AS 3764—1990
ISO 4867—1984

Australian Standard®

The measurement and reporting of shipboard vibration data

This Australian Standard was prepared by Committee AV/8, Vibration and Shock — Instrumentation and Measurement. It was approved on behalf of the Council of Standards Australia on 14 December 1989 and published on 11 June 1990.

The following interests are represented on Committee AV/8:

Australian Environment Council
Australian Gas Association
Confederation of Australian Industry
CSIRO, Division of Applied Physics
Department of Defence
Department of Industrial Relations and Employment, N.S.W.
Monash University
National Association of Testing Authorities Australia
Royal Institution of Naval Architects
Water Board Sydney

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PREFACE

This Standard was prepared by the Standards Australia Committee on Vibration and Shock—Instrumentation and Measurement. It is identical with and has been reproduced from ISO 4867—1984, *Code for the measurement and reporting of shipboard vibration data*.

For the purposes of this Australian Standard, the ISO text should be modified as follows:

(a) Substitute a point (.) for a comma (,) as a decimal marker.

(b) The references to other publications should be replaced by references to Australian Standards:

Reference to International Standard		*Australian Standard*	
ISO		AS	
4868	Code for the measurement and reporting of local vibration data of ship structures and equipment	3762	Measurement and reporting of local vibration data of ship structures and equipment
6954	Mechanical vibration and shock—Guidelines for the overall evaluation of vibration in merchant ships	3763	Mechanical vibration and shock—Guidelines for the overall evaluation of vibration in merchant ships

Contents

Measurement and reporting of shipboard vibration data

0 Introduction

The need for comparative data on ship vibration requires uniform test conditions. In general, comparative data can best be obtained during ship trials with known ballast loading. The relatively uniform vibration resulting from propulsion machinery excitation (turbine or diesel drive) can be masked or distorted by transient vibrations due to wave impact or slamming. Changes in wake distribution due to rudder angle and yaw can produce large increases in exciting forces. Operation in shallow water also has a significant effect on hull vibration. Propeller emergence, whether continuous or periodic, causes large increases in exciting forces. The effect of lateral vibration of the aft part of line shafting on hull and superstructure vibration should also be considered.

The aft part of the line shaft may have a lateral resonant frequency within the speed range of the ship which can be excited to strong vibrations by either unbalance or propeller forces.

Alternating thrust forces may cause dangerous vibration of the thrust bearing or machinery as a result of a longitudinal resonance in the propulsion system.

Diesel engines may vibrate about the three rotational axes and three translational axes and generate large forces which in turn may cause largeship vibrations.

The principal response of a ship hull is usually similar to that of a free-free beam in its lower modes. At higher frequencies, the response of the hull girder is equivalent to a forced response with ill-defined resonances and maximum response in the stern area. The stern area is an antinode for all bending and torsional modes excited by the propulsion system and is an appropriate reference point for the measurement of beam-like vibration and forced response. The response of superstructures and local structures may be evaluated in terms of the ratio of their vibratory amplitude to the amplitude of hull girder vibration at that location.

In this International Standard, the term “vibration severity” is used to describe the vibration conditions in the ship and, based on long-established practice in the industry, the peak value of vibration velocity has been chosen as the primary quantity of measurement; since, however, much data have been accumulated in terms of vibration acceleration and vibration displacement, a plotting sheet has been adopted on which data may easily be plotted using any of these quantities of measurement .

1 Scope and field of application

This International Standard establishes uniform procedures for gathering and presenting data:

a) on hull vibration in single or multiple-shaft sea-going merchant ships;

b) for vibration of propulsion-shaft systems as it affects hull vibration.

Such data are necessary to establish uniformly the vibration characteristics of hull and propulsion-shaft systems and to provide a basis for design predictions, improvements and comparison against vibration reference levels.

The procedures, where applicable, can also be used for inland ships and tug boats. In special cases, where objectionable vibration is found to exist, specific investigative studies may be required.

This International Standard is concerned with:

a) vibration of the main hull girder and superstructure excited by the propulsion system

— at shaft rotational frequency,

— at propeller blade rate, harmonics of blade rate and

— at frequencies associated with the major components of machinery;

b) excitation of the propulsion shaft and main machinery system.

It does not deal with other aspects of ship vibration at this time. Local vibration is dealt with in ISO 4868.

Anchor drop-and-snub tests in calm water may be an effective means of obtaining the first few vertical hull modes of vibration and their damping constants (see warning in 4.5.5).

Detailed design information on the ship is required to assist in developing empirical constants useful in evaluating the vibration of hull and machinery vibratory characteristics.

This International Standard gives general principles of vibration measurement on board ships to improve vibration engineering. Therefore, in individual cases, items to be measured may be selected or added to meet the aims of the vibration measurement of each ship.