



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

MATERIAL STANDARD
FOR
PACKAGED COOLING TOWERS

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1 SCOPE

1.1 This standard covers the requirements for design, fabrication, workmanship, marking, testing, packing and construction of package cooling tower (hereafter referred to as "Cooling Tower" or "Package" for brevity) and is intended to supplement the applicable codes.

1.2 The compliance with this standard doesn't relieve fabricator from his own responsibilities and guarantees for the soundness of cooling tower to be delivered.

2 STANDARDS AND CODES (LATEST EDITION AND ADDENDA)

- CTI STD-111 & 113
- AGMA American Gear Manufacturers Association, STD 420.04.
- ASTM Section II Material Specifications.
- NDS National Design Specification for Wood Construction Published by National Forest Products Association.
- OSHA Occupational Safety and Health Administration.
- AWS American Welding Society.
- All Codes Referred to, in this Standard.

3 STANDARD COMPONENTS AND FEATURES

3.1 MECHANICAL EQUIPMENT

3.1.1 Fans

The fan selection and fan speed for a given tower are based on tower cell size, system losses, and horsepower requirements.



Depending on fan size, blade material is glass reinforced polyester (GRP), glass reinforced epoxy (GRE), or cast aluminum alloy. Large fan hubs may be heavy-duty steel weldments or heavy-gauge steel plates, hot dip galvanized after fabrication. Smaller fan hubs are either epoxy-coated cast iron or heat-treated aircraft alloy aluminum plate. All materials shall be selected for the harsh cooling tower environment.

3.1.2

Fan Cylinders

Venturi-shaped cylinders combine minimal entrance losses with close blade tip clearances to produce optimum fan performance. As cylinder heights increase, cylinders are flared to promote recovery of velocity pressure allowing fans to move the required amount of air at significantly reduced horsepower. Fan cylinders have exceptionally large entrance diameters which contribute to the "eased inlet" effect so necessary to good fan performance. Smaller entrances do not provide sufficient transition to deter turbulent flow at the fan. Fan cylinders shall be through-bolted to the fan deck and supporting framework. The combination of a large foundation "footprint" and through-bolting shall enable them to withstand wind velocities in which others have failed. Material of cylinder shall be impervious to the corrosive conditions atop the tower.

3.1.3

Gear Reducers

The specific gear reducer selection is based on fan speed and horsepower requirements. Gear reducers shall be designed to meet or exceed the requirements of CTI STD-111 and AGMA Std. 420.04, and shall run-in under load prior to shipment. Housings shall be gray cast Iron (ASTM Class 20), heat-treatment stress-relieved, and covered with two coats of epoxy-polyamide paint. Gears shall be high-strength, case hardened alloy steel. All bearings are to be tapered roller bearings with minimum B₁₀ service life of 100,000 hours. Service factors are at least 2.0 at applied horsepower. All gear reducers shall be right-angle type with motors located outside the saturated effluent airstream. Splash-type lubrication and integral cooling fins preclude the need for maintenance-intensive oil pumps and coolers. A constant oil bath or flow lubricates every bearing. Lubrication is maintained in forward or reverse motion-at full or half speed. Gear reducers shall be equipped with remote sight gauge and drain lines, which permit constant surveillance of oil level in each unit.

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3.1.4 Drive Shafts

Drive shafts transmit power from the motor to the gear reducer. All drive shafts shall be built from 304 or 316 Stainless Steel tubes with welded-on stainless steel flanges. Bonded neoprene flexible elements transmit torque and require no lubrication. Drive shafts shall be full-floating assemblies with flexible couplings on each end. Their tolerance to misalignment and torsional shock is unequalled in non-specialized units. All drive shafts shall be dynamically balanced at the factory to minimize operating vibrations.

3.1.5 Unitized Support

Torque-tube unitized support stabilizes the fan within the fan cylinder and maintains constant alignment between the motor and the gear reducer. It shall be a welded unit of pipe, heavy angles, and plate, hot dip galvanized after assembly. The giant tube design gives super-elevation to the fan wheel and provides excellent torsion resistance along all potential axes of movement. It shall be fastened to the wood structure through heavy wide flange beams and castings. Formed retainers surround and guard the drive shafts. The torque-tube shall offer minimal airflow restriction in comparison to typical boxlike configurations. Its cylindrical shape also minimizes air turbulence in the fan entrance region.

3.2 FILL

High-performance film fill is the heart of the cooling tower. Sheets, formed in a pattern of angular corrugations, produce the wetted surface and air turbulence necessary for proper heat transfer, while keeping pressure losses low in order to reduce fan energy requirements. Alternate reversal of corrugation angles from sheet to sheet assures constant, uniform fill spacing. Fill depth (air travel) and sheet spacing can be varied to produce the ideal combination required.

Each cooling tower application shall be individually reviewed to assure selection of the proper fill height and fill spacing. Performance shall be computer optimized to assure maximum cooling from a given tower cell size for the design performance conditions.

3.3 WATER DISTRIBUTION SYSTEM

The spray system distributes water evenly over the entire fill surface. Its design assures uniform flow with minimal operating pump head and also requires very little maintenance.

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