

ICS 77.040.99

CCS H 04



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 33463.1-2017

**Technology specification of seawater desalination for iron and
steel industry - Part 1: Low temperature multiple effect
distillation**

钢铁行业海水淡化技术规范 第1部分：低温多效蒸馏法

Issued on: February 28, 2017

Implemented on: November 1, 2017

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine;
Standardization Administration of the PRC**

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Foreword

SAC/TC 183 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This part is Part 1 of GB/T 33463.

This part is drafted in accordance with the rules given in the GB/T 1.1-2009 Directives for standardization - Part 1: Structure and drafting of standards.

This part was proposed by the China Iron and Steel Association.

This part was prepared by SAC/TC 183 National Technical Committee on Steel of Standardization Committee of China.

1 Scope

China's national specification for the low temperature multiple effect distillation plants that iron and steel works build to make their own fresh water out of the sea. A large integrated steel plant on the coast drinks water on a scale that no municipal supply can comfortably carry, and at the same time it throws away enormous quantities of low-grade waste steam that is too cold to drive anything useful. Low temperature multiple effect distillation (LT-MED) is the process that turns the second problem into the answer to the first: seawater is sprayed over tube bundles held under vacuum, boiled at well under 70 degrees C by that otherwise worthless steam, and the vapour of each effect heats the next, so a single kilogram of steam yields several kilograms of distilled water. This part of GB/T 33463 fixes what such a plant has to satisfy - the terms and definitions, the quality of the seawater fed to it and of the desalted water it produces, the steam conditions it may run on, the design of the intake, pretreatment, distillation, storage, wastewater, brine and dosing systems, the corrosion-resistant materials and equipment it must be built from, and the rules for operating, maintaining, monitoring and testing it. It is written for the iron and steel industry but is offered as a reference for other industries, and it also covers the MED stage inside a coupled MED and seawater reverse osmosis (MED-SWRO) plant. Its practical effect is to make the steam side, the water side and the metallurgy of a desalination unit negotiable on one common set of numbers, so that a steelmaker, a process licensor and an equipment supplier can agree on what the plant will deliver before it is built.

This part of GB/T 33463 specifies terms and definitions, media requirements, system requirements, materials and equipment requirements, operation, maintenance and monitoring, Testing method.

This part is applicable to desalted water production from low parameter steam through low temperature multiple effect seawater desalination system for iron and steel industry and can be the reference for other industries. It is also applicable to the low temperature multiple effect distillation system (MED) in low temperature multiple effect distillation and seawater

reverse osmosis coupling system (MED-SWRO).

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.

GB/T 1576 Water quality for industrial boilers.

GB 3097 Sea water quality standard.

GB 5749 Standards for drinking water quality.

GB/T 5750 Standard examination method for drinking water.

GB 17323 Bottled purified water for drinking.

GB 17378.3 The specification for marine monitoring - Part 3: Sample collection, storage and transportation.

GB 17378.4 The specification for marine monitoring - Part 4: Seawater analysis.

GB 19298-2014 National food safety standard - Bottled water for drinking.

GB 50050 Code for design of industrial recirculating cooling water treatment.

3 Terms and definitions

For the purposes of this document, the following terms and definitions are applied.

3.1 top temperature of brine, TTB: the highest brine temperature in the low temperature multiple effect seawater desalination system.

3.2 MED-TVC running mode: the mode that the secondary vapor is compressed by the thermal compressor and enters the st effect.

3.3 MED running mode: the mode in which thermal compressor is closed, and the st effect directly uses extra low pressure steam.

3.4 cool running mode: the mode that no desalted water is produced, and other systems are operating normally except for that of low-pressure steam.

3.5 brine: the seawater concentrated by the desalination system.

4.1 Quality of seawater spray in MED system

The quality of seawater spray in MED system shall comply with the requirements of Table 1. When the heat-exchange tube is made of aluminum alloy, the ion content of aluminum, copper, nickel, manganese and iron shall be monitored. The total amount of these five

substances in the seawater spray ought to be not more than 0.5 mg/L.

Table 1 gives, for each item, a recommended value and a permissible value. Suspended solids (SS): recommended not more than 20 mg/L, permissible not more than 50 mg/L. Diameter of suspended particle: permissible not more than 100 micrometres. Turbidity: recommended not more than 5 NTU, permissible less than 10 NTU. Water temperature: recommended 30 degrees C to 40 degrees C, permissible 2 degrees C to 40 degrees C. Petroleum: recommended not more than 0.50 mg/L, permissible less than 1 mg/L. Salinity: recommended 2.0 % to 4.0 %. Free chlorine: permissible 0.01 mg/L to 0.1 mg/L. Total iron: recommended not more than 0.05 mg/L, permissible not more than 0.1 mg/L.

4.2 Quality of seawater for heat exchange

The quality of seawater for heat exchange shall comply with the requirements of Table 2.

Table 2 lists thirteen items with their units, recommended values and permissible values. Suspended solids (SS): recommended not more than 20 mg/L, permissible not more than 30 mg/L. Diameter of suspended particle: recommended not more than 100 micrometres. Turbidity: permissible not more than 10 NTU. Methyl orange alkalinity (as CaCO₃): permissible not more than 350 mg/L. Calcium ion: permissible not more than 1 000 mg/L. Magnesium ion: permissible not more than 3 200 mg/L. Total iron: permissible less than 1.0 mg/L. Chloride ion: permissible not more than 42 000 mg/L. Sulfate ion: permissible not more than 6 000 mg/L. Petroleum: permissible less than 5 mg/L. pH: permissible 6.8 to 8.8. Water temperature: permissible 4 degrees C to 40 degrees C. Total count of heterogeneous bacteria: recommended less than 1 000 CFU/mL, permissible less than 500 000 CFU/mL.

4.3 Steam conditions for LT-MED (low temperature multi effect distillation) seawater desalination

4.3.1 The heating steam shall be the steam that the iron and steel plant may provide economically and steadily, and low-parameter waste heat steam should be preferred.

4.3.2 Parameter requirements for heating steam in LT-MED: a) The extra low pressure steam in iron and steel plant shall have absolute pressure ranging from 0.02 MPa to 0.04 MPa and a temperature range of 60 degrees C to 76 degrees C. b) The low pressure steam from a steam pipe network or turbine extraction in iron and steel plant, with an absolute pressure of 0.3 MPa to 1.2 MPa, enters the thermal compressor through decompression, temperature reduction or other pressure regulating means.

4.3.3 The supply method of LT-MED seawater desalination steam source is determined according to the following principles: a) In order to avoid the shutdown of the desalination system, the steam supply system may use parallel dual header, annular dual header or another similar means. The minimum steam supply is to meet the minimum steam demand of the desalination system. The steam supply source should adopt multiple steam sources