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Gas turbines — Procurement —

Part 2: Standard reference conditions and ratings

Turbines à gaz — Spécifications pour l'acquisition —
Partie 2: Conditions normales de référence et caractéristiques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 192, *Gas turbines*.

This second edition cancels and replaces the first edition (ISO 3977-2:1997), which has been technically revised.

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The main changes are as follows:

— revisions to text (clarifications).

A list of all parts in the ISO 3977 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This is a procurement International Standard developed for gas turbines reference conditions and ratings.

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Gas turbines — Procurement —

Part 2: Standard reference conditions and ratings

1 Scope

This document specifies the standard reference conditions and ISO standard ratings for gas turbines.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2314:2009, *Gas turbines — Acceptance tests*

3 Terms and definitions

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No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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4 Standard reference conditions

4.1 General

The standard reference conditions on ISO power, efficiency, heat rate and specific fuel consumption are as specified in 4.2 to 4.5.

The conditions shall be as described in ISO 2314:2009, 3.9.

4.2 Air intake conditions

Air intake conditions shall be defined at the gas turbine compressor flange (alternatively, the compressor intake flare) with:

— a total pressure of 101,325 kPa;

— a total temperature of 15 °C;

— a relative humidity of 60 %.

4.3 Exhaust conditions

For the exhaust at the turbine exhaust flange (or regenerator outlet, if a regenerative cycle is used), the static pressure shall be 101,325 kPa.

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4.4 Cooling water conditions (if applicable)

The inlet water temperature shall be 15 °C if cooling of the working fluid is used.

4.5 Working fluid heater or cooler

Where a heater or a cooler is used that uses ambient air, the standard reference conditions of the ambient air shall be 15 °C and 101,325 kPa.

5 Ratings

5.1 General

Output power, performance rating and fuel are defined as through 5.1.1 to 5.1.3.

5.1.1 Output power

The output power of a given gas turbine at a given reference turbine inlet temperature is, in general, proportional to the absolute ambient pressure and is also greatly dependent on the air intake temperature (normally outside dry bulb temperature). Likewise, the output at a given air intake temperature is dependent on the reference turbine inlet temperature as published value or alternatively the ISO 2314 turbine inlet temperature. To achieve a rating, it is necessary to adopt standard conditions of ambient temperature and pressure, but gas turbine ratings will nevertheless vary considerably owing to the differing operational modes demanded of them as well as the varying criteria used in the design of the basic elements. ISO standard ratings neglect pressure drop at the inlet and exhaust, but site ratings allow for these losses.

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NOTE Steam or water injection can be used to increase the power output and to reduce the NOx emissions.

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5.1.2 Performance ratings

The performance ratings of gas turbines shall be assessed on the net specific energy, or lower heating value (LHV), of the fuel used, as follows:

a) turbines intended for use on liquid fuel: 42 000 kJ/kg;

b) turbines intended for use on gaseous fuel (100 % methane): 50 033 kJ/kg;

c) turbine intended for use on hydrogen (100 % H_2): 119 907,4 kJ/kg;

d) any site specific fuel agreed with the manufacturer.

The specific energy at constant pressure of the fuel, whether liquid, gaseous or solid, is based on a pressure of 101,325 kPa and a temperature of 15 °C.

5.1.3 Fuel

If the fuel to be used for testing the gas turbine is different from that agreed between the purchaser and the manufacturer for service operation, a test fuel of a mutually agreed specification shall be used.

5.2 Power ratings

Net power rating shall be defined taking into consideration the life requirements of the turbine and all operational conditions affecting this life.

NOTE 1 A higher power can be achieved if life is reduced, generally. It is important that the operational conditions (which can be described as “peak”, “baseload”, max. number of starts, etc.) are understood to allow the life to be stated adequately.

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NOTE 2 Operational modes defined per ranges and classes have been used in the past to define where the bulk of the turbine life would be spent.

5.3 ISO standard ratings

The manufacturer shall declare standard ratings, based on electrical power at the generator terminals or on turbine output shaft power under the standard reference conditions defined in Clause 4, associated with the following:

a) ISO standard peak load rating (2 000 h and 500 starts per annum average);

b) ISO standard base load rating (8 760 h and 25 starts per annum average).

In each case, the manufacturer shall state the type, frequency and degree of inspection and/or maintenance required.

5.4 Site ratings

The site power rating shall be specified by the manufacturer as follows.

a) Generating plant: the net electrical power at the generator terminals, with adjustment for auxiliary power as given in ISO 2314:2009, 8.1.2.

b) Mechanical drives: the net shaft power, adjusted for any auxiliaries not driven directly by the turbine (as defined in ISO 2314:2009, 8.1.1).

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In either case, the site power rating shall relate to specified site conditions of the installation (such as ambient pressure and temperature, and pressure losses, steam and water injection, etc.) and operational profile under which the plant is intended to run in service.

When the gas generator is supplied separately, its site power shall be expressed as the gas power arising from the isentropic expansion of the gas generator exhaust flow (using total pressure and temperature) to the ambient atmospheric pressure when it is operated under the specified site conditions of the installation and operating modes under which the plant is intended to run in service.

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