BS ISO 7919-4:2009+A1:2017

BSI Standards Publication

Mechanical vibration — Evaluation of machine vibration by measurements on rotating shafts

Part 4: Gas turbine sets with fluid-film bearings

bsi.

National foreword

This British Standard is the UK implementation of ISO 7919-4:2009+A1:2017. It supersedes BS ISO 7919-4:2009, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by ▌A1⟩ ⟨A1▌.

The UK participation in its preparation was entrusted to Technical Committee GME/21/5, Mechanical vibration, shock and condition monitoring - Vibration of machines.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 94286 0

ICS 27.040; 17.160

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2009.

Amendments/corrigenda issued since publication

Date	Text affected
31 October 2017	Implementation of ISO Amendment 1:2017

INTERNATIONAL STANDARD

ISO 7919-4

Second edition
2009-10-01

Mechanical vibration — Evaluation of machine vibration by measurements on rotating shafts —

Part 4: Gas turbine sets with fluid-film bearings

Vibrations mécaniques — Évaluation des vibrations des machines par mesurages sur les arbres tournants —

Partie 4: Turbines à gaz à paliers à film fluide

Reference number
ISO 7919-4:2009(E)

© ISO 2009

COPYRIGHT PROTECTED DOCUMENT

© ISO 2009, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **2**
3 Measurement procedures **2**
4 Evaluation criteria **3**
4.1 General 3
4.2 Criterion I: Vibration magnitude 4
4.2.1 General 4
4.2.2 Vibration magnitude at normal operating speeds under steady-state operating conditions 4
4.2.3 Operational limits for steady-state operation 6
4.2.4 Vibration magnitude during non-steady-state conditions (transient operation) 7
4.3 Criterion II: Change in vibration magnitude under steady-state conditions at normal operating speed 9
4.4 Supplementary procedures/criteria 10
4.5 Evaluation based on vibration vector information 10
Annex A (normative) **Evaluation zone boundaries** **11**
Annex B (informative) **Evaluation zone boundary limits and bearing clearance** **13**
Bibliography **14**

© ISO 2009 – All rights reserved

Foreword

A1 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures.*

This second edition cancels and replaces the first edition (ISO 7919-4:1996), which has been technically revised. The main changes are:

— clarification that the document applies only to gas turbine sets with fluid-film bearings;

— emphasis on acceptance specifications always being agreed on between the supplier and the purchaser of the gas turbine set prior to installation;

— the addition of provisions for evaluating the vibration of coupled gas turbine sets during transient operation;

— closer alignment of this part of ISO 7919 with ISO 10816-4 .

A list of all parts in the ISO 7919 series can be found on the ISO website. A1

 © ISO 2009 – All rights reserved

Introduction

[A1] ISO 20816-1 gives general guidelines for evaluating the vibration of various machine types when the vibration measurements are made on rotating and on non-rotating (and, where applicable, non-reciprocating) parts of complete machines.[A1] This part of ISO 7919 gives specific provisions for assessing the severity of radial shaft vibration measured at, or close to, the bearings of gas turbine sets. Measurements at these locations characterize the state of vibration reasonably well. Evaluation criteria, based on previous experience, are presented. These can be used for assessing the vibratory condition of such machines.

Two criteria are provided for assessing the machine vibration when operating under steady-state conditions. One criterion considers the magnitude of the observed vibration; the second considers changes in the magnitude. In addition, different criteria are provided for transient operating conditions. However, shaft vibration does not form the only basis for judging the severity of vibration. For gas turbine sets, it is also common to judge the vibration based on measurements taken on non-rotating parts. For such vibration measurement requirements, see [A1]ISO 20816-1[A1] and ISO 10816-4 .

The evaluation procedures presented in this part of ISO 7919 are based on broad-band measurements. However, because of advances in technology, the use of narrow-band measurements or spectral analysis has become increasingly widespread, particularly for the purposes of vibration evaluation, condition monitoring and diagnostics. The specification of criteria for such measurements is beyond the scope of this part of ISO 7919. They are dealt with in greater detail in ISO 13373 (all parts), which establish provisions for the vibration condition monitoring of machines.

© ISO 2009 – All rights reserved

This page deliberately left blank

INTERNATIONAL STANDARD **ISO 7919-4:2009+A1:2017(E)**

Mechanical vibration — Evaluation of machine vibration by measurements on rotating shafts —

Part 4: Gas turbine sets with fluid-film bearings

1 Scope

This part of ISO 7919 establishes provisions for evaluating the severity of *in-situ*, broad-band shaft vibration measured radial (i.e. transverse) to the shaft axis at, or close to, the main bearings. These are in terms of:

— vibration under normal steady-state operating conditions;

— vibration during other (non-steady-state) conditions when transient changes are taking place, including run up or run down, initial loading and load changes;

— changes in vibration which can occur during normal steady-state operation.

This part of ISO 7919 is applicable to heavy-duty gas turbine sets used in electrical and mechanical drive applications, with fluid-film bearings, outputs greater than 3 MW and an operating speed range under load between 3 000 r/min and 30 000 r/min. This includes gas turbines coupled to other rotating machinery either directly or through a gearbox. In some cases, this part of ISO 7919 is not applicable to the evaluation of the vibration of the coupled equipment (see the list of exclusions in this clause).

EXAMPLE For single-shaft combined-cycle power units in which a gas turbine is coupled to a steam turbine and/or generator, the evaluation of the gas turbine vibration is according to this part of ISO 7919, but that of the steam turbine and generator is according to [A1] text deleted [A1] ISO 7919-3 .

[A1] This part of ISO 7919 is not applicable to the following:

a) aero-derivative gas turbines (including gas turbines with dynamic properties similar to those of aero-derivatives);

NOTE ISO 3977-3 defines aero-derivatives as aircraft propulsion gas generators adapted to drive mechanical, electrical or marine propulsion equipment. Large differences exist between heavy-duty and aero-derivative gas turbines, for example in casing flexibility, bearing design, rotor-to-stator mass ratio and mounting structure. Different criteria therefore apply for these two turbine types.

b) gas turbines with outputs greater than 40 MW and with rated speeds of 1 500 r/min, 1 800 r/min, 3 000 r/min or 3 600 r/min (see ISO 20816-2);

c) gas turbines with outputs less than or equal to 3 MW (see ISO 7919-3);

d) gas turbine driven rotodynamic pumps (see ISO 7919-3 and ISO 10816-7);

e) coupled steam turbines and/or generators with outputs less than or equal to 40 MW (see ISO 7919-3);

f) coupled steam turbines and/or generators with outputs greater than 40 MW and speeds of 1 500 r/min, 1 800 r/min, 3 000 r/min or 3 600 r/min (see ISO 20816-2);

g) coupled steam turbines and/or generators with outputs greater than 40 MW and speeds other than 1 500 r/min, 1 800 r/min, 3 000 r/min or 3 600 r/min (although generators seldom fall into this category) (see ISO 7919-3);

© ISO 2009 – All rights reserved