



# IRS

---

## **RULES FOR BUILDING AND CLASSING STEEL VESSELS**

**PART14  
HABITABILITY**

**DECEMBER 2013**

---

**INTERNATIONAL REGISTER OF SHIPPING**  
Technical Appraisal Department  
4770 Biscayne Boulevard  
Suite 800  
Miami, Florida 33137, USA



## PREFACE

IRS has produced this Guide for Crew Habitability on Ships in order to provide a single source for habitability criteria suitable for ships. This Guide may be applied to vessels falling under the categories of oil or chemical tankers, bulk or combination carriers, container carriers, multi-purpose cargo vessels, passenger vessels, vessels such as offshore support vessels, tug boats, towboats, dredgers, research vessels, drill ships, anchor handling vessels or any other vessel providing service to offshore oil and gas exploration and production.

This Guide provides the assessment criteria and describes the measurement methodology for obtaining a ship Habitability notation. It is intended for use by vessel Owners or companies requesting the **optional notations** of ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++).

For the ACCOM level, this Guide focuses on five (5) categories of habitability criteria that can affect task performance and can be controlled, measured, and assessed in crew work, rest, and recreation areas of ships.

These categories are: accommodation area, whole-body vibration (separate criteria for accommodation areas and workspaces), noise, indoor climate, and lighting.

For the ACCOM+ level, this Guide invokes more stringent accommodation area, whole-body vibration and noise criteria aimed at increasing crew comfort and safety. For the ACCOM++ level, there are more stringent accommodation area, whole-body vibration, noise, and indoor climate criteria.

To be awarded any of these notations, a vessel must meet the appropriate prescriptive criteria across the various habitability categories. Meeting the baseline ACCOM criteria of this Guide will fulfill the accommodation area arrangement requirements contained in International Labor Organization (ILO) Conventions 92 and 133 and the related quantitative ILO MLC 2006, Title 3 accommodation area criteria.

**CHANGES**

## CONTENTS

CHAPTER 1 GENERAL .....	<b>6</b>
SECTION 1 GENERAL .....	7
CHAPTER 2 ACCOMMODATION AREA .....	16
SECTION 1 GENERAL .....	17
SECTION 2 ACCOMODATION AREA CRITERIA .....	20
CHAPTER 3 VIBRATIONS .....	43
SECTION 1 GENERAL .....	44
SECTION 2 TESTING .....	48
CHAPTER 4 NOISE PREVENTION.....	54
SECTION 1 GENERAL .....	55
SECTION 2 TESTING .....	58
CHAPTER 5 INDOOR CLIMATE .....	65
SECTION 1 GENERAL .....	66
SECTION 2 DESIGN REQUIREMENTS.....	69
SECTION 3 TESTING .....	73
CHAPTER 6 LIGHTING .....	<b>78</b>
SECTION1 GENERAL .....	79
SECTION 2 TESTING .....	88
CHAPTER 7 PROCEDURAL REQUIREMENTS FOR AMBIENT ENVIRONMENT TESTING.....	94
SECTION 1 GENERAL .....	95
SECTION 2 PROCEDURE FOR APPROVAL AND CERTIFICATION .....	97

## CHAPTER 1 GENERAL

### CONTENTS

SECTION 1 GENERAL .....7

---

## SECTION 1 GENERAL

### Contents

1.1.	Introduction .....	8
1.2.	Application .....	8
1.3.	Scope.....	8
1.4.	Terminology.....	8
1.5.	Data and plans to be submitted.....	10
1.6.	Process for obtaining a notation.....	11
1.7.	Initial requirements .....	12
1.8.	Survey after construction.....	12
1.9.	Alternatives.....	14

### 1.1. Introduction

The IRS has identified the positive impact that appropriate habitability criteria and design practices may have on the productivity, safety, morale, and overall well-being of seafarers. The objective for the development of IRS Guide for Crew Habitability on Ships has been to improve and enhance the quality of crew member comfort and performance by improving working and living environments in terms of ambient environmental traits and accommodation area design. These habitability criteria have been chosen to facilitate means that help decrease crew fatigue, enhance their performance and to also help in crew recruitment and retention.

### 1.2. Application

This Guide is applicable to new as well as existing ships for which an optional ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++) notation has been demanded. The habitability criteria are a measure of the acceptability of crew accommodation areas and workspaces. Meeting the baseline ACCOM criteria of this Guide will realize the accommodation area arrangement requisites contained in International Labor Organization (ILO) Conventions 92 and 133 and the related quantitative ILO MLC 2006, Title 3 accommodation area criteria. IRS has produced this Guide for Crew Habitability on Ships so as to furnish a single source for habitability criteria appropriate for ships. This Guide may be applied to vessels falling under the categories of chemical or oil tankers, container carriers, bulk or combination carriers, multi-purpose cargo vessels, or passenger vessels.

### 1.3. Scope

This Part 14 of the IRS Rules primarily focuses on five (5) habitability aspects of ship layout and design that can be measured, controlled and assessed. These five (5) aspects are divided into two (2) categories in this Part namely, accommodation areas and the ambient environment.

Accommodation area criteria relate to dimensional and outfitting aspects of spaces and open deck areas where crew members recreate, sleep, eat and perform all their routine day-to-day activities. The ambient environmental aspects of habitability relate to the environment that the crew is exposed to during periods of work, leisure, and rest. Specifically, this Part gives criteria, restrictions, and measurement methodologies for the following:

- i. Whole-body Vibration (separate criteria for accommodation areas and workspaces).
- ii. Noise
- iii. Lighting
- iv. Indoor climate

The criteria given in this Part are based on currently available research data and standards for the purpose of improving and enhancing crew performance and giving a base level of habitability and elements of safety pertaining to habitability.

### 1.4. Terminology

*IRS Recognized ambient environmental testing specialists:* Companies facilitating test or measurement services on vessel Owner or shipyard's behalf for the purposes of meeting any of the IRS Habitability or Passenger Comfort notations.

*Accommodation areas/accommodation block:* Vessel areas where the primary purpose is to relax and recreate. Accommodation spaces comprises of cabins and staterooms, medical facilities (sick bays), recreation rooms, offices and manned spaces within the accommodation block such as the bridge or control room. For the purposes of this Part, accommodation areas also cover service spaces such as mess rooms, laundry, and storerooms.

*Ambient environment:* Ambient environment refers to the environmental conditions that the crew is exposed to during periods of work, leisure or rest. This Guide specifically gives criteria and limits for whole-body vibration, noise, lighting and indoor climate.

*Dynamic Positioning:* A system to automatically maintain an installation's position and heading by controlling propellers and/or thrusters. Dynamic positioning can maintain a position to a fixed point

over the bottom, or in relation to a moving object (such as another vessel). It can also be used to position the vessel at a favorable angle towards wind, waves, and current.

*Associated documentation:* Documents referenced in this Guide that is required to give measuring techniques and further guidance is referred to as associated documentation.

*Cargo vessel:* A cargo vessel is any vessel which is not basically a passenger vessel and is occupied with commercial trade.

*Offshore Installation:* A buoyant or non-buoyant structure, supported by or attached to the sea floor, whose design is based on foundation and long term environmental conditions at a particular site where it is intended to remain.

*Crew member / Personnel:* Any person excluding passengers who are onboard a vessel, including the Master. All through this document, this term is used interchangeably with “seafarer”.

*Crew spaces / Personnel Spaces:* All areas on a vessel exclusively meant for seafarers only, such as seafarer accommodation spaces and seafarer work spaces. All through this document, this term is also used interchangeably with “seafarer spaces”.

*Habitability:* The tolerability of the conditions of a vessel in terms of whole-body vibration, noise, indoor climate, and lighting, as well as physical and spatial characteristics, as per the prevailing research and standards for human productivity and comfort.

*Manned space:* Any space on the ship where normally during routine day-to-day activities, a seafarer may be present for twenty (20) minutes or longer, at a particular time. Such space covers all the working or living spaces.

*Passenger:* Every person other than the Master and the members of the crew or those employed or engaged in any capacity onboard a vessel for the business of that vessel is referred to as passenger.

*Passenger vessel:* A vessel whose primary job is to transmit more than twelve (12) passengers for simply transportation purposes or even recreational purposes. This includes cruise ships and ferries (conventional and high-speed craft).

*Recreation and public spaces:* Those portions of the accommodation areas that are used for halls, lounges and dining rooms and similar permanently enclosed spaces.

*Seafarer:* Every person onboard a vessel, including the Master, who is not a passenger. All through this document, this term is used interchangeably with “crew member”.

*Seafarer spaces:* All areas on a vessel proposed for seafarers only, such as seafarer accommodation spaces and seafarer work spaces. All through this document, this term is also used interchangeably with “crew spaces / Personnel Spaces”.

*Shall:* Indicates a provision that is obligatory.

*Test plan:* Document covering the requisite information regarding vessel design and layout, test conditions, test personnel, measurement locations, data acquisition, instruments, data analysis, and test schedule vital for corroborating the measurements for the ambient environmental aspects of habitability.

*Workspaces:* These are the areas allocated for work. Categories of workspaces include, but are not restricted to, navigation spaces, service spaces (galley, laundry) and machinery spaces.

**1.5. Notation**

At the Owner’s or shipyard’s request, a vessel complying with the minimum criteria for accommodation areas and the ambient environment (i.e., whole-body vibration, noise, indoor climate, and lighting) provided in this Guide may be assigned a notation of ACCOM.

A vessel complying with the ACCOM criteria and the more stringent criteria with respect to accommodation, whole-body vibration, noise, and indoor climate may be distinguished in the Record by the notation ACCOM+. A vessel satisfying all the criteria in the Guide may be distinguished in the Record by the notation ACCOM++. A summary of the differences among each of these notations is presented below.

**Table 1.1.1**

	<b>ACCOM</b>	<b>ACCOM+</b>	<b>ACCOM++</b>
Accommodation Areas	<b>ACCOM</b> Requirements for Accommodation Areas	<b>ACCOM</b> and <b>ACCOM+</b> Requirements for Accommodation Areas	<b>ACCOM+</b> and <b>ACCOM++</b> Requirements for accommodation Areas
Whole-body Vibration	Level of vibration – reducing discomfort and promoting job performance	Lower level of vibration – promoting job performance and increased comfort	Lowest level of vibration – promoting job performance and increased comfort
Noise	IMO Code on Noise with modifications	<b>ACCOM</b> with additional requirements	<b>ACCOM+</b> with additional requirements
Indoor Climate	No provision for individual temperature adjustment		Aimed at enhancing crew comfort by making provisions for individual adjustments of indoor climate temperature
Lighting	No differences among the notations		

**1.6. Data and plans to be submitted**

1.6.1. General

The underlying General Arrangement-type drawings of the vessel shall be submitted:

- i. Inboard profile with details of the location of the main vertical zone boundaries, various deck levels and the location of the main watertight bulkheads.
- ii. Plan view of each deck annotating all the spaces on each deck.

1.6.2. Accommodation areas

To IRS, at a minimum, scaled arrangement drawings of the various accommodation spaces (elevation and plan views) and the vessel’s accommodation area specifications shall be submitted. The crew accommodation area data details and requisites are given in Chapter 2.

1.6.3. Ambient environment

The underlying items are to be submitted for each ambient environmental aspect:

i. *Test Plans*

Test Plans shall serve as the major means for validating the measurements for the ambient environmental aspects of habitability. Separate Test Plans are required for whole-body vibration, indoor climate, noise and lighting. In later sections of this Part, Specific Test Plan details for the various ambient environmental criteria are outlined.

**Table 1.1.2**

<b>Environmental Aspect</b>	<b>Test Plan Details</b>
Whole-body Vibration	Part 14, Ch 3
Noise	Part 14, Ch4
Indoor Climate	Part 14, Ch5
Lighting	Part 14, Ch6

IRS needs to give approval for Test Plans before any measurements are made. IRS shall notify the vessel Owner or shipyard whether the Test Plans have been approved or require alteration. An IRS approved copy of the Test Plan shall become part of the vessel's official documentation.

ii. *Test Reports*

After the ambient environmental testing is done, Test Reports shall be submitted to the IRS Surveyor. Also, a copy of the Test Reports shall become part of the vessel's official documentation. These reports contain ambient environmental information such as test results, testing details, measurement equipment details, etc. in later sections of this Guide; the specific report contents for the various ambient environmental criteria are outlined.

**Table 1.1.3**

<b>Environmental Aspect</b>	<b>Test Report Details</b>
Whole-body Vibration	Part 14, Ch 3
Noise	Part 14, Ch 4
Indoor Climate	Part 14, Ch 5
Lighting	Part 14, Ch6

**1.7. Process for obtaining a notation**

Before scheduling accommodation area verification or ambient environmental testing activities, the vessel Owner or shipyard shall validate the operational status of the vessel as being fully operational and/or inclusive of all equipment and furnishings. If it is not fully operational, for review, a comprehensive listing of deficiencies of areas, components, equipment, etc. shall be submitted to IRS. IRS shall then be determined to notify the vessel Owner or shipyard as to whether accommodation area validation activities or ambient environmental testing can initiate. The intent is to align testing during sea trials with the ambient environmental testing so that all the testing is completed during sea trials.

1.7.1. Accommodation areas

It is required to prepare and submit plans, arrangement drawings and vessel design specifications for accommodation spaces to IRS for review. For new construction, the drawings shall be provided to IRS during the detailed design phase. For existing vessels, before IRS Surveyor does verifications, the plans and arrangement drawings, reflecting the current accommodation area configurations shall be provided to and approved by IRS. Then, an IRS Surveyor shall execute follow-up physical verification measurements of accommodation area criteria. The IRS Surveyor shall choose verification measurement

sites. During the notation confirmation process, the outcome of the IRS review and actual IRS Surveyor verification shall be reviewed by the IRS Surveyor.

1.7.2. Ambient environment

Ambient environmental Test Plans for whole-body vibration, indoor climate, noise and lighting shall be prepared and submitted to IRS. These Test Plans shall serve as a primary medium for substantiating the measurement locations and measurement process, as well as specifying the Testing Specialist who will execute the ambient environmental testing.

The Testing Specialist shall execute testing, inspections, and data collection and an IRS Surveyor shall witness this. Test Reports for ambient environmental testing shall be prepared by the Testing Specialist and submitted to the IRS Surveyor for review.

1.7.3. Results

The IRS Surveyor shall review the IRS accommodation area assessment, IRS Surveyor verification measurements, and ambient environmental Test Reports for determination of notation confirmation.

**1.8. Initial requirements**

The primary process for obtaining any ship Habitability notation shall comprise of IRS reviews, ambient environmental testing, and IRS Surveyor verifications. Testing shall be as per the submitted Test Plans, reviewed and approved by IRS, before the testing. IRS Surveyor shall witness the testing. If the criteria specified in this Guide have been met, then the appropriate notation may be confirmed.

**1.9. Survey after construction**

All surveys after construction are intended to be aligned with Classification Surveys. Harmonization of surveys is to be executed at the first available occasion.

1.9.1. Annual surveys

To maintain the ACCOM, ACCOM+, or ACCOM++ notation, an Annual Survey shall be made within three (3) months before or after each annual anniversary date of the crediting of the Initial Survey or the previous Special Periodical Survey. The information given below shall be reviewed by the attending IRS Surveyor for issues that could affect the ship Habitability notation.

- i. Collision and grounding reports since previous Initial, Annual or Special Periodical Survey.
- ii. Fire, repair, and damage reports since previous Initial, Annual or Special Periodical Survey.
- iii. A list of all structural or mechanical modifications to the vessel since previous Initial, Annual or Special Periodical Survey.
- iv. Verification that equipment and facilities continue to be fit for purpose and are operating as per accommodation area criteria stated within this Guide.

During the attending IRS Surveyor's review of the submitted information, a determination will be made as to whether changes or alterations have taken place that could affect the ship Habitability notation. As a result, the vessel may be subject to the review, ambient environmental testing, and inspection requirements of this Guide.

1.9.2. Special periodic surveys

To maintain the ACCOM, ACCOM+, or ACCOM++ notation, a Special Periodical Survey shall be completed within five (5) years after the date of build or after the crediting date of the earlier Special Periodical Survey. A Special Periodical Survey will be credited as of the completion date of the survey but not later than five (5) years from date of build or from the date recorded for the previous Special Periodical Survey.

If the Special Periodical Survey is completed within three (3) months before the due date, the Special Periodical Survey will be credited to agree with the effective due date. The Special Periodical Survey may be initiated fifteen (15) months before the due date and can be continued till completion by the due date.

### 1.9.3. Survey requirements

The Survey shall comprise IRS reviews, IRS Surveyor verifications, and ambient environmental testing. The Survey will cover all five (5) habitability aspects. The following shall be submitted to IRS three (3) months before conducting the ambient environmental testing:

- i. Fire, repair, or damage reports since previous Annual Survey.
- ii. A list of all structural or mechanical modifications to the vessel since previous Annual Survey.
- iii. Drawings/arrangements of seafarer spaces, HVAC, electrical, etc., affected by alterations.
- iv. Copy of approved Initial Test Plans and Test Reports.
- v. Test Plans and Test Reports resulting from Annual Surveys.
- vi. Previous Special Periodical Survey Test Plans and Reports, if applicable.
- vii. Proposed Special Periodical Survey Test Plans for the current survey.

The Special Periodical Survey data submittal serves three purposes. The first is to execute an IRS review of seafarer spaces against any alterations to the vessel since the Initial Survey, with measurements substantiated by an IRS Surveyor. The second purpose is to provide a history of ambient environmental testing, as well as the Special Periodical Survey ambient environmental Test Plans for review and approval. The third is to permit scheduling of measurement verifications and ambient environmental testing.

A Special Periodical Survey Test Plan for each ambient environmental aspect of Habitability shall be submitted as per the criteria given below. The approved Initial Test Plans should be used as a basis for creating the Special Periodical Survey Test Plans.

For creation of the Special Periodical Survey Test Plans, Subsection, "Test Plan", and Subsection, "Test Requirements", of this Guide specify the requirements for each ambient environmental aspect. For specifying measurement locations for the Special Periodical Survey Test Plans, the following changes to , " Testing positions/ Selection of Spaces where Measurements are to be Conducted", of each ambient environmental aspect of Habitability shall be followed:

- i. Measurements shall be taken in all areas affected by vessel alterations. Measurements are restricted to the ambient environmental aspect affected by the alteration. For instance, structural changes require both whole-body vibration and noise measurements. Structural changes do not essentially require indoor climate or lighting measurements. Changes to luminaires need lighting measurements but not whole-body vibration, noise, or indoor climate measurements.
- ii. Throughout the vessel, additional measurements shall be taken in crew cabins and staterooms for whole-body vibration. For vessels with less than one hundred (100) crew cabins and staterooms, ten (10) percent of cabins and staterooms shall be measured.

For vessels with one hundred (100) or more crew cabins and staterooms, following applies:

- In the forward one-third (1/3) of the vessel, three (3) percent or 1 in 33 of cabins and staterooms shall be measured.
- In the midsection (center 1/3) of the vessel, two (2) percent or 1 in 50 of cabins and staterooms shall be measured in the aft one-third (1/3) of the vessel, five (5) percent 1 in 20 of the cabins and staterooms shall be measured.

Within each one-third (1/3) section of the vessel, measurement locations shall be distributed throughout the length of each section and on each deck.

- iii. For all ambient environmental aspects, measurements shall be taken in all worst case or problem area locations based on the requirements set forth in Ch 3 Sec 2[2.3] where Measurements are to be Conducted", of the appropriate Section of this Part. [For example, worst case for whole body vibration as described in Part 14, Ch 3.
- iv. Measurements shall be taken in twenty-five (25) percent of crew cabins and staterooms identified in the initial Test Plans for all ambient environmental aspects. The cabin locations must be representative of locations port, fore, starboard, amidships and aft. If applicable, any worst case locations can be considered part of the representative sample for crew cabins and staterooms.
- v. Measurements shall be taken where a single instance of one (1) type of a manned space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc.) for all ambient environmental aspects. If applicable, the worst case locations can be considered part of the single instance representative sample.
- vi. Where multiple instances of the same type space exist, a representative sample of at least twenty-five (25) percent of each type shall be selected for measurement for all ambient environmental aspects. If applicable, the worst case locations are to be considered part of the representative sample.

For all ambient environmental conditions, visual/walk-through inspections shall be conducted in as per Ch 3 Sec 2 [2.3] of the suitable Section of this Guide.

#### 1.9.4. Requirements for vessel alterations

No alterations which affect or may affect the ship's awarded Habitability notation, including alterations to the machinery, structure, electrical systems, furnishings, piping or lighting systems, are to be made to the vessel unless plans of the proposed alterations are submitted to and approved by IRS before the work of alteration is initiated. If IRS determines that the alteration will affect the ship Habitability notation, the altered vessel may be subject to the review, verification, and ambient environmental testing requisites of this Guide.

### 1.10. Alternatives

#### 1.10.1. General

IRS will consider other substitute arrangements, procedures and criteria, which can be depicted to meet the criteria directly cited or referred to in this Guide. The demonstration of an alternative's tolerability can be made through either the systematic analysis based on valid engineering principles or presentation of satisfactory service experience.

#### 1.10.2. National regulations

IRS will consider for its recognition, substitute arrangements and details, which can be shown to conform to standards recognized in the country (flag State) in which the vessel is registered or built, if they are deemed not less effective.

**1.10.3. Departures from criteria**

The criteria contained in this Guide are envisaged to apply to vessels that are engaged in the usual trades and services expected of such vessels, within the scope of the underlying:

- IRS Rules for Building and Classing Steel Vessels.
- IRS Rules for Building and Classing Steel Vessels for Service on Inland Waterways  
IRS Rules for Materials and Welding.

It is recognized that unusual or unforeseen conditions may lead to a case where one or more of the parameters of interest in granting a notation may temporarily fall outside the range of tolerability.

In consultation with the Owner, IRS shall review, when a departure from criteria is identified, during either the notation's initial issuance or reconfirmation process. When the design of the accommodation areas or ambient environmental test results contains departures from the stated criteria, these will be subject to special consideration upon the receipt of details about the departure. Depending on the degree and consequences of the departure, the shipyard or Owner may be required to provide an assessment and remediation plan to get as well as maintain the notation. The notation will be withdrawn if the agreed remediation by the due date is not accomplished.

## CHAPTER 2 ACCOMMODATION AREA

### CONTENTS

SECTION 1 GENERAL .....	17
SECTION 2 ACCOMODATION AREA CRITERIA.....	20

---

## SECTION 1 GENERAL

### Contents

1.1.	General .....	18
1.2.	Scope.....	18
1.3.	Terminology.....	18
1.4.	Documentation .....	18
1.5.	Equivalents and alternatives .....	18

### 1.1. Background

It is crucial that seafarers maintain appropriate levels of mental and physical fitness while onboard ships in order to promote safety, efficiency and habitability. In order to accomplish this, seafarers are to be provided with suitable accommodation areas. Appropriate accommodation area design helps to promote reliable performance by reducing the potential for fatigue and human error. Appropriate accommodation areas may also enhance recruiting, retention, morale, comfort and overall quality of life at sea. On the contrary, inappropriate accommodation areas can adversely impact a seafarer's ability to reliably perform assigned duties, sleep, fully relax and recover from mentally and physically demanding work activities. This in turn has an impact on their ability to carry out duties on succeeding watches with the required diligence and accuracy. Providing an onboard environment that increases seafarer alertness and well-being should be of concern to ship owners.

### 1.2. Scope

This section covers criteria for access and egress, as well as sanitary spaces, offices, crew cabins, food services, laundry, recreation areas and medical spaces. The criteria were selected in order to help increasing crew member productivity, quality of work, retention and morale.

**Note:** The criteria for access/egress are applicable only to the crew accommodation block and does not include crew member workspaces outside the accommodation block.

### 1.3. Terminology

Accommodation Areas/Accommodation Block: Refers to areas in the ship primarily meant for rest and recreation. Accommodation spaces include staterooms and cabins, medical facilities (sick bays), offices, recreation rooms and manned spaces within the accommodation block such as the bridge or control room. For the purposes of this Guide, accommodation areas come with service spaces such as laundry, mess rooms and storerooms.

### 1.4. Documentation

Location and general arrangement of crew accommodation spaces, deck by deck at a scale not less than 1/100, adequately detailing:

- The use of various spaces.
- The type of cabins (ratings, officers).
- The surfaces of spaces.
- The number of persons (crew/passengers) on board.
- The disposition of furniture and fittings, and
- The sanitary arrangements.

### 1.5. Accommodation Area Documentation

"Accommodation Areas", accommodation area documentation shall be prepared and submitted to IRS for review. Confirmatory verification measurements shall be performed by an IRS Surveyor. The following data shall be submitted to IRS:

#### 1.5.1. Data Requirements

The submitted data shall serve as a means for verifying that the vessel meets the accommodation area criteria specified.

##### 1.5.1.1. New Construction

For new construction, scaled arrangement drawings of the accommodation spaces (elevation and plan views), details of the accommodation area outfitting and vessel's design specification in relation to the accommodation spaces shall be submitted to IRS.

##### 1.5.1.2. Existing Vessels

For existing vessels, appropriate arrangement drawings and plans, reflecting the current accommodation area configurations shall be provided to IRS along with any current vessel accommodation area design specifications.

## 1.6. Equivalents and alternatives

### 1.6.1. National requirements

In case of a discrepancy between the national regulations and the provisions of the present Guidance Note, the former always has priority. However, IRS has the authority to call for the necessary adaptation to pre-serve the intention of this Guidance Note.

### 1.6.2. Technical alternatives

When authorized by the Administration, IRS will consider alternative arrangements and criteria for compliance with this Guidance Note, proposed by the interested parties always on behalf of the owner, provided that their relevance has been demonstrated through sound engineering analysis or service experience.

## 1.7. Submittal Review and Verification

Arrangement drawings, plans, and vessel specifications for the accommodation areas shall be prepared and submitted for review by IRS. For new construction, the drawings shall be provided to IRS during the detailed design phase. For existing vessels, the arrangement drawings and plans reflecting the current accommodation area configurations shall be provided to IRS, in advance of onboard IRS Surveyor verifications.

IRS shall review the submitted accommodation area documentation. IRS shall report any deviation from criteria to the Owner/shipyard for resolution and shall also identify any criteria that the IRS must field verify.

The IRS Surveyor shall verify that the submitted drawings match the constructed vessel. The IRS surveyor shall also verify any criteria that are outstanding from the IRS review and document deviations from criteria.

## 1.8. Results

The results of the IRS review and the IRS Surveyor verification shall be reviewed by the IRS Surveyor against the appropriate ACCOM, ACCOM+, or ACCOM++ criteria for notation confirmation.

## SECTION 2 ACCOMODATION AREA CRITERIA

### Contents

2.1. Accommodation Area Criteria ..... 21

**2.1. Accommodation Area Criteria**

The accommodation area criteria are contained in this section, "Accommodation Area Criteria". Meeting the baseline ACCOM criteria in this section fulfill the physical accommodation area arrangement requirements contained in the ILO Conventions 92 and 133 and the related quantitative ILO MLC 2006, Title 3 accommodation area criteria, denoted by a "#" symbol in the tables. Please refer to the individual flag States to determine whether additional requirements have been put into place, since those requirements are not covered by this Part.

To use the tables in this section, first determine which notation is being requested ACCOM, ACCOM+, or ACCOM++.

- For a ACCOM notation, the 'X' marked boxes under "Meets ACCOM Requirements" must be met.
- For a ACCOM+ notation, the 'X' boxes under "Meets ACCOM+ Requirements" need to be met as well as ACCOM requirements.
- For a ACCOM++ notation, the 'X' boxes under "Meets ACCOM++ Requirements" need to be met as well as ACCOM requirements and ACCOM+ requirements.

**Instructions for All table in this Section:** For a ACCOM notation, the boxes marked with 'x' "Meets ACCOM Requirements" must be met. For a ACCOM+ notation, the boxes marked with 'x' under "Meets ACCOM+ Requirements" need to be met as well as ACCOM requirements. For a ACCOM++ notation, the boxes under "Meets ACCOM++ Requirements" need to be met as well as ACCOM requirements and ACCOM+ Requirements.

Table 2.2.1: Accommodation Area Criteria - General

Requirement # = Related ILO MLC 2006, Title 3 Requirement		Meets ACCOM Requirements	Meets ACCOM + Requirements	Meets ACCOM ++ Requirements	
#	1	Headroom in all passageways, sleeping rooms, stairs, sanitary spaces, offices, food service areas, and recreational areas is at least 2030 mm(80.0 in.)	x	o	o
	2	Non-slip type deck covering is supplied where occasional water, oil or liquid on the floors is expected.	x	o	o
	3	Outside corners of bulkheads, doors, etc. are rounded	x	o	o
	4	All edges that crew members may strike are rounded	x	o	o
	5	Drawers and doors are designed	o	o	o
		• to prevent opening and closing due to vessel motion	x	o	o
		• to be operable with one hand	o	x	o
#	6	Painted wall surfaces and deck heads are light in color.	x	o	o
	7	Interior finish materials and furnishings are designed to ease cleaning efforts and improve maintenance	x	o	o
	8	For workstations where seafarers will be working while standing for extended periods of time, a kick space of 100 mm (4 in.) high by 100 mm (4 in.) deep shall be provided.	x	o	o
	9	Toilets are conveniently located to workplace, recreation areas, mess rooms, and shower rooms.	x	o	o

Table 2.2.1 (Continued ....)

		<b>Requirement # = Related ILO MLC 2006, Title 3 Requirement</b>	<b>Meets ACCOM Requirements</b>	<b>Meets ACCOM+ Requirements</b>	<b>Meets ACCOM++ Requirements</b>
	10	A means of escape that is not readily apparent to a person from both the inside and outside of the space is adequately marked.	x	o	o
#	11	Wall surfaces and decks are washable and impervious to damp or moisture absorption.	x	o	o
#	12	For accommodation areas and recreational facilities where the floorings are made of composite materials, the joints with the sides shall be profiled to avoid crevices.	x	o	o
	13	Accommodation areas and recreational and catering facilities shall be located as far as practicable from the engines, steering gear rooms, deck winches, ventilation, heating, and air-conditioning equipment, and other noisy machinery and apparatus.	x	o	o
	14	Accommodation area stairways have a maximum angle of inclination from the horizontal of :	o	o	o
		• 50 degrees	x	o	o
		• 45 degrees	o	x	o
		• 40 degrees	o	o	x

Table 2.2.2: Accommodation Area Criteria – Access / Egress

Requirement # = Related ILO MLC 2006, Title 3 Requirement		Meets ACCOM Requirements	Meets ACCOM+ Requirement	Meets ACCOM++ Requirement
<b>GENERAL</b>				
1	Doors, hatches, or scuttles used as a means of escape are capable of being operated by one person, from either side, in both light and dark conditions.	x	o	o
2	The method of opening a means of escape is obvious and rapid.	x	o	o
3	Doors in accommodation spaces (with the exception of staterooms), stairway, stair tower, passageway, or control spaces, open in the direction of escape, where practicable.	x	o	o
4	Deck scuttles that serve as a means of escape are fitted with a quick acting release and a holdback device to hold the scuttle in an open position.	x	o	o
5	High voltage electrical cabinet doors are lockable with keys provided to qualified personnel.	x	o	o
<b>DOOR DIMENSIONS</b>				
6	Horizontal doors that are self-closing must close in a time period of not less than 5 seconds or more than 10seconds and be capable of closing against a 3.5-degree list.	x	o	o
7	Vertical doors have the following dimensions :	o	o	o
	• doors (other than emergency egress) used solely by crew members have a clear opening width of approximately 710 mm (28 in.) or ASTM size 4 doors.	x	o	o
	• the distance from the deck to the top of the door is at least 1900 mm (75 in.)	x	o	o
	• the distance from the deck to the top of the door is at least 1980 mm (78 in.)	o	o	x

Table 2.2.2 (Continued ....)

RAILINGS				
	Requirement # = Related ILO MLC 2006, Title 3 Requirement	Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
8	Suitable storm rails/handrails are provided in all interior passageways and at all deckhouse sides where persons onboard might have normal access	o	o	o
	• storm rails/handrails are installed on both sides of passageways that are 1830 mm (72 in.) or more in width	x	o	o
	• storm rails/handrails are 865 mm (34 in.) to 965 mm (38 in.) high	x	o	o
	• the distance between/or behind storm rails/handrails and any obstruction is 75 mm (3 in.) or greater.	x	o	o
9	Rails are installed parallel to the deck along deck edges and walkways and around open hatches, elevators, antenna platforms and along other boundaries in the following areas	o	o	o
	• wherever there is danger of crew members falling to a lower level of 600 mm (23.5 in.) or more in the vessel	x	o	o
	• wherever there is danger of crew members becoming enmeshed with hazardous operating machinery	x	o	o
	• around unprotected openings with a coaming height below 760 mm(30 in.)	x	o	o
	<i>Note:</i> temporary rails can be used around unprotected openings into which a person may slip, trip or fall.	o	o	o

Table 2.2.2 (Continued ....)

10	Deck/guard railings have the following design:	o	o	o
	<ul style="list-style-type: none"> <li>the heights of rails or bulwarks are at least 1000 mm (39.5 in.) from the deck except where this height would interfere with the normal operation of the vessel, and toeboards which are at least 100 mm (4.0 in) in height and have no more than a 6 mm (0.25 in.) clearance between the bottom edge of the toeboard and the walking surface</li> </ul>	x	o	o
	<ul style="list-style-type: none"> <li>the heights of rails are at least 1070 mm (42 in.) from the deck except where this height would interfere with the normal operation of the vessel and toeboards which are at least 100 mm (4.0 in) in height and have no more than a 6 mm (0.25 in.) clearance between the bottom edge of the toeboard and the walking surface</li> </ul>	o	o	x
	<ul style="list-style-type: none"> <li>vertical stanchions for railings are spaced no more than 1525 mm (60 in.) apart horizontally</li> </ul>	x	o	o
	<ul style="list-style-type: none"> <li>at least every third vertical stanchion is supported by a bracket or stay</li> </ul>	x	o	o
	<ul style="list-style-type: none"> <li>Chain or wire rope used as a rail is set such that the sag is not greater than 25 mm (1 in.) at the chain/rope's centerspan.</li> </ul>	x	o	o
	<ul style="list-style-type: none"> <li>Maximum lengths of openings protected by wire or chain are 1830 mm (72 in.). A removable stanchion will constitute the start of a new opening</li> </ul>	x	o	o

Table 2.2.2 (Continued ....)

STAIRS					
Requirement # = Related ILO MLC 2006, Title 3 Requirement			Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
	11	A clear landing at least as wide as the tread width and a minimum of 915 mm (36 in.) long is provided at the top and bottom of each stairway	x	o	o
	12	Any change of direction in a stairway is accomplished by means of an intermediate landing at least as wide as the tread width and a minimum of 915 mm (36 in.) long	x	o	o
	13	An intermediate landing is provided at each deck level serviced by a stair, or a maximum of every 3600 mm (144 in.) of vertical travel for stairs with a vertical rise of 6100 mm (240 in.).	o	o	x
	14	Accommodation area stairways have a maximum angle of inclination from the horizontal of:	o	o	o
		• 50 degrees	x	o	o
		• 45 degrees	o	x	o
		• 40 degrees	o	o	x
	15	Stair risers and treads have the following design	o	o	o
		• the riser height is no more than 230 mm (9 in.) and the tread depth is approximately 190 mm (7.5 in.), including a 25 mm (1 in.) tread nosing	x	o	o
		• the riser height is no more than 230 mm (9 in.) and the tread depth is approximately 230 mm (9 in.), including a 25 mm (1 in.) tread nosing	o	x	o
		• the riser height is no more than 230 mm (9 in.) and the tread depth is approximately 275 mm (10.75 in.), including a 25 mm (1 in.) tread nosing	o	o	x

Table 2.2.2 (Continued ....)

		• stairs in a stairway or stair tower, the depth of the tread and the height of the riser are consistent	x	o	o
		• the minimum tread width on one-way (one person) stairs is at least 610 mm (24 in.)	x	o	o
		• the minimum tread width on two-way (two person) stairs is at least 915 mm (36 in.)	o	x	o
		• the minimum tread width on two-way (two person) stairs is at least 1,015 mm (40 in.)	o	o	x
		• once a minimum tread width has been established at any deck, in that stair run, it is not decreased in the direction of escape	x	o	o
		• all nosings have a non-slip surface	x	o	o
	16	Stairway or stair towers are fitted with handrails with the following design:	x	x	x
		• a handrail is provided on one side of the stair	x	o	o
		• a handrail is provided on both sides of the stair	o	o	x
		• the handrails are parallel to the pitch line of the stair flight and level at landing	x	o	o
		• the handrail is continuous from the top to the bottom of the stair and terminates in a safe manner at both ends	x	o	o
		• the vertical height above the tread at its nosing is at least 940 mm (37 in.) to 990 mm (39 in.)	x	o	o
		• the distance between handrails and any obstruction is 75 mm (3 in.) or greater	x	o	o
		• handrails on adjacent, parallel stair flights have a minimum of 100 mm (4 in.) clear distance between rails.	x	o	o

Table 2.2.2 (Continued ....)

<b>LADDERS</b>					
		<b>Requirement # = Related ILO MLC 2006, Title 3 Requirement</b>	<b>Meets ACCOM Requirements</b>	<b>Meets ACCOM+ Requirements</b>	<b>Meets ACCOM++ Requirements</b>
	17	All inclined ladders and handrails are located so as not to interfere with the opening and closing of hatches, doors, gratings, or other types of access; in all areas of the vessel other than accommodation block	x	o	o
	18	Inclined ladders are between 50° and 60° from the horizontal	x	o	o
	19	Each vertical ladder used as a means of escape has the following design features:	o	o	o
		• the ladder is mounted at least 180 mm (7 in.) from the nearest permanent object in the back of the ladder (distance behind each rung)	x	o	o
		• rungs are at least 410 mm (16 in.) in width	x	o	o
		• rungs are between 275 mm (11 in.) and 300 mm (12 in.) apart	x	o	o
		• rungs are uniformly spaced for the length of the ladder	x	o	o
		• at least 760 mm (30 in.) clearance in front of the ladder (climbing space)	x	o	o
		• each ladder rung is skid/slip resistant.	x	o	o
		• grab bars are provided that extend at least 1070 mm (42 in.) above the landing platform.	o	x	o
	20	Ladder landings at the top and bottom of inclined ladders:	o	o	o
		• at least 760 mm (30 in.) clear in length	x	o	o
		• at least 915 mm (36 in.) clear in length	o	o	x

Table 2.2.2 (Continued ....)

<b>RAMPS</b>					
		Requirement # = Related ILO MLC 2006, Title 3 Requirement	Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
	21	Ramps are sloped < 15 degrees for inclined walking surfaces	x	o	o
	22	Ramps have a non-skid surface.	x	o	o
	23	Ramps have a handrail on any open side of the ramp if the distance from the ramp to the nearest adjacent surface is 600 mm (23.5 in.) or more.	x	o	o
	24	Access to lifeboats is provided such that a person in a stretcher can be easily embarked into the survival craft (e.g., ramp)	x	o	o
<b>PASSAGE WAY / WALKWAY DESIGN</b>					
	25	The clear walkway width for one person in an unrestricted area, here two persons could pass is at least 710 mm (28 in.	x	o	o
	26	The clear walkway width for normal two-way traffic or any means of egress that leads to an exit or entrance is at least 915 mm (36 in.).	x	o	o
	27	The clear walkway width for normal two-way traffic or any means of egress that leads to an exit or entrance is at least 1015 mm (40 in.).	o	o	x

Table 2.2.3: Accommodation Area Criteria – Crew Cabins

Requirement # = Related ILO MLC 2006, Title 3 Requirement						Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
NON-PASSENGER AND NON-SPECIAL PURPOSE SHIP FLOOR AREA FOR VARIOUS VESSEL SIZES								
		Under 1000 tons	1000 to 3000 tonnes	3000 to 10000 tons	Over 10000 tons			
One person Room								
#	1	4.5 m <sup>2</sup> (48.5 ft <sup>2</sup> )	4.5 m <sup>2</sup> (48.5 ft <sup>2</sup> )	5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	7.0 m <sup>2</sup> (75 ft <sup>2</sup> )	x	o	o
		5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	o	x	o
		6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	o	o	x
Two person Room								
#	2	7.0 m <sup>2</sup> (75 ft <sup>2</sup> )	x	o	o			
		7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	8.0 m <sup>2</sup> (86 ft <sup>2</sup> )	8.0 m <sup>2</sup> (86 ft <sup>2</sup> )	o	x	o
		8.0 m <sup>2</sup> (86 ft <sup>2</sup> )	8.0 m <sup>2</sup> (86 ft <sup>2</sup> )	9.0 m <sup>2</sup> (97 ft <sup>2</sup> )	9.0 m <sup>2</sup> (97 ft <sup>2</sup> )	o	o	x
Junior Officer and senior officer								
#	3	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	10m <sup>2</sup> (107.5m <sup>2</sup> )	x	o	o

Table 2.2.3 (Continued ....)

Requirement # = Related ILO MLC 2006, Title 3 Requirement						Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
PASSENGER AND SPECIAL PURPOSE SHIP FLOOR AREA FOR VARIOUS VESSEL SIZES								
		Under 1000 tons	1000 to 3000 tonnes	3000 to 10000 tons	Over 10000 tons			
One person Room								
#	4	4.5 m <sup>2</sup> (48.5 ft <sup>2</sup> )	4.5 m <sup>2</sup> (48.5 ft <sup>2</sup> )	5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	7.0 m <sup>2</sup> (75 ft <sup>2</sup> )	x	o	o
		5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	5.5 m <sup>2</sup> (60 ft <sup>2</sup> )	6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	o	x	o
		6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	6.5 m <sup>2</sup> (70 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	o	o	x
Two person Room								
#	5	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	x	o	o			
		8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	o	x	o			
		9.5 m <sup>2</sup> (102.5 ft <sup>2</sup> )	o	o	x			
Three person room								
#	6	11.5 m <sup>2</sup> (124 ft <sup>2</sup> )	x	o	o			
		12.5 m <sup>2</sup> (134.5 ft <sup>2</sup> )	o	x	o			
		13.5 m <sup>2</sup> (145.5 ft <sup>2</sup> )	o	o	x			

Table 2.2.3 (Continued ....)

Four person rooms								
#	7	14.5 m <sup>2</sup> (156 ft <sup>2</sup> )	14.5 m <sup>2</sup> (156 ft <sup>2</sup> )	14.5 m <sup>2</sup> (156 ft <sup>2</sup> )	14.5 m <sup>2</sup> (156 ft <sup>2</sup> )	x	o	o
		15.5 m <sup>2</sup> (167 ft <sup>2</sup> )	15.5 m <sup>2</sup> (167 ft <sup>2</sup> )	15.5 m <sup>2</sup> (167 ft <sup>2</sup> )	15.5 m <sup>2</sup> (167 ft <sup>2</sup> )	o	x	o
		16.5 m <sup>2</sup> (177.5 ft <sup>2</sup> )	16.5 m <sup>2</sup> (177.5 ft <sup>2</sup> )	16.5 m <sup>2</sup> (177.5 ft <sup>2</sup> )	16.5 m <sup>2</sup> (177.5 ft <sup>2</sup> )	o	o	x
Junior Officer								
#	8	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	7.5 m <sup>2</sup> (80.5 ft <sup>2</sup> )	x	o	o
Senior officer								
#	9	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	8.5 m <sup>2</sup> (91.5 ft <sup>2</sup> )	x	o	o
OCCUPANCY LEVEL								
#	10	Individual berths are provided for each crew member.				x	o	o
#	11	Sleeping rooms in non-passenger vessels are not occupied by more than two person				x	o	o
	12	Individual sleeping rooms are provided (as appropriate) for:				o	o	o
		• officers in charge of a department				x	o	o
		• navigating officers				x	o	o
		• engineering officers in charge of a watch				x	o	o
		• senior radio officers				x	o	o
#		• each seafarer, exemption may be granted by the competent authority for ships less than 3000 gross tonnage or special purpose ship				o	x	o
#	13	Separate sleeping rooms shall be provided for men and for women				x	o	o
#	14	Crew members sharing rooms are in same occupation group and day persons do not share a room with watch-keepers				x	o	o
	15	Maximum number of persons to be accommodated in any sleeping room is marked indelibly and legibly in some conveniently seen place:				o	o	o
		• in the room				x	o	o
		• outside the room				x	o	o

Table 2.2.3 (Continued ....)

CREW CABIN LOCATION					
	16	Location, means of access, structure and arrangement in relation to other spaces of crew accommodation areas is to	o	o	o
		• provide adequate security	x	o	o
		• protect against weather and sea	x	o	o
		• insulate from heat and cold	x	o	o
		• insulate from undue noise and effluvia (odors) from other spaces	x	o	o
#	17	There is no direct communication into sleeping areas from cargo areas, machinery spaces, chain lockers, galleys, lamp and paint rooms or from engine, deck and other bulk storerooms, drying rooms, communal wash places or water closets	x	o	o
	18	Crew quarters are not located:	o	o	o
		• further forward in the vessel than a vertical plane located at 5 percent of the vessel's length abaft of the forward side of the stem at the designed summer load water line	x	o	o
		• immediately beneath working alleyways	x	o	o
		• below load line amidships or aft, unless satisfactory arrangements are made for lighting and ventilation and approved by the flag Administration	x	o	o
#		• forward of the collision bulkhead	x	o	o
	19	Main steam and exhaust pipes for winches, electric cableways, ducting and similar gear/equipment do not pass through alleyways leading to crew accommodation areas or through the crew accommodation area	x	o	o

Table 2.2.3 (Continued ....)

ROOM DESIGN					
General					
#	20	Internal bulkheads are of approved material that is not likely to harbor vermin	x	o	o
	21	Wall surfaces are not constructed from tongued and grooved boarding or any other form of construction likely to harbor vermin.	x	o	o
#	22	Where practicable a sitting or day room, adjoining the sleeping room is provided for the Master and Chief Mate	x	o	o
	23	Pipes, ventilation ducts, or other installations do not obstruct berths	x	o	o
	24	Sleeping rooms are ventilated and heated	x	o	o
	25	HVAC vents shall not be directed at the heads of berths	x	o	o
	26	Radiators and other heating apparatus are so placed and, where necessary, shielded as to avoid risk of fire or danger or discomfort to the occupants	x	o	o
Berths					
	27	Berths are not side by side so that access to one berth can only be obtained over another	x	o	o
	28	Berths are generally oriented fore and aft	x	o	o
	29	Berths contain individually operated privacy curtains	x	o	o
	30	Berths contain individually operated fans/blowers	o	x	o
#	31	Crew cabin arrangements are either single tier or double tiered.	x	o	o
#	32	Berths with portlights above them are only in a single tier arrangement.	x	o	o
Emergency					
	33	An emergency alerting system (e.g., an audible alarm) is present for all crew cabin spaces.	x	o	o

Table 2.2.3 (Continued ....)

Outfitting					
#	34	Sleeping rooms with portlights, have curtains that completely block out light.	x	o	o
#	35	Sleeping rooms are lighted with natural light and are provided with artificial light (subject to special arrangements as may be permitted in passenger vessels).	x	o	o
	36	Grab bars and stepping surfaces are provided for access to upper berths	x	o	o
#	37	An electric reading light is provided at the head of each berth	x	o	o
#	38	The top berth in a tier has a dust-proof bottom of wood, canvas, or other suitable material	x	o	o
	39	In sleeping rooms with more than one occupant, furniture (beds, lockers, drawers, etc.) are labeled identifying which furniture is dedicated to which berth	x	o	o
	40	Each sleeping room is provided with at least the following furniture (in addition to berths and clothes lockers):	o	o	o
#		• a table or desk	x	o	o
#		• chair	x	o	o
#		• a mirror with a light	x	o	o
#		• a small cabinet for toilet requisites for each person in the room	x	o	o
#		• a book rack	x	o	o
#		• Coat hooks.	x	o	o
#	41	Furniture is of smooth, hard material not liable to warp or corrode.	x	o	o
#	42	In vessels regularly trading to mosquito-infested ports, suitable screens are fitted to side scuttles, ventilators and doors to the open deck	x	o	o

**Table 2.2.3 (Continued ....)**  
**DIMENSIONAL ASPECTS**

Aisles					
	43	Aisle widths in sleeping areas are	o	o	o
		• at least 610 mm (24 in.), between a single berth and the nearest obstruction	x	o	o
		• at least 915 mm (36 in.), between facing berths	x	o	o
Berths					
#	44	The lower berth in a tier is at least 300 mm (12 in.) above the deck	x	o	o
#	45	The upper berth is placed approximately midway between the bottom of the lower berth and the lower side of the deck head beams	x	o	o
	46	Head clearance above each berth is:	o	o	o
		• at least 610 mm (24 in.)	x	o	o
		• at least 810 mm (32 in.)	o	o	x
	47	Berth inside dimensions are	o	o	o
#		• at least 1980 mm (78 in.) by 800 mm (31.5 in.)	x	o	o
#		• at least 2030 mm (80 in.) by 965 mm (38 in.)	o	o	x
#	48	The framework and leeboard of a berth is of approved material, hard, smooth and not likely to corrode or to harbor vermin	x	o	o
#	49	Berths constructed from tubular frames are completely sealed and without perforations which would give access to vermin.	x	o	o
Storage spaces					
	50	Sleeping rooms provide storage space for each occupants:	o	o	o
		• the clothes locker is fitted with a shelf and hasp	x	o	o
#		• the clothes locker is at least 0.475 m <sup>3</sup> (16.75 ft <sup>3</sup> )	x	o	o
#		• a drawer or equivalent space of at least 56 liters; if the drawer is incorporated in the clothes locker then the combined minimum volume of the clothes locker shall be 500 liters; it shall be fitted with a shelf and be able to be locked by the occupant so as to provide privacy	x	o	o
	51	Accommodation areas for the hanging of oilskins (wet weather gear) are:	o	o	o
		• sufficient	x	o	o
		• adequately ventilated	x	o	o
		• provided outside but convenient to the sleeping rooms.	x	o	o

**Table 2.2.4: Accommodation Area Criteria – Sanitary Spaces**

Requirement		Meets AACOM Requirements	Meets ACCOM + Requirements	Meets ACCOM ++ Requirements	
# = Related ILO MLC 2006, Title 3 Requirement					
GENERAL					
	1	Sanitary spaces are:	o	o	o
#		•lighted	x	o	o
#		•heated	x	o	o
#		•ventilated.	x	o	o
		Floors in sanitary spaces are:	o	o	o
#		• non-slip type deck covering	x	o	o
#		• easily cleaned	x	o	o

**PART 14**  
**CHAPTER 2**

**IRS Rules for Building and Classing Steel Vessels**

#		• impervious to damp or moisture absorption	x	o	o
#		• Properly drained.	x	o	o
	3	For every six crew members who do not have a private sanitary space, there is:	o	o	o
#		•one or more tubs and/or shower baths	x	o	o
#		•one or more toilets	x	o	o
#		•washbasins.	x	o	o
	4	Where the radio officers or operators are accommodated in an isolated position, sanitary facilities are provided near or adjacent thereto.	x	o	o
	5	Someone standing on a wet deck in sanitary spaces cannot reach light switches or electrical outlets without ground fault interrupters (GFI)	x	o	o
	6	Common/Shared spaces are gender identifiable without entering the space.	x	o	o
#	7	Separate multiple occupancy sanitary spaces are provided for men and women.	x	o	o
	8	Bulkheads in sanitary spaces are:	o	o	o
#		•steel or other approved material	x	o	
#		•watertight up to 230 mm (9 in.) above deck level.	x	o	
	9	A public sanitary facility shall be situated near the ship's office if it is not conveniently located near the navigation bridge.	x	o	
#	10	All sanitary spaces shall have ventilation to the open air, independently of any other part of the accommodation areas	x	o	
	11	Free space (space available for movement without hindrance of any objects) in a common sanitary space per person is:	o	o	o
		•at least 0.75 m <sup>2</sup> (8 ft <sup>2</sup> )	x	o	o
		•at least 1.1 m <sup>2</sup> (12 ft <sup>2</sup> )	o	o	x
	12	Single or double occupancy sleeping rooms have a private sanitary space with a toilet, shower or tub and sink modules.	o	o	x

**Table 2.2.4 (Continued ....)**  
**GENERAL – BASED ON VESSEL’S SIZE**

Note: tons = gross registered tons

	13	On vessels over 1,600 tons, a toilet and washbasin having hot and coldrunning potable water is within easy access of the:	o	o	o
#		• navigation bridge deck and primarily for those on duty in the area	o	x	x
#		•machinery space if not fitted near the engine room control center.	o	x	x
	14	On vessels over 1,600 tons, without private or semi-private sleeping rooms or sanitary spaces, clothes changing facilities are provided for engine department personnel. These facilities are:	o	o	o
#		•outside but within easy access of the machinery space and navigating bridge	x	o	o
#		•fitted with individual lockers	x	o	o
#		•fitted with tubs and/or showers and washbasins.	x	o	o
	15	In vessels between 5,000 and 15,000 tons, at least five officers have sleeping rooms with an attached private sanitary space with a toilet, tub and/or shower and washbasin. The washbasin may be in the sleeping room.	x	o	o
	16	In vessels between 10,000 and 15,000 tons, all officers without private sanitary spaces have private intercommunicating sanitary spaces fitted with a toilet, tub and/or shower and washbasin.	x	o	o
	17	In vessels over 15,000 tons, all officers have sleeping rooms with an attached private sanitary space fitted with a toilet, tub and/or shower and washbasin. The washbasin may be in the sleeping room.	x	o	o
	18	In non-passenger vessels over 25,000 tons, a sanitary space is provided for every two ratings, either in an intercommunicating space between adjoining sleeping rooms or opposite the entrance of such rooms. The sanitary spaces are fitted with a toilet, tub and/or shower and washbasin.	x	o	o
#	19	Each sleeping room (both officer and ratings) is provided with a washbasin with hot and cold running potable water (except when a private sanitary space is provided).	x	o	o

Table 2.2.4 (Continued ....)

SHOWERS/BATHS					
	20	Water heaters supplying showers	o	o	o
		•do not support areas that have higher water temperature requirements, such as food service areas	x	o	o
		•are provided with anti-scalding devices.	x	o	o
	21	Handholds are provided for shower and bath sanitary spaces.	x	o	o
	22	In sanitary spaces intended for more than one person, the shower is screened.	x	o	o
CLEANING / MAINTENANCE					
	23	Clearance is provided around and behind sanitary fixtures to easily adjust, service, or repair them	x	o	o
	24	Fixtures are bulkhead mounted for ease of cleaning.	x	o	o
TOILETS					
	25	Where there is more than one toilet in a space, they are sufficiently screened to provide privacy.	x	o	o
	26	All toilets:	o	o	o
		•have flush water available at all times	x	o	o
		•are independently controllable	x	o	o
		•have a hand washing station.	x	o	o
	27	Toilets, intended for more than one crew member, are situated convenient to, but separate from, sleeping rooms and wash rooms without direct access from:	o	o	o
#		• the sleeping rooms	x	o	o
#		• toilets to which there is no other access. (This requirement does not apply where a toilet is located in a space between two sleeping rooms having a total of not more than four persons.)	x	o	o
#	28	All toilets have ventilation to the open air, independent of any other part of the space.	x	o	o
	29	All toilet spaces shall be ventilated sufficiently to be reasonably free of disagreeable odors and condensation.	x	o	o
	30	The following minimum number of separate toilets are provided:	o	o	o
		•3 in vessels under 800 tons	x	o	o
		•4 in vessels 800 tons or over but under 3,000 tons	x	o	o
		•6 in vessels 3,000 tons or over.	x	o	o

Table 2.2.4 (Continued ....)

WASHBASINS					
	31	Water heaters supplying washbasins:	o	o	o
		• do not support areas that have higher water temperature requirements	x	o	o
		• are provided with anti-scalding devices.	x	o	o
	32	The following at a minimum are provided for each washbasin:	o	o	o
		• a mirror with light	x	o	o
		• toiletry shelf	x	o	o
		• electrical outlets that crew members have ready access to are equipped with ground fault interrupters (GFI)	x	o	o
	33	Facilities to dry hands are provided at all washbasins.	x	o	o
	34	Washbasins are:	o	o	o
		• constructed of approved material	x	o	o
		• smooth surfaced	x	o	o

		• Not liable to crack, flake or corrode.	x	o	o
<b>URINALS</b>					
	35	Urinals have privacy partitions between units and at the end of rows if not provided by sanitary space structures.	x	o	o
	36	The dimension between the centerline of two urinals side-by-side is 690 mm (27 in.) or greater.	x	o	o
	37	The dimension between the centerline of a urinal and bulkhead next to the urinal is 380 mm (15 in.) or greater	x	o	o
	38	The height of the front edge of a urinal is between 455 mm (18 in.) and 605 mm (24 in.) above the deck surface	x	o	o

**Table 2.2.5: Accommodation Area Criteria – Office**

<b>Requirement</b> # = Related ILO MLC 2006, Title 3 Requirement			<b>Meets ACCOM Requirements</b>	<b>Meets ACCOM + Requirements</b>	<b>Meets ACCOM ++ Requirements</b>
<b>GENERAL</b>					
	1	In vessels of over 3000 tons	o	o	o
#		<ul style="list-style-type: none"> <li>• One room is provided and equipped for use as an office for the deck department</li> </ul>	x	o	o
#		<ul style="list-style-type: none"> <li>• One room is provided and equipped for use as an office for the engine department</li> </ul>	x	o	o
<b>OUTFITTING</b>					
	2	The vessel's office has a toilet and washbasin in close proximity	x	o	o

---

## CHAPTER 3 VIBRATIONS

### CONTENTS

SECTION 1 GENERAL .....	44
SECTION 2 TESTING .....	48

## SECTION 1 GENERAL

### Contents

1.1.	Background .....	45
1.2.	Scope .....	45
1.3.	Terminology .....	45
1.4.	Associated Documentation .....	46
1.5.	Criteria.....	46

### 1.1. Background

While working and/or living onboard vessels, a series of generally low-frequency mechanical vibration, as well as single-impulse shock loads is imposed on the human body.

Vessel motions produced by the various sea states in conjunction with vessel speed also imposes low-frequency vibrations. These motions can lead to fatigue, motion sickness, body instability and increased health risk aggravated by shock loads induced vessel slamming. Vessel slamming may occur due to dynamic impact loads being exerted on the vessel's bottom or bow flare due to vessel size, speed, and wave conditions.

Higher-frequency vibration which has an influence on human comfort is often associated with rotating machinery. The imposition of higher frequency vibrations (about 1 to 80 Hz) induces corresponding motions and forces within the human body, creating discomfort and possibly resulting in degraded performance and health.

### 1.2. Scope

This Section includes the criteria and methods for the assessment of whole-body vibration relating to habitability onboard vessels. The criteria were selected to limit potential vibration related interference with work tasks and to improve crew comfort.

Consideration of the vibration loads imposed on the body is restricted to motions transmitted from surrounding structures to the entire human body through the feet of a standing person in the frequency range 1 to 80 Hz. Motions transmitted to the body of a seated or recumbent person have been omitted from this Guide. Due to the provision of resilient or non-rigid surfaces on seats and beds, these surfaces will generally attenuate the transfer of vibration to levels that are lower than those experienced when standing. The motions transmitted through the feet are expected to be the highest vibration levels to which crew will be exposed.

Whole-body vibration limits defined in this Section are based on currently available standards. Compliance with this Section is a prerequisite for being awarded the ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++) notation.

### 1.3. Terminology

*Acceleration:* The rate of change of velocity over time (i.e., meters-per-second squared  $m/s^2$ ).

*Dynamic Positioning:* A system to automatically maintain an installation's position and heading by controlling propellers and/or thrusters. Dynamic positioning can maintain a position to a fixed point over the bottom, or in relation to a moving object (such as another vessel). It can also be used to position the vessel at a favorable angle towards wind, waves, and current.

*Exposure action value:* The value of vibration/repetitive shock above which controlling the whole-body vibration exposure to humans is recommended.

*Exposure limit value:* A value of vibration/repetitive shock above which humans should not be exposed.

*Frequency:* The number of complete cycles of a periodic process occurring per unit time. Frequency is expressed in Hertz (Hz) which corresponds to the number of cycles observed-per-second.

*Frequency weighting:* A transfer function used to modify a signal according to a required dependence on vibration frequency.

- In human response to vibration, various frequency weightings have been defined in order to reflect known or hypothesized relationships between vibration frequency and human response.
- The frequency weighting used to evaluate whole-body vibration in this Guide is  $W_m$  (whole-body) for all three axes (x, y, and z), in accordance with ISO 6954.

*Manned space:* Any space where a seafarer may be present for twenty (20) minutes or longer at one time during normal, routine daily activities. Such spaces would include working or living spaces.

*Multi-axis acceleration value:* The multi-axis acceleration value is calculated from the root-sums-of-squares of the weighted RMS acceleration values in each axis ( $a_{xw}$ ,  $a_{yw}$  and  $a_{zw}$ ) at the measurement point using the following expression:

$$a_w = \sqrt{a_{xw}^2 + a_{yw}^2 + a_{zw}^2}$$

Where  $a_{xw}$ ,  $a_{yw}$  and  $a_{zw}$  are the weighted RMS acceleration values measured in the x-, y- and z-axes, respectively.

*Multi-axis vibration:* Mechanical vibration or shock acting in more than one (1) direction simultaneously.

*Reference calibration:* Calibration of a measuring instrument conducted by an accredited Testing and Calibration Laboratory with traceability to a national or international standard.

*Vibration:* The variation with time of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value.

*Weighted root-mean-square acceleration value ( $a_w$ ):* The weighted root-mean-square (RMS) acceleration,  $a_w$ , in meters-per-second squared, is defined by the expression:

$$a_w = \sqrt{\frac{1}{T} \int_0^T a_w^2 t dt}$$

Where  $a_w(t)$  is the weighted acceleration as a function of time in meters-per-second squared ( $m/s^2$ ) and  $t$  is the duration of the measurement in seconds.

*Whole-body vibration:* Mechanical vibration (or shock) transmitted to the human body as a whole. Whole-body vibration is often due to the vibration of a surface supporting the body.

#### **1.4. Associated documentation**

The following documents provide details about Test Plan preparation, test measurement procedures and/or test reporting:

- ISO 6954:2000, Mechanical Vibration and Shock – Guidelines for the Measurement, Reporting and Evaluation of Vibration with Regard to Habitability on Passenger and Merchant Ships.
- ISO 2631-2:2003, Mechanical Vibration and Shock – Evaluation of Human Exposure to Whole Body Vibration – Part 2, Vibration in Buildings.
- ISO 8041:2005, Human response to vibration – Measuring instrumentation.
- ISO 5348:1998, Mechanical vibration and shock – Mechanical mounting of accelerometers.
- WMO: 1995, Sea State Code.

Further guidance can be found in:

- ISO 2923: 1996, Acoustics – Measurement of noise onboard vessels.
- ISO 20283-2:2008, Mechanical Vibration – Measurement of Vibration on Ships – Part 2: Measurement of Structural Vibration.

#### **1.5. Criteria**

- 1.5.1. The whole-body vibration criteria for the ship Habitability notations (ACCOM, ACCOM+, or ACCOM++) are provided in Table 3.1.1, “Maximum Weighted Root-Mean-Square Acceleration Level”. The severity of the vibration shall be indicated by the weighted root-mean-square acceleration value ( $a_w$ ) as defined in ISO 8041.
- 1.5.2. Whole-body vibration measurements shall only be taken in manned spaces. A space is considered “manned” if it is occupied by a crew member for twenty (20) minutes or longer at a time for normal, routine daily activities. Specific locations are referred to in Ch 3 Sec 2 [2.4], “Measurement Locations”.
- 1.5.3. The maximum vibration levels for accommodation areas and workspaces in Table 3.1.1 “Maximum Root-Mean-Square Acceleration Level” shall not be exceeded under normal operating conditions. The ACCOM notation’s maximum vibration level is primarily aimed at reducing discomfort and interference with task performance. The more stringent maximum level for the ACCOM+ and ACCOM++ notations are aimed at improving performance and comfort. In this instance, “comfort” means the ability of the crew to use a space for its intended purpose with minimal interference or annoyance from whole-body vibration.
- 1.5.4. For the purpose of this Section, the notation applies to the vibration levels occurring on the deck supporting the human body in the three (3) translational (x-, y- and z-) axes. The vibration levels are computed for each axis individually, as well as combined as a multi-axis acceleration value. Each is expressed as a frequency weighted root-mean-square ( $a_w$ ) value. To meet the vibration criteria, the multi-axis  $a_w$  level must be less than or equal to the maximum level expressed in Table 3.1. 1.  
Please note that flag States may have different whole-body vibration requirements from those presented in this Guide. If the flag State’s requirements are more stringent, they take precedence. If this Guide’s criteria are more stringent, this Guide takes precedence.

**Table 3.1.1: Maximum weighted root-mean-square acceleration level**

Notation	Frequency Range	Acceleration Measurement	Maximum RMS Level	
			Accommodation Areas	Workspaces
ACCOM	1-80Hz	$a_w$	178 mm/s <sup>2</sup> (5.0 mm/s)	214 mm/s <sup>2</sup> (6.0 mm/s)
ACCOM+	1-80Hz	$a_w$	143 mm/s <sup>2</sup> (4.0 mm/s)	178 mm/s <sup>2</sup> (5.0 mm/s)
ACCOM++	1-80Hz	$a_w$	107 mm/s <sup>2</sup> (3.0 mm/s)	143 mm/s <sup>2</sup> (4.0 mm/s)

## **SECTION 2 TESTING**

### **Contents**

2.1	Test Plan .....	49
2.2	Test Requirements .....	49
2.3	Test Conditions .....	50
2.4	Measurement Locations .....	51
2.5	Test report .....	52

**2.1. Test plan**

As stated in Ch1 Sec 1[1.6.3 (i)], "Test Plans", a Test Plan shall be developed that can serve as the principal means for verification of the measurements which are performed to check compliance with whole-body vibration criteria. The Test Plan shall include the following:

**2.1.1. Documentation**

The Test Plan shall include appropriate drawings indicating the location of all vibration sources.

**2.1.2. Test personnel**

The Test Plan shall provide necessary information about the Testing Specialist who will be responsible for conducting the test and their approval and certification in accordance with Chapter 7, "Procedural Requirements for IRS Recognized Ambient Environmental Testing Specialists".

**2.1.3. Test conditions**

The Test Plan shall contain details of the conditions under which the tests will be carried out.

**2.1.4. Measurement locations**

The Test Plan shall document, in detail, on appropriate drawings, all spaces where measurements will be taken. In addition, transducer measurement positions shall be indicated. Details on selecting measurement locations and determining transducer measurement positions are provided in Sec 2 [2.4], "Measurement Locations".

**2.1.5. Data acquisition and instruments**

The Test Plan shall provide information regarding the methods and instrumentation to be used for measurement and data collection. Instrumentation specification details shall include type of instruments to be used, accuracy, calibration, sensitivity, conformance with ISO 8041, and frequency range. More details on data acquisition and instruments are provided in Sec 2 [2.2.2], "Data Acquisition and Instruments".

**2.1.6. Data analysis**

The Test Plan shall provide information regarding the methods, software, and instrumentation to be used for data analysis.

**2.1.7. Test schedule**

The Test Plan shall provide information related to the proposed test schedule.

**2.2. Test requirements****2.2.1. General**

Whole-body vibration measurements shall be in accordance with the procedures described in ISO 6954. When the procedures described in this Guide deviate from any requirements or procedures mentioned in ISO 6954, the requirements of this Guide take precedence.

**2.2.2. Data acquisition and instruments**

For the ACCOM, ACCOM+, or ACCOM++ notation, a sample of data shall be recorded for each whole-body vibration measurement position. Each whole-body vibration measurement sample shall be at least sixty (60) seconds in duration. For each location measured, a data sample shall be taken in accordance with the requirements of [2.3], "Test Conditions".

The above measurement samples shall all be taken using the appropriate Type 1 instrumentation (ISO 8041), then frequency weighted and analyzed in accordance with ISO 6954. It is desirable to employ equipment that records and stores acceleration time histories.

**2.3. Test conditions**

The test conditions required for the whole-body vibration measurements shall be in accordance with each of the following Subparagraphs.

**2.3.1. Power output**

The propulsion machinery shall run at contractual service conditions.

**2.3.2. Equipment operation**

All other rotating machinery essential for vessel operation shall run under normal conditions throughout the measurement period. Heating, Ventilation, and Air Conditioning (HVAC) systems are to be running as for normal seagoing conditions during the whole-body vibration measurements.

**2.3.3. Course and water depth**

Whole-body vibration measurements are to be taken with the vessel in a depth of water not less than five (5) times the draft of the vessel. For vessels that do not operate in water depths of five (5) times draft, measurements shall be taken under normal operating and steady state transit conditions.

The vessel shall maintain a single heading and a constant speed during the test.

**2.3.4. Rudder conditions**

The rudder action shall be minimized

**2.3.5. Sea conditions**

Measurements are to be taken under conditions of Sea State 3 or less, as defined by the World Meteorological Organization (WMO) (1995) Sea State Code.

**2.3.6. Loading conditions**

The loading condition of a passenger vessel shall be as close as possible to normal operating conditions. For cargo vessels, measurements shall be taken under ballast conditions. If this is not practicable, the loading condition shall be recorded in the Whole-body Vibration Test Report.

**2.3.7. Test interference**

During the whole-body vibration measurements, vibration that can arise due to unnecessary human activity shall be avoided. For this reason, only the personnel needed to carry out normal operation of the equipment in the space and those who are taking the measurements shall be present in the space being tested.

**2.3.8. Heading Control**

Thrusters used to maintain or assist the heading of an installation should be operating as required under normal operating environmental conditions.

**2.4. Measurement locations****2.4.1. Selection of spaces where measurements are to be conducted**

While selecting vibration measurement locations, the aim is to obtain a representative sample of data that reflects the actual conditions in manned spaces. For practical reasons, it is important to select such locations from where an appropriate amount of sample data can be collected during the testing phase. The measurement locations shall be selected in accordance with the following criteria:

- i. Select potential worst case locations based on their proximity to various sources of vibration such as propulsion or other rotating machinery or where vibration is likely to be transmitted to manned spaces, personnel accommodation areas/ crew accommodation areas and recreation areas via the vessel's structure. Measurements shall be taken in all those identified worst case locations (e.g., cabin adjacent to a machinery space).
- ii. Where a single instance of one (1) type of manned space exists within the vessel (e.g., bridge, mess room, gymnasium, library, etc.), that location shall be selected for measurement.
- iii. Select a representative sample of crew cabins and staterooms throughout the vessel. For vessels with fewer than one hundred (100) crew cabins and staterooms, twenty (20) percent of cabins and staterooms shall be measured.

For vessels with one hundred (100) or more crew cabins and staterooms, apply the following:

- In the forward one-third (1/3) of the vessel, seven (7) percent or 1 in 15 of cabins and staterooms shall be measured.
- In the midsection (center 1/3) of the vessel, five (5) percent or 1 in 25 of cabins and staterooms shall be measured.
- In the aft one-third (1/3) of the vessel, ten (10) percent 1 in 10 of the cabins and staterooms shall be measured.

Within each one-third (1/3) section of the vessel, measurement locations shall be distributed throughout the length of each section and on each deck.

- iv. Regardless of the number of crew cabins and staterooms on a vessel, proper attention must be given for selecting a variety of locations port, starboard, fore, amidships and aft. The worst case locations can be considered part of the representative sample for crew cabins and staterooms, if applicable.
- v. Where multiple instances of the same type accommodation space exist that are not crew cabins, a representative sample of at least fifty (50) percent of each type shall be selected for measurement. The worst case locations are to be considered part of the representative sample, if applicable.

**2.4.2. Walkthrough verification inspection locations**

All normally manned spaces shall be subject to a walkthrough inspection by the IRS Surveyor. The number and locations of the walkthrough inspections will be determined by the IRS Surveyor. The purpose of the walkthrough verification is to subjectively assess the vibration qualities. At the discretion of the IRS Surveyor, additional measurements may be required.

**2.4.3. Transducer measurement positions**

Vibration transducers (accelerometers) shall be located and attached properly to the floor surface in order to measure the vibration at the interface between the standing crew member and the source of vibration. The mounting of accelerometers shall comply with ISO 5384. When the vibration enters the human body from a non-rigid or resilient material (e.g.,

floor covering), secure the transducers with a suitably formed mount that does not alter the pressure distribution on the surface of the floor covering.

In cabins or staterooms, the vibration transducers shall be placed on the deck in the center of the space. (Note: This location may not provide the maximum vibration levels for this particular space. The objective is to minimize the number of measurements yet still obtain a fair and representative sample of the exposure conditions of the person occupying the cabin or stateroom). For larger spaces (public rooms, messes, recreation areas, etc.), it shall be necessary to place transducers at a number of locations in order to obtain a representative sample of the whole-body vibration levels for that space. Transducer locations shall be evenly distributed throughout the space. For a specific room size, the minimum number of measurement locations shall be as indicated in Table 3.2.1, "Distribution of Transducer Positions within Spaces".

**Table 3.2.1: Distribution of transducer positions within spaces**

<b>Space size</b>	<b>Minimum Number of Measurement Positions in Room</b>
Less than 40 m <sup>2</sup> (431 ft <sup>2</sup> )	1
Less than 80 m <sup>2</sup> (861 ft <sup>2</sup> )	2
Less than 200 m <sup>2</sup> (2142 ft <sup>2</sup> )	3
Greater than or equal to 200 m <sup>2</sup> (2142 ft <sup>2</sup> )	4

For vessels without crew cabins and staterooms, transducers shall be located at standing positions normally occupied by crew near the port side, near the centerline and near the starboard side. Transducers shall be evenly distributed fore and aft. Transducers located at one (1) measurement position shall be orthogonally positioned to measure whole-body vibrations in the vertical, longitudinal and transverse axes. Translational accelerometers oriented in different axes at a single measurement position shall be as close together as possible.

**2.5. Test report**

As stated in Ch 1 Sec 1[1.6.3(i)], "Test Reports", a Test Report shall be submitted to the IRS Surveyor to determine whether the vibration levels meet the whole-body vibration criteria and whether this part of the notation requirement has been met. The details listed in the following paragraphs shall be provided in the Whole-body Vibration Test Report.

**2.5.1. Test details**

The following details shall be recorded for each period of testing:

- i. Loading (mean draft and trim);
- ii. Number of crew and other persons onboard during tests;
- iii. Bridge confirmation that operating conditions complied with contractual service conditions;
- iv. Vessel course and speed as well as latitude and longitude coordinates of tests;
- v. Average water depth under keel;
- vi. Weather conditions and meteorological data (i.e., wind speed and direction, ambient outdoor air temperature, outdoor humidity, barometric pressure) at the onset of every data collection period and at intervals of every four (4) hours (if needed) during any data collection period. Weather conditions shall also be reported at the end of each data collection period.
- vii. Sea state;

- viii. Direction of swell relative to vessel heading;
- ix. Any indications of abnormal activity during the test that might skew results;
- x. Vessel equipment operated during the test.

#### **2.5.2. Transducer measurement positions**

Actual transducer positions within the measured spaces shall be indicated on appropriate drawings.

#### **2.5.3. Measurement equipment details**

Details of measurement and analysis equipment (e.g., manufacturer, type and serial number, accuracy and resolution), including frequency analysis parameters (e.g., resolution, averaging time, and filtering), shall be provided. Copies of the relevant instrumentation reference calibration certificates, together with the results of field setup and calibration checks before and after the field tests, shall be provided.

#### **2.5.4. Results**

The following results, per sample period and measurement axis, as appropriate for notation, shall be provided in table format:

- i. Measurement position (i.e., space and location within space);
- ii. Measurement period if different from requirements;
- iii. Sample number;
- iv. Multi-Axis weighted RMS values;
- v. Equipment operating in proximity to the measurement position.

For spaces that were subjected to walkthrough verification inspection measurements, the following information shall be provided:

- i. Name and number of spaces;
- ii. Walkthrough inspection observations;
- iii. Measurement results, if necessary.

#### **2.5.5. Deviations**

All deviations from the approved Test Plan shall be reported.

#### **2.5.6. Surveyor witnessing documentation**

The equipment calibration and data collection process of vibration tests conducted at sea shall be witnessed by an IRS Surveyor. The IRS Surveyor shall provide documentation stating whether all steps of the vibration testing were completed to their satisfaction. A copy of the witnessing document shall be given to the person conducting the onboard testing, for insertion into the final Whole-body Vibration Test Report. The original shall be retained for IRS' files.

#### **2.5.7. Results**

The Whole-body Vibration Test Report shall be reviewed by the IRS Surveyor against the appropriate ACCOM, ACCOM+, or ACCOM++ criteria for notation confirmation.

## CHAPTER 4 NOISE PREVENTION

### CONTENTS

SECTION 1 GENERAL .....	55
SECTION 2 TESTING.....	58

---

## SECTION 1 GENERAL

### Contents

1.1. Background .....	56
1.2. Scope.....	56
1.3. Terminology.....	56
1.4. Associated Documentation.....	56
1.5. Criteria .....	57

### 1.1. Background

A large amount of research has been performed on the effects of noise on humans. Established or commonly used criteria exist for the effects of noise on speech communication, hearing loss, sleep, concentration, and “annoyance”. These have provided a basis for the criteria in this Guide.

### 1.2. Scope

In this Section, noise criteria have been selected to improve crew performance and to facilitate communication and sleep in appropriate vessel spaces. An additional goal is to improve crew safety and comfort. In this instance, “comfort” means the ability of the crew to use a space for its intended purpose with minimal interference or annoyance from noise.

The noise criteria presented in this Section are lower than the levels commonly associated with hearing loss. Further guidance with respect to hearing conservation is provided in the IMO Resolution A.468(XII) (1981) Code on Noise Levels On-board Ships and should be followed for noise levels and exposure duration, particularly for areas with noise levels in excess of 85 dB(A).

This Section applies to manned spaces and other areas occupied by seafarers for twenty (20) minutes or longer at any one time during normal, routine daily activities. Examples of such spaces include cabins, staterooms, workspaces (duty stations), mess areas, and recreation spaces, both inside and in other vessel locations outside the accommodation block.

Compliance with this Section is a prerequisite for the ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++) notation.

### 1.3. Terminology

*A-weighted sound pressure level:* The magnitude of a sound, expressed in decibels (i.e., 20 micropascals); the various frequency components are adjusted according to the A-weighted values given in IEC 61672-1 (2004) in order to account for the frequency response characteristics of the human ear. The symbol is  $L_A$ ; the unit is dB(A). The measurement  $L_{Aeq}$  is an equivalent continuous A-weighted sound pressure level, measured over a period of time.

*Calibration checks:* Field calibration of a measuring instrument conducted before and after a field test, using a reference calibrated signal or through zero calibration.

*Dynamic Positioning:* A system to automatically maintain an installation’s position and heading by controlling propellers and/or thrusters. Dynamic positioning can maintain a position to a fixed point over the bottom, or in relation to a moving object (such as another vessel). It can also be used to position the vessel at a favorable angle towards wind, waves, and current.

*Equivalent continuous A-weighted sound pressure level:* The A-weighted sound pressure level of a notional steady sound, over a certain time interval, which would have the same acoustic energy as the variable-loudness real sound under consideration, over that same time interval. The symbol is  $L_{Aeq}$ ; the unit is dB(A).

*Reference calibration:* Calibration of measuring instrument, conducted by an accredited Testing and Calibration Laboratory, with traceability to a national or international standard.

### 1.4. Associated documentation

The following documents provide details about Test Plan preparation, test measurement procedures and/or test reporting:

- ISO 2923:1996, Acoustics – Measurement of noise onboard vessels.
- IEC 61672-1:2004, Electro acoustics – Sound Level Meters – Part 1: Specifications IEC 61672-1 (2004).
- IMO Resolution A.468(XII): 1981, Code on noise levels onboard ships.
- WMO: 1995, Sea State Code.

1.5. Criteria

1.5.1. Equivalent continuous A-weighted sound pressure level

The noise criteria for the ship Habitability notations (ACCOM, ACCOM+, and ACCOM++) are provided in Table 4.1.1, “Noise Criteria for Ships”. Noise levels shall be determined for the test conditions specified in Sec 2 [2.3] , “Test Conditions” and shall not exceed the maximum acceptable  $L_{Aeq}$  levels indicated in , Table 4.1.1, “Noise Criteria for Ships”, for each type of space or area. The maximum acceptable noise levels given in Table 4.1.1, “Noise Criteria for Ships” are  $L_{Aeq}$  values, determined as appropriate to the character of the noise (see [2.5], “Measurement Procedures and Recorded Results”). These limit values are for sea-going conditions only and do not include any in-port activities.

Please note that flag States may have different noise requirements from those presented in this Guide. If the flag State’s requirements are more stringent, they take precedence. If this Guide’s criteria are more stringent, this Guide takes precedence.

Table 4.1.1: Noise criteria for ships

Space <sup>(1,2)</sup>	Maximum Acceptable Noise $L_{Aeq}$ Level dB(A)		
	ACCOM	ACCOM+	ACCOM +++
<b>Crew Accommodation Spaces and Open Deck Recreation Areas</b>			
Cabins	60	55	50
Sanitary Spaces( if separate from the cabin)	65	60	55
Dining (mess) Spaces	65	60	55
Indoor recreation spaces	65	60	55
Gymnasiums	65	60	60
Medical and first aid center	60	55	55
Open deck	75	70	70
<b>Navigation and Control Spaces</b>			
Wheelhouse, Pilothouse, Bridge	65	60	55
Radio Room	60	55	55
Offices	65	60	60
Cargo Control Rooms	65	60	60
Machinery Control Rooms	75	70	70
<b>Service Spaces</b>			
Food Preparation (e.g., Galley, Scullery)	75	70	65
Pantries <sup>(2)</sup>	75	70	70
Storerooms	75	70	70
Laundry Areas	75	70	70
<b>Operating and Maintenance Spaces</b>			
Continuously Manned Machinery Spaces	90	90	90
Not Continuously Manned Machinery Spaces	110	110	110
Workshops	85	80	80
Fan and Generator Rooms	90	90	90
<b>Notes:</b>			
1. In any manned space with noise levels above 85 dB(A), hearing protection should be worn in accordance with appropriate IMO regulations.			
2. Unless this space is normally manned, no confirmatory measurements for the ship Habitability notations are required.			

## SECTION 2 TESTING

### Contents

2.1.	Test plan.....	59
2.2.	Test requirements .....	59
2.3.	Test conditions .....	60
2.4.	Measurement locations .....	61
2.5.	Measurement procedures and recorded results .....	62
2.6.	Test report.....	62

## 2.1. Test plan

As stated in Ch 1 Sec 1[1.6.3(i)], “Test Plans”, a Test Plan shall be developed to serve as the principal means for verifying the measurements to be performed to demonstrate or confirm compliance with noise criteria. The Test Plan shall include the following:

### 2.1.1. Documentation

The Test Plan shall include appropriate design information including noise specifications for the vessel. It shall also include layout drawings indicating the locations of all noise sources and noise generating equipment. The information shall be of such detail to enable an IRS Surveyor to verify compliance with the criteria set in this Guide.

The Test Plan shall be submitted to IRS for review and approval.

### 2.1.2. Test personnel

The Test Plan shall provide information about the Testing Specialist who will be conducting the test and their approval and certification in accordance with Chapter 7, “Procedural Requirements for IRS Recognized Ambient Environmental Testing Specialists”.

### 2.1.3. Test conditions

Measurements are to be taken under conditions of Sea State 3 or less, as defined by the World Meteorological Organization (WMO) (1995) Sea State Code.

### 2.1.4. Measurement locations

The Test Plan shall document, in detail, on appropriate drawings, all spaces or areas where measurements will be taken. In addition, measurement positions shall be indicated on the drawings. Details on selecting measurement locations are provided in Sec [2.4], “Measurement Locations”.

### 2.1.5. Data acquisition and instruments

The Test Plan shall provide information regarding the methods and instrumentation to be used for measurement and data collection. Instrumentation specification details shall include type of instruments to be used, accuracy, calibration, and sensitivity. More details on data acquisition and instruments are provided in Sec 2[2.2.2], “Data Acquisition and Instruments”.

### 2.1.6. Data analysis

The Test Plan shall provide information regarding the methods, software, and instrumentation to be used for data analysis.

### 2.1.7. Test schedule

The Test Plan shall provide information regarding the proposed test schedule.

## 2.2. Test requirements

### 2.2.1. General

In general, the noise measurements shall be carried out in accordance with the requirements of IMO Resolution A.468 (XII) Code on Noise Levels On-board Ships.

However, where the IMO requirements differ from those in this Guide, this Guide shall take precedence.

2.2.2. Data acquisition and instruments

The integrating-averaging sound level meter shall meet the requirements for a Type 1 instrument specified in IEC 61672-1. For each location sampled, a measurement shall be taken in accordance with the requirements in Sec [2.3], "Test Conditions".

**2.3. Test conditions**

The test conditions required for the noise measurements shall be in accordance with each of the following Subparagraphs, based on ISO 2923.

2.3.1. Power output

The propulsion machinery shall run at contractual service conditions.

2.3.2. Equipment operation

All machinery essential for vessel operation shall operate under normal conditions throughout the measurement period. Heating, Ventilation, and Air Conditioning (HVAC) systems are to be running as for normal seagoing conditions during the noise measurements. For the galley/scullery, all equipment that runs for twenty (20) minutes or more (e.g., ventilation hoods) should be running during the noise measurements. Equipment that is used only intermittently (e.g., blender/mixer/meat cutter) need not be running during the noise measurements. Note the equipment that is running in the Noise Test Report.

2.3.3. Course and water depth

Noise measurements are to be taken with the vessel in a depth of water not less than five (5) times the draft of the vessel. For vessels that do not operate in water depths of five (5) times draft, measurements shall be taken under normal operating and transit conditions. The course of the vessel shall be as straight as possible and at a constant speed.

2.3.4. Rudder conditions

The rudder action shall be minimized.

2.3.5. Sea conditions

Measurements are to be taken under conditions of Sea State 3 or less, as defined by the World Meteorological Organization (WMO) (1995) Sea State Code.

2.3.6. Loading conditions

The loading condition of a passenger vessel shall be as close as possible to normal operating conditions. For cargo vessels, measurements shall be taken under ballast conditions. If this is not practicable, then the loading condition would be recorded in the Noise Test Report.

2.3.7. Test interference

During noise measurements, noise arising from any kind of unnecessary human activity shall be avoided. For this reason, only the personnel needed for the normal operation of the

equipment in the space and those carrying out the measurements shall be present in the space being tested. Doors and windows shall be closed, except where they are normally left open (such as the door on the lee side of the navigation bridge, which may normally be open). Any open doors or windows shall be noted in the Noise Test Report. Spaces shall be furnished with all usual equipment and furnishings normally found in the space. Equipment shall be configured to operate in its normal operating mode.

## 2.4. Measurement locations

### 2.4.1. Selection of spaces where measurements are to be conducted.

The aim when selecting noise measurement locations shall be to obtain a representative sample of data that reflects the actual conditions in manned spaces. For practical reasons, it is important to select the locations such that an appropriate amount of sample data can be collected during the testing phase. The measurement locations shall be selected in accordance with the following criteria:

- i. Select potential worst case locations based on their proximity to noise emitting sources such as propulsion or other rotating machinery or where noise is likely to be transmitted to manned spaces, accommodation areas and recreation areas via the vessel's structure. Measurements shall be taken in all identified worst case locations (e.g., cabin adjacent to a machinery space).
- ii. Where a single instance of one (1) type of manned space exists within the vessel (e.g., bridge, mess room, gymnasium, library, etc.), that location shall be selected for measurement.
- iii. Select a representative sample of crew cabins and staterooms throughout the vessel. For vessels with less than 20 cabins, fifty (50) percent of cabins on each deck shall be selected. For vessels with greater than 20 cabins, thirty (30) percent of cabins on each deck shall be selected. These measurement locations must be selected at locations port, starboard, fore, amidships and aft. The worst case locations can be considered part as the representative sample for crew cabins and staterooms, if applicable.
- iv. Measurements in passageways shall be conducted at distances not smaller than 2 m (6.5 ft) and not greater than 7 m (23 ft) throughout the space. The worst case locations (e.g., inlets and outlets of air-circulation systems, locations adjacent to stairwells and elevator shafts) shall be considered part of the measurements, if applicable.
- v. If any of the spaces or passageways identified for measurement extend or are situated over a large portion of the vessel, then measurement locations would be selected throughout the length of the vessel and on each deck.
- vi. Where multiple instances of the same type accommodation space exist, that are not crew cabins, a representative sample of at least fifty (50) percent of each type shall be selected for measurement. The worst case locations are to be considered part of the representative sample, if applicable.

### 2.4.2. Walkthrough verification inspection locations

All normally manned spaces shall be subject to a walkthrough inspection by the IRS Surveyor. The number and locations of the walkthrough inspections will be determined by the IRS Surveyor. The purpose of the walkthrough verification is to subjectively assess the noise qualities. At the discretion of the IRS Surveyor, additional measurements may be required.

### 2.4.3. Measurement positions

The measurement positions described below are taken or adapted from ISO 2923 and IMO Resolution A.468 (XII). Measure at positions where persons will be seated or standing. The microphone shall be at a height of approximately 1200 mm (47 in.) from the deck to represent seated persons and approximately 1600 mm (63 in.) from the deck to represent

standing persons, as appropriate for the measurement position. In crew accommodation spaces/ personnel accommodation spaces, measure in the middle of the space. For all measurements, the microphone shall not be closer than 500 mm (20 in.) from the boundary surface (e.g., bulkhead) of a space. The measurement time shall be at least fifteen (15) seconds and shall be long enough to enable the measurement of the equivalent continuous A-weighted sound pressure level for any specified time interval within the stated limits of overall measurement uncertainty. If practicable, do not measure closer than 1000 mm (39.5 in.) from operating machinery, air inlets, or from decks, bulkheads or other large surfaces. Where this is not possible, take measurements midway between the machinery and an adjacent reflecting surface.

## **2.5. Measurement procedures and recorded results**

### **2.5.1. Persons present during measurements**

When Testing Specialist personnel are conducting noise level measurements in any space, only crew members necessary for the operation of that space should be present.

### **2.5.2. Sampling duration**

Equivalent continuous A-weighted sound pressure levels ( $L_{Aeq}$ ) shall be reported for each measurement location. The  $L_{Aeq}$  sampling duration shall be sufficient to achieve a stable reading. Sampling time shall be fifteen (15) seconds or longer.

### **2.5.3. Cyclic noise**

If the noise within a space is cyclic, then the  $L_{Aeq}$  sampling duration shall be sufficient to capture an integer number of complete cycles. If a long-duration sample is judged impractical, then a  $L_{Aeq}$  value would be determined and reported for the high-noise portion of the cycle.

### **2.5.4. Intermittent noise**

If the noise within a space is present intermittently, then an  $L_{Aeq}$  value would be determined and reported for a period of high-level noise.

### **2.5.5. HVAC related noise**

If HVAC system-related noise is a large contributor to the noise level in the space, then a noise measurement would be made approximately 300 mm (12 in.) from the vent, measured in line with the direction of airflow, and recorded in the Noise Test Report.

## **2.6. Test report**

As stated in Ch 1 Sec 1 [1.6.3(i)], "Test Reports", a Test Report shall be submitted to the IRS Surveyor to determine whether the noise levels are at or below the limits and whether this part of the notation requirement has been met. The details listed in the following paragraphs shall be provided in the Noise Test Report.

### **2.6.1. Test details**

The following details shall be provided for each period of testing:

- i. Loading (mean draft and trim);
- ii. Number of crew and number of other persons onboard during testing;
- iii. Bridge confirmation that operating conditions complied with contractual service conditions.

- iv. Vessel course and speed;
- v. Average water depth under keel;
- vi. Weather conditions and meteorological data (i.e., wind speed and direction, ambient outdoor air temperature, outdoor humidity, barometric pressure) at the onset of every data collection period and at intervals of every four (4) hours (if needed) during any data collection period. Weather conditions shall also be reported at the end of each data collection period.
- vii. Sea state;
- viii. Any indications of abnormal activity during the test that might skew results.
- ix. Vessel's equipment operated during the test.

2.6.2. Measurement positions

Actual measurement location positions shall be indicated on appropriate drawings.

2.6.3. Measurement equipment details

Details of measurement and analysis equipment (e.g., manufacturer, type and serial number, accuracy, sampling frequency and resolution) shall be provided. Copies shall be provided of the relevant instrumentation reference calibration certificates, together with the results of field setup and calibration checks, before and after the field tests.

2.6.4. Results

The Noise Test Report and test results shall be reviewed by the IRS Surveyor against the noise criteria for notation confirmation.

The following results, per measurement location and sample period as appropriate for notation, shall be provided in table format:

- i. Measurement position (i.e., space and location within space).
- ii. Number of people present in the space at time of measurement.
- iii. Measurement period.
- iv. Time at start and finish of measurement.
- v. Equivalent continuous A-weighted sound pressure level ( $L_{Aeq}$ ).
- vi. Note any open doors and windows.
- vii. Note equipment operating in proximity to the measurement position.
- viii. Note observed direct sources of noise (such as ventilation devices) and any measurement data collected.

For all the remaining spaces that were checked through walkthrough verification inspection and spot check measurements, the following information shall be provided:

- i. Name and number of space;
- ii. Walkthrough inspection observations;
- iii. Measurement results, if necessary.

2.6.5. Deviations

All deviations from the approved Test Plan shall be reported. Where there are noted deviations from criteria and measurements were taken during Installation and Commissioning, those deviations can be retested during operation of the unit to determine if compliance is met in the operational setting.

2.6.6. Surveyor witnessing documentation

The equipment calibration and data collection process of the noise level tests shall be witnessed by an IRS Surveyor. The IRS Surveyor shall provide documentation stating whether all steps of the noise level testing were completed to their satisfaction. A copy of

the witnessing document shall be given to the person conducting the testing, for insertion into the final Noise Test Report. The original shall be retained for IRS' files.

2.6.7 Results

The Noise Test Report and test results shall be reviewed by the IRS Surveyor against the noise criteria for notation confirmation.

---

## CHAPTER 5 INDOOR CLIMATE

### CONTENTS

SECTION 1 GENERAL .....	66
SECTION 2 DESIGN REQUIREMENTS.....	69
SECTION 3 TESTING .....	73

**SECTION 1 GENERAL**

**Contents**

1.1. Background ..... 67  
1.2. Scope ..... 67  
1.3. Terminology ..... 67  
1.4. Associated Documentation ..... 68

### 1.1. Background

In ISO 7730, thermal comfort is defined as "...that state of mind which expresses satisfaction with the thermal environment". Henceforth, sensation of thermal comfort is majorly subjective and will vary from person to person. Due to the inherent differences in metabolism and expectations, there are discrete individual differences among people's perception of comfort as a function of temperature, humidity and other atmospheric characteristics. The perceived comfort is influenced by habits, acclimatization and expectations. These individual differences make it tricky to specify a single thermal environment that will be satisfactory for all. Therefore, a thermal environment is typically defined to be acceptable to up to eighty (80) percent of the occupants of an interior space. Individually, the perception of thermal comfort is largely determined by the interaction of thermal environmental factors such as air velocity, air temperature, relative humidity and factors related to activity and clothing. The thermal control or Heating, Ventilation, and Air Conditioning (HVAC) systems on a vessel should be designed to effectively control the indoor thermal environmental parameters to within acceptable limits to aid the thermal comfort of the occupants.

### 1.2. Scope

This Section gives the verification, assessment criteria and measurement methodology for indoor climate concerned with habitability on ships. The criteria are based on currently available standards and were selected to give an index of crew thermal comfort. The thermal environmental variables covered by this Guide covers the ambient qualities of air temperature, air velocity and relative humidity. Vertical thermal gradient is used to indicate uncomfortable temperature differentials between a person's head and feet. The crew cabin area horizontal gradient temperature differential between the temperature of inside bulkhead surfaces adjoining crew cabins and the average air temperature within the space serves as an indication of potential thermal comfort or discomfort. The thermal environmental criteria given in this Guide are for persons wearing typical indoor clothing occupied with light, primarily sedentary activity and resulting in a thermal environment acceptable to up to eighty (80) percent of the occupants. This Section applies to enclosed manned spaces occupied by crew members for twenty (20) minutes or longer at any one time for normal, routine day-to-day activities. Examples of seafarer spaces include bridge, engine control room, crew accommodation areas and indoor workspaces.

Conformation to this Section is a must for the ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++) notation confirmation.

### 1.3. Terminology

*Air temperature:* The air temperature is the temperature of the air surrounding a person, measured with a standard thermometer.

*Air velocity or movement:* The rate of displacement of ambient air in a specific direction in meters-per-second (m/s) or feet-per-second (ft/s).

*Comfort zone:* It is that range of environmental conditions in which at least eighty (80) percent of crew members experience thermal comfort.

*Horizontal gradient:* The difference of temperature between the average air temperature within the cabin and the inside surface temperatures of the bulkheads bounding the berth. The horizontal gradient is used as an indication to assess potential thermal discomfort due to radiant thermal sources within the cabin.

*HVAC zone:* A group of spaces or space that is (are) independently controlled for temperature, humidity and air distribution. A zone usually comprises of common duct work fed from an air handler.

*Reference calibration:* Calibration of a measuring instrument, conducted by an accredited Testing and Calibration Laboratory, with traceability to a national or international standard.

*Relative humidity (RH):* The ratio of the amount of vapor contained in the air (IR Solute humidity) to the maximum amount of vapor the air can hold at a given temperature prior to precipitation (condensation) occurs.

*Thermal comfort:* Subjective index of “that condition of mind which expresses satisfaction with the thermal environment”.

*Ventilation:* Ventilation is the process of supplying air to and removing air from any space by natural or mechanical means. From the standpoint of comfort and health, ventilation issues involve both quantity and quality.

*Vertical gradient:* The vertical air temperature difference within an enclosed space. The vertical gradient is used as an indication of potential local discomfort at the head and feet.

#### **1.4. Associated documentation**

- ANSI/ASHRAE 55a, (2010). Thermal environmental conditions for human occupancy.
- ANSI/ASHRAE (15) (2010). Practices for Measuring, Testing, Adjusting, and Balancing Shipboard HVAC&R Systems.
- ISO 7726 (E), (1998), Ergonomics of the thermal environment – Instruments for measuring physical quantities.
- NEBB, (2005). Procedural standards for testing, adjusting, balancing of environmental Systems.

---

## SECTION 2 DESIGN REQUIREMENTS

### Contents

2.1.	Criteria .....	70
2.2.	Air temperature .....	70
2.3.	Relative humidity .....	70
2.4.	Enclosed space vertical gradient.....	70
2.5.	Air velocity .....	70
2.6.	Crew/ Personnel cabin area horizontal gradient .....	70
2.7.	Air exchange rate .....	71
2.8.	Summary .....	71

**2.1. Criteria**

The indoor climate criteria for the ship Habitability notations (ACCOM, ACCOM+, and ACCOM++) are given in Table 5.2.1, "Summary of Indoor Climate Requirements".

For taking indoor climate measurements only indoor manned spaces are suitable. Specific measurement locations are discussed in Section 3, [3.4] "Measurement Locations".

The thermal environmental comfort ranges and conditions shall be practicable, under the test conditions specified in Section 3, [3.3] "Test Conditions" in all manned spaces, for normal operating conditions. The ACCOM and ACCOM+ notations criteria provide for a preset return air temperature range maintained by a temperature controller for each zone and are primarily meant for HVAC systems that do not make provision for individual adjustment to go with personal preferences and activities within a particular space. The ACCOM++ notation is targeted at enhancing crew comfort by making provisions for the crew to adjust indoor climate conditions, with respect to air temperature to go well with personal needs within a particular space. Take note that flag States may have different indoor climate requisites from those presented in this Guide. If the flag State's requisites are stern, they take precedence, otherwise this Guide's criteria takes precedence.

**2.2. Air temperature**

**2.2.1. For a ACCOM or a ACCOM+ notation**

The HVAC system shall be capable of providing a preset return air temperature of 22 to 27°C (71.5 to 80°F) during summer months and 20 to 25°C (68 to 77°F) during winter months in an HVAC zone for a set of habitable spaces. A temperature controller shall maintain this temperature. A thermostat is required in each zone for reheat and dehumidification purposes.

**2.2.2. For a ACCOM++ notation**

The HVAC system shall have the potential of supporting an adjustable range of air temperatures between 22 to 27°C (71.5 to 80°F) during summer months and 20 to 25°C (68 to 77°F) inclusive during winter months and in all indoor manned spaces. This temperature shall be maintained by a temperature controller. For temperature regulation, each manned space shall have its own individual controller.

**2.3. Relative humidity**

The HVAC system shall have the potential of providing and maintaining a relative humidity within a range from thirty (30) percent minimum to seventy (70) percent maximum.

**2.4. Enclosed space vertical gradient**

The temperature difference between 100 mm (4 in.) and 1700 mm (67 in.) above the deck shall be maintained within 3°C (6°F).

**2.5. Air velocity**

Air velocities shall not go beyond 30 meters-per-minute or 100 feet-per-minute (0.5 m/s or 1.7 ft/s) at the measurement sites in the space.

**2.6. Crew/ Personnel cabin area horizontal gradient**

In crew cabin areas, the difference between the inside bulkhead surface temperature adjoining crew cabins and the average air temperature within the space shall be less than 10°C (18°F).

**2.7. Air exchange rate**

The rate of air exchange for enclosed spaces shall be at least six (6) complete changes-per-hour.

**2.8. Summary**

A summary of the indoor climate requisites is presented in, Table 5.2.1, “Summary of Indoor Climate Requirements”.

**Table 5.2.1:**

Item	Requirement or Criterion	
	ACCOM&ACCOM+	ACCOM++
Adjustability	Non-adjustable air temperature	Adjustable range of air temperatures
Air Temperature	Winter:20 to 25°C (68 to 77°F) Summer:22 to 27°C (71.5 to 80°F)	
Relative Humidity	A range from 30% minimum to 70% maximum	
Vertical Gradient	The acceptable range is 0 – 3°C (0 – 6°F)	
Air Velocity	Not exceed 30 meters-per-minute or 100 feet-per-minute (0.5 m/s or 1.7 ft/s)	
Horizontal Gradient (Crew Cabin Areas)	The horizontal temperature gradient in crew cabin areas shall be <10°C (18°F)	
Air Exchange Rate	The rate of air change for enclosed spaces shall be at least six (6) complete changes-per-hour	

**SECTION 3 TESTING**

**Contents**

3.1. General ..... 74

3.2. Data Acquisition and Instruments ..... 74

3.3. Test Conditions ..... 74

3.4. Measurement Locations ..... 75

3.5. Test Report ..... 76

3.6. Test Details ..... 76

3.7. Transducer Measurement Positions ..... 76

3.8. Measurement Equipment Details ..... 76

3.9. Results ..... 76

3.10. Deviations ..... 77

3.11. Surveyor Witnessing Documentation ..... 77

### 3.1. General

Indoor climate measurements shall be as per the requisites of ANSI/ASHRAE 55a and ANSI/ASHRAE 15. When the procedures described in this Guide deviate from those in ANSI/ASHRAE 55a and ANSI/ASHRAE 15, the requisites of this Guide shall take priority.

### 3.2. Data acquisition and instruments

The thermal measurement instrumentation shall meet or exceed the minimum characteristics of instruments for measuring physical quantities characterizing an environment specified in ISO 7726.

The quantities given under shall be measured in each of the spaces or zones identified in the Test Plan and the results noted in the Indoor Climate Test Report:

- a. Air temperature
- b. Air velocity
- c. Relative humidity
- d. Horizontal gradient (in crew cabin spaces only).
- e. Vertical gradient

The air temperature and humidity measurements shall be made at least every five (5) minutes for a minimum period of one (1) hour. The minimum, maximum, and average values for the 1-hour period shall be reported for each space measured. For the ACCOM++ notation, the temperature control for a specific space shall be set to the lower requirement level of 20°C (68°F) for the first half-hour and to 27°C (80°F) for the second half-hour of measurement.

**Note:** Data loggers are a type of device that can be left unattended to capture data. These type of devices have been proven effective in assembling temperature and humidity values.

At any site, the measuring period for determining the average air velocity shall be three (3) minutes.

Surface temperatures for all wall surfaces that are adjoining crew cabins shall be measured for determining the horizontal gradient in crew cabin spaces.

### 3.3. Test conditions

To find out the effectiveness of the HVAC system at facilitating the environmental conditions specified in this Guide, measurements shall be made under the conditions given below:

#### 3.3.1. Testing

Testing of identified spaces can be executed in port and at sea, provided the provisions of the requisite test conditions stated here are in conformation at the time the measurements are taken and recorded. In a case where some testing is executed in port, confirmatory testing shall be done with all normally functioning operations. This testing will comprise of a sample of manned spaces on the weather boundary and will be chosen by the IRS Surveyor.

#### 3.3.2. Equipment operation

The HVAC system shall be operating in the normal operation or mode.

#### 3.3.3. Doors and windows

During the evaluation period, the space doors and windows shall be closed, except for routine entry and exit. Any open doors or windows should be noted in the Indoor Climate Test Report.

#### 3.3.4. Equipment and furnishings

Spaces shall be furnished with all usual equipment and furnishings normally found in the space. Equipment shall be configured to operate in its normal operating mode.

#### 3.3.5. Weather and climatic conditions

When thermal conditions in the manned space have a high sensitivity to time of day and weather conditions (e.g., spaces adjacent to exterior bulkheads), the measurement should be made such that the high and low extremes of the thermal parameters are determined (e.g., measurements could therefore be taken during the day and night in the same space). If feasible, measurements should be taken with little or no cloud cover.

#### 3.3.6. Test interference

During the indoor climate measurements, any activity that might affect the indoor climatic variables in the space shall be avoided. For this purpose, only the personnel needed for the normal operation of the equipment in the space and those executing the measurements shall be present in the space being tested. Doors and windows shall be closed, except where they are normally left open (such as the door on the lee side of the navigation bridge, which may normally be open). Any open doors or windows shall be noted in the Indoor Climate Test Report.

### 3.4. Measurement locations

#### 3.4.1. Selection of spaces where measurements are to be conducted

The aim when selecting indoor climate measurement sites shall be to obtain a representative sample of data that reflects the actual conditions in manned spaces. For practical reasons, it is vital to select the sites such that an appropriate amount of sample data can be collected during the testing phase. The measurement locations shall be selected as per the following criteria:

- i. Select probable problem areas where the influence of internal conditions or factors may unfavorably impact the quality of the indoor climate in manned spaces, accommodation areas and recreation areas. Internal conditions cover space proximity to equipment that radiates or IR Sorbs heat (e.g., engine exhaust trunks, freezer spaces, galley, scullery, etc.) and surfaces with thermal differentials in excess of 10°C (18°F) from the ambient temperature in the space. Living and working areas at the ends of HVAC ductwork or piping runs (for heating or cooling) shall be selected as potential problem locations. Measurements shall be taken in all identified potential problem areas.
- ii. Select potential problem areas where the influence of external ambient environmental conditions (e.g., sun, wind, precipitation, etc.) may adversely impact the quality of the indoor climate. These areas include manned spaces, accommodation areas and recreation areas which may be outboard or adjacent to the vessel's hull. Measurements shall be taken in all identified problem areas.
- iii. Where a single instance of one (1) type of space exists within the vessel (e.g., bridge, mess room, gymnasium, library, etc), the location shall be selected for measurement.
- iv. Where multiple instances of one (1) type of space exist (e.g., cabins/staterooms, or recreation areas), a representative sample of at least twenty-five (25) percent of each type (e.g., one-man room, two-man room, etc.) shall be selected for measurement. If applicable, the worst case locations are to be considered part of the representative sample.

All of these measurement sites must be selected at locations port, starboard, fore, amidships, and aft. The worst case locations can be considered part of the representative sample for crew cabins and staterooms, if applicable.

#### 3.4.2. Walkthrough verification inspection locations

All normally manned spaces shall be subject to a walkthrough inspection by the IRS Surveyor. The number and locations of the walkthrough inspections will be determined by the IRS Surveyor. The purpose of the walkthrough verification is to subjectively assess the indoor climate qualities. At the discretion of the IRS Surveyor, additional measurements may be needed.

**3.4.3. Transducer measurement positions**

For each space identified in the Test Plan, the transducer sites shall be standardized as under:

- i. Air temperature and relative humidity measuring instrumentation shall be set up in the middle of the space to measure general space temperature and humidity levels. Air temperature shall be simultaneously measured at approximately 100 mm (4 in.), 1100 mm (43 in.) and 1700 mm (67 in.) above the deck. Relative humidity shall be measured at a height of approximately 1700 mm (67 in.) above the deck.
- ii. Air velocity shall be measured at approximately 100 mm (4 in.), 1100 mm (43 in.) and 1700 mm (67 in.) above the deck in manned spaces, as applicable (to assure air velocity is not excessive). This measurement should be taken in the center of the space. For every testing location, air velocity only needs to be measured once.
- iii. In case of crew cabin spaces, inside wall surface temperatures shall be captured at approx. 300 mm (12 in.) above the mattress.

**3.5. Test report**

A Test Report shall be submitted to the IRS Surveyor, as stated in Chapter 1, Section 1 [1.5.3 i] "Test Reports", to determine whether the indoor climate levels meet the criteria and whether this part of the notation requisite has been met. The details listed in the underlying Paragraphs shall be provided in the Indoor Climate Test Report.

**3.6. Test details**

The details given under shall be provided for each period of testing:

- i. Vessel latitude and longitude coordinates during testing.
- ii. Weather conditions and meteorological data (i.e., wind speed and direction, ambient outdoor air temperature, outdoor humidity, barometric pressure) at the beginning of every data collection period and at intervals of every four (4) hours (if required) during any data collection period. At the end of each data collection period, weather conditions shall also be reported.
- iii. Any indications of abnormal activities or conditions during the test that might distort results.

**3.7. Transducer measurement positions**

Actual measurement locations and transducer sites shall be indicated on appropriate drawings.

**3.8. Measurement equipment details**

Details of measuring and analysis equipment (e.g., type, manufacturer and serial number, accuracy, sampling frequency and resolution) shall be given. Copies of the relevant instrumentation reference calibration certificates, along with the results of field setup and calibration checks prior to and post the field tests, shall be given.

**3.9. Results**

The underlying results, per measurement location and sample period as appropriate for notation, shall be given in tabulated format:

- a. Measurement position
- b. Measurement period
- c. Number of people present in the space at time of measurement.
- d. Time at beginning and end of measurement.
- e. Air temperature (minimum, maximum, and average) at 100 mm (4 in.) above deck.
- f. Air temperature (minimum, maximum, and average) at 1100 mm (43 in.) above deck.
- g. Air temperature (minimum, maximum, and average) at 1700 mm (67 in.) above deck.
- h. Relative humidity (minimum, maximum, and average) at 1700 mm (67 in.) above deck.
- i. Air velocity at 100, 1100, and 1700 mm (4, 43, and 67 in.) above deck at measurement positions.
- j. Vertical gradient (Average air temperature at 1700 mm (67 in.) minus average air temperature at 100 mm (4 in.) above deck).
- k. Horizontal gradient (Side wall surface temperature in crew cabin spaces minus average air temperature at 1100 mm (43 in.) above deck crew cabin areas).
- l. Wind speed and direction, outdoor humidity, ambient outdoor air temperature and barometric pressure corresponding to indoor measurement periods.

For rest of the spaces that were checked through walkthrough verification inspection and spot check measurements, the information given under shall be provided:

- a. Measurement results, if required.
- b. Name and number of space.
- c. Walkthrough inspection observations.

### 3.10. Deviations

All the deviations from the approved Test Plan shall be reported.

### 3.11. Surveyor witnessing documentation

IRS Surveyor must witness the equipment calibration and data collection process of the indoor climate tests. The IRS Surveyor shall also give the documentation stating whether all steps of the indoor climate testing were done to their satisfaction. The person who is conducting the testing shall also be given a copy of the witnessing document for insertion into the final Indoor Climate Test Report. The original shall be kept for IRS' files.

## CHAPTER 6 LIGHTING

### CONTENTS

SECTION 1 GENERAL .....	79
SECTION 2 TESTING.....	88

---

## SECTION 1 GENERAL

### Contents

1.1. Background .....	80
1.2. Scope.....	80
1.3. Terminology.....	80
1.4. Associated documentation .....	81
1.5. Criteria .....	81
1.6. General and task lighting.....	82
1.7. Red or low-level white illuminance .....	82

## 1.1. Background

- 1.1.1. The lighting of seafarer spaces should facilitate in visual task performance, movement in the space and create an appropriate visual environment. Lighting design involves integrating these aspects to provide adequate illumination for the safety and well-being of the crew as well as for the various tasks performed onboard vessels.
- 1.1.2. The selection of appropriate illuminance levels for specific tasks and seafarer spaces is an important consideration in the design of lighting systems. There is a difference of opinion as to what levels of light may be considered best for visual tasks. Since illuminance recommendations are generally consensus values, for any task, a range of illuminances may apply. As visual tasks performed within habitable spaces onboard a vessel are generally similar to tasks encountered ashore, requirements for illuminance on vessels generally correspond to those tasks performed in living, working, and recreation areas on shore.
- 1.1.3. Visual tasks encountered on vessels vary and lighting provided can influence ability to see and perform those tasks. Some vision and lighting considerations include task duration, visual fatigue, task criticality, veiling reflections, shadows, and abilities of the observer. The presence of glare is a concern and is often difficult to identify, measure, and assess. Glare is often transient (based on factors such as the direction of the sun to illuminated components or from the placement of lighting fixtures) and therefore, difficult to anticipate. As part of lighting data collection, glare shall be subjectively evaluated jointly by the Testing Specialist and the attending Surveyor witnessing the collection of lighting data. These assessments shall be made as a part of the activities discussed in Sec-2, 2.2.4.2, "Walkthrough Verification Inspection Locations". Measurement of ambient lighting need only be performed once during transit or at pier side when all external source of light can be blocked out.

## 1.2. Scope

- 1.2.1. This section provides criteria for assessing the illuminance levels of general lighting and task lighting on vessels. The main objective of the assessment is to determine whether the various lighting systems comply with minimum standards to accommodate crew visual task performance and facilitate crew movements and well-being and safety onboard vessels.
- 1.2.2. Lighting criteria are based on currently available objective standards and research data. Compliance with this Section is a prerequisite for the ship Habitability (ACCOM), ship Habitability Plus (ACCOM+), or ship Habitability Plus Plus (ACCOM++) notation confirmation.

## 1.3. Terminology

*Disability glare:* Glare which reduces the ability to perform a visual task.

*Discomfort glare:* Glare which produces viewer discomfort, but which does not significantly interfere with visual task performance or visibility.

*General lighting:* Lighting designed to provide a substantially uniform level of illuminance throughout an area, exclusive of any provision for special, localized tasks. Such lighting should be provided by fixed luminaires.

*Glare:* The discomfort or impairment of vision experienced when parts of the visual field are excessively bright in relation to the general surroundings.

*Illuminance:* The luminous flux density at a surface (or the amount of light falling on an object or surface), i.e., the luminous flux incident-per-unit area. Illuminance is measured in units of Lux ( $\text{lm}/\text{m}^2$ ) or foot-candles (fc;  $\text{lm}/\text{ft}^2$ ). One foot-candle equals 10.76 Lux.

*Lumen:* The International System of Units (SI) of luminous flux, used in describing a quantity of light emitted by a source or received by a surface.

*Luminaire:* A complete lighting unit consisting of a lamp(s) together with the parts designed to distribute the light, to position and protect the lamp and to connect the lamp to the power supply.

*Luminance:* The photometric brightness of an illuminated surface (or the amount of light emitted or reflected from the surface). The SI unit of luminance is candela-per-square meter ( $\text{cd}/\text{m}^2$ ).

*Luminous flux:* The light emitted by a source, or received by a surface and indicates the intensity of a source. Flux is expressed in lumens.

*Lux:* A unit of illumination, equivalent to 0.0929 foot-candle and equal to the illumination produced by luminous flux of one lumen falling perpendicularly on a surface one meter square. Also called meter-candle

*Red or low-level white illuminance:* Lighting provided to accommodate efficient dark adaptation in areas where seeing tasks are performed during nighttime operations and in areas where people need to move from a lit interior into a dark environment and maintain good vision.

*Reference calibration:* Calibration of a measuring instrument, conducted by an accredited Testing and Calibration Laboratory, with traceability to a national or international standard.

*Task lighting:* Lighting provided to meet the illuminance requirements of a specific task. Task lighting refers to the total illuminance requirement that may be obtained by supplementary lighting provided in addition to the general illuminance. Such lighting may be provided by fixed luminaires' or via floor lamps or table lamps.

*Task plane:* The horizontal, vertical, or inclined plane in which the visual task lies. If no information is available, then the task plane may be considered to be the horizontal and at 750 mm (29.5 in.) above the deck for seated tasks and 1000 mm (39.5 in.) for standing tasks.

#### 1.4. Associated documentation

The following documents provide details about test plan preparation, test measurement procedures and/or test reporting:

- IESNA RP-12-97, Recommended Practice for Marine Lighting.
- ISO 8995:2000 (CIE S 008/E), Lighting of indoor work places.

#### 1.5. Criteria

The lighting criteria for the ship Habitability notation are provided in:

- Table 6.1.1, "Lighting Criteria for Crew Accommodation Spaces".
- Table 6.1.2, "Lighting Criteria for Navigation and Control Spaces".
- Table 6.1.3, "Lighting Criteria for Service Spaces".
- Table 6.1.4, "Lighting Criteria for Operating and Maintenance Spaces/Areas".
- Table 6.1.5, "Lighting Criteria for Red or Low-level White Illuminance".

For lighting, the criteria for ACCOM, ACCOM+, and ACCOM++ are the same. In this section, general lighting and task lighting requirements are provided for crew tasks and spaces normally encountered on vessels. The lighting levels provided in the tables are for new lamps. Emergency lighting is covered in SOLAS and IMO Resolutions and was not considered in the selection of the lighting levels provided in this Guide.

Please note that flag States may have different lighting requirements from those presented in this Guide. If the flag State's requirements are more stringent, then they take precedence. If this Guide's criteria are more stringent, then this Guide takes precedence.

The criteria in this section are applicable to the entire vessel, not just manned spaces.

**1.6. General and task lighting**

The minimum maintained illuminance levels in Lighting Criteria Tables 1 through 4 of this Section shall be achieved under the test conditions specified in Section 2, [2.1.3], "Test Conditions", measured with task lighting turned on where provided but with daylight excluded.

**1.7. Red or low-level white illuminance**

In workspaces where red or low-level white illuminance is provided to facilitate dark adaptation, the maintained illuminance levels in Table 6.1.5, "Lighting for Red or Low-level White Illuminance", are provided for guidance only and are not required for an ACCOM notation.

**Table 6.1.1: Lighting criteria for crew accommodation spaces**

Space	Illuminance Level in Lux	Space	Illuminance Level in Lux
<b>Entrances and Passageways</b>			
Interior Walkways, Passageways, Stairways and Access Ways	100	Exterior Walkways, Passageways, Stairways and Access Ways (Night)	100
Corridors in Living Quarters and Work Areas	100	Stairs, Escalators	150
		Muster Area	200
<b>Cabins, Staterooms, and Sanitary Spaces*</b>			
General Lighting	150	Bath/Showers (General Lighting)	150
Reading and Writing (Desk or Bunk Light)	500	All other Areas within Sanitary Space (e.g., Toilets)	200
Mirrors (Personal Grooming)	500	Light During Sleep Periods	<30
<b>Dining Spaces</b>			
Mess Room and Cafeteria	300	Snack or Coffee Area	150
<b>Recreation Spaces</b>			
Lounges	200	Gymnasiums	300
Library	300	Bulletin Boards/Display Areas	150
Multimedia Resource Center	500	All other Recreation Spaces (e.g. Game Rooms)	200
TV Room	150	Training/Transit Room Office/Meeting rooms	500
<b>Medical, Dental and First Aid Center</b>			
Dispensary Hospital/Ward	500	Wards - General Lighting - Critical Examination - Reading - Hospital/Ward	150 500 300 500
Medical and Dental Treatment/ Examination Room Hospital/Ward	500		
Medical Waiting Areas	200		
Laboratories	500		

**Table 6.1.2: Lighting criteria for navigation and control spaces**

<b>Space</b>	<b>Illuminance Level in Lux</b>	<b>Space</b>	<b>Illuminance Level in Lux</b>
Wheelhouse, Pilothouse, Bridge	300	Offices	300
Chart Room - General Lighting - On Chart Table	150 500	- General Lighting - Computer Work - Service Counters	300 300
Other Control Rooms (e.g., Cargo Transfer etc.) - General Lighting - Computer Work - Central Control Room	300 300 500	Control Stations - General Lighting - Control Consoles and  Boards, Panels, Instruments	300 300
Radar Room	200	- Switchboards - Log Desk - Local Instrument Room	500 500 400
Radio Room	300	Gyro Room	200

**Table 6.1.3: Lighting criteria for service spaces**

Space	Illuminance Level in Lux	Space	Illuminance Level in Lux
Food Preparation	500	Laundries	
- General Lighting	500	- General Lighting	300
- Galley	300	- Machine, Pressing, Finishing and Sorting	300
- Pantry	500		
- Butcher Shop	300	Chemical Storage	300
- Thaw Room	750		
- Working Surfaces, Food Preparation Counter and Range Tops	300	Storerooms	200
- Food Serving Lines	300	- Large Parts	300
- Scullery (Dishwashing)	500	- Small Parts	300
- Extract Hood Store Rooms	100	- Issue Counters	300
Package Handling/Cutting	300	Elevators	150
Mail Sorting	500	Food Storage	200
		- Non-refrigerated	100
		- Refrigerated	

**Table 6.1.4: Lighting criteria for operating and maintenance spaces/areas**

<b>Space</b>	<b>Illuminance Level in Lux</b>	<b>Space</b>	<b>Illuminance Level in Lux</b>
Machinery Spaces (General)	200	Cargo Holds (Portable Lighting)	30
Unmanned Machinery Spaces	200		80
Engine Room	300		300
Generator and Switchboard Room	300	- General Lighting - During Cargo Handling - Passageways and Trunks	300
Switchboard, Transformer Room	500		
Main Generator Room/Switch Gear	200		
Fan Room	200	Inspection and Repair Tasks	300
HVAC Room	200		
Motor Room	300		
Motor-Generator Room (Cargo Handling)	150	- Rough	500
		- Medium	750
		- Fine	1000
		- Extra Fine	
Pump Room, Fire Pump Room	200	Workshops	300
Steering Gear Room	200	Paint Shop	750
Windlass Rooms	200	Workshop Office	500
Battery Room	200	Mechanical Workshop	500
Emergency Generator Room	200	Inst/Electrical Workshop	500
Boiler Rooms	100		
Bilge/Void Spaces	75	Unmanned Machinery Room	200
Muster/Embarkation Area	200	Shaft Alley	100
		Escape Trunks	50
Cargo Handling (Weather Decks)	200	Crane Cabin	400
Lay Down Area	200		
General Process and Utility Area	200		
Loading Ramps/Bays	200		
Cargo Storage and Maneuvering Areas	350	Hand signaling areas between crane shack and ship deck	300

**Table 6.1.5: Lighting for red or low-level white illuminance\***

Area	Illuminance Level in Lux
Where seeing is essential for charts and instruments	1 to 20
Interiors or Spaces	5 to 20
Bridge Areas (including chart tables, obstacles and adjacent corridors and spaces)	0 to 20 (Continuously Variable)
Corridors	5 to 20
Repair work (with smaller to larger size detail)	5 to 55
Stairways	5 to 20

## SECTION 2 TESTING

### Contents

2.1. Test plan.....	89
2.2. Test requirements .....	89
2.3. Test report.....	93

## 2.1. Test plan

As stated in Chapter 1, Section 1[1.5.3 i] “Test Plans”, a Test Plan shall be developed that serve as the principal means for submitting design details of the lighting system for review purpose by IRS Engineering and for verifying the measurements to be performed to prove compliance with lighting criteria. The Test Plan shall include the following:

### 2.1.1. Documentation

The Test Plan shall include required design information and layout drawings showing bulkheads, the hull outline, access routes, outlines of major furniture and equipment, location of luminaires, and the space name and number. The drawings shall be to a scale and sized to permit the scaling of survey points (2.1.4 below “Measurement Locations”) and lighting equipment and the recording of luminance and other relevant data.

### 2.1.2. Test personnel

The Test Plan shall provide relevant information about the Testing Specialist who will be conducting the test and their approval and certification. The Testing Specialist shall provide supervision for all services provided. The responsible supervisor shall have had a minimum of two (2) years experience in supervising tests in the ambient environmental aspect for which the Testing Specialist is recognized.

### 2.1.3. Test conditions

The Test Plan shall contain detail information regarding the conditions under which the tests will be carried out. Particulars about test conditions are given in 2.2.3, “Test Conditions”.

### 2.1.4. Measurement locations

The Test Plan shall document, in detail, on appropriate drawings, all spaces or areas where measurements will be taken. In addition, measurement positions within these areas shall be indicated. Details on selecting measurement locations are provided in 2.2.4, “Measurement Locations”.

### 2.1.5. Data acquisition and instruments

The Test Plan shall include information regarding the methods and instrumentation to be used for measurement and data collection. Instrumentation specification details shall include type of instruments to be used, accuracy, calibration, and sensitivity. More details on data acquisition and instruments are provided in 2.2.2, “Data Acquisition and Instruments”.

### 2.1.6. Data analysis

The Test Plan shall furnish the details of the methods used for the purpose of data analysis.

### 2.1.7. Test schedule

The Test Plan shall provide information related to the proposed test schedule.

## 2.2. Test requirements

### 2.2.1. General

Illuminance measurements shall be carried out as described below.

2.2.2. Data acquisition and instruments

The illuminance meter (light meter) should meet the requirements specified in Section B.5 of IESNA RP-12-97. This defines the instrumentation requirements for measuring white light. Instruments used to measure red illuminance should meet the requirements specified in Section B.8.4 of IESNA RP-12-97.

2.2.3. Test conditions

The test conditions required for lighting measurements shall be in accordance with the following subparagraphs:

2.2.3.1. Location

Lighting measurements may be taken in port, at sea, or both, since the measurements are not dependent on vessel operation.

2.2.3.2. Spaces with windows / portlights

In spaces with windows or portlights where the minimum lighting level should be provided by artificial light sources only, lighting measurements shall be taken after dark. In case, lighting measurements are taken during the day, all natural lighting has to be blocked out.

2.2.3.3. Spaces without windows/portlights

Interior spaces with no windows or portlights can be measured during daylight hours.

2.2.3.4. Stray light

Stray light (e.g., deck lighting and moonlight) shall be capable of being masked out as far as practicable. Where it is not possible, measurements of stray light, at appropriate positions, with all lighting turned off, shall be obtained. These readings shall then be deducted from readings taken at the same positions, with the lighting turned on, to determine the illuminance from the lighting.

2.2.3.5. Light for sleep

Lighting measurements shall be taken in cabins and staterooms with all cabin and stateroom lights turned off and curtains, shutters, etc., closed.

2.2.3.6. Test interference

During the lighting measurements, shadows on the light meter caused by any kind of human activity shall be avoided. For this reason, only the personnel required for the normal operation of the equipment in the space and those carrying out the measurements shall be present in the space being tested.

Doors and windows shall remain closed, except where they are normally left open (such as the door on the lee side of the navigation bridge, which may normally be open). Any open doors or windows shall be mentioned in the Lighting Test Report. Spaces shall be furnished with all usual equipment and furnishings normally found in the space.

2.2.3.7. External (deck) lighting

External areas (cargo handling, cargo lay down areas, and external operating consoles) shall be tested on dark evenings without contribution of light to the deck and cargo handling areas from shore lights. Light measurements taken for these locations shall result from lighting systems aboard (excepting star and moon light contributions).

#### 2.2.4. Measurement locations

##### 2.2.4.1. Selection of spaces where measurements are to be conducted

The aim when selecting lighting measurement locations shall be to obtain a representative sample of data that represents the actual conditions in the manned crew spaces listed in the Lighting Criteria Tables 6.1.1 to 6.1.4 of the previous section. For practical reasons, it is important to select those locations where an appropriate amount of sample data can be collected during the testing phase. The measurement locations shall be selected in accordance with the following criteria:

- i. Select problem areas based on the potential for excessive external illumination (daylight) into the space (e.g., bridge). Measurements shall be taken in all identified problem areas.
- ii. Select potential problem areas based on the positioning of luminaires in the space as indicated on the drawings (e.g., uneven spacing of luminaires resulting in non-uniform illuminance levels and dimly lit areas). Measurements shall be taken in all problem areas.
- iii. Where a single instance of one (1) type of space exists within the vessel (e.g., bridge, mess room, gymnasium, library, etc), the location shall be selected for measurement.
- iv. Where multiple instances of one (1) type of space exist (e.g., recreation areas) with the exception of cabins/staterooms, a representative sample of at least twenty-five (25) percent of each type shall be selected for measurement. The problem area locations are to be considered part of the representative sample, if applicable.
- v. Where a number of crew cabin/stateroom spaces are identical in configuration in terms of lighting systems, surface treatments, geometry, furnishings and equipment layout, only two (2) of the spaces on each deck shall be selected to determine whether the lighting requirements are met. Where cabins are not identical in configuration in terms of lighting system, surface treatments, geometry, furnishing, and equipment at least twenty-five (25) percent shall be selected on each deck for measurement.
- vi. All of these measurement locations must be selected at locations port, starboard, fore, amidships and aft. The worst case locations can be considered part as the representative sample for crew cabins and staterooms, if applicable.
- vii. Where external nighttime measurements are taken, spaces shall be selected according to human presence in the space or task location, including: operating consoles, hand signaling locations, anchor handling locations, mooring locations, crew embarkation and debarkation areas, and cargo handling.

##### 2.2.4.2. Walkthrough verification inspection locations

All normally manned spaces shall be subject to a walkthrough inspection by the IRS Surveyor. The number and locations of the walkthrough inspections will be determined by the IRS Surveyor. The purpose is to subjectively assess the lighting qualities. The presence of discomfort or disability glare shall be specifically and subjectively assessed by the Surveyor and the Testing Specialist, and a result of that assessment noted as “no glare present”, “some glare present”, “discomfort

glare present”, or “disability glare present” shall be noted for each lighting test location. At the discretion of the IRS Surveyor, additional measurements or assessments may be required. The Surveyor will determine, if any follow-on activity is required for any note discomfort or disability glare.

**2.2.4.3. General illuminance measurement positions**

General lighting levels shall be measured with all lights turned on except supplementary task lighting, such as desk lights and berth lights. Daylight shall be excluded during the measurements.

Measurements shall be taken on a horizontal plane approximately 750 mm (29.5 in.) above the deck. For traffic areas, readings shall be taken on the deck.

For larger spaces (public rooms, messes, recreation areas, etc.), it is necessary to place measurements at a number of locations in order to obtain a representative sample of the illumination for that space. Measurement locations shall be evenly distributed throughout the space. For a specific room size, the minimum number of measurement locations shall be as indicated in Table 6.2.1, “Distribution of Measurement Positions within Spaces”.

**Table 6.1.2: Distribution of measurement positions within spaces**

<b>Space Size</b>	<b>Minimum Number of Measurement Positions in Room</b>
Less than 40 m <sup>2</sup> (431 ft <sup>2</sup> )	1
Less than 80 m <sup>2</sup> (861 ft <sup>2</sup> )	2
Less than 200 m <sup>2</sup> (2142 ft <sup>2</sup> )	3
Greater than or equal to 200 m <sup>2</sup> (2142 ft <sup>2</sup> )	4

The arithmetic mean of the measurement shall be used for the measure of illuminance of the General area. In the case of corridor lighting, measurements shall be taken approximately every 3000 mm (10 ft) of corridor length. The arithmetic mean shall not be used to determine compliance with corridor lighting requirements.

**2.2.4.4. Task lighting measurement positions**

For task area lighting (such as consoles, control stations, workbenches, computer workstations, desktops and meeting tables, medical stations, galley areas, and maintenance workstations), a representative set of readings shall be taken over the task surface with the worker in the normal working position. Task lighting shall be measured with both general and supplementary task lighting turned on. Daylight shall be excluded during the measurements. Measurements of task lighting shall be made on the surface or in the plane of the task (horizontal, vertical or at an angle). For small task surfaces, smaller than 0.5 m<sup>2</sup> (5 ft<sup>2</sup>), a single measurement shall be taken at the center of the task surface. For larger task surfaces (0.5 m<sup>2</sup> (5 ft<sup>2</sup>) or larger), the illuminance shall be measured by dividing the task surface into a grid no larger than 0.5 m<sup>2</sup> (5 ft<sup>2</sup>) and averaging the measurements taken at the grid intersections. Measurements for mirrors shall be taken approximately 400 mm (16 in.) away from the surface of the mirror. For berths and bunks, measurements shall be taken at a point approximately 300 mm (12 in.) above the top of the mattress and 600 mm (24 in.) from the head of the bed.

**2.2.4.5. Red and low-level white illuminance**

Guidance for the measurement of red and low-level white is provided in B.8.4 in IESNA RP-12-97. These measurements are not required for the Habitability notation.

### 2.3. Test report

As stated in Chapter 1 Section 1 [1.5.3 i] "Test Reports", a Test Report shall be submitted to the IRS Surveyor to determine whether the lighting levels meet the minimum requirements and whether this part of the notation requirement has been met. The details listed in the following paragraphs shall be provided in the Lighting Test Report.

#### 2.3.1. Test details

The following details shall be provided for each period of testing:

- i. Time of day.
- ii. External lighting conditions (e.g., were measurements taken in port or at sea? Were measurements taken during daylight hours or after dark?).

#### 2.3.2. Measurement positions

Actual measurement locations shall be indicated on appropriate drawings.

#### 2.3.3. Measurement equipment details

Details of measuring equipment (e.g., manufacturer, type and serial number, accuracy and resolution) shall be provided. Copies of the relevant instrumentation reference calibration certificates, together with the results of field setup and calibration checks before and after the field tests, shall be provided.

#### 2.3.4. Results

- a. The following results, per space, shall be provided in table format:
  - i. Name and number of space.
  - ii. Task areas (if any) in space.
  - iii. Average lighting level for general lighting.
  - iv. Average lighting level for task lighting on each task surface or plane in space.
  - v. Corridor lighting measurements.
  - vi. Lighting level in cabins/staterooms with lights turned off and curtains, shutters, deadlights, etc., closed.
  - vii. Presence of glare at specific workstations within the space and any follow-up activity requirements.
- b. For all the remaining spaces that were checked through visual inspection and spot check measurements, the following information shall be provided:
  - i. Name and number of space.
  - ii. Visual inspection observations.
  - iii. Measurement results, if necessary.

#### 2.3.5. Deviations

All deviations from the approved Test Plan shall be reported.

#### 2.3.6. Surveyor witnessing documentation

An IRS Surveyor shall witness the equipment calibration and data collection process of the lighting tests. The IRS Surveyor shall provide documentation stating whether all steps of the lighting testing were completed to their satisfaction. A copy of the witnessing document shall be given to the person conducting the testing, for insertion into the final Lighting Test Report. The original shall be retained for IRS' files.

#### 2.3.7. Results

The Lighting Test Report and test results shall be reviewed by the IRS Surveyor against the lighting criteria for notation confirmation.

## CHAPTER 7 PROCEDURAL REQUIREMENTS FOR AMBIENT ENVIRONMENT TESTING

### CONTENTS

SECTION 1 GENERAL .....	95
SECTION 2 PROCEDURE FOR APPROVAL AND CERTIFICATION.....	97

---

## SECTION 1 GENERAL

### CONTENTS

1.1. Terminology.....	96
1.2. Objective.....	96
1.3. Application.....	96

1.1. Terminology

IRS Recognized Ambient Environmental Testing Specialists: Companies providing test or measurement services on behalf of the Owner of a ship or shipyard for the purposes of meeting IRS Habitability (ACCOM, ACCOM+, ACCOM++), notation requirements.

*Calibration checks:* Field calibration of a measuring instrument, conducted before and after a field test, using a reference calibrated signal or through zero calibration.

Reference calibration: Calibration of a measuring instrument, conducted by an accredited Testing and Calibration Laboratory, with traceability to a national or international standard.

1.2. Objective

The objective of this procedure is setting basic standards for qualifying and certifying Testing Specialists performing ambient environmental testing and evaluation.

1.3. Application

This procedure is applicable to the approval of Testing Specialists that provide the following ambient environment test services:

- i. Whole-body Vibration measurements and analysis.
- ii. Noise measurements and analysis.
- iii. Indoor Climate measurement and analysis.
- iv. Lighting measurement and analysis.

General requirements concerning Testing Specialists are given in 2.2, "General Requirements". Specific requirements for the test services listed above are in 2.8, "Detailed Requirements by Ambient Environmental Aspect".

---

## SECTION 2 PROCEDURE FOR APPROVAL AND CERTIFICATION

### Contents

2.1.	Documentation requirements .....	98
2.2.	General requirements.....	98
2.3.	Auditing of the testing specialist .....	99
2.4.	Certification.....	99
2.5.	Quality assurance system .....	99
2.6.	Testing specialist relations with the test equipment manufacturer.....	99
2.7.	Certificate of approval.....	100
2.8.	Detailed requirements by ambient environmental aspect .....	100
2.9.	Noise.....	102
2.10.	Indoor climate .....	103
2.11.	Lighting .....	104

## 2.1. Documentation requirements

IRS should be provided with the following documents for review:

- a. An outline of the company (for example organization and management structure) including subsidiaries or subcontractors to be included in the certification/approval.
- b. A list of company experience in the specific ambient environmental aspect.
- c. A list of test personnel documenting training and experience in conducting tests within the relevant ambient environmental aspect and qualifications according to recognized national, international, or industry standards, as applicable.
- d. Description of equipment used for the measurement and analysis of the particular ambient environmental aspect for which approval is sought (e.g., calibration, accuracy, etc.).

During the initial approval audit (refer to 2.3, "Auditing of the Testing Specialist") the following documents are to be reviewed:

- a. A guide for operators of such equipment.
- b. Training programs for test personnel.
- c. Draft checklists and data recording sheets for recording results of the services referred to in 1.3, "Application".
- d. Quality Manual and/or documented procedures covering requirements in 2.5, "Quality Assurance System".
- e. Evidence of approval/acceptance by certifying bodies, if any.
- f. Information about other activities which may present a conflict of interest.
- g. Record of customer claims and of corrective actions requested by certification bodies for the past year.
- h. Where relevant, list and documentation of licenses granted by equipment's manufacturer.
- i. Example Test Plan(s) for the ambient environmental quality for which approval is requested.
- j. Example Test Reports.

## 2.2. General requirements

- 2.2.1. *Extent of approval:* The Testing Specialist shall demonstrate, as required by 2.3 "Training of Personnel" through 2.2.8, "Reporting", that they have the competence, quality control, and quality assurance needed to perform the test and analysis services for which approval is sought.
- 2.2.2. *Training of personnel:* The Testing Specialist is responsible for the qualification and training of its personnel to a recognized national, international, or industry standard as applicable. Where such standards are nonexistent, the Testing Specialist is to define standards for the training and qualification of its personnel relevant to the functions each is authorized to perform. The personnel shall also have adequate experience and be familiar with the operation of any necessary equipment.
- 2.2.3. *Supervision:* The Testing Specialist is accountable for all services provided. The responsible supervisor should have a minimum of 2 years experience in supervising tests in the ambient environmental aspect for which the Testing Specialist is recognized.
- 2.2.4. *Personnel records:* The Testing Specialist is to keep records of the recognized test personnel. The records are to contain information about formal education, training and experience for the ambient environmental test services for which they are recognized.
- 2.2.5. *Equipment and facilities:* The Testing Specialist is to have the necessary equipment and facilities for the ambient environmental aspect to be tested. It is required to keep a record of the equipment used for ambient environmental testing. The record should contain information about maintenance and calibration.  
The Testing Specialist is to have documented work procedures covering all ambient environmental test services supplied.

- 2.2.6. *Subcontractors*: The Testing Specialist is to give information of agreements and arrangements in case any part(s) of the services provided are subcontracted. The Testing Specialist is to emphasize on quality management in following up of such subcontracts. Subcontractors providing anything other than subcontracted personnel or equipment shall also meet the requirements of 2.2, "General Requirements" and 2.5, "Quality Assurance System".
- 2.2.7. *Verification*: The Testing Specialist is to verify that the services provided are carried out in accordance with approved procedures.
- 2.2.8. *Reporting*: The report has to be prepared in a form acceptable to IRS as outlined within this Guide. The report should also contain a copy of the Certificate of Approval.

### 2.3. Auditing of the testing specialist

Upon reviewing the submitted documents with satisfactory result, the Testing Specialist shall be audited for the initial certification process and then every three (3) years in order to ascertain that the Testing Specialist is duly organized and managed in accordance with the submitted documents and that it is considered capable of conducting the test services for which approval/certification is sought.

### 2.4. Certification

Certification is conditional on a practical demonstration to IRS or its agent of the specific ambient environmental test service performance, as well as a sample of a satisfactory report.

### 2.5. Quality assurance system

The Testing Specialist is to have a documented system covering at the most the following:

- i. Operating instructions for the test equipment.
- ii. Maintenance and reference calibration of equipment.
- iii. Training programs for test personnel.
- iv. Supervision and verification to verify compliance with test procedures.
- v. Recording and reporting of information.
- vi. Quality management of subsidiaries and subcontractors.
- vii. Job preparation.
- viii. Periodic review of test process procedures, complaints, corrective actions, and issuance, maintenance, and control of documents. A documented Quality Assurance system complying with the applicable ISO 9000 standard or equivalent and including the above items would be considered acceptable.

### 2.6. Testing specialist relations with the test equipment manufacturer

A company, which works as a service station and conducts reference calibrations of equipment for a manufacturer (and is a Testing Specialist in this field) shall be assessed by the manufacturer(s) and nominated as their agent. The manufacturer shall verify that appropriate instruction manuals, material, etc., are available for the agent, as well as verifying proper training of the agent's technicians has occurred. Such Testing Specialists shall be recognized either on a case-by-case basis or as follows:

If a manufacturer of equipment (and the Testing Specialist) applies for inclusion of its nominated agents and/or subsidiaries in the approval, then the manufacturer must have implemented a quality assurance system certified in accordance with the relevant ISO 9000 standard or equivalent. The manufacturer must have effective controls of its agents and/or subsidiaries, and these agents/subsidiaries must have an equally effective quality control system complying with the relevant ISO 9000 or equivalent. Such approvals shall be based upon an evaluation of the quality

assurance system implemented by the applicable company ISO 9000 or equivalent. IRS shall follow-up the adherence to this quality assurance system by performing audits on such agents or subsidiaries against the relevant ISO 9000 standard or equivalent.

## **2.7. Certificate of approval**

Upon satisfactory completion of both the audit of the Testing Specialist and practical demonstration, IRS shall issue a Certificate of Approval stating that the Testing Specialist's test and analysis service operation system has been found to be satisfactory and that the results of test and analysis services performed in accordance with that system may be accepted and utilized by IRS in making decisions affecting optional Habitability/Comfort classification notations. The Certificate is to clearly state the type and scope of services and any limitations or restrictions imposed. The Testing Specialist shall also be included in IRS' records of recognized Testing Specialists. Where several ambient environmental aspect measurements are conducted by a given company, each aspect is to be assessed and recognized, except as specified in 2.6, "Testing Specialist Relations with the Test Equipment Manufacturer".

### **2.7.1. Renewal**

As per the Testing Specialist procedure, the Certificate of Approval is to be subjected to renewal or endorsement at intervals not more than three (3) years. The renewal or endorsement has to be accomplished by verification through audits for verifying that approved conditions are maintained.

### **2.7.2. Alterations**

IRS is to be notified immediately when any alteration to the certified test and analysis service operation system of the Testing Specialist is made. As when deemed necessary by IRS, re-audit may be required.

### **2.7.3. Cancellation of approval**

In the following cases, approval maybe cancelled:

- i. Where the service was carried improperly or the results were reported improperly
- ii. Where deficiencies are found in the recognized services of the Testing Specialist and appropriate corrective action is not taken
- iii. Where IRS is not informed of any alteration, as in Subsection A2/6, "Alterations" by the Testing Specialist.
- iv. Where a renewal audit, if requested per 2.7.1, "Renewal", has not been carried out
- v. Where willful acts or omissions are ascertained IRS reserves the right to cancel the approval if any of these cases are met.

A Testing Specialist whose approval was cancelled has the right to apply for re-approval on the condition that the non-conformities, which resulted in cancellation, have been corrected and that IRS is able to confirm that the corrective action has been effectively implemented.

## **2.8. Detailed requirements by ambient environmental aspect**

### **2.8.1. Whole-body vibration**

#### **2.8.1.1. Extent of engagement**

Whole-body vibration measurement Testing Specialists are engaged in conducting vibration measurements and analyses onboard ships.

#### 2.8.1.2. Supervisor

The Supervisor should:

- i. Be qualified to Level II according to a recognized national or international Nondestructive Testing (NDT) standard ((ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- ii. Be a Certified Industrial Hygienist (CIH) with experience in this ambient environmental aspect or
- iii. Have a documented history of at least two (2) years supervising vibration testing onboard marine ships.

The supervisor should have sufficient knowledge of ship structures and equipment, measurement and analysis of whole body vibration according to ISO 6954, for verifying that test procedures are in compliance with the required test conditions.

#### 2.8.1.3. Test personnel

The test personnel carrying out the measurements shall:

- i. Be qualified to Level I according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or;
- ii. Have a documented history of experience in performing vibration environmental testing onboard marine ships.
- iii. Have adequate knowledge of ship structures and equipment.

#### 2.8.1.4. Equipment

IRS has the authority to verify that the equipment to be used is in accordance with the applicable measurement standard. It should be demonstrated to IRS that it is fit for the intended purpose.

#### 2.8.1.5. Procedures

Documented work procedures or test instructions are to contain, at a minimum, information about the following:

- a. Test preparation
- b. Selection and identification of measurement locations
- c. Surface preparation
- d. Calibration checks
- e. Testing methods
- f. Equipment handling
- g. Report preparation and content
- h. Method for handling previous results if subsequent calibration shows instruments to be out of tolerance.

#### 2.8.1.6. Reporting

The report shall be based on the instructions given in Ch 3 Sec 2[.5], "Test Report Framework".

**2.9. Noise**

2.9.1. Extent of engagement

Noise measurement Testing Specialists are engaged for conducting noise measurements and analyze onboard ships.

2.9.2. Supervisor

The Supervisor should:

- a. Be qualified to Level II to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- b. Be a Certified Industrial Hygienist (CIH) with experience in this ambient environmental aspect or
- c. Have a documented history of at least two (2) years supervising noise testing onboard marine ships.

The supervisor should have sufficient knowledge of ship structures, measuring equipment, ISO 2923, IEC 61672-1, and IEC 60804, for verifying that test procedures are in compliance with the required test conditions.

2.9.3. Test personnel

The test personnel carrying out the measurements should:

- a. Be qualified to Level I according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- b. Have a documented history of experience in performing noise testing onboard marine ships.
- c. Have adequate knowledge of ship structures and equipment.

2.9.4. Equipment

IRS shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to IRS that it is fit for the intended purpose.

2.9.5. Procedures

Documented work procedures or test instructions are to contain, at a minimum, information about the following:

- a. Test preparation
- b. Selection and identification of measurement locations
- c. Surface preparation
- d. Calibration checks
- e. Testing methods
- f. Equipment handling
- g. Report preparation and content
- h. Method for handling previous results if subsequent calibration shows instruments to be out of tolerance.

2.9.6. Reporting

The report shall be based on the instructions given in ch 4,[2.5] "Test Report framework".

## 2.10. Indoor climate

### 2.10.1. Extent of engagement

Indoor climate measurement Testing Specialists are engaged for conducting indoor climate measurements and analyze onboard ships.

### 2.10.2. Supervisor

The Supervisor should:

- i. Be qualified to Level II according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or;
- ii. Be a Certified Industrial Hygienist (CIH) with experience in this ambient environmental aspect or have a documented history of at least two (2) years supervising ambient environmental testing onboard marine ships.
- iii. The supervisor should have sufficient knowledge of ship structures, measuring equipment, ANSI/ASHRAE 15 and 55a as well as ISO 7726, for verifying that test procedures are in compliance with the required test conditions.

### 2.10.3. Test personnel

The test personnel carrying out the measurements shall:

- i. Be qualified to Level I according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or;
- ii. Have a documented history of experience in performing ambient environmental testing onboard marine ships.
- iii. Have adequate knowledge of ship structures and equipment.

### 2.10.4. Equipment

IRS shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to IRS that it is fit for the intended purpose.

### 2.10.5. Procedures

Documented work procedures or test instructions are to contain, at a minimum, information about the following:

- a. Test preparation
- b. Selection and identification of measurement locations
- c. Surface preparation, if applicable
- d. Testing methods
- e. Equipment handling
- f. Report preparation and content
- g. Method for handling previous results if subsequent calibration shows instruments to be out of tolerance.

### 2.10.6. Reporting

The report shall be based on the instructions given in Ch 5 Sec 3, [3.5], "Test Report".

**2.11. Lighting**

2.11.1. Extent of engagement

Lighting measurement Testing Specialists are engaged for conducting illuminance measurements and analyze onboard ships.

2.11.2. Supervisor

The Supervisor should:

- a. Be qualified to Level II according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- b. Be a Certified Industrial Hygienist (CIH) with experience in this ambient environmental aspect or
- c. Have a documented history of at least two (2) years supervising ambient environmental testing onboard marine ships.  
The supervisor should have sufficient knowledge of ship structures, measuring equipment, and IESNA RP-12, to verify that test procedures are compliant with the required test conditions.

2.11.3. Test personnel

The test personnel carrying out the measurements should:

- a. Be qualified to Level I according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- b. Have a documented history of experience in performing ambient environmental testing onboard marine ships.
- c. Have ample knowledge of ship structure and equipment.

2.11.4. Equipment

IRS shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to IRS that it is fit for the intended purpose.

2.11.5. Procedures

Documented work procedures or test instructions are to contain, at a minimum, information about the following:

- a. Test preparation
- b. Selection and identification of measurement locations
- c. Surface preparation
- d. Calibration checks
- e. Testing methods
- f. Equipment handling
- g. Report preparation and content
- h. Method for handling previous results if subsequent calibration shows instruments to be out of tolerance

2.11.6. Reporting

The report shall be based on the instructions given in Ch 6 Sec 2 [2.3], "Test Report".