

Mechanical vibration — Evaluation of machine vibration by measurements on non-rotating parts —

**Part 6: Reciprocating machines with
power ratings above 100 kW**

ICS 17.160

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

National foreword

This British Standard is the UK implementation of ISO 10816-6:1995+A1:2015. It supersedes BS 7854-6:1996 which is withdrawn.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 by Technical Committee GME/21, Mechanical vibration, shock and condition monitoring, to Subcommittee GME/21/5, Mechanical vibration, shock and condition monitoring - Vibration of machines. A list of organizations represented on this subcommittee 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.

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

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 June 1996

© The British Standards Institution 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 87049 1

Amendments/corrigenda issued since publication

Date	Comments
30 June 2015	Implementation of ISO amendment 1:2015. This standard has also been renumbered as BS ISO 10816-6:1995

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	2
3 Definitions	2
4 Measurements	2
5 Vibration criteria	4
Annex A (normative) Machine vibration classification	5
Annex B (informative) Forms for vibration measurements on reciprocating machines	6
Annex C (informative) Vibration severity grade nomograph	8
Annex D (informative) Bibliography	9
Figure 1 — Example of a vertical in-line machine	3
Figure 2 — Example of a multicylinder Vee machine	3
Figure 3 — Example of a horizontal opposed machine	3
Figure C.1 — Vibration severity grade nomograph	8
Table 1 — Vibration severity grades	4
Table 2 — Example of vibration values	4
Table A.1 — Vibration classification numbers and guide values for reciprocating machines	5
List of references	Inside back cover

This page deliberately set blank

Introduction

ISO 10816-1 gives general guidelines for the evaluation of machine vibration by measurements on non-rotating parts. This part of ISO 10816 is a new document which establishes procedures and guidelines for the measurement and classification of mechanical vibration of reciprocating machines. In general, this part of ISO 10816 refers to vibration of the main structure of the machine, and the guide values given for these vibrations are defined primarily to classify the vibration of the machine and to avoid problems with auxiliary equipment mounted on this structure. Recommendations for measurements and evaluation criteria are provided in this part of ISO 10816.

Typical features of reciprocating machines are the oscillating masses, the cyclically varying output (input) torques and the pulsating forces in the associated pipework. All these features cause considerable alternating forces on the main supports and vibration amplitudes of the main frame. The vibration amplitudes are generally higher than for rotating machinery but, since they are largely determined by the design features of the machine, they tend to remain more constant over the life of the machinery than for rotating machinery.

In the case of reciprocating machines, the vibration measured on the main structure of the machine and quantified according to this part of ISO 10816 may only give a rough idea of the stresses and vibratory states of the components within the machine itself. For example, torsional vibration of rotating parts cannot generally be determined by measurements on the structural parts of the machine. The damage, which can occur when exceeding the guide values based on experience with similar machines, is sustained predominantly by machine-mounted components (e.g. turbochargers, heat-exchangers, governors, filters, pumps), connecting elements of the machine with its peripheral parts (e.g. pipelines) or monitoring instruments (e.g. pressure gauges, thermometers). The question as from which vibration values damage is to be expected largely depends on the design of these components and their fastenings.

In some cases, special measurements on certain machine components will be required to ascertain that the vibration values are permissible. It also happens that even if measured values are within permissible guide values, problems may occur owing to the great variety of components which can be attached. Such problems can be, and have to be, rectified by specific “local measures” (e.g. by elimination of resonances). Experience has shown, however, that it is possible in the majority of cases to state measurable quantities characterizing the vibratory state and to give guide values for these. This shows that the measurable variables and the guide values permit a reliable evaluation in most cases. For the quantity described, which characterizes the vibration values of reciprocating piston machines in a simple manner, the term “vibration severity” will be used.

The vibration values of reciprocating piston machines are not only affected by the properties of the machine itself but also to a large degree by the foundation. Since a reciprocating machine can act as a vibration generator, vibration isolation between the machine and its foundation may be necessary. This, as well as the vibration response of the foundation, can have considerable effect on the vibration of the machine itself. These vibration conditions are also dependent on the transmissibility of the environment surrounding the machine and are therefore not entirely determined by the vibration values of the machine itself. This part of ISO 10816 can therefore only take an advisory role in relation to the effects of the machine on the environment.

1 Scope

This part of ISO 10816 specifies the general conditions and procedures for the measurement and evaluation of vibration, using measurements made on the non-rotating and non-reciprocating parts of complete machines. Shaft vibration, including torsional vibration, is beyond the scope of this part of ISO 10816.

It generally applies to reciprocating piston machines mounted either rigidly or resiliently with power ratings of above 100 kW. Typical examples of application are: marine propulsion engines, marine auxiliary engines, engines operating in diesel generator sets, A_1 reciprocating pumps A_1 and engines for diesel locomotives.

The general evaluation criteria which are presented relate to both operational monitoring and acceptance testing. They are also used to ensure that the machine vibration does not adversely affect the equipment directly mounted on the machine.