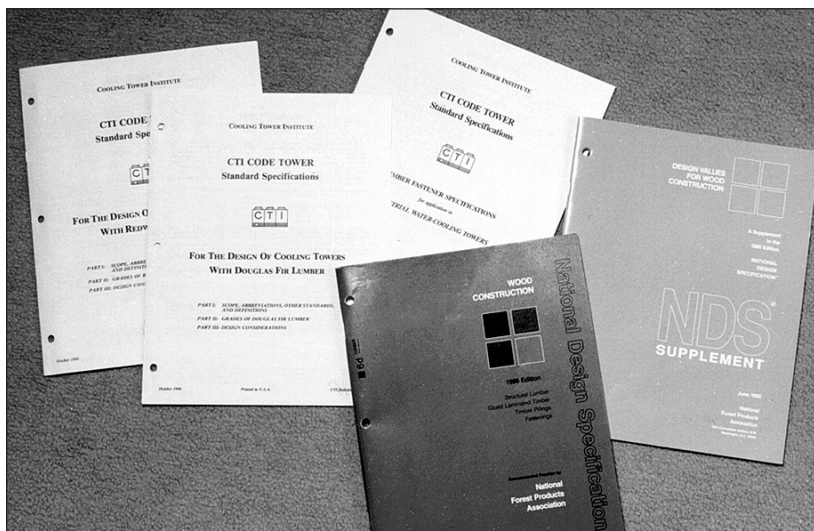
The basic design of timber structures is governed by the National Design Specification for Wood Construction (NDS), published by the American Forest and Paper Association. Cooling towers, however, are subjected to a uniquely harsh operating environment, as well as dynamic forces that dictate structural concerns somewhat beyond accepted norms. To address this special application of timber structures, The Cooling Technology Institute has issued CTI Code Tower Standard Specifications including:

- *CTI Bulletin STD-114 for the design of cooling towers with Douglas Fir Lumber,*
- *CTI Bulletin STD-103 for the design of Redwood towers.*
- *CTI Bulletin STD-119 for timber fastener specifications.*

The purpose of these standards is to assure the proper structural design of cooling towers. They are meant both to assist the designer – and to protect the user. They are invaluable to the concerned specifier.

Specific Provisions of CTI Bulletins STD-114 and STD-103

- Structural grades of lumber are required for framework members. In Douglas Fir, No. 2 Structural is the minimum grade allowed. For Redwood, No. 1 Structural is the minimum grade allowed. Industrial Clear grades of Douglas Fir and General purpose RIS grades of Redwood may be used only for non-framework members.
- Boxed heart lumber is not allowed for cooling tower construction. (See Marley Difference Item MC-4)
- All lumber must be pressure treated in accordance with the requirements of CTI Bulletin STD-112. (See Marley Difference Item MC-3)
- Minimum wind load shall be in accordance with ASCE 7. Potential shielding from adjacent structures may not be considered.
- Seismic loads shall be in accordance with the Uniform Building Code (UBC).
- Minimum construction and maintenance load shall be 60 psf applied over the entire fan deck area. The design shall also consider rolling and concentrated loads resulting from moving tower components (motors, gear boxes, etc.) across the fan deck.



Specific Provisions of CTI Bulletins STD-114 and STD-103

- Gravity loads for the tower design shall include the wet weight of the lumber (46 lb/cu ft for Douglas Fir and 45 lb/cu ft for Redwood); the water loading in the tower, including water in the distribution system and distribution basins at overflow depth; snow and ice loads; and construction and maintenance loads.
- For structural members subjected to operating loads, allowable design values are reduced to provide for an anticipated 50 year load duration. Except for modulus of elasticity and compression perpendicular-to-grain, this reduction in allowable load is 5%.
- Allowable design values for members subjected to temperatures in excess of 68° F, shall be reduced by factors corresponding to the actual temperature to which the member is subjected. Alternatively, the design hot water temperature can be used to calculate the reduction for members in the top half of the flooded portion of the tower, and an average of the design hot water and cold water temperatures for members in the lower half.
- Axially-loaded members shall be designed to take into account stresses resulting from eccentricity induced by Bow and Crook permitted for the grade used, or eccentricity induced at joints where loads are transferred from members on one side of the axially-loaded member. (An example of the latter is a girt-to-column connection where the girt is on one side of the column only.)

Specific Provisions of CTI Bulletin STD-119

- Fasteners not listed in CTI Bulletin STD-119 may be used only if the capacity can be substantiated by an independent testing agency.
- By reference to NDS, grooves fabricated in timber members for connectors shall conform accurately to the dimensions and shape of the connector used. (See Marley Difference S-3)
- Bolt capacities established in STD-119 are based on machine bolts with full body (shank) diameter equal to the nominal bolt diameter. (See Marley Difference Item S-7)
- Identifies acceptable joint configurations, and establishes specific reduction factors for service conditions as well as connector spacing, end distance, and edge distance. (See Marley Difference Item S-3 and Item S-6)
- Permits no connections to be made at the location of a knot.

The Marley Difference

We abide by the standards described herein, because we believe in providing our customers with dependable, long-lasting cooling towers.

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