



# DRAFT INTERNATIONAL STANDARD ISO/DIS 16345

ISO/TC 86/SC 6

Secretariat: **ANSI**

Voting begins on  
**2012-04-13**

Voting terminates on  
**2012-09-13**

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

## Water-cooling towers — Testing and rating of thermal performance

*Tours de refroidissement de l'eau — Essais et détermination des caractéristiques de performance*

ICS 27.080

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ISO 16345 was prepared by Technical Committee ISO/TC 86, *Refrigeration*, Subcommittee SC 6.

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## Introduction

The **introduction** is an optional preliminary element used, if required, to give specific information or commentary about the technical content of the standard, and about the reasons prompting its preparation. It shall not contain requirements.

The introduction shall not be numbered unless there is a need to create numbered subdivisions. In this case, it shall be numbered 0 with subclauses being numbered 0.1, 0.2, etc. Any numbered figure, table, displayed formula or footnote shall be numbered normally beginning with 1.

A **paragraph** is an unnumbered subdivision of a clause or subclause.

A **clause** is the basic component in the subdivision of the content of a standard. The clauses in each standard or part shall be numbered with Arabic numerals, beginning with 1 for the "Scope" clause. The numbering shall be continuous up to but excluding any annexes. Numbers given to the clauses of an annex shall be preceded by the letter designating that annex followed by a full-stop. The numbering shall start afresh with each annex.

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## 1 Scope

**1.1** This International Standard covers the measurement of the thermal performance and pumping head of open and closed circuit, mechanical draft, wet and wet-dry cooling towers and, natural draft, and fan-assisted natural draft wet and wet-dry cooling towers. The standard rating boundaries for series mechanical draft, open and closed-circuit cooling towers are specified.

**1.2** This standard does not apply to the testing and rating of closed-circuit towers where the process fluid undergoes a change in phase as it passes through the heat exchanger or where the thermophysical properties of the process fluid are not available.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO ab-c:199x, *General title of series of parts — Part c: Title of part*

ISO xyz (all parts), General title of the series of parts

## 3 Terms and definitions

For the purposes of this International Standard, the following definitions apply. The symbols used to identify the terms contained in this standard are listed and defined in Annex M.

### 3.1

#### **air flow rate**

total amount of dry air and associated vapor water moving through the cooling tower.

### 3.2

#### **ambient air conditions**

atmosphere adjacent to, but not affected by, the cooling tower.

### 3.3

#### **approach**

the difference between cold (recooled) water temperature and the inlet air wet-bulb temperature.

### 3.4

#### **approach deviation**

deviation between the guaranteed and adjusted test approach.

### 3.5

#### **atmospheric gradient (lapse rate)**

the average rate of change of dry bulb temperature with change in altitude from cold water basin curb, or sill, level, to around twice the height of the cooling tower. The convention for use with this document will be to use a negative value for decrease in temperature as height increases.

### 3.6

#### **average wind direction**

predominant direction of the wind over the duration of the test period.

- 3.7**  
**average wind speed**  
the arithmetical average of wind speed measurements taken over the duration of the test period.
- 3.8**  
**barometric pressure**  
the atmospheric pressure taken over the duration of each test period.
- 3.9**  
**basin**  
an open structure located beneath the cooling tower for collecting the circulating water and directing it to the sump or suction line of the circulating pump.
- 3.10**  
**basin curb**  
top elevation of the tower basin. Usually the datum from which tower elevations are measured.
- 3.11**  
**blow-down**  
water discharged from the system to control the concentration of salts or other impurities in the circulating water.
- 3.12**  
**capability**  
measured thermal capacity of a cooling tower, expressed as a percentage of the design water flow rate.
- 3.13**  
**cell**  
smallest subdivision of the tower, bounded by exterior walls and partition walls, which can function as an independent unit. Each cell may have one or more fans or stacks and one or more distribution systems.
- 3.14**  
**cell dimensions**  
dimensions that describe the size of a cooling tower cell include: (a) width: dimension perpendicular to the tower longitudinal axis and usually at right angles to the air inlet faces; (b) length: dimension parallel to the longitudinal axis and the plane where air inlets are usually located; (c) height: on induced draft towers, the distance from the basin curb to the top of the fan deck, but not including the fan stack. On forced and natural draft towers, the distance from the basin curb to the discharge plane of the tower.
- 3.15**  
**closed circuit cooling tower**  
a cooling tower comprised of a water flow loop recirculating over the outside of a closed circuit heat exchanger containing the process fluid loop. Air is drawn through the water passing over the outside of the closed circuit heat exchanger, enabling cooling by evaporation. No direct contact occurs between the process fluid loop and the open evaporative cooling loop.
- 3.16**  
**cold (re-cooled water temperature)**  
in an open cooling tower, the average temperature of the water entering the tower basin. In the case where the measurement is downstream of the basin or the pump, corrections are needed for the effects of the pump, and any other make-up water blow down or heat sources entering the basin. The convention from here on will be to use "cold water" in ISO Standard 16345.
- 3.18**  
**cooling range**  
the difference between the hot and cold water or process fluid temperatures. (NOTE: the term 'range' is also applied to this definition, but is regarded as a non-preferred term).
- 3.19**  
**cooling tower**  
apparatus in which process fluid is cooled by evaporative heat exchange with ambient air.