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Gas turbine exhaust systems with or without waste heat recovery

Systèmes d'échappement des turbines à gaz avec ou sans récupération de la chaleur résiduelle

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Foreword

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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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

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.

Introduction

This document has been developed in response to the international market need for a specification relating to the exhaust and heat recovery systems for gas turbines. Purchasers and suppliers will benefit from a standard against which equipment can be purchased, designed and constructed - especially given the challenging nature of the turbulent exhaust gas flow and associated complexity of mechanical design. Equipment is frequently installed in remote and challenging locations both onshore and offshore where maintenance and repair can be prohibitively expensive.

A waste heat recovery unit recovers thermal energy from the waste heat available in gas turbine exhaust gases, exchanged into various heat transfer media such as water, water/glycol mixtures, thermal oils and hydrocarbon gases.

The application of heat recovery devices to gas turbines results in significant thermal efficiency gains and resultant environmental benefit from reduction in CO_2 emissions. Gas turbine exhaust is one of many sources of waste heat energy and can be classed as medium grade within a typical temperature range between 400 °C and 600 °C suitable for Rankine cycle applications.

Gas turbine exhaust systems with or without waste heat recovery

1 Scope

This document specifies requirements and gives recommendations for the design, materials of construction, modelling, controlling, fabrication, inspection, testing, installation, start-up and operation of industrial gas turbine (GT) exhaust systems with or without waste heat recovery unit (WHRU). Gas turbines can be on-shore or off-shore for such sectors as oil and gas, chemical and process industries, utilities, or other intensive energy users.

For this document, the exhaust system means all items in the turbine exhaust gas stream between the GT exhaust gas collector outlet flange and the termination/s to the atmosphere.

The following items are not covered by this document:

— heat recovery steam generator equipment (HRSG);

— supplementary fired systems;

— auxiliary fired systems;

— exhaust gas collector (also known as exhaust plenum);

— fire detection and extinguishing systems;

— emissions controls equipment intended to modify the gaseous composition of the exhaust gas;

— WHRUs that are of the firetube type, where the turbine exhaust gas (TEG) passes through the tubes.

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 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 9614, *Acoustics — Determination of sound power levels of noise sources using sound intensity*

ISO 10494, *Turbines and turbine sets — Measurement of emitted airborne noise — Engineering/survey method*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 12241, *Thermal insulation for building equipment and industrial installations — Calculation rules*

ISO 13704, *Petroleum, petrochemical and natural gas industries — Calculation of heater-tube thickness in petroleum refineries*

ISO 13705:2012, *Petroleum, petrochemical and natural gas industries — Fired heaters for general refinery service*

ISO 13916, *Welding — Measurement of preheating temperature, interpass temperature and preheat maintenance temperature*

ISO 14122, *Safety of machinery — Permanent means of access to machinery*

ISO 14555, *Welding — Arc stud welding of metallic materials*

ISO 15612, *Specification and qualification of welding procedures for metallic materials — Qualification by adoption of a standard welding procedure specification*

ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*

ASME B16.9, *Wrought steel butt-welding short radius elbows and returns*

ASME B31.3, *Petroleum Refinery Piping*

ASTM C680-10, *Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs*

EN 287-1, *Qualification test of welders — Fusion welding — Steels*

EN 1011-2, *Welding — Recommendations for welding of metallic materials — Part 2: Arc Welding of Ferritic Steels*

EN 1991-1-4, *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

EN 10025-2, *Hot rolled products of structural steels — Technical delivery conditions for non-alloy structural steels*

EN 10025-3, *Hot rolled products of structural steels — Technical delivery conditions for normalized/ normalized rolled weldable fine grain structural steels*

EN 10253-2, *Butt-welding pipe fittings. Non alloy and ferritic alloy steels with specific inspection requirements*

EN 13445-3:2014, *Unfired pressure vessels — Part 3: Design*

EN 13480, *Metallic Industrial piping*

EN 15614, *Specification and qualification of welding procedures for metallic materials*

3 Terms and definitions

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

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 http://www.electropedia.org/

3.1
analogue control signal
control or digital signal that represents a continuous range of values

EXAMPLE A traditional 4-20 mA current loop.