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Ships and marine technology — Piping and machinery — Ballast water sampling and analysis

Part 1: Discharge sampling port

National foreword

This British Standard is the UK implementation of ISO 11711-1:2013.

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Part 1: Discharge sampling port

Navires et technologie maritime — Tuyauterie et machines — Échantillonnage et analyse de l'eau de ballast —

Partie 1: Appareillage de prélèvement à l'évacuation

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Contents

Page

Foreword

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The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

ISO 11711 consists of the following parts, under the general title *Ships and marine technology — Piping and machinery — Ballast water sampling and analysis*:

— *Part 1: Discharge sampling port*

The following parts are under preparation:

— *Part 2: On-board ballast water sampling and sample processing*

— *Part 3: Analyses of ballast water samples*

Introduction

This part of ISO 11711 provides guidance to shipboard personnel and other concerned parties on the design and installation of the sampling port required to obtain representative samples of ballast water from the ballast water discharge piping prior to discharge. Parts 2 and 3 of this part of ISO 11711 will provide guidance on how to handle and process the samples on board the vessel, and on how to analyse the samples to determine compliance with ballast water discharge requirements, respectively.

Although it is recognized that sampling of the actual tanks is possible through various methods, the primary concern for port and flag state officials is verification of the efficacy of the ballast water management system (BWMS) in preventing the unwanted discharge. The only true way to measure what is being sent overboard in ballast water is to sample the ballast discharge as near as possible to the actual overboard.

NOTE This part of ISO 11711 is written for sampling after the BWMS treatment, and prior to the discharge of ballast water, in order to assess the effectiveness of the BWMS. However, sample ports can also be installed elsewhere on a vessel for other purposes, such as experimental assessment of prototype BWMSs. In such cases, similar sample ports could also be installed prior to the treatment (ballast uptake side) in order to make a comparison between the ballast uptake and discharge.

Ships and marine technology — Piping and machinery — Ballast water sampling and analysis —

Part 1: Discharge sampling port

1 Scope

This part of ISO 11711 provides guidance to shipboard personnel and other concerned parties on the materials, design, and installation of equipment used to take samples of treated ballast water from the ballast water discharge pipe onboard a vessel. The purpose of the sampling system is to enable the taking of a representative sample in order to verify that the ballast water management system (BWMS) is working as designed, i.e. the treatment is reducing the concentration of living organisms to levels established in discharge standards. The intent of the sampling installation is to provide a representative sample of the ballast water effluent with adequate pressure and flow.

2 Normative references

The following referenced documents are indispensable for the application 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 14726, *Ships and marine technology — Identification colours for the content of piping systems*

ISO 15614 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure test*

3 Terms and definitions

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

3.1
ballast water
water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship

3.2
ballast water system
arrangement of pumps, piping and tanks on ships used to control vessel trim, draft and stability

Note 1 to entry: Benefits of this system can include increased propeller immersion and improved steering. One disadvantage of ballast water systems is the potential dispersal of harmful aquatic organisms.

3.3
ballast water management system
BWMS
equipment that processes ballast water such that the water discharged (the treated water) meets the specified performance requirements for elimination of harmful aquatic organisms

Note 1 to entry: The BWMS includes all associated control equipment, monitoring equipment, and sampling facilities.

3.4
sampling point
place in the ballast water piping where the sample is taken

3.5
sampling port
equipment installed to take the sample

3.6
treatment
process or combination of mechanical, physical, or chemical methods to kill, remove or render infertile, harmful or potentially harmful organisms within ballast water

4 Sampling port design

4.1 Colour

The sampling port and any associated piping, particularly valve handles, shall be appropriately couloured green in accordance with ISO 14726 to indicate a sea water system.

4.2 Materials

In order to prevent galvanic corrosion and potential leaking or flooding, the sampling port flange, piping and valves should be constructed of the same or galvanically compatible material as the ballast water discharge piping and be mechanically suitable for potential long-term installation.

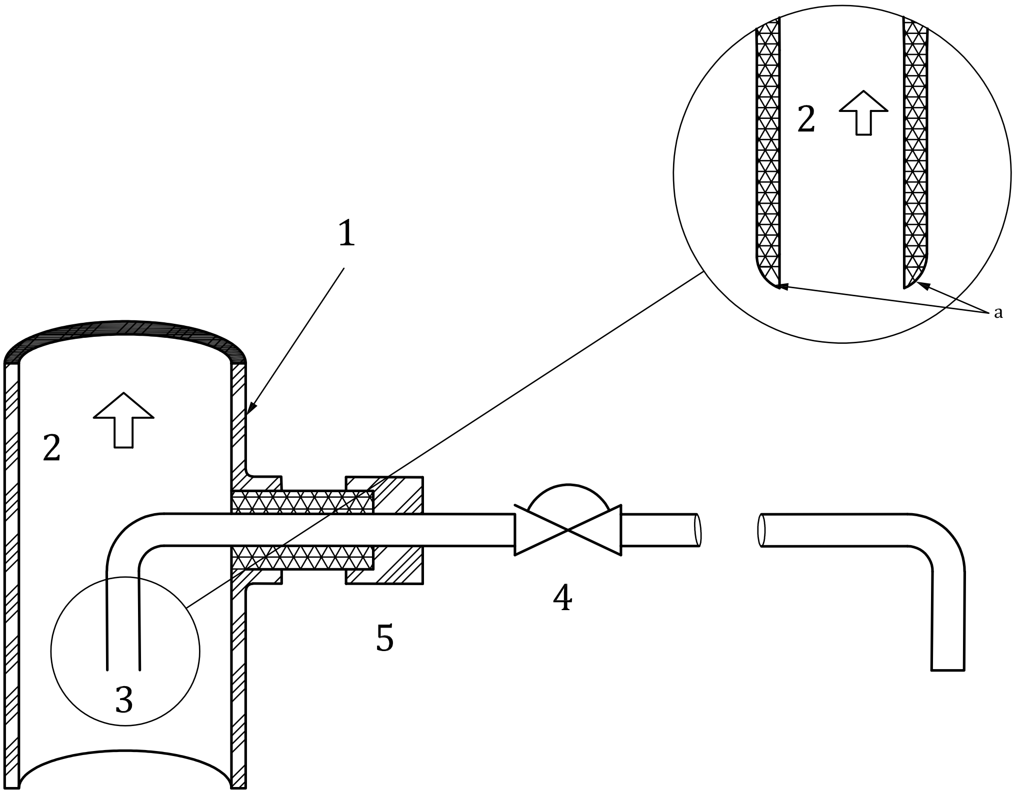
4.3 Configuration of a semi-permanent sample port

Samples shall be taken from the discharge line as near to the point of discharge as practicable and the location of the sample port shall take this into consideration. The sample port shall incorporate a system similar to that shown in Figure 1. A one-valve configuration such as in Figure 1 may be used provided the sampling pipe end is fitted with a removable pipe cap. As an alternative, a two-valve system may also be used, where the valve closest to the main ballast water discharge piping is designed to be either fully open (sampling mode) or fully closed. The second (sampling) valve should be a valve that does not cause organism mortality, such as a diaphragm valve. A flanged configuration provides for easy removal of the sample pipe for cleaning, repair or replacement.

Additional guidelines on sample port diameter sizing are contained in IMO Resolution MEPC.173(58) Annex, emphasizing the need for isokinetic (constant velocity) sampling.

The length of straight sample pipe (see Figure 1) facing into the flow can vary, but should not be less than one diameter of the sampling pipe. The radius of the pipe bend should be a minimum of 3 X diameter of sample pipe. The opening should face into the flow and be rounded at the edges to provide a smooth transition.

The sample port should be located within the central half of the main pipe (within one-half the radius of the main pipe axis) to ensure the sample is obtained from the well developed portion of turbulent flow and is thus representative.



Key

1 ballast water discharge pipe

2 direction of flow

3 ballast water sample intake pipe

4 diaphragm valve

5 pipe flange

a Rounded edges.

Figure 1 — Sample port design (sample pipe centre-located within R/2 of main pipe axis)

NOTE Dimensions and materials can vary depending on design and materials of main ballast water discharge pipe. However, the shape of the sampling pipe should be curved as indicated in Figure 1 to provide the smoothest flow possible.

4.3.1 Sample intake pipe

It is recommended that the sample intake pipe be standardized based on current or anticipated demands for ballast sample volumes and practical limits on such equipment. For example, if three tons of ballast water must be collected over a period of one hour, then the sampling port should support that demand.

NOTE It is uncommon for ballasting rates to exceed 3,65 m/s (12 feet per second), and possible for rates to reach near zero at the end of gravitating ballast.

Sample port size should be based on the combination of maximum sample flow rate and minimum ballast flow rate that yields the largest isokinetic diameter.

Thus, sampling should be understood before sizing the sample tube. The isokinetic diameter should be determined as follows:

$$D\text{iso} = D\text{m} \sqrt{(Q\text{iso} / Q\text{m})}$$

where

Diso, diameter of the sample port opening;

Dm, diameter of the main discharge line;

Qiso, volumetric flow through the sample port; and

Qm, volumetric flow through the discharge line.

The sample port diameter should be between 1,5 and 2 times the isokinetic diameter.

Sample port size is determined as follows. Determine the sample flow rate (Qiso) based on requisite sample volume and duration of sample collection. Using the diameter of the main ballast discharge line (Dm) and minimum and maximum ballast flow rates (Qm), determine the isokinetic diameter (Diso) at requisite sample flow. Size the sample port according to the nearest available pipe size that is 1,5 to 2 x Diso.

Table 1 provides example sample port sizing given a range of sample flows between 2,47 m^3/h and 211,94 m^3/h and typical ballast velocities between 1,21 m/s to 3,65 m/s. (See Table 1).

Table 1 — Example sample port size, ballast main velocity and sample flow rate

Ballast main velocity(m/s)	**Sample port size (in)**								
	0,75	1,00	1,25	1,50	2,00	2,50	3,00	3,50	4,00
	Sample port size (cm)								
	1,91	2,54	3,18	3,81	5,08	6,35	7,62	8,89	10,16
	Sample flow rate (m^3/h)								
3,65	7,45	13,25	20,70	29,80	52,98	82,79	119,21	162,26	211,94
2,43	4,96	8,82	13,78	19,84	35,27	55,12	79,37	108,03	141,10
1,21	2,47	4,39	6,86	9,88	17,56	27,44	39,52	53,79	70,26

4.3.2 Valve

If flow control of the sample flow rate is required, ball, gate, and butterfly valve types shall be avoided as they may cause significant shear forces which may result in organism mortality. For flow control, diaphragm valves or similar valve types shall be used to minimize sharp velocity transitions. For flow distribution, ball valves may be utilized in such a manner that they are either fully open or closed.

The valves shall be capped with a tamper proof seal that shall be broken only when sampling is performed by authorized persons.

4.4 Installation

In general, the sample port shall be installed after the treatment system and prior to overboard discharge, in order to verify the effectiveness of the treatment and to best ascertain the condition of the ballast water that is being discharged overboard.

Before any work is done to install sampling ports on existing ballast water discharge piping, the piping shall be certified isolated from system pressure and any potential ingress of water from the sea.

4.4.1 Location of the sample port in the ballast system

Sample ports should be installed in a section of the discharge pipe with as long a run of pipe as practicable, upstream and down, without elbows, tees or other fittings to avoid the negative effects of such fittings on flow conditions in the discharge line. Ideal sampling is from a long, straight vertical pipe section. In any case, computational fluid dynamics should be conducted to determine whether the location of the sampling point is appropriate for taking a representative sample.

4.4.2 Installation at the selected point

Sample piping shall be installed by the welding process in accordance with ISO 15614 procedures, classification society rules, or other international or national standards approved by the authority having jurisdiction in ship modifications.

There shall be a clear label or marking on the sampling piping or valves indicating the purpose of the assembly.

Annex A
(informative)

Sample pipe velocity profiles

A.1 General

Figure A.1 provides an example of sample piping velocity and flow trajectories.

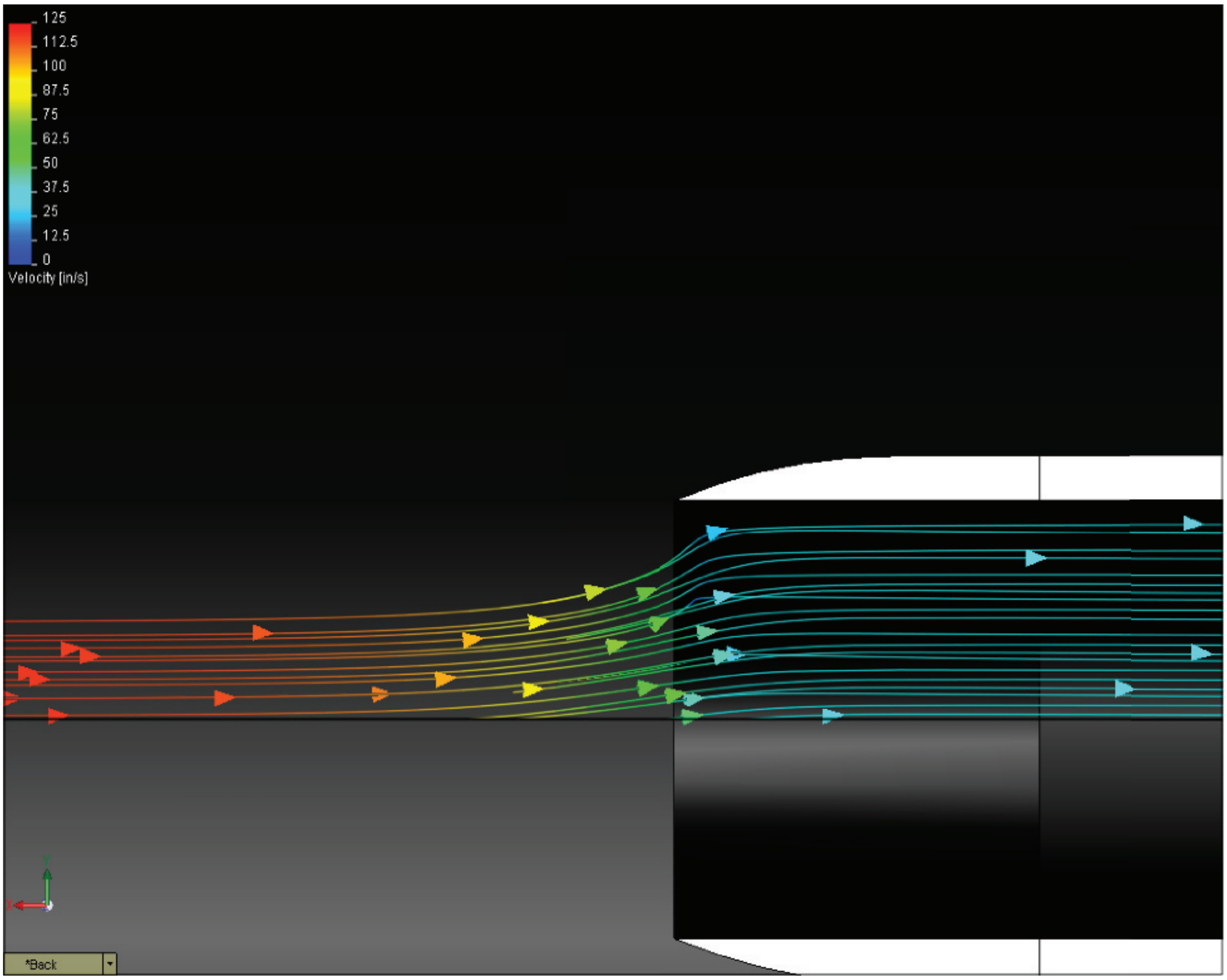


Figure A.1 — Example velocity and flow trajectories

Source: US. Department of Homeland Security, US. Coast Guard Research and Development Center, Analysis of Ballast Water Sampling Port Designs Using Computational Fluid Dynamics, Report No. CG-D-01-08, February 2008

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[1] International Maritime Organization (IMO), Marine Environmental Protection Committee (MEPC), Resolution MEPC.174(58), Guidelines for approval of ballast water management systems (G8)

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