



INTLREG
INTERNATIONAL REGISTER OF SHIPPING

RULES AND REGULATIONS FOR CLASSIFICATION OF STEEL VESSELS

2021

Part 10

Habitability

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PREFACE

INTLREG has produced this Part for Crew Habitability on Ships in order to provide a single source for habitability criteria suitable for ships. This Part 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 Part 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 Part 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 Part 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 Part 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 HISTORY

Refer Changes history in Part 1

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CHAPTER 1 GENERAL

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SECTION 1 GENERAL

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1.1. Introduction

The INTLREG 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 INTLREG Part 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 Part 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 Part 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. INTLREG has produced this Part for Crew Habitability on Ships so as to furnish a single source for habitability criteria appropriate for ships. This Part shall 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 (crew areas).

1.3. Scope

This Part 14 of the INTLREG 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 mentioned 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

INTLREG 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 INTLREG Habitability or Passenger Comfort notations. (ACCOM, ACCOM+, ACCOM++) notation requirements. Approval of the Testing Specialist for ships shall also allow for testing and measurement services for other INTLREG Habitability, Comfort, and MLC 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 Part 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 Part 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".

Gross Tonnage: The gross tonnage calculated in accordance with the tonnage measurement regulations contained in Annex I to the International Convention on Tonnage Measurement of Ships, 1969, or any successor Convention

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. For machinery spaces, a manned space shall be associated with the presence of a local work/control duty station manned for twenty (20) minutes or longer at one time during normal, routine daily activities. Normal inspection, walkthrough (patrolling) and maintenance tasks in machinery spaces are not considered tasks contributing towards a particular space being considered manned

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. This document is to be primarily prepared by the INTLREG Recognized Ambient Environment Testing Specialist with additional input provided by the designer/builder. Submission of the document for approval can be by either the Testing Specialist or the designer/builder.

Test Report: Document containing the actual testing results from the ambient environmental tests including details of the testing conditions, measurement locations, measurement equipment, and the results of the data collected and analyzed.

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 and duty/control stations

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 Part 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 Part 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

	ACCOM	ACCOM+	ACCOM++
Accommodation Areas	ACCOM Requirements for Accommodation Areas	ACCOM and ACCOM+ Requirements for Accommodation Areas	ACCOM+ and ACCOM++ 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	ACCOM with additional requirements	ACCOM+ 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 INTLREG, 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 individually 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 as follows.

Table 1.1.2

Environmental Aspect	Test Plan Details
Vibration	Part 10, Ch 3
Noise	Part 10, Ch4
Indoor Climate	Part 10, Ch5
Lighting	Part 10, Ch6

INTLREG needs to give approval for Test Plans before any measurements are made. INTLREG shall notify the vessel Owner or shipyard whether the Test Plans have been approved or require alteration. An INTLREG 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 INTLREG 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 Part; the specific report contents for the various ambient environmental criteria are outlined in Table 1.1.2 above.

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 INTLREG. INTLREG 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 INTLREG for review. For new construction, the drawings shall be provided to INTLREG during the detailed design phase. For existing vessels, before INTLREG Surveyor does verifications, the plans and arrangement drawings, reflecting the current accommodation area configurations shall be provided to and approved by INTLREG. Then, an INTLREG Surveyor shall execute follow-up physical verification measurements of accommodation area criteria. The INTLREG Surveyor shall choose verification measurement sites. During the notation confirmation process, the outcome of the INTLREG review and actual INTLREG Surveyor verification shall be reviewed by the INTLREG Surveyor. The physical verification measurements of accommodation area criteria shall be performed for all vessels in a series of vessels

1.7.2. Ambient environment

Ambient environmental Test Plans for whole-body vibration, indoor climate, noise and lighting shall be prepared and submitted to INTLREG. 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 INTLREG Surveyor shall witness this. Test Reports for ambient environmental testing shall be prepared by the Testing Specialist and submitted to the INTLREG Surveyor for review.

For a vessel that is expected to operate in extreme environmental conditions (e.g., Polar regions, the Persian Gulf, etc.) that are significantly different from the conditions during sea trials, the designer/shipyard is required to submit information on the design/engineering analysis performed as part of the Test Plan submission verifying that the appropriate ACCOM criteria can be met in the actual area of operations. If there were instances during sea trials, where the criteria was either not met, or passed by a small margin, the ABS Surveyor in conjunction with the designer and Owner, may request additional confirmatory tests to be carried out in the actual area of operation.

Full ambient environmental testing as described in this Part is required for the first vessel in a series of vessels. For the second and subsequent sister vessels (i.e., vessels being part of the same series of vessels that have identical structural, machinery, and outfitting designs), full scale testing for the ambient environmental aspects of the notation, is not required.

For the second or all subsequent sister vessels constructed in the same shipyard, the following is applicable for all aspects of ambient environmental testing (whole-body vibration, noise, indoor climate and lighting):

- Spaces that were identified as “worst case” locations in the test plans for the first vessel need to be tested.
- By review of the first vessel’s Test Reports (all ambient environment aspects), the INTLREG Surveyor shall identify the locations which were out of compliance or close to non-compliance (refer Table below) that need to be tested.
- Spaces that required some type of mitigation for the first vessel need to be tested.
- All vessels are subject to INTLREG Surveyor walkthroughs. Additional testing shall be required at the INTLREG Surveyor’s discretion.

Threshold for Measurements to be Considered Close to Non- Compliance

Ambient Environment Aspect	Testing Threshold
Whole Body Vibration	Within 10% of the criteria
Noise	Within 3 dB(A) of the criteria
Indoor Climate	Within 2°C (3.6°F) from the Lower or upper air temperature range limits
Lighting	Within 10% of the criteria

For sister vessels constructed at a different shipyard the following is applicable:

- Full testing is required for the first vessel at each shipyard
- For the subsequent sister vessels, the procedure described previously for vessels built at the same shipyard is applicable

1.7.3. Results

The INTLREG Surveyor shall review the INTLREG accommodation area assessment, INTLREG 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 INTLREG reviews, ambient environmental testing, and INTLREG Surveyor verifications. Testing shall be as per the submitted Test Plans, reviewed and approved by INTLREG, before the testing. INTLREG Surveyor shall witness the testing. If the criteria specified in this Part 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 INTLREG 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 Part.

During the attending INTLREG 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 Part.

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 INTLREG reviews, INTLREG Surveyor verifications, and ambient environmental testing. The Survey will cover all five (5) habitability aspects.

The following shall be submitted to INTLREG 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 INTLREG review of seafarer spaces against any alterations to the vessel since the Initial Survey, with measurements substantiated by an INTLREG 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 Part 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 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 Part.

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 INTLREG before the work of alteration is initiated. If INTLREG 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 Part.

1.10. Alternatives

1.10.1. General

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

1.10.2. National regulations

INTLREG shall 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 Part 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:

- INTLREG Rules for Building and Classing Steel Vessels.
- INTLREG Rules for Building and Classing Steel Vessels for Service on Inland Waterways
- INTLREG 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 shall temporarily fall outside the range of tolerability.

In consultation with the Owner, INTLREG 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 shall 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 shall be required to provide an assessment and remediation plan to get as well as maintain the notation. The notation shall be withdrawn if the agreed remediation by the due date is not accomplished.

CHAPTER 2 ACCOMMODATION AREA

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SECTION 1 GENERAL

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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 shall 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 shall also enhance crew 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 shall 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 Part, 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 INTLREG for review. Confirmatory verification measurements shall be performed by an INTLREG Surveyor. The following data shall be submitted to INTLREG:

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 INTLREG.

1.5.1.2. Existing Vessels

For existing vessels, appropriate arrangement drawings and plans, reflecting the current accommodation area configurations shall be provided to INTLREG 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, INTLREG 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, INTLREG 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 INTLREG. For new construction, the drawings shall be provided to INTLREG during the detailed design phase. For existing vessels, the arrangement drawings and plans reflecting the current accommodation area configurations shall be provided to INTLREG, in advance of onboard INTLREG Surveyor verifications.

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

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

1.8. Results

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

SECTION 2 ACCOMODATION AREA CRITERIA

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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.) This height is clear of any obstructions such as cableways, ducting, pipes, etc	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 internal 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)

		Requirement # = Related ILO MLC 2006, Title 3 Requirement	Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
	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
GENERAL					
	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 cabins), 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
DOOR DIMENSIONS					
	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"> 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 	x	o	o
		<ul style="list-style-type: none"> 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 	o	o	x
		<ul style="list-style-type: none"> vertical stanchions for railings are spaced no more than 1525 mm (60 in.) apart horizontally 	x	o	o
		<ul style="list-style-type: none"> at least every third vertical stanchion is supported by a bracket or stay 	x	o	o
		<ul style="list-style-type: none"> 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. 	x	o	o
		<ul style="list-style-type: none"> 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 	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.),with an additional 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.), with an additional 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.), with an additional 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)

LADDERS					
		Requirement # = Related ILO MLC 2006, Title 3 Requirement	Meets ACCOM Requirements	Meets ACCOM+ Requirements	Meets ACCOM++ Requirements
	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)

RAMPS					
		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
PASSAGE WAY / WALKWAY DESIGN					
	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 ² (48.5 ft ²)	4.5 m ² (48.5 ft ²)	5.5 m ² (60 ft ²)	7.0 m ² (75 ft ²)	x	o	o
		5.5 m ² (60 ft ²)	5.5 m ² (60 ft ²)	6.5 m ² (70 ft ²)	7.5 m ² (80.5 ft ²)	o	x	o
		6.5 m ² (70 ft ²)	6.5 m ² (70 ft ²)	7.5 m ² (80.5 ft ²)	8.5 m ² (91.5 ft ²)	o	o	x
Two person Room								
#	2	7.0 m ² (75 ft ²)	7.0 m ² (75 ft ²)	7.0 m ² (75 ft ²)	7.0 m ² (75 ft ²)	x	o	o
		7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	8.0 m ² (86 ft ²)	8.0 m ² (86 ft ²)	o	x	o
		8.0 m ² (86 ft ²)	8.0 m ² (86 ft ²)	9.0 m ² (97 ft ²)	9.0 m ² (97 ft ²)	o	o	X
Junior Officer and senior officer								
#	3	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	8.5 m ² (91.5 ft ²)	10m ² (107.5m ²)	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 ² (48.5 ft ²)	4.5 m ² (48.5 ft ²)	5.5 m ² (60 ft ²)	7.0 m ² (75 ft ²)	x	o	o
		5.5 m ² (60 ft ²)	5.5 m ² (60 ft ²)	6.5 m ² (70 ft ²)	7.5 m ² (80.5 ft ²)	o	x	o
		6.5 m ² (70 ft ²)	6.5 m ² (70 ft ²)	7.5 m ² (80.5 ft ²)	8.5 m ² (91.5 ft ²)	o	o	x
Two person Room								
#	5	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	x	o	o
		8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	o	x	o
		9.5 m ² (102.5 ft ²)	9.5 m ² (102.5 ft ²)	9.5 m ² (102.5 ft ²)	9.5 m ² (102.5 ft ²)	o	o	x
Three person room								
#	6	11.5 m ² (124 ft ²)	11.5 m ² (124 ft ²)	11.5 m ² (124 ft ²)	11.5 m ² (124 ft ²)	x	o	o
		12.5 m ² (134.5 ft ²)	12.5 m ² (134.5 ft ²)	12.5 m ² (134.5 ft ²)	12.5 m ² (134.5 ft ²)	o	x	o
		13.5 m ² (145.5 ft ²)	13.5 m ² (145.5 ft ²)	13.5 m ² (145.5 ft ²)	13.5 m ² (145.5 ft ²)	o	o	x

Table 2.2.3 (Continued)

Four person rooms								
#	7	14.5 m ² (156 ft ²)	14.5 m ² (156 ft ²)	14.5 m ² (156 ft ²)	14.5 m ² (156 ft ²)	x	o	o
		15.5 m ² (167 ft ²)	15.5 m ² (167 ft ²)	15.5 m ² (167 ft ²)	15.5 m ² (167 ft ²)	o	x	o
		16.5 m ² (177.5 ft ²)	16.5 m ² (177.5 ft ²)	16.5 m ² (177.5 ft ²)	16.5 m ² (177.5 ft ²)	o	o	x
Junior Officer								
#	8	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	7.5 m ² (80.5 ft ²)	x	o	o
Senior officer								
#	9	8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	8.5 m ² (91.5 ft ²)	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	A sitting or day room, adjoining the sleeping room is provided for The Master, The Chief Engineer The Chief Navigating Officer The Second Engineer Officer <i>Note: Ships of less than 3,000 tons may be exempted from this requirement by the flag State</i>	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	Multi crew cabin 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	Multi crew cabin berths contain individually operated privacy curtains	x	o	o
	30	Multi crew cabin berths contain individually operated fans/blowers	o	x	o
#	31	Multi crew cabin crew cabin arrangements are either single tier or double tiered.	x	o	o
#	32	Multi crew cabin berths with port lights above them are only allowed 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 port lights, 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 all ventilation inlets 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 ³ (16.75 ft ³)	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 # = Related ILO MLC 2006, Title 3 Requirement		Meets AACOM Requirements	Meets ACCOM + Requirements	Meets ACCOM ++ Requirements
GENERAL				
	1	Sanitary spaces are:	o	o
#		•lighted	x	o
#		•heated	x	o
#		•ventilated.	x	o
		Floors in sanitary spaces are:	o	o
#		• non-slip type deck covering	x	o
#		• easily cleaned	x	o
#		• impervious to damp or moisture absorption	x	o
#		• Properly drained.	x	o
	3	For every six crew members who do not have a private sanitary space,there is:	o	o
#		•one or more tubs and/or shower baths	x	o
#		•one or more toilets	x	o
#		•washbasins.	x	o
	4	Where the radio officers or operators are accommodated in an isolated position, sanitary facilities are provided near or adjacent thereto.	x	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
	6	Common/Shared spaces are gender identifiable without entering the space.	x	o
#	7	Separate multiple occupancy sanitary spaces are provided for men and women.	x	o
	8	Bulkheads in sanitary spaces are:	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 the office(s) is not conveniently located near the navigation bridge <i>Note: In this context, near is defined as being on the same deck or on the deck below (or above) adjacent to the stairway</i>	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
		•at least 0.75 m2 (8 ft2)	x	o
		•at least 1.1 m2 (12 ft 2)	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 cold running 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. <ul style="list-style-type: none"> • galley/mess room(s) • recreation room(s) • gymnasium <i>Note:</i> In this context, easy access is defined as being on the same deck or on the deck below (or above) adjacent to the stairway	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
URINALS					
	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

Requirement # = Related ILO MLC 2006, Title 3 Requirement			Meets ACCOM Requirements	Meets ACCOM + Requirements	Meets ACCOM ++ Requirements
GENERAL					
	1	In vessels of over 3000 tons	o	o	o
#		• One room is provided and equipped for use as an office for the deck department	x	o	o
#		• One room is provided and equipped for use as an office for the engine department	x	o	o
OUTFITTING					
	2	The vessel's office has a toilet and washbasin in close proximity	x	o	o

CHAPTER 3 VIBRATIONS

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SECTION 1 GENERAL

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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 Part. 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.

This Section applies to manned spaces as defined in Section 1. Examples of such spaces include accommodation spaces (e.g., cabins, mess areas, recreation spaces, etc.) and work spaces (e.g., galley, control rooms, duty stations, etc.) both inside and, in other vessel locations, outside the accommodation block

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).

Calibration Checks: Field calibration of a measuring instrument conducted before and after a field test, using a reference calibrated signal. Field calibrators (portable calibrators) shall comply with an international or national standard.

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 Part is Wm (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 and of a portable calibrator conducted at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended, with traceability to a national or international standard.

Velocity: The rate of change of distance over time (i.e., millimeters per second, mm/s).

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 – lines 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.Manual on codes,No.306,Part A,Alpha numerical Codes(2011 Edition,Updated in 2014)

Further guidance shall find 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 Part. If the flag State’s requirements are more stringent, they take precedence. If this Part’s criteria are more stringent, this Part takes precedence.

Measurement Axes

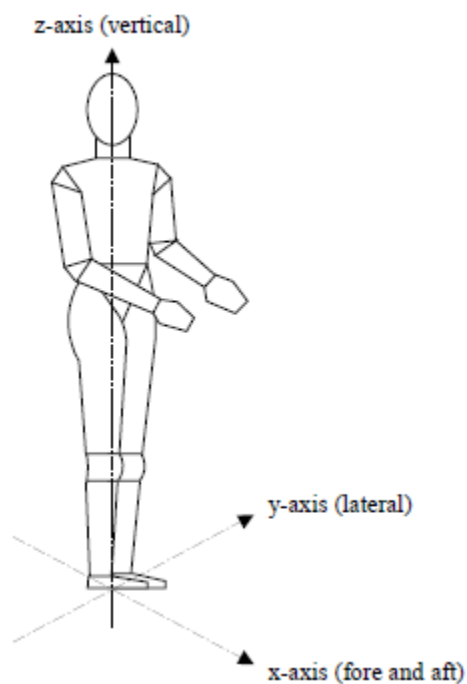


Table 3.1.1: Maximum weighted root-mean-square acceleration level

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

SECTION 2 TESTING

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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 INTLREG 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.

The Test schedule shall include information on the approximate date and duration of testing (including a summary of the scheduled measurements per day).

Data Collection Sheets

The Test Plan shall provide sample data sheets (in table format) that will be used for reporting the measurement data.

Conflict of Interest Declaration

In the case that the Testing Specialist has, in any capacity or to any extent, provided input into the design of the vessel, their participation shall be indicated in the Test Plan including details of the Testing Specialist's involvement. INTLREG shall review any potential conflicts of interest and determine.

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 Part deviate from any requirements or procedures mentioned in ISO 6954, the requirements of this Part 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 80% of the maximum continuous rating (MCR). Controllable pitch and Voith-Schneider propellers, if any, shall be in the normal seagoing position. For ships with special propulsion and power configurations, such as diesel-electric systems, the actual ship's design or operating parameters as defined in the ship's specifications (i.e., contractual service conditions) will be used.

2.3.2. Equipment operation and machinery

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. Manual on Codes, No. 306, Part A, Alphanumerical Codes (2011 Edition, Updated in 2014).

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 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.

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 INTLREG Surveyor. The number and locations of the walkthrough inspections will be determined by the INTLREG Surveyor. The purpose of the walkthrough verification is to subjectively assess the vibration qualities. At the discretion of the INTLREG 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

Space size	Minimum Number of Measurement Positions in Room
Less than 20 m ² (215 ft ²)	1
> 20–40 m ² (215–431 ft ²)	2
> 40–80 m ² (431–861 ft ²)	3
> 80–120 m ² (861–1291 ft ²)	4
> 120–200 m ² (1291–2150 ft ²)	5
Greater than 200 m ² (2150 ft ²)	6

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 (positioned at a 90 degree angle) 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 INTLREG 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 conditions (mean draft and trim);
- ii. Number of crew and other persons onboard during tests;
- iii. Power output
- 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. Machinery and equipment operated during the test.

2.5.2. Transducer measurement positions

Actual transducer placement 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.
- vi. Indication of Pass/Fail

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 field calibration and data collection process of vibration tests conducted at sea shall be witnessed by an INTLREG Surveyor. The INTLREG Surveyor shall sign or initial each page of the Test Report and shall prepare a witnessing document 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 INTLREG' files.

2.5.7. Results

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

CHAPTER 4 NOISE PREVENTION

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SECTION 1 GENERAL

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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 Part.

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 MSC 337(91) 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 accommodation spaces (e.g., cabins, mess areas, recreation spaces, etc.) and work spaces (e.g., galley, control rooms, duty stations, etc.) 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. Sound calibrators shall comply with the standard IEC 60942:2003, as amended, type/class (1) standard and shall be approved by the manufacturer of the measuring instrument used.

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 noise fluctuating, over a period of time T , expressed as the amount of average energy. The symbol is L_{Aeq} ; the unit is dB(A).

Reference calibration: Calibration of measuring instrument and sound calibrator, conducted at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended, 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 61672-1:2013, Electro acoustics – Sound Level Meters – Part 1: Specifications IEC 61672-1 (2004).
- IEC 60942:2003, Electro-acoustics – Sound Calibrators
- • IMO Resolution MSC.337(91) (2012), Code on Noise Levels Onboard Ships
- • ISO 10140-2:2010, Acoustics – Laboratory Measurement of Sound Insulation of Building Elements – Part 2: Measurements of Airborne Sound Insulation
- • ISO 717-1:2013, Acoustics – Rating of Sound Insulation in Buildings and of Building Elements – Part 1: Airborne Sound Insulation
- • WMO: Manual on Codes, No. 306, Part A, Alphanumerical Codes (2011 Edition, Updated in 2014)

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 Part. If the flag State’s requirements are more stringent, they take precedence. If this Part’s criteria are more stringent, this Part takes precedence.

Table 4.1.1: Noise criteria for ships

Space (1,2)	Maximum Acceptable Noise LAeq Level dB(A)					
	ACCOM		ACCOM+		ACCOM++	
	Vessel Size (Gross Tonnage)					
	<10,000	≥10,000	<10,000	≥10,000	<10,000	≥10,000
Crew Accommodation Spaces and Open Deck Recreation Areas						
Cabins	60	55	55	55	50	50
Sanitary Spaces (if separate from the cabin)	65	65	60	60	55	55
Dining (Mess) Spaces	65	60	60	55	55	50
Indoor Recreation Spaces	65	60	60	55	55	50
Gymnasiums	65	60	60	55	60	55
Medical and First Aid Center	60	55	55	55	55	50
Open Deck Recreation Areas	75	75	70	70	70	70
Navigation and Control Spaces						

Wheelhouse, Pilothouse, Bridge	65	65	60	60	55	55
Radio Room	60	60	55	55	55	55
Offices	65	60	60	55	60	55
Cargo Control Rooms ⁽³⁾	65	65	60	60	60	60
Machinery Control Rooms	75	75	70	70	70	70
Service Spaces						
Food Preparation (e.g., Galley,	75	75	70	70	65	65
Pantries	75	75	70	70	70	70
Storerooms	75	75	70	70	70	70
Laundry Areas	75	75	70	70	70	70
Operating and Maintenance Spaces						
Machinery Spaces	110	110	110	110	110	110
Workshops (other than those forming part of machinery spaces)	85	85	80	80	80	80
Non-specified work spaces ⁽⁴⁾ (other work spaces)	85	85	80	80	80	80

Notes:

- 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.
- 3 If located within machinery spaces, it is to comply with the machinery control room's criteria.
- 4 Examples of non-specified work spaces are open deck workspaces that are not machinery spaces, and open deck workspaces where communication is relevant.

Acoustic Insulation

The airborne sound insulation properties for bulkheads and decks within the accommodation shall comply at least with the following weighted sound reduction index (R_w) according to ISO Standard 717-1:2013

Cabin to cabin	$R_w = 35$
Mess rooms, recreation rooms, public spaces and entertainment areas to cabins	$R_w = 45$
Corridor to cabin	$R_w = 30$
Cabin to cabin with communicating door	$R_w = 30$

The airborne sound insulation properties shall be determined by laboratory tests in accordance with ISO 10140-2:2010 as identified in IMO Code on Noise. The manufacturer of the acoustic insulation shall provide the weighted sound reduction index (R_w) value and evidence of the laboratory test.

SECTION 2 TESTING

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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 INTLREG Surveyor to verify compliance with the criteria set in this Part.

The Test Plan shall also include the acoustic insulation plan and relevant supporting documentation.

The Test Plan shall be submitted to INTLREG 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 INTLREG 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.

The Test schedule shall include information on the approximate date and duration of testing (including a summary of the scheduled measurements per day).

2.1.8 Data Collection Sheets

The Test Plan shall provide sample data sheets (in table format) that will be used for reporting the measurement data.

2.1.9 Conflict of Interest Declaration

The Testing Specialist has, in any capacity or to any extent, provided input into the design of the vessel, their participation shall be indicated in the Test Plan including details of the Testing Specialist's involvement. INTLREG shall review any potential conflicts of interest and determine if any further action is necessary

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 MSC.337(91) Code on Noise Levels On-board Ships. However, where the IMO requirements differ from those in this Part, this Part 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 80% of the maximum continuous rating (MCR). Controllable pitch and Voith-Schneider propellers, if any, shall be in the normal seagoing position. For ships with special propulsion and power configurations, such as diesel-electric systems, the actual ship's design or operating parameters as defined in the ship's specifications (i.e., contractual service conditions) shall be used.

2.3.2. Equipment operation and machinery

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) Manual on Codes, No. 306, Part A, Alphanumeric Codes (2011 Edition, Updated in 2014)..

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 INTLREG Surveyor. The number and locations of the walkthrough inspections will be determined by the INTLREG Surveyor. The purpose of the walkthrough verification is to subjectively assess the noise qualities. At the discretion of the INTLREG 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 MSC 337(91). 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 equipment or machinery in that space shall 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 INTLREG 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. Power output
- 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. Machinery and 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 INTLREG 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 if different from requirement
- 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.
- ix. Indication of Pass/ Fail

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 field calibration and data collection process of the noise level tests shall be witnessed by an INTLREG Surveyor. The INTLREG Surveyor shall sign or initial each page of the Test Report and shall prepare a witnessing document 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 INTLREG' files.

2.6.7 Results

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

CHAPTER 5 INDOOR CLIMATE

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SECTION 1 GENERAL

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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 Part 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 Part 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 Supply Quantity: The total amount of air supplied to a specific space consisting of a percentage of recirculated air and a percentage of fresh air supply quantity, measured in liters per second (l/s).

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.

Fresh Air Supply Quantity: The amount of fresh/outdoor air supplied to a specific space, expressed in liters per second (l/s).

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 at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended,, with traceability to a national or international standard.

Relative humidity (RH): The ratio of the amount of vapor contained in the air (absolute 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. The vertical temperature difference in all designated spaces shall be measured in the geometric centre of the occupancy zone at the following distances above the floor: 0.2 m, 1.0 m and 1.8 m. For larger spaces measurements shall be taken in representative positions. The positions shall reflect the temperature at ankle, abdomen and head level

1.4. Associated documentation

- ANSI/ASHRAE 55-2013,. Thermal environmental conditions for human occupancy.
- ANSI/ ASHRAE (15) (2010). Practices for Measuring, Testing, Adjusting, and Balancing Shipboard HVAC&R Systems.
- ISO 7547:2002, Ships and Marine Technology – Air-Conditioning and Ventilation of Accommodation Spaces – Design Conditions and Basis of Calculations
-
- NEBB, (2005). Procedural standards for testing, adjusting, balancing of environmental Systems.

SECTION 2 DESIGN REQUIREMENTS

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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 indoor 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 Part. If the flag State’s requisites are stern, they take precedence, otherwise this Part’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 an air temperature within the range a preset return air temperature of 23 to 28°C (73.5 to 82.5°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 crew accommodation spaces. This temperature shall be maintained by a temperature controller. For temperature regulation, each indoor manned crew accommodation 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.

The mean air velocity is to be measured at the geometric centre of the room. However the surveyor may request alterations of the measurement position based on findings during the survey. Typical alteration may be to carry out the measurement at the most commonly occupied position in the room in question.

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 Supply Quantity

The minimum quantity of fresh/outdoor air supply shall be not less than 40% of the total air supplied to a specific space. The fresh/outdoor air supply quantity shall not be less than 8 l/s per the number of person(s) for which the specific space is designed for (e.g., for cabins is the number of beds, for mess rooms is the number of seats, for workspaces is the number of workstations, etc.).

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:
Summary of Indoor Climate Requirements".

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:23 to 28°C (73.5 to 82.5°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 supply quantity	The minimum quantity of fresh/outdoor air supply shall be not less than 8 l/s per person and in addition will need to be at least 40% of the total air supplied to a specific space	

SECTION 3 TESTING

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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 Part deviate from those in ANSI/ASHRAE 55a and ANSI/ASHRAE 15, the requisites of this Part 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 Part, 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 equipment in its operational mode. This confirmatory testing shall comprise of a sample of manned spaces selected as follows:

- Spaces which were out of compliance or close to non-compliance (refer Section 1, Table 1.1.2).
- Spaces that required some type of mitigation.
- Additional testing shall be required at the INTLREG Surveyor's discretion.

3.3.2. Equipment operation

The HVAC system shall be operating in the normal operation or mode. A written confirmation issued by the builder confirming that the HVAC system has been tested, adjusted and balanced shall be provided to the ABS Surveyor before any measurement commences. The total system Testing, Adjusting, and Balancing (TAB) shall be conducted in accordance with the National Environmental Balancing Bureau (NEBB) standard "*NEBB Procedural*

Standards for Testing, Adjusting, Balancing of Environmental Systems” or other similar certification standard.

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 enclosed 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 INTLREG Surveyor. The number and locations of the walkthrough inspections will be determined by the INTLREG Surveyor. The purpose of the walkthrough verification is to subjectively assess the indoor climate qualities. At the discretion of the INTLREG 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 for determining the horizontal gradient shall be captured at approx. 300 mm (12 in.) above the mattress.

3.5. Test report

A Test Report shall be submitted to the INTLREG 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 if different from requirement
- 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.
- m. Indication of Pass /Fail

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

INTLREG Surveyor must witness the equipment field calibration and data collection process of the indoor climate tests. The INTLREG Surveyor shall sign or initial each page of the Test Report and shall prepare a witnessing document 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 INTLREG' files.

CHAPTER 6 LIGHTING

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SECTION 1 GENERAL

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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 (lm/m^2) or foot-candles (fc ; lm/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 (cd/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 at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended, 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.

Veiling Reflection (or Reflected Glare): A reflection of incident light that partially or totally obscures the details to be seen on a surface by reducing the contrast

1.4. Associated documentation

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

- ISO 8995-1: 2002, Lighting of Work Places – Part 1: Indoor
- DIN EN 12464-1:2011, Light and Lighting – Lighting of Work Places – Part 1: Indoor Work Places
- DIN 5032-7:1985, Photometry; Classification of Illuminance Meters and Luminance Meters
- CIE S 023/E:2013 (ISO/CIE 19476:2014), Characterization of the Performance of Illuminance Meters and Luminance Meters
- BS 667:2005, Illuminance meters. Requirements and test methods

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 Part.

Please note that flag States may have different lighting requirements from those presented in this Part. If the flag State's requirements are more stringent, then they take precedence. If this Part's criteria are more stringent, then this Part 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 external light sources (e.g., daylight, moonlight, shore light, etc.) 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 Criteria 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
Entrances and Passageways			
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
Cabins, Staterooms, and Sanitary Spaces*			
General Lighting	150	Bath/Shower (General Lighting)	150
Reading and Writing (Desk or BunkLight)	500	All other Areas within Sanitary Space (e.g., Toilets)	200
Mirrors (Personal Grooming)	500	Light During Sleep Periods	<30
Dining Spaces			
Mess Room and Cafeteria	300	Snack or Coffee Area	150
Recreation Spaces			

Recreation Room/Lounges	200	Gymnasiums	300
Library - General Lighting - Reading Area	150 500	Bulletin Boards/Display Areas	150
Multimedia Resource Center(e.g.computer room)	300	All other Recreation Spaces (e.g. Game Rooms)	200
TV Room/(Movie Theater)	150	Reception Areas	300
Medical, Dental and First Aid Center			
General Lighting/Medical Waiting Areas	150	Dispensary -General Lighting -On dispensary Table	150 500
Medical and Dental Treatment/ Examination Room	500	Laboratories	500
Reading and Writing (Desk)	500	Other Medical Spaces	300

Table 6.1.2: Lighting criteria for navigation and control spaces

Space	Illuminance Level in Lux	Space	Illuminance Level in Lux
Wheelhouse, Pilothouse, Bridge -Day -Night when underway ⁽¹⁾	300 <30	Offices - General Lighting - Reading and Writing (desk) -Meeting, Training Rooms	300 500 500
Chart Room - General Lighting - On Chart Table	150 500	Control Stations ⁽³⁾ - General Lighting - Control Consoles and	300 300
Other Control Rooms (e.g., Cargo Transfer etc.) - General Lighting - Computer Work - Central Control Room	300 300 500	Boards, Panels, Instruments - Switchboards - Log Desk - Local Instrument ,etc Room	500 500 400
Radar/Gyro Room ⁽²⁾	200		
Radio Room ⁽²⁾	300		500

Notes:

- 1 . At night, the wheelhouse must be kept as dark as possible to permit visibility of objects on the water, hazards to navigation, and navigational lights.
2. When the space is separate from the wheelhouse.
3. Includes control rooms and stations such as Engine Control Room, Cargo Control Room, Ballast Control Room, Fire Control Room, etc.

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	Chemical Storage(e.g.paint store)	300
- Butcher Shop	300	Storerooms	200
- Thaw Room	500	- Large Parts	300
- Working Surfaces, Food Preparation Counter and Range Tops	300	- Small Parts	300
- Food Serving Lines	300	- Issue Counters	
- Scullery (Dishwashing)	500	Elevators	150
- Extract Hood Store Rooms	100		
Package Handling/Cutting	300		
Mail Sorting	500	Food Storage	200
		- Non-refrigerated	100
		- Refrigerated	

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

Space	Illuminance Level in Lux	Space	Illuminance Level in Lux
Machinery Spaces (General)	200	Cargo Holds (Portable Lighting)	30 200 80
Unmanned Machinery Spaces	200		
Engine Room	300		
Generator and Switchboard Room	200		
Switchboard, Transformer Room	500	- General Lighting ⁽²⁾	
Emergency Generator Room	200	- During Cargo Handling ⁽³⁾	
		- Passageways and Trunks	
Fan Room	200	Inspection and Repair Tasks	
HVAC Room	200	- Rough	300
Motor Room	300	- Medium	500
Motor-Generator Room (Cargo Handling)	150	- Fine	750
		- Extra Fine	1000
Pump Room, Fire Pump Room	200	Workshops ⁽⁴⁾	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 (Portable lighting)	75	Unmanned Machinery Room	200
Muster/Embarkation Area	200	Shaft Alley	100
		Escape Trunks	50
Cargo Handling (Weather Decks) ⁽¹⁾	200	Crane Cabin	400
Lay Down Area ⁽¹⁾	200		

General Process and Utility Area ⁽¹⁾ Loading Ramps/Bays ⁽¹⁾	200		
Cargo Storage and Maneuvering Areas	200	Hand signaling areas between crane shack and ship deck	300

Notes:

- 1 Covers all the activities related to the safe transferal, stowing, lashing and securing of the various cargoes to be transported on deck.
- 2 Refers to the general illumination of the cargo hold by a portable light which should be able to provide the required illuminance level on the inner bottom.
- 3 Refers to the illumination of the immediate points of activity (where the cargo handling activity takes place within the cargo hold) when this is applicable depending the ship type.
- 4 Refers to the illumination of mechanical workshop, welding workshop, instrument/electrical workshop, etc.

Table 6.1.5: Lighting Criteria 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

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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 INTLREG 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 measurement 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

Visual tasks encountered on vessels vary and the lighting provided can influence the 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 INTLREG Surveyor witnessing the collection of lighting data.

Illuminance measurements shall be carried out as described below.

Measurement of ambient lighting need only be performed once during sea trials or at pier side when all external light sources shall be blocked out

2.2.2. Data acquisition and instruments

The illuminance meter (light meter) shall conform to any of the International Standards specified below (or equivalent):

- DIN 5032-7:1985 (Class A)
- CIE S 023/E:2013 (ISO/CIE 19476:2014)
- BS 667:2005 (Type F)

Note: The measurement of red and/or low level white illuminance is not required for ship Habitability notation

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. If testing is done in port, ship's power and not shore power shall be used

2.2.3.2. Spaces with windows / port lights

In spaces with windows or portlights where the minimum lighting level is intended to 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/port lights

Interior spaces with no windows or port lights 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 during testing 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). Areas at the end of cable runs shall be selected as potential problem locations. 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: exterior passageways and access ways operating consoles, hand signaling locations, anchor handling locations, mooring locations, crew embarkation and debarkation areas, and cargo handling locations – particularly with regard to attaching and detaching cargo from crane hooks..

2.2.4.2. Walkthrough verification inspection locations

All normally manned spaces shall subject to a walkthrough inspection by the INTLREG Surveyor. The number and locations of the walkthrough inspections will be determined by the INTLREG 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 INTLREG 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

<i>Space Size</i>	<i>Minimum Number of Measurement Positions in Room</i>
Less than 20 m ² (215 ft ²)	1
> 20–40 m ² (215–431 ft ²)	2
> 40–80 m ² (431–861 ft ²)	3
> 80–120 m ² (861–1291 ft ²)	4
> 120–200 m ² (1291–2150 ft ²)	5
Greater than 200 m ² (2150 ft ²)	6

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 m² (5 ft²), a single measurement shall be taken at the center of the task surface. For larger task surfaces (0.5 m² (5 ft²) or larger), the illuminance shall be measured by dividing the task surface into a grid no larger than 0.5 m² (5 ft²) 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 bunk light fixture.

2.2.4.5. Red and low-level white illuminance

Guidance for the measurement of red and low-level white is provided other national and international standards. 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 INTLREG 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.
 - viii. Indication of Pass/Fail
- 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 INTLREG Surveyor shall witness the equipment calibration and data collection process of the lighting tests shall be witnessed by an INTLREG Surveyor. The INTLREG Surveyor shall sign or initial each page of the Test Report and shall prepare a witnessing document 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 INTLREG' files.

2.3.7. Results

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

CHAPTER 7 PROCEDURAL REQUIREMENTS FOR AMBIENT ENVIRONMENT TESTING

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SECTION 1 GENERAL

CONTENTS

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1.1. Terminology

INTLREG 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 INTLREG 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

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2.1. Documentation requirements

INTLREG shall 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 Part 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. Documented procedures for communication with the crew prior to commencing work in order to provide a safe system of work in place as necessary
- f. Evidence of approval/acceptance by certifying bodies, if any.
- g. Information about other activities which may present a conflict of interest. (i.e., in the case that the Testing Specialist provides, in any capacity or to any extent, input on the design of in part or whole of a vessel)
- h. Record of customer claims and of corrective actions requested by certification bodies for the past year.
- i. Where relevant, list and documentation of licenses granted by equipment's manufacturer.
- j. Example Test Plan(s) for the ambient environmental quality for which approval is requested.
- k. 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. Personnel shall have had a minimum of one year tutored on-the-job training. Where it is not possible to perform internal training, a program of external training may be considered as acceptable.
- 2.2.3. *Supervision:* The Testing Specialist is accountable for all services provided. The responsible supervisor should have a minimum of one (1) year experience in supervising tests and at least two (2) years of performing 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 INTLREG as outlined within this Part. The report should also contain a copy of the Certificate of Approval.
- 2.2.9. *Control of Data:* When computers are used for the acquisition, processing, recording, reporting, storage, measurement assessment and monitoring of data, the ability of computer software to satisfy the intended application shall be documented and confirmed by the Testing Specialist.

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 INTLREG 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.
- ix. Code of conduct for the relevant activity.

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. INTLREG 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, INTLREG 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 INTLREG 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 INTLREG's 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

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

2.7.3. Cancellation of approval

In the following cases, approval may be 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 INTLREG 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 INTLREG 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 INTLREG 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 one (1) year supervising and of at least two (2) years performing 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 one (1) year experience in performing vibration environmental testing onboard ships.
- iii. Have adequate knowledge of ship structures and equipment.
- iv. have knowledge in the field of vibration, vibration measurements and handling of measurement equipment. In addition, be able to document theoretical and practical training onboard in using a vibration transducer

2.8.1.4. Equipment

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

Whole Body Vibration measurement shall be taken using an instrument manufactured to ISO 8041:2005, as amended, type/class (1) standard then frequency weighted and analyzed in accordance with ISO 6954:2000, as amended. It is desirable to employ equipment that records and stores acceleration time histories.

Portable calibrators shall comply with an international or national standard.

Calibration of the vibration transducer and of the portable calibrator, is to be conducted at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended.

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".

2.8.1.7 Access to Documents

The Testing Specialist shall have access to the following documents:

- ISO 6954:2000, Mechanical Vibration and Shock – Part lines for the Measurement, Reporting and Evaluation of Vibration with Regard to Habitability on Passenger and Merchant Ships.

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 one (1) year and of at least two (2) years performing supervising noise testing onboard ships.

The supervisor should have sufficient knowledge of ship structures, measuring equipment, ISO 2923, IEC 61672-1, and IMO Res. MSC.337(91), 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 one (1) year experience in performing noise testing onboard marine ships, including participation in a minimum of 5 measurement campaigns as an assistant test personnel.
- c. have knowledge in the field of noise, sound measurements and handling of measurement equipment. In addition, be able to document theoretical and practical training onboard in using a sound level meter.
- d. have adequate knowledge of the applicable international requirements (SOLAS Regulation II-1/3-12, as amended, and IMO Code on noise levels onboard Ships, as amended)
- e. have training concerning the procedures specified in IMO Code on Noise Level
- f. Have adequate knowledge of ship structures and equipment.

2.9.4. Equipment

INTLREG shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to INTLREG that it is fit for the intended purpose. Noise measurement shall be taken using an integrating-averaging sound level meter manufactured to IEC 61672-1:2013, as amended, type/class (1) standard.

When used alone, or in conjunction with a sound level meter, as appropriate, an octave filter set shall conform to IEC 61260-1:2014, as amended, standard.

Sound calibrators shall comply with the standard IEC 60942:2003, as amended, type/class (1) standard and shall be approved by the manufacturer of the measuring instrument used.

Calibration of the sound level meter and of the sound calibrator, is to be conducted at least every two (2) years by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended.

A microphone wind screen shall be used when taking readings outside or on deck, and below deck where there is any substantial air movement. The wind screen should not affect the measurement level of similar sounds by more than 0.5 dB(A) in "no wind" conditions.

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".

2.9.7 Access to Documents

The Testing Specialist shall have access to the following documents:

- SOLAS 1974, as amended (Reg.II-1/3-12)
- Resolution A.468(XII) and IMO Resolution MSC.337(91) code on noise levels on board ships
- Resolution A.343(IX) Recommendation on methods of measuring noise levels at listening posts

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 shall :

- 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 one (1) years supervising and of at least two (2) years performing ambient environmental testing onboard ships.
- iii. The supervisor shall have a sufficient knowledge of ship structures, measuring equipment, ANSI/ASHRAE 15-2013 as well as ISO 7726 and ISO 7547, for verifying that test procedures are in compliance with the required test condition

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.

- iv. have knowledge in the field of indoor climate, indoor climate measurements and handling of measurement equipment

2.10.4. Equipment

INTLREG shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to INTLREG that it is fit for the intended purpose. Indoor Climate measurement shall be taken using an instrument manufactured to meet or exceed the minimum characteristics of instruments for measuring physical quantities characterizing an environment specified in ISO 7726:1998, as amended, or those of an equivalent standard.

Calibration of the measuring instrument is to be conducted at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended

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".

2.10.7. Access to Documents

The Testing Specialist shall have access to the following documents:

- ANSI/ASHRAE 55-2013, Thermal Environmental Conditions for Human Occupancy
- ISO 7726:1998, Ergonomics of the Thermal Environment – Instruments for Measuring Physical Quantities

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 one (1) year supervising and of at least two (2) years performing ambient environmental testing onboard marine ships.

The supervisor should have sufficient knowledge of ship structures, measuring equipment, and ISO 8995:2002 and DIN EN 12464-1:2011, 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 one (1) year of experience in performing ambient environmental testing onboard marine ships.
- c. Have ample knowledge of ship structure and equipment.
- d. have knowledge in the field of lighting, illuminance level measurements and handling of measurement equipment

2.11.4. Equipment

INTLREG shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to INTLREG that it is fit for the intended purpose. Lighting measurement shall be taken using an illuminance meter conforming to any of the International Standards specified below (or equivalent):

- DIN 5032-7:1985 (Class A)
- CIE S 023/E:2013 (ISO/CIE 19476:2014)
- BS 667:2005 (Type F)

Calibration of the illuminance meter is to be conducted at least every two (2) years (or more frequently if specified by the manufacturer) by an accredited Testing and Calibration Laboratory accredited according to ISO 17025:2005, as amended.

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".