

ICS 17.160
CCS J 04



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

GB/T 33199.1-2016

**Mechanical vibration -- Torsional vibration of rotating
machinery -- Part 1: Land-based steam and gas turbine
generator sets in excess of 50 MW**

机械振动 旋转机械扭振 第1部分：50MW以上陆地安装的透平和燃气轮机发电机
组

(English Translation)

Issued on: December 13, 2016

Implemented on: July 1, 2017

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine of the People's Republic of China**

Table of Contents

- Preface
- Introduction
- 1 Scope
- 2 Normative reference document
- 3 Terms and definitions
- 4 Torsional vibration basic principles
 - 4.1 Overview
 - 4.2 Effects of leaves

Foreword

This part is part 1 of GB/T 33199 "Mechanical vibration rotary machinery torsional vibration".

This part is drafted in accordance with the rules given in GB/T 1.1-2009.

This part uses the translation method equivalent to ISO 22266-1.:2009 "Mechanical vibration Rotary machinery Torsional vibration Part 1. 50MW Onshore installation of turbines and gas turbine generators "(in English).

In this part of the normative reference to the international documents have a consistent correspondence between the following documents.

GB/T 2298-2010 Mechanical vibration, shock and condition monitoring vocabulary (ISO 2041.:2009, IDT) GB/T 1883.1-2005 Reciprocating internal combustion engine vocabulary - Part 1. Engine design and operation terms (ISO 2710-1.

2000, IDT)

GB/T 1883.2-2005 Reciprocating internal combustion engine vocabulary - Part 2. Engine maintenance terminology (ISO 2710-2.:1999, IDT) this part of the National Mechanical Vibration, Impact and Condition Monitoring Standardization Technical Committee (SAC/TC53) proposed and centralized.

This part of the drafting unit. Xi'an Thermal Engineering Research Institute Co., Ltd., Nanjing Gas Turbine Research Institute, Nanyang explosion-proof Group Co., Ltd., North Beijing North Heavy Steam Turbine Motor Co., Ltd., State Grid Henan Electric Power Company Electric Power Research Institute, Southeast University, North China Electric Power University, Dongfang Electric Group Dongfang Electric Co., Ltd., Shanghai Power

Equipment Complete Design and Research Institute.

This part of the main drafters. Zhang Xueyan, Ge Xiang, Tu Yali, Wang Zewei, An Shengli, Luo Jianbin, Fu Xingjun, Fu Zhongguang, Chen Changlin, He Guoan.

Introduction

In the 1970s, there were many major accidents due to torsional vibration in the power plant, resulting in a low-pressure turn of the generator rotor and some turbines Sub-long leaves of the damage. The cause of the accident is usually the coupling mode frequency of the shaft and the blade system coincides with the excitation frequency of the grid.

Vibration Subsequent detailed studies have shown that the mathematical model used to predict the natural frequency of the torsional vibration is not comprehensive enough.

Have enough precise consideration of the coupling relationship between the long blade and the shaft. Thus, further research work more accurately analyzes leaf - leaf the influence of the coupling effect on the calculation of the natural frequency of the torsional vibration of the shaft system is taken into account.

In the 1980s, in order to verify the frequency of the predicted low-pressure rotor blade-impeller dynamics coupling system, Rotational force test. These tests in the factory are very useful for confirming the necessary corrective measures before service. However, yes it is usually not possible to test all the rotor parts assembled as shafts. Therefore, unless the test is installed in the overall situation of the scene , Otherwise the overall system model and the actual installation of the machine is still there are differences.

Taking into account the calculated and measured torsional vibration of the natural frequency of the inevitable inevitably there is a certain degree of uncertainty, therefore, in the design of the entire system, it is necessary to make the torsional vibration natural frequency and the grid system frequency enough to avoid the margin to compensate for these deviations. Acceptable margin is a change , Depending on the degree of coincidence of the torsional vibration frequency and the calculated result determined by the test. The purpose of this part of this standard is to design the unit and the site is fully connected with the machine to select the frequency to avoid the margin to provide a guide.

In general, the only concern is whether a natural frequency is consistent with an excitation frequency within the frequency limits specified in this section, and whether There is some modal distribution that allows the energy to be supplied to the corresponding vibration modes. The natural frequency that does not satisfy these two conditions does not have practical consequences.

In other words, if a particular vibration mode can not be excited, this vibration mode is irrelevant. In this section, the excitation is due to changes in the electromechanical torque induced in the generator air gap. Any torsional vibration of the shaft that is insensitive to

these excitation torques State, regardless of the natural frequency of the modal, is not dangerous to the entire turbine generator (see 4.2 and 5.2).

Mechanical vibration rotating machinery torsional vibration Part 1. Land installation above 50MW Turbine and Gas Turbine Generators

1 Scope

This part of GB/T 33199 specifies the torsional vibration of the coupling shaft of a turbine with a long blade installed under normal operating conditions Then, especially for the grid-connected turbine generator coupling shaft torsional vibration of the natural frequency to avoid the grid frequency and 2 times the line frequency the scope of the. If the torsional vibration frequency does not meet the specified frequency range, it also specifies the measures that the supplier can take.

This section applies to land-mounted rated power greater than 50 MW, rated speed of 1500r/min, 1800r/min, 3000r/min, 3600r/min power plant turbine generator set and the speed of 3000r/min, 3600r/min power station gas turbine Motor group.

In this part, the method of analyzing and evaluating the natural frequency of torsional vibration of shaft system is given.

2 Normative reference documents

The following documents are indispensable for the application of this document. For dated references, only the dated edition applies to this article Pieces. For undated references, the latest edition (including all modifications) applies to this document.

ISO 2041 Mechanical vibration, shock and condition monitoring vocabulary (Mechanical vibration, shockandconditionmonito-ring-Vocabulary ISO 2710-1 Reciprocating internal combustion engine vocabulary - Part 1. Engine design and operation terms (Reciprocatinginternal combustionengines-Vocabulary-Part 1. Termsforenginedesignandoperation) ISO 2710-2 Reciprocating internal combustion engine vocabulary - Part 2. Engine maintenance terms (Reciprocatinginternal combustionengines-Vocabulary-Part 2. Termsforenginemaintenance)

3 Terms and definitions

ISO 2041, ISO 2710-1, ISO 2710-2 and the following terms and definitions apply to this document.

Unit set

A system formed by assembling one or more components in a high pressure, medium pressure, low pressure turbine and generator, exciter.

Shafts

All the rotating parts of the unit are fully connected to the assembled rotating system.

Note 1: Figure 1 shows an example of a shaft.

Note 2: When calculating the torsional vibration natural frequency, the entire shaft system must be considered.

Torsional vibration

The rotation of the rotary shaft by the angular displacement (twist) of the oscillation.