BSI Standards Publication

Ships and marine technology — Marine environment protection — Oil booms

Part 1: Design requirements

National foreword

This British Standard is the UK implementation of ISO 17325-1:2014.

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Ships and marine technology — Marine environment protection — Oil booms —

Part 1: Design requirements

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Partie 1: Exigences de conception

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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 2, *Marine environment protection*.

ISO 17325 consists of the following parts, under the general title *Ships and marine technology — Marine environment protection — Oil booms*:

— *Part 1: Design requirements*

The following parts are under preparation:

— *Part 2: Strength and performance requirements*

— *Part 3: End connectors*

— *Part 4: Auxiliary equipment*

Introduction

Oil booms can be classified in two major types:

— fence booms typically provide a stiffened barrier designed to float vertically in the water; and

— curtain booms are provided with flexible material for the underwater portion of the membrane (called the skirt).

There are other types of booms, such as special purpose booms and sorbent booms, which are not the subject of this part of the International Standard.

All parts of ISO 17325 will give some general guidelines for manufacturers as well as users with regard to subjects associated with producing, purchasing, and using such types of equipment. It will not define any specific type and size of boom for a particular application, as many variables have to be taken into consideration.

This part of ISO 17325 specifies the basic design requirements, general function, designations and marking of oil booms. It further specifies minimum information regarding design, dimensions and materials of oil booms to be provided by the manufacturer.

This International Standard has been developed after considering the below standards and national legislative requirements.

The American Society for Testing and Materials (ASTM) Committee F-20 has prepared two standards relating to boom connectors. ASTM F1093 specifies static laboratory tests of the strength of an oil spill response boom under tensile loading. ASTM F1523 provides a guide on the selection of a containment boom that may be used to control spills of oil and other substances that float on the water.

The Japanese Industrial Standard JIS F 9900 (Parts 1 and 2) provides the necessary conditions and specifications for the design, manufacture, etc. of oil booms.

Ships and marine technology — Marine environment protection — Oil booms —

Part 1: Design requirements

1 Scope

This part of ISO 17325 specifies the basic design requirements, general function, designations and marking of oil booms. It further specifies minimum information regarding design, dimensions and materials of oil booms to be provided by the manufacturer.

The intent of this International Standard is to assist manufacturers and facilitate user selection of booms by technical criteria. It does not purport to address all aspects of booms or safety concerns associated with boom use, nor does it define boom operational procedures. It is the responsibility of the user of this International Standard to establish the appropriate safety and health practices, and determine applicability of regulatory limitations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

International Maritime Organization, Manual on Oil Pollution, Section IV, Combating Oil Spills, IMO 596E, London, 2004

ISO 34-1:2010, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*

ISO 505:1999, *Conveyor belts — Method for the determination of the tear propagation resistance of textile conveyor belts*

ISO 1817:2011, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 16165:2013, *Ships and marine technology — Marine environment protection — Terminology relating to oil spill response*

ISO 17325-2, *Ships and marine technology — Marine environment protection — Oil booms — Part 2: Strength and performance requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16165, ASTM F1093, and the following apply.

3.1
end connector
device attached to the boom used for joining boom sections to one another or to other accessory devices

3.2
gross buoyancy
weight of fresh water displaced by an entire boom section when totally submerged

3.3
oil containment boom
floating barrier used to control the movement of substances that float

3.4
operational draught
minimum vertical depth of the boom below the waterline in the working condition

3.5
operational freeboard
minimum vertical height of the boom above the waterline in the working condition

3.6
tensile strength
force required to stretch boom material to the point where it fails and tears apart

4 Boom design

4.1 Application

A boom is dedicated for use in water. As its main purpose is to control the movement and/or stop spreading of an oil slick and other substances on the water surface, it has to be both above and below the water surface.

4.2 Environmental considerations

Design and production of booms shall occur in the most environmentally friendly manner. The boom and its components shall not contain any substances of potential risk to health and/or the environment, e.g. lead and tributyltin (TBT), or any other substances regulated by international/national/local legislation.

4.3 Parts of booms

In general, a boom consists of, but is not limited to the following parts:

— boom wall;

— buoyancy chamber;

— skirt;

— tension member;

— ballast member;

— end connector;

— anchor points.

4.4 Types of booms

4.4.1 General

By intended application, booms can generally be categorized as follows.

4.4.2 Curtain boom

A boom which is supported by floatation that is symmetric in the vertical cross-section. The skirt is flexible in relation to the buoyancy chamber. High buoyancy to weight ratio gives good wave response.

Often it is used in offshore conditions. The boom material usually consists of PVC-, PU-, or rubber-coated synthetic fabrics.

4.4.3 Fence boom

A boom which consists of a self-supporting or stiffened membrane supported by floatation, which is rigid in the vertical cross-section, and usually has solid floats as buoyancy material. Fence booms are often used in areas with no or limited waves.

4.4.4 Fire resistant boom

A boom intended for containment of a burning oil slick and used for *in situ* burning. The main criterion of the boom is fire resistance of the boom material above the waterline. Although most of the fire resistant boom types will only be used once, some have a cooling system incorporated which could allow the boom to be used more times. Other fire resistant booms are made of stainless steel and can also be reused.

4.4.5 Shore sealing boom

A boom that, when grounded, seals against the shoreline. It is a special type of boom used in inter-tidal zones. It is normally designed with two lower parallel water chambers and one top air chamber. This design creates an oil tight seal when the boom is situated directly on the beach or river bank. The top air chamber ensures the boom will float when in the water.

5 Boom functions and configurations

5.1 General

Functions of booms are normally divided into the following categories.

5.2 Containment

A boom is used to keep the oil from uncontrolled or unintended movement during oil spill response scenarios.

5.3 Deflection

A boom that can be deployed before an oil slick reaches the shoreline in order to protect a specific location by guiding the oil slick into less sensitive areas or collection devices, such as skimmers.

5.4 Protection

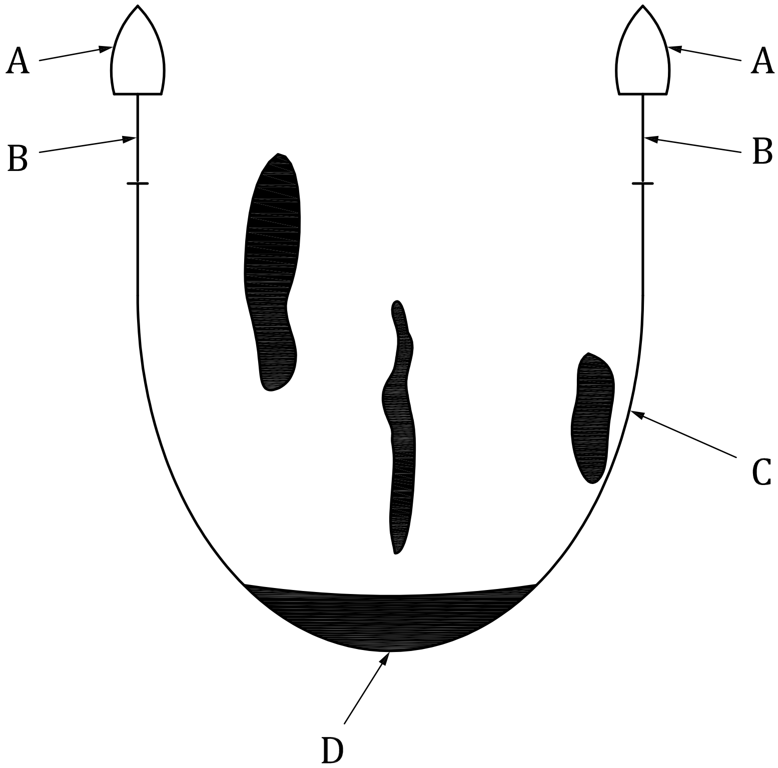
A boom is normally deployed around a potential spillage area.

5.5 Configurations

5.5.1 General

The following figures show basic boom configurations.

5.5.2 U-configuration



Key

A towing vessel(s)

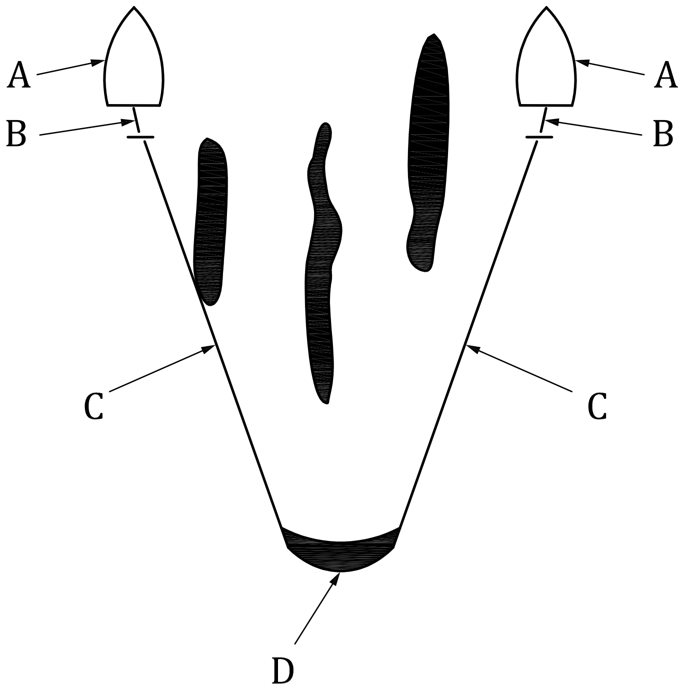
B towing gear

C boom

D oil collection (accumulation) point

Figure 1 — U-configuration

5.5.3 V-configuration



Key

A towing vessel(s)

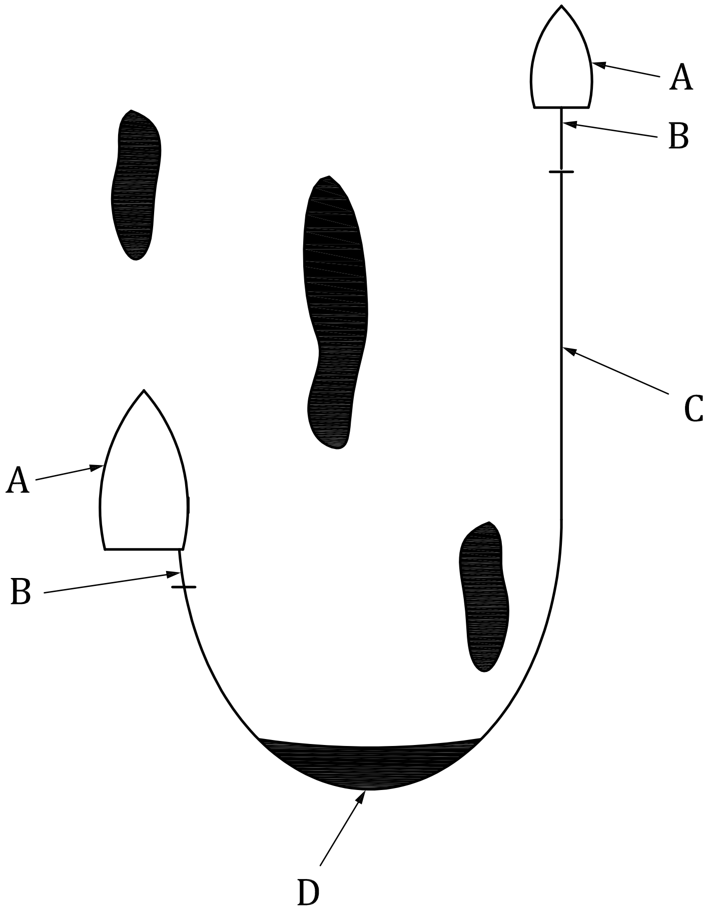
B towing gear

C boom

D oil collection (accumulation) point

Figure 2 — V-configuration

5.5.4 J-configuration



Key

A towing vessel(s)

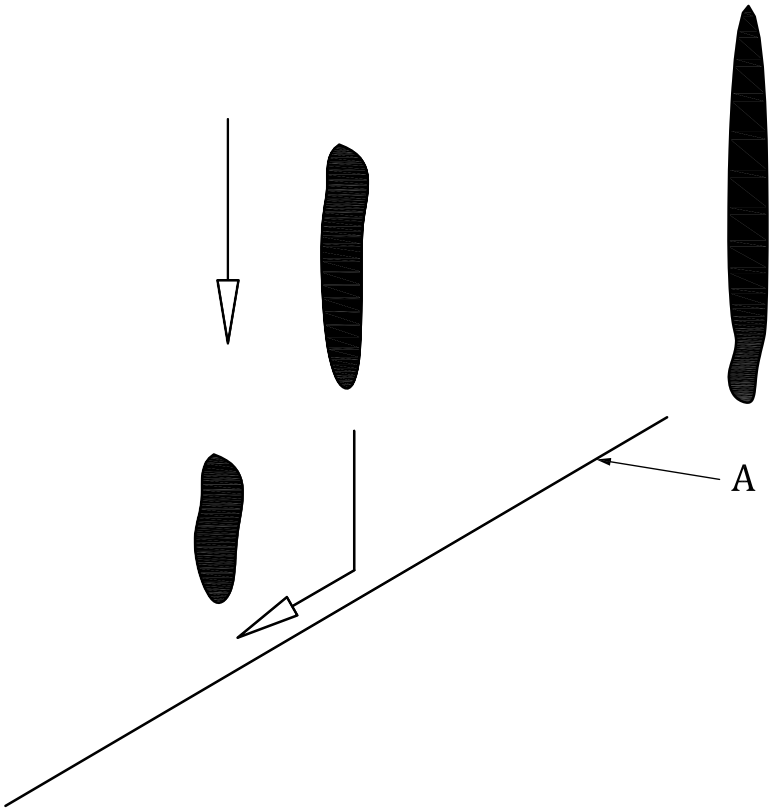
B towing gear

C boom

D oil collection (accumulation) point

Figure 3 — J-configuration

5.5.5 Deflection



Key
A boom

Figure 4 — Deflection

6 Forces on boom assemblies

For design calculations, forces acting on boom assemblies are due to water resistance resulting from towing, current and/or wind forces and must be added together to determine the maximum permissible work load. See Annex 1.

7 Classification of booms by environmental conditions

Table 1 can be used to determine the body size of a boom required for a specific environment.

Table 1 — Classification of booms by environmental conditions

	Body Size mm		**Specific environment**
Boom class	Freeboard	Draught	Wave height
A	Up to 200	Up to 400	Calm water with waves < 0,3 m
B	201 to 600	401 to 900	Sheltered water with waves < 1,0 m
C	601 and upward	901 and upward	Open water with waves > 1,0 m

8 Data requirements for manufacturers

The manufacturer's specification and instruction handbook shall include information on the following design criteria:

a) Operational height [mm or m];

b) Operational freeboard [mm or m]:

- For inflatable booms, the freeboard shall be given when it is inflated;
- In the case where the boom has a curved top, the freeboard shall be the lowest;

c) Operational draught [mm or m]:

- This includes the boom wall construction, but not any chain or wire used for ballast which is placed underneath the actual boom wall;

d) Operational weight [kg/m]:

- The net weight when operable includes ballasts and accessories;

e) Section length [m]:

- With an inflatable boom, the section length shall be given for the inflated boom as it may be shorter than the deflated boom;

f) Number of buoyancy chambers per section;

g) Length of each buoyancy chamber [mm or m]:

- For inflatable booms, the length shall be given when inflated;

h) Operational and minimum bursting pressure [kPa];

NOTE For inflatable booms only.

i) Type or kind of ballast members to be specified (e.g. wire, chain, cast iron blocks, etc.) as well as the materials (e.g. stainless steel (AISI 316), hot galvanised steel (St37 or SJ235), etc.);

j) Boom wall material;

NOTE The material used shall be resistant to oil, seawater, UV radiation. The test results shall be documented by individual component manufacturers' certificates in accordance with referenced ISO standards.

k) Floatation material;

NOTE Does not apply to inflatable booms.

l) Breaking strength of entire boom assembly [N or kN]:

- All end connectors, chain attachments, brackets, anchor points, etc. shall be included, and be recorded on the test certificate;

NOTE See ISO 17325-2.

m) Gross buoyancy to weight ratio:

- Gross buoyancy divided by boom weight (e.g. 10:1 or 4:1);

NOTE The value shall be determined on complete sections, including end connectors and similar accessories needed for operation.

n) Wave following capability:

— Wave response in metres significant wave height with a defined wavelength/wave height;

o) Operational temperature range (º C);

p) Storage temperature range (º C);

q) Tensile strength of the boom wall:

— The maximum tensile strength shall be recorded;

NOTE See ISO 17325-2.

[ISO 1431-1]

r) Thickness of boom wall [mm]:

— In cases where the boom wall does not have the same thickness for the entire width or length, this shall be noted and only the least thickness shall be used;

— Boom material composed of synthetic coated fabrics is classified in g/m^2;

s) Tear resistance of the boom wall [N/5 cm]:

— In any case where the boom wall consists of more than one material, the tear resistance shall be given for all materials included;

NOTE See ISO 17325-2.

[ISO 34-1 or ISO 505]

t) Abrasion resistance of boom wall material:

— The resistance to wear by mechanical action upon the surface;

NOTE See ISO 17325-2.

— The result shall be expressed either as a relative volume loss or as an abrasion resistance index;

[ISO 4649, ISO 5470, ASTM D4157]

u) Weathering resistance:

— Due to influences such as ozone and/or temperature changes;

[ISO 3011, ISO 1432, ISO 4675]

v) Resistance to ozone cracking;

w) Oil resistance:

— Change in length and volume during liquid immersion;

[ISO 1817]

x) Transport unit:

— Size, weight and volume per unit;

y) Maintenance instructions:

— To include frequency and method of maintenance and cleaning, tools, recommended spare parts, and accessories.

9 Designation and marking

9.1 General

Each containment boom shall be provided with an easily visible marking, permanently fixed to the outside of the boom. Further, the marking can be placed on the storage device for the containment boom.

9.2 Marking

Only after successful testing per ISO 17325-2, a boom may be marked with:

a) Manufacturer's name and address;

b) Trade name, type, model and serial number;

c) Year of manufacture;

d) Designation ISO A-XX-NNN;

where

A	is the boom class (see Table 1);
XX	is operational height [mm or m];
NNN	is section length [m];

e) Lifting points for transportation;

f) Designated anchoring points, if applicable.

Annex A
(informative)

Forces on boom assemblies — Calculations

A.1 Water resistance

Water resistance force (F_c) can be calculated based on the following equation

$F_c = 26 \times A \times V^2$ [kgf]

where

A	$= l \times d$;
l	is the length (projected boom length) of the boom, in metres;
d	is the draught of the boom, in metres;
V	is the boom formation speed relative to the current, in knots.
A	is the projected boom area below water that is exposed to the current in m^2.

NOTE 1 For V, if using the unit m/s instead of knots, the factor of 98,2 should be used in lieu of 26.

NOTE 2 That means, if a “U” formation has a total boom length of 600 m with a sweep width of 200 m, the value of A would only be 200 m × boom draught in metres.

NOTE 3 For water resistance, see IMO Manual on Oil Pollution, Section IV, Combating Oil Spills.

An example of the calculation of water resistance is shown as follows:

Boom length	= 600
Projected boom length (l)	= 200 m
Boom draught (d)	= 0,6 m
Boom speed relative to current (V) (units in knots)	= 0,7 kn (0,36 m/s)

$F_c = 26 \times (200 \times 0{,}6) \times 0{,}7^2 = 1528.8$ [kgf], or approximately 15 kN

If the speed of the formation is increased to 1,9 kn (1,0 m/s), the boom forces are as follows:

$F_b = 255 \times (200 \times 0{,}6) \times 1{,}9^2 = 110\ 466$ N, or 110 kN

NOTE Different formulas are in use internationally, but the measured tow forces differ significantly from the predictions by Schultze and ITOPF formulas (see S.L. Ross (1999)). Thus, the above ITOPF formula should be understood to be rough guidance only and by no means a precise prediction of forces occurring in practice.

A.2 Wind resistance

Wind resistance force (F_W) can be calculated based on the following equation

$F_W = 26 \times A \times (V/40)^2$ [kgf]

where

A	$= l \times d$;
l	is the length (projected boom length) of the boom, in metres;
h	is the freeboard of the boom, in metres;
V	is the boom formation speed relative to the current, in knots.
A	is the projected boom area below water that is exposed to the wind in m^2.

NOTE 1 For V, if using the unit m/s instead of knots, the factor of 98,2 should be used in lieu of 26.

NOTE 2 Different formulas are in use internationally, but the measured tow forces differ significantly from the predictions by Schultze and ITOPF formulas (see S.L. Ross (1999)). Thus, the above ITOPF formula should be understood to be rough guidance only and by no means a precise prediction of forces occurring in practice.

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