GUIDE FOR

COMPLIANCE WITH THE ILO MARITIME LABOUR CONVENTION, 2006 TITLE 3 REQUIREMENTS

SEPTEMBER 2014

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

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Foreword

The International Labour Organization (ILO) is the United Nation's (UN) specialized agency that seeks the promotion of social justice and internationally recognized human and labor rights.

The ILO provides legal instruments aimed at protecting and improving working conditions, including those of seafarers. The ILO has produced the Maritime Labour Convention (MLC), 2006 which was adopted during the 94th Session of the ILO on February 23, 2006.

The Regulations and the Code are organized into general areas under five Titles:

- Title 1: Minimum requirements for seafarers to work on a ship
- Title 2: Conditions of employment
- Title 3: Accommodation, recreational facilities, food and catering
- Title 4: Health protection, medical care, welfare, and social security protection
- Title 5: Compliance and enforcement

Title 3, Regulation 3.1 addresses vessel design issues related to quality of life at sea, including the physical design of seafarer accommodation areas and the characteristics of the ambient environment (e.g., whole-body vibration, noise, indoor climatic variables, and lighting) which seafarers are exposed to during rest and recreation. Guidance for complying with the Title 3, Regulation 3.1 requirements are provided in this Guide. This Guide is based on the MLC objective requirements and ABS' interpretation of the intent of the Part A requirements and on what ABS considers satisfactory compliance with the Part A subjective requirements.

Note: Additional or different criteria imposed by individual Flag Administrations may also be applicable. As a result, adherence to the criteria in this Guide does not guarantee acceptance by any flag Administration that has ratified the ILO MLC, 2006 as prima facie evidence of compliance with the MLC's Title 3, Regulation 3.1 requirements.

This Guide, originally published in May 2009, has undergone significant revision including requirements from the revised International Maritime Organization (IMO) Code on Noise (Resolution MSC.337(91) *Code on Noise Levels on Board Ships*) and input from industry (i.e., Owners, designers, and construction yards).

This Guide provides the assessment criteria and measurement methodology for obtaining an ABS Maritime Labor Convention (MLC) Accommodation (ACCOM) related notation (**MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)**. This Guide provides criteria for three categories of vessels seeking an **MLC-ACCOM** notation:

- **MLC-ACCOM** – for vessels complying with the criteria contained in this Guide relating to Regulation 3.1 of the ILO MLC
- **MLC-ACCOM(SPS)** – for special purpose vessels obtaining the ABS **SPS** notation
- **MLC-ACCOM(WB)** – for non-SPS vessels (e.g., offshore/platform support vessels, tow boats, anchor handling vessels, etc.).

For vessels requesting the **MLC-ACCOM** notation, the vessel must meet all the appropriate criteria across the various categories contained in this Guide.

For the **MLC-ACCOM(SPS)** notation, vessels must be awarded (or in the process of being awarded) the ABS Classification Notation of **SPS** and meet all the appropriate criteria in this Guide considering the allowances permitted for special purpose ships as provided in the ILO MLC. These allowances have been included in Appendix 3.

The **MLC-ACCOM(WB)** notation applies to non-SPS vessels (e.g., offshore/platform support vessels, tow boats, anchor handling vessels, etc.) wanting to demonstrate compliance with the ILO MLC with consideration given to specific flag State ILO MLC guidance, as applicable.

Enhanced levels of accommodation area and ambient environmental criteria intended to improve seafarer habitability, safety, and comfort can be found in the following:

- ABS *Guide for Crew Habitability on Ships*
- ABS *Guide for Crew Habitability on Offshore Installations*
- ABS *Guide for Crew Habitability on Workboats*
- ABS *Guide for Crew Habitability on Mobile Offshore Drilling Units*

General guidance for complying with Titles 1, 2, 3, 4 and 5 is provided in a separate document titled the ABS *Guidance Notes on the ILO Maritime Labour Convention, 2006*. The ABS *Guidance Notes on the ILO Maritime Labour Convention, 2006* is intended to assist vessel Owners and Operators in understanding the requirements of the MLC and provide relevant examples for addressing these requirements within a company's management system.

This Guide becomes effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of this Guide is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.

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SECTION 1 General

1 Introduction

Accommodation standards are a measure of the acceptability of seafarer accommodation areas for living and working. The ABS *Guide for Compliance with the ILO Maritime Labour Convention, 2006 Title 3 Requirements* has been developed to assist vessel Owners and Operators in understanding and fulfilling the Maritime Labour Convention's (MLC) Title 3, "Accommodation, Recreational Facilities, Food and Catering" requirements. This Guide is intended for use by vessel Owners or companies requesting the optional notation of **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)**.

The criteria provided in this Guide have been extracted from Regulation 3.1 of the MLC and derived from human factors, ergonomics, and safety practices and principles, as well as currently available research data and standards. These criteria establish levels of safety and health consistent with the intent of the MLC. The criteria are based on the MLC objective requirements and ABS' interpretation of the intent of the Part A requirements and on what ABS considers satisfactory compliance with the Part A requirements of the MLC Regulation 3.1.

2 Application

Except where otherwise stated, the ILO Maritime Labour Convention applies to any vessel engaged in international voyages or flying the flag of a member state and operating from a port, or between ports, in another country. It defines international voyage as a voyage from a country to a port outside such a country. The Convention does not apply to vessels engaged in fishing or in similar pursuits, vessels which navigate exclusively in inland waters or waters within, or closely adjacent to, sheltered waters or areas where port regulations apply; and vessels of traditional build such as dhows and junks. The Convention does not apply to warships or naval auxiliaries.

In the event of doubt as to whether this Convention applies to a vessel or particular category of vessels, the question shall be determined by the competent authority in each ILO Member State after consultation with the vessel Owners' and the seafarers' organizations concerned. [Article II, paragraphs 4 and 5]

3 Scope

This Guide focuses on five (5) aspects of vessel design and layout that can be controlled, measured, and assessed. These five (5) aspects are broken into two (2) categories in this Guide: accommodation area design and characteristics of the ambient environment.

Accommodation area criteria pertain to dimensional and outfitting aspects of spaces where seafarers, eat, sleep, recreate, and perform routine daily activities.

The ambient environmental aspects pertain to the environment that seafarers are exposed to during periods of leisure and rest. Specifically, this Guide provides criteria, and measurement methodologies for the following:

i) Whole-body Vibration

ii) Noise

iii) Indoor Climate

iv) Lighting

The criteria associated with the **MLC-ACCOM**, the **MLC-ACCOM(SPS)**, and the **MLC-ACCOM(WB)** notations is applicable only to accommodation spaces where seafarers sleep, rest, dine, and recreate.

For the purposes of this Guide, the criteria do not include seafarer workspaces. Section 3, "Whole-body Vibration" and Section 4, "Noise", provide additional guidance related to seafarer work spaces that can be used if any voluntary ambient environmental testing is to be done in seafarer work spaces. This testing is recommended, but not required.

While producing this Guide, ABS has taken a practical approach to measurements, test personnel (Testing Specialists), and test equipment.

4 Terminology

ABS Recognized Ambient Environmental Testing Specialists: Companies providing test or measurement services on behalf of the Owner of a vessel or shipyard for the purposes of meeting the **MLC-ACCOM**. **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notation.

Accommodation Areas/Accommodation Block: Vessel areas where the primary purpose is to rest and recreate. Accommodation spaces include cabins and staterooms, medical facilities (sick bays), recreation rooms, and other similar manned spaces within the accommodation block. For the purposes of this Guide, accommodation areas also include service spaces such as mess rooms, laundry, changing rooms and storerooms.

Ambient Environment: Ambient environment refers to the environmental conditions that the seafarer is exposed to during periods of work, leisure, or rest. Specifically, this Guide provides criteria and limits for whole-body vibration, noise, indoor climate, and lighting.

Associated Documentation: Documents referenced in this Guide that are needed to provide measuring techniques and further guidance.

Manned Space: Any accommodation space where a seafarer may be present for twenty (20) minutes or longer at one time during normal, routine daily activities.

Recreational and Public Spaces: Those portions of the seafarer accommodation areas which are used for halls, dining rooms, lounges, and similar spaces.

Seafarer: Any person who is employed or engaged or works in any capacity on board a ship to which the ILO MLC applies.

Seafarer Spaces: All areas on a vessel intended for seafarers only, such as seafarer accommodation spaces.

Shall: Expresses a provision that is necessary.

Test Plan: Document containing the requisite information regarding vessel design and layout, test personnel, test conditions, measurement locations, data acquisition, instruments, data analysis, and test schedule necessary for verifying the measurements for the ambient environmental aspects of accommodation areas.

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.

5 Associated Documentation

- Appendix 2, "Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists"

6 Notations

At the request of the Owner or shipyard, a vessel complying with the criteria contained in this Guide for seafarer accommodation areas and the associated ambient environmental characteristics (i.e., whole-body vibration, noise, indoor climate, and lighting) may be assigned a notation of **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)**.

7 Data and Plans to be Submitted

7.1 General

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

i) Inboard profile detailing the location of the main vertical zone boundaries, the location of the main watertight bulkheads, as well as the various deck levels

ii) Plan view of each deck annotating the various spaces on each deck

7.2 Accommodation Areas

At a minimum, scaled arrangement drawings of the various seafarer accommodation spaces (elevation and plan views) and the vessel's accommodation area specifications shall be submitted to ABS Engineering. Details of the seafarer accommodation area data requirements are provided in Subsection 2/6, "Accommodation Area Documentation".

7.3 Ambient Environment

The following items are to be submitted separately for each ambient environmental aspect.

7.3.1 Test Plans

Test Plans shall serve as the principal means for verifying the measurements for the ambient environmental aspects of accommodation areas. Separate Test Plans are required for whole-body vibration, noise, indoor climate, and lighting. Specific Test Plan details for the various ambient environmental criteria are outlined in later sections of this Guide as follows:

Environmental Aspect	*Test Plan Details*
Whole-body Vibration	Subsection 3/6
Noise	Subsection 4/6
Indoor Climate	Subsection 5/6
Lighting	Subsection 6/6

The test plans require approval by ABS Engineering before any measurements are made. ABS shall notify the vessel Owner or shipyard whether the test plans have been approved or require alteration. An ABS-approved copy of the Test Plan shall become part of the vessel's official documentation.

7.3.2 Test Reports

Upon completion of the ambient environmental testing, Test Reports shall be submitted to the ABS Surveyor. In addition, 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. The specific Report contents for the various ambient environmental criteria are outlined in later sections of this Guide as follows:

Environmental Aspect	*Test Report Details*
Whole-body Vibration	Subsection 3/8
Noise	Subsection 4/8
Indoor Climate	Subsection 5/8
Lighting	Subsection 6/8

8 Process for Obtaining a Notation

Prior to scheduling accommodation area verification or ambient environmental testing activities, the vessel Owner or shipyard shall certify the operational status of the vessel as being fully operational and/or inclusive of all equipment and furnishings. If the vessel is not fully operational, a complete listing of deficiencies of areas, components, equipment, etc., shall be submitted to ABS for review.

ABS shall then make a determination and notify the vessel Owner or shipyard as to whether verification activities or ambient environmental testing can commence. The intent is to align sea trials with the ambient environmental testing so that all testing is completed during sea trials.

Section 1, Figure 1, "Process for Obtaining an **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** Notation", charts the process for obtaining an **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notation. The following Paragraphs briefly describe the notation process.

8.1 Accommodation Areas

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

Follow-up physical verification measurements of accommodation area criteria shall be performed by an ABS Surveyor. The ABS Surveyor shall select verification measurement sites.

The results of the ABS Engineering review and actual ABS Surveyor verification shall be reviewed by the ABS Surveyor during the notation confirmation process.

8.2 Ambient Environment

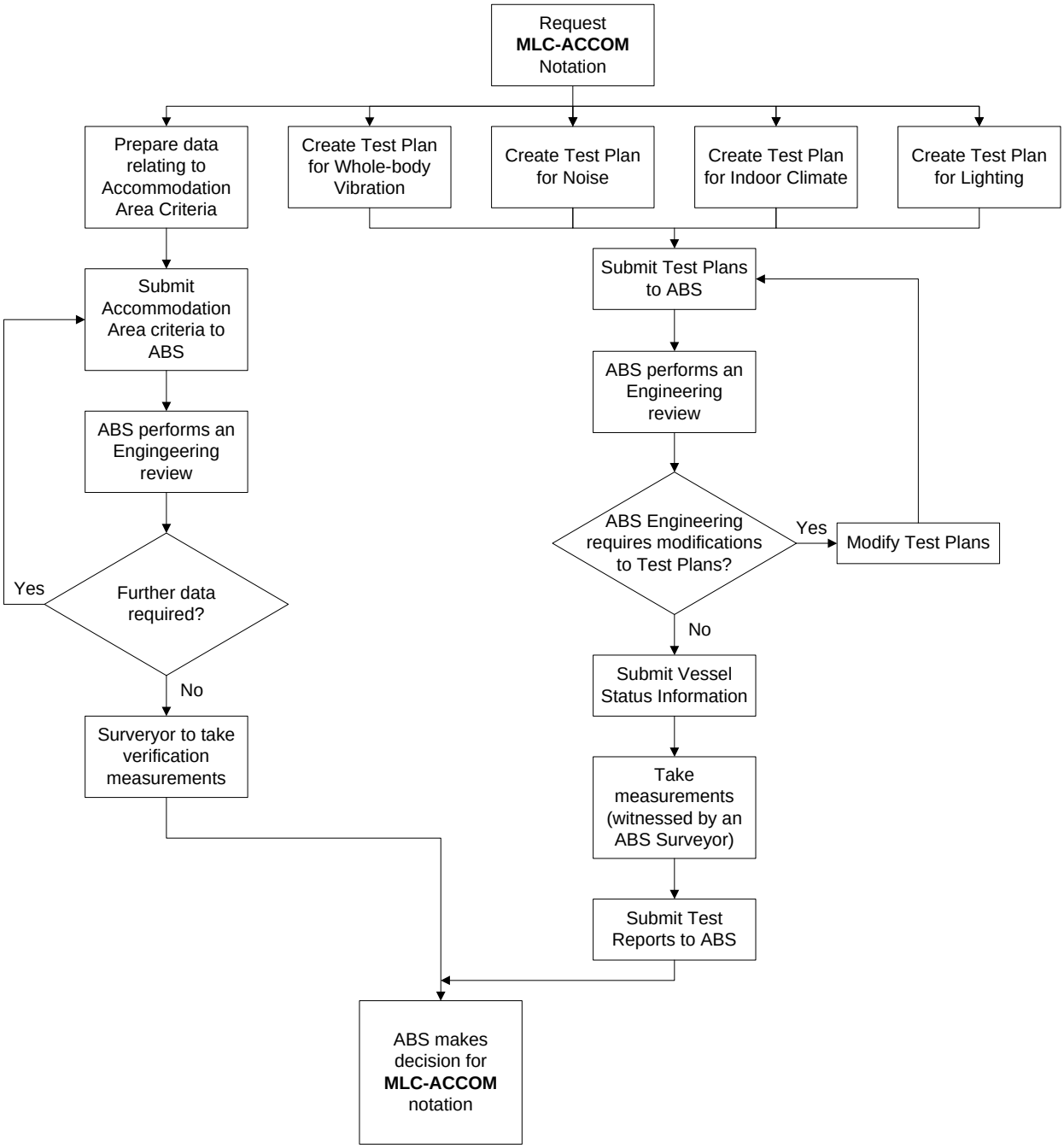
Ambient environmental Test Plans for whole-body vibration, noise, indoor climate, and lighting shall be prepared and submitted to ABS Engineering. These Test Plans shall serve as a primary means for verifying the measurement locations and measurement process, as well as specifying the Testing Specialist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

Testing, inspections, and data collection shall be performed by the Testing Specialists and witnessed by an ABS Surveyor. Test Reports for ambient environmental testing shall be prepared by the Testing Specialists and submitted to the ABS Surveyor for review.

8.3 Results

The ABS Engineering accommodation area assessment, ABS Surveyor verification measurements and ambient environmental Test Reports shall be reviewed by the ABS Surveyor for determination of notation confirmation.

FIGURE 1
Process for Obtaining an MLC-ACCOM, MLC-ACCOM(SPS), or MLC-ACCOM(WB) Notation



9 Initial Requirements

The initial process for obtaining an **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notation shall comprise ABS Engineering reviews, ambient environmental testing, and ABS Surveyor verifications. Testing shall be in accordance with the submitted Test Plans reviewed and approved by ABS Engineering in advance of the testing. Testing shall be witnessed by an ABS Surveyor. If the criteria specified in this Guide have been met, then the notation may be confirmed.

10 Surveys after Construction

It is intended that all surveys after construction are to be aligned with Classification Surveys. Harmonization of surveys is to be carried out at the first available opportunity.

10.1 Annual Surveys

In order to maintain the **MLC-ACCOM**, **MLC-ACCOM(SPS),** or **MLC-ACCOM(WB)** 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 following information shall be reviewed by the attending ABS Surveyor for issues that could affect the Accommodation 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 in accordance with accommodation area criteria stated within this Guide

During the attending ABS 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 notation. As a result, the vessel may be subject to the review, ambient environmental testing, and inspection requirements of this Guide.

10.2 Special Periodical Surveys

In order to maintain the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notation, a Special Periodical Survey shall be completed within five (5) years after the date of build or after the crediting date of the previous 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 prior to the due date, the Special Periodical Survey will be credited to agree with the effective due date. The Special Periodical Survey may be commenced fifteen (15) months prior to the due date and be continued with completion by the due date.

10.2.1 Survey Requirements

The Survey shall comprise ABS Engineering reviews, ABS Surveyor verifications, and ambient environmental testing. The Survey will cover all five (5) accommodation aspects.

The following shall be submitted to ABS three (3) months prior to carrying out 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 perform an ABS Engineering review of seafarer spaces against any alterations to the vessel since the Initial Survey, with measurements verified by an ABS 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 allow scheduling of measurement verifications and ambient environmental testing.

A Special Periodical Survey Test Plan for each ambient environmental aspect of accommodation areas shall be submitted in accordance with the criteria stated 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 6, "Test Plan", and Subsection 7, "Test Requirements", of this Guide specify the requirements for each ambient environmental aspect (i.e., 3/6, 3/7, 4/6, 4/7, etc.). For specifying measurement locations for the Special Periodical Survey Test Plans, the following changes to 7.4.1, "Selection of Spaces where Measurements are to be Conducted", of each ambient environmental aspect shall be followed.

i) Measurements shall be taken in all areas affected by vessel alterations. Measurements are limited to the ambient environmental aspect affected by the alteration. For example, structural changes require both whole-body vibration and noise measurements. Structural changes do not necessarily require indoor climate or lighting measurements. Changes to luminaires require lighting measurements but not whole-body vibration, noise, or indoor climate measurements.

ii) For all ambient environmental aspects, measurements shall be taken in all worst case or problem area locations based on the requirements set forth in 7.4.1, "Selection of Spaces where Measurements are to be Conducted", of the appropriate Section of this Guide. [For example, worst case for whole-body vibration is described in 3/7.4.1i)].

iii) For all ambient environmental aspects, measurements shall be taken in twenty-five (25) percent of crew cabins and staterooms identified in the initial Test Plans. The cabin locations must be representative of locations port, starboard, fore, amidships, and aft on each deck. Any worst case locations can be considered part of the representative sample for crew cabins and staterooms, if applicable.

iv) For all ambient environmental aspects, measurements shall be taken where a single instance of one (1) type of a manned space exists within the vessel (e.g., officer's mess, gymnasium, library, etc.). The worst case locations can be considered part of the single instance representative sample, if applicable.

v) 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. The worst case locations are to be considered part of the representative sample, if applicable.

For all ambient environmental conditions, visual/walkthrough verification inspection locations shall be conducted in accordance with 7.4, "Measurement Locations" of the appropriate Section of this Guide.

10.3 Requirements for Vessel Alterations

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

11 Alternatives

11.1 General

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

11.2 National Regulations

ABS will consider for its acceptance alternative arrangements and details, which can be shown to comply with standards recognized in the country (flag State) in which the vessel is registered or built, provided they are deemed not less effective.

11.3 Departures from Criteria

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

- ABS *Rules for Building and Classing Steel Vessels*
- ABS *Rules for Building and Classing Steel Vessels Under 90 meters (295 feet) in Length*
- ABS *Rules for Building and Classing High-Speed Craft*
- ABS *Rules for Building and Classing Offshore Support Vessels*

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

When a departure from criteria is identified, during either the notation's initial issuance or reconfirmation process, it shall be reviewed by ABS in consultation with the Owner. When the design of the accommodation areas or ambient environmental test results contain departures from the stated criteria, these will be subject to special consideration upon the receipt of details about the departure. Depending on the degree and consequences of the departure, the shipyard or Owner may be required to provide an assessment and remediation plan to obtain or maintain the notation. Failure to complete the agreed remediation by the due date will lead to withdrawal of the notation.

SECTION 2 Accommodation Areas

1 Background

To promote maritime safety, efficiency, and habitability, it is important that seafarers maintain appropriate levels of mental and physical fitness while onboard vessels. To help accomplish this, seafarers should be provided with suitable accommodation areas. Appropriate accommodation area design helps promote reliable performance by reducing the potential for fatigue and human error. Appropriate accommodation areas may also enhance morale, recruiting, retention, comfort, and overall quality of life at sea.

Conversely, inappropriate accommodation areas can adversely impact a seafarer's ability to reliably perform assigned duties, fully relax, sleep, and recover from mentally and physically demanding work activities. This in turn can impact their ability to carry out duties on succeeding watches with the required diligence, accuracy, and attention to safety procedures. Providing an onboard environment that increases seafarer alertness and well-being should be of concern to vessel Owners.

2 Scope

This Section and Appendix 3, "Accommodation Area Criteria", provide the assessment and measurement criteria for accommodation spaces. In particular, Appendix 3 encompasses the criteria for cabins, sanitary spaces, food services, recreation areas, laundry, and medical spaces.

Compliance with this Section and Appendix 3, "Accommodation Area Criteria" is a prerequisite for the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)** notation confirmation. For vessels requesting the **MLC-ACCOM** notation, the vessel must meet all the appropriate criteria contained in Appendix 3. For the **MLC-ACCOM(SPS)** notation vessels must be awarded (or in the process of being awarded) the ABS Classification Notation of **SPS** and meet all the appropriate criteria considering the allowances permitted for special purpose ships as provided in the MLC and included in Appendix 3. The **MLC-ACCOM(WB)** applies to non-SPS vessels (e.g., offshore/platform support vessels, tow boats, anchor handling vessels, etc.) wanting to demonstrate compliance with the ILO MLC with consideration given to specific flag State ILO MLC guidance, as applicable.

Note: Additional or different criteria imposed by individual flag Administrations may also be applicable.

Enhanced levels of accommodation area criteria intended to improve seafarer habitability, comfort, and safety can be found in the following:

- ABS *Guide for Crew Habitability on Ships*
- ABS *Guide for Crew Habitability on Offshore Installations*
- ABS *Guide for Crew Habitability on Workboats*
- ABS *Guide for Crew Habitability on Mobile Offshore Drilling Units*

3 Terminology

Accommodation Areas/Accommodation Block: Vessel areas where the primary purpose is to rest and recreate. Accommodation spaces include cabins and staterooms, medical facilities (sick bays), offices, recreation rooms, and other similar manned spaces within the accommodation.

4 Associated Documentation

- Appendix 3, "Accommodation Area Criteria"
- International Maritime Labour Organization (ILO) Maritime Labour Convention (MLC), 2006

5 Criteria

The Accommodation area criteria for the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)** notations are provided in Appendix 3, "Accommodation Area Criteria".

6 Accommodation Area Documentation

As stated in 1/7.2, "Accommodation Area", accommodation area documentation shall be prepared and submitted to ABS Engineering for review. Confirmatory verification measurements shall be performed by an ABS Surveyor. The following data shall be submitted to ABS Engineering:

6.1 Data Requirements

The submitted data shall serve as a means for verifying that the vessel meets the accommodation area criteria specified in Appendix 3, "Accommodation Area Criteria".

6.1.1 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 ABS Engineering.

6.1.2 Existing Vessels

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

7 Submittal Review and Verification

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

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

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

8 Results

The results of the ABS Engineering review and the ABS Surveyor verification shall be reviewed by the ABS Surveyor against the appropriate **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** criteria for notation confirmation.

SECTION 3 Whole-body Vibration

1 Background

Working and/or living onboard vessels imposes a series of generally low-frequency mechanical vibrations as well as single-impulse shock loads on the human body.

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

Higher-frequency vibration influencing 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 (Griffin, 1990).

2 Scope

The 2006 MLC has Regulations relating to whole-body vibration levels aboard vessels. They are contained in the following list:

i) Regulation A3.1.6(h) states: *"accommodation and recreational and catering facilities shall meet the requirements in Regulation 4.3, and the related provisions in the Code, on health and safety protection and accident prevention, with respect to preventing the risk of exposure to hazardous levels of noise and* ***vibration*** *and other ambient factors and chemicals on board ships, and to provide an acceptable occupational and on-board living environment for seafarers."*

ii) MLC Regulation A3.1.6(h) calls out Regulation 4.3. Below is listed the physical design and arrangement related aspects of Regulation 4.3:

- A4.3.1(b) *"reasonable precautions to prevent occupational accidents, injuries and diseases on board ship, including measures to reduce and prevent the risk of exposure to harmful levels of ambient factors and chemicals as well as the risk of injury or disease that may arise from the use of equipment and machinery on board ships;"*
- A4.3.2(a) *"take account of relevant international instruments dealing with occupational safety and health protection in general and with specific risks, and address all matters relevant to the prevention of occupational accidents, injuries and diseases that may be applicable to the work of seafarers and particularly those which are specific to maritime employment;"* and
- A4.3.4 *"Compliance with the requirements of applicable international instruments on the acceptable levels of exposure to workplace hazards on board ships and on the development and implementation of ships' occupational safety and health policies and programmes shall be considered as meeting the requirements of this Convention."*

ABS considers compliance with the whole-body vibration criteria in this Section satisfactory for compliance with the hazardous vibration aspects of A3.1.6(h).

The criteria in this Section provide an acceptable level of exposure to and methods for assessing whole-body vibration relating to seafarer accommodation areas onboard vessels. The criteria were selected to limit potential vibration-related interference with seafarer tasks and to promote the seafarers living conditions. Whole-body vibration limits defined in this Section are based on currently available standards and research.

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 Hertz (Hz). Motions transmitted to the body of a seated or recumbent person have been omitted from this Guide. Due to the provision of resilient or non-rigid surfaces on seats and beds, these surfaces will generally attenuate the transfer of vibration to levels that are lower than those experienced when standing. The motions transmitted through the feet are expected to be the highest vibration levels to which crew will be exposed.

Whole-body vibration limits in this Section are based on currently available standard and research. Compliance with this Section is a prerequisite for being awarded the Accommodation notations **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notation.

3 Terminology

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

Dynamic Positioning: A system to automatically maintain a vessel'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.

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

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

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

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

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

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

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

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

Transit Conditions: Those conditions where the vessel is transitioning (moving) from one location to another.

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.

4 Associated Documentation

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

- ISO 6954: 2000, Mechanical Vibration and Shock – Guidelines for the Measurement, Reporting and Evaluation of Vibration with Regard to Habitability on Passenger and Merchant Ships
- ISO 2631-2:2003, Mechanical Vibration and Shock – Evaluation of Human Exposure to Whole Body Vibration – Part 2, Vibration in Buildings.
- ISO 8041:2007, Human Response to Vibration – Measuring Instrumentation
- ISO 5348:1998, Mechanical Vibration and Shock – Mechanical Mounting of Accelerometers.
- WMO: 1995, Sea State Code

Further guidance can be found in:

- ISO 20283-2:2008, Mechanical Vibration – Measurements of Vibration on Ships – Part 2: Measurement of Structural Vibration.

5 Criteria

The whole-body vibration criteria for the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)** notations are provided in Section 3, Table 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.

Whole-body vibration measurements shall only be taken in manned accommodation spaces. A space is considered "manned" if it is occupied by a seafarer for twenty (20) minutes or longer at a time for normal, routine daily activities. Specific locations are referred to in 3/7.4, "Measurement Locations".

The maximum vibration levels in Section 3, Table 1, "Maximum Weighted Root-Mean-Square Acceleration Level", shall not be exceeded under normal operating conditions. Expression and assessment of vibration levels can be based on acceleration or velocity values. The maximum vibration level is primarily aimed at preventing severe discomfort and interference with seafarer's task performance.

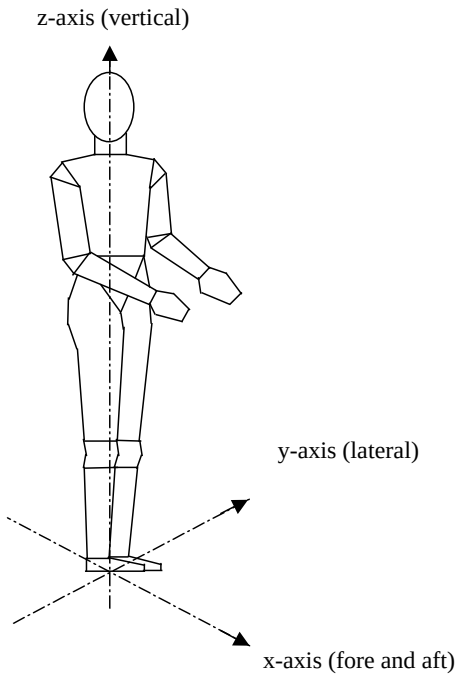
TABLE 1
Maximum Weighted Root-Mean-Square Acceleration Level

Notation	*Frequency Range*	*Acceleration Measurement*	*Maximum RMS Level*	
			Transit Conditions	*Dynamic Positioning Conditions*
MLC-ACCOM **MLC-ACCOM(SPS)** **MLC-ACCOM(WB)**	1 - 80 Hz	a_w	214 mm/s^2 (6.0 mm/s)	286 mm/s^2 (8.0 mm/s)

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 as shown in Section 3, Figure 1, "Measurement 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 Section 3, Table 1.

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

FIGURE 1
Measurement Axes



6 Test Plan

As stated in 1/7.3.1, "Test Plans", a Test Plan shall be developed to serve as the principal means for verifying the measurements to be performed to verify compliance with whole-body vibration criteria. The Test Plan shall include the following:

6.1 Documentation

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

6.2 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 Appendix 2, "Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists".

6.3 Test Conditions

The Test Plan shall detail the conditions under which the tests are expected to be performed. Further details about test conditions are given in 3/7.3, "Test Conditions".

6.4 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 3/7.4, "Measurement Locations".

6.5 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 3/7.2, "Data Acquisition and Instruments".

6.6 Data Analysis

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

6.7 Test Schedule

The Test Plan shall provide information regarding the proposed test schedule. It shall include the following: Date of measurements, list of measurement locations per date, list of measuring personnel, and test duration.

7 Test Requirements

7.1 General

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

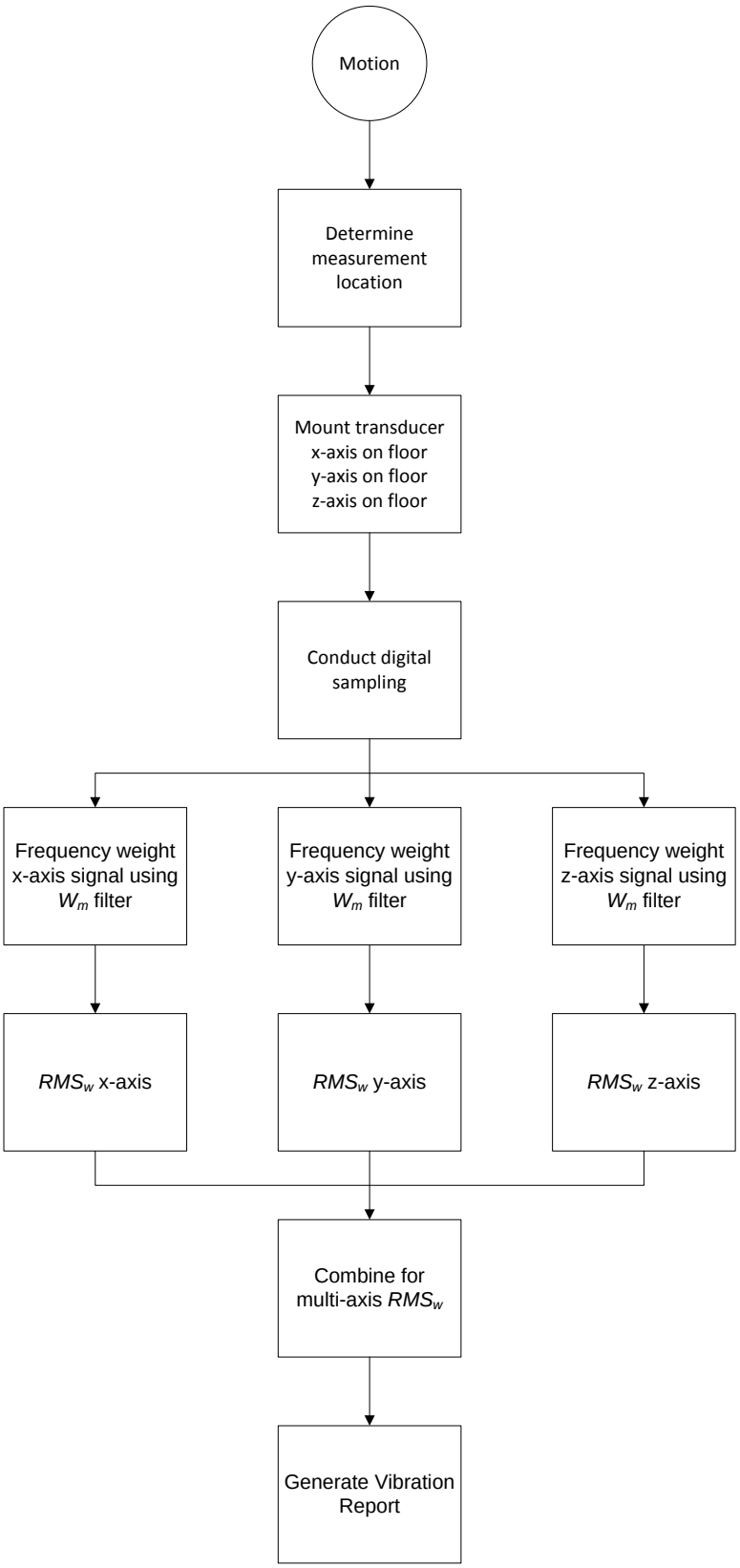
The relationship between the various factors to be considered when taking whole-body vibration measurements and computing results is illustrated in Section 3, Figure 2, "Process for the Measurement and Analysis of Whole-body Vibration".

7.2 Data Acquisition and Instruments

For the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)** notations, 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 3/7.3, "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.

FIGURE 2
Process for the Measurement and Analysis of Whole-body Vibration



7.3 Test Conditions

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

7.3.1 Power Output

i) *Transit:* The propulsion machinery shall run at contractual service conditions.

ii) *Dynamic Positioning:* Devices such as azimuth or tunnel thrusters automatic or manual shall run at contractual service conditions or with at least 40% power on the thrusters.

7.3.2 Equipment Operation

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

7.3.3 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 conditions. The vessel shall maintain a single heading and a constant speed during the test. Measurements during dynamic positioning shall be taken while the vessel is maintaining a position relative to another vessel or fixed point (e.g., offshore installation).

7.3.4 Rudder Conditions

During transit measurements, rudder action shall be minimized. During dynamic positioning, measurements shall be taken while the vessel is maintaining a position relative to another vessel or fixed point (e.g., offshore installation).

7.3.5 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*.

7.3.6 Loading Conditions

The loading condition of the vessel shall be as close as possible to normal operating conditions.

7.3.7 Test Interference

During the whole-body vibration measurements, vibration arising from every 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.

7.4 Measurement Locations

7.4.1 Selection of Spaces where Measurements are to be Conducted

The aim when selecting vibration 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 vibration emitting sources such as propulsion or other rotating machinery or where vibration is likely to be transmitted to accommodation areas and recreation areas via the vessel's structure. Measurements shall be taken in all identified worst case locations (e.g., a cabin adjacent to a machinery space).

ii) Where a single instance of one (1) type of manned space exists within the vessel (e.g., 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 of the representative sample for crew cabins and staterooms, if applicable.

iv) 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.

7.4.2 Walkthrough Verification Inspection Locations

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

7.4.3 Transducer Measurement Positions

Vibration transducers (accelerometers) shall be located and attached properly to the floor surface 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 Section 3, Table 2, "Distribution of Transducer Positions within Spaces"

TABLE 2
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 (1291–2142 ft^2)	5
Greater than 200 m^2 (2142 ft^2)	6

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.

8 Test Report

As stated in 1/7.3.2, "Test Reports", a Test Report shall be submitted to the ABS 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.

8.1 Test Details

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

i) Loading (mean draft and trim)

ii) Number of crew and other persons onboard during tests

iii) Bridge confirmation that operating conditions complied with contractual service conditions

iv) Class of Dynamic Positioning (e.g., DP-0, DP-1, etc.), if applicable

v) Vessel course and speed, as well as latitude and longitude coordinates of tests

vi) Average water depth under keel

vii) Sea state

viii) Direction of swell relative to vessel heading

ix) Any indications of abnormal activity during the test that might skew results

x) Vessel equipment operated during the test

8.2 Transducer Measurement Positions

Actual transducer positions within the measured spaces (for both transit and dynamically positioned operations) shall be indicated on appropriate drawings.

8.3 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.

8.4 Results

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

i) Measurement positions (i.e., space and location within space)

ii) Measurement period if different from requirements

iii) Sample number

iv) Multi-Axis weighted RMS values

v) Equipment operating in proximity to the measurement position

For 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

8.5 Deviations

All deviations from the approved Test Plan shall be reported.

8.6 Surveyor Witnessing Documentation

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

9 Results

The Whole-body Vibration Test Report shall be reviewed by the ABS Surveyor against the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** criteria for notation confirmation.

SECTION 4 Noise

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". The noise levels provided in this Section were obtained from the newly revised IMO Resolution MSC.337(91): *Code on noise levels on board ships*. This Code was designed to provide standards to prevent the occurrence of potentially hazardous noise levels on board ships and to provide standards for an acceptable environment for seafarers. The Code's intent is to limit noise levels and to reduce exposure to noise, in order to:

i) Provide for safe working conditions by giving consideration to the need for speech communication and for hearing audible alarms

ii) Provide an environment where clear-headed decisions can be made in control stations, navigation and radio spaces and manned machinery spaces

iii) Protect the seafarer from excessive noise levels which may give rise to a noise-induced hearing loss

iv) Provide the seafarer with an acceptable degree of comfort in rest, recreation and other spaces and also provide conditions for recuperation from the effects of exposure to high noise levels

2 Scope

The 2006 MLC has Regulations relating to noise levels aboard vessels. They are contained in the following list:

i) Regulation A3.1.6(h) states: *"accommodation and recreational and catering facilities shall meet the requirements in Regulation 4.3, and the related provisions in the Code, on health and safety protection and accident prevention, with respect to preventing the risk of exposure to hazardous levels of* ***noise*** *and vibration and other ambient factors and chemicals on board ships, and to provide an acceptable occupational and on-board living environment for seafarers."*

ii) MLC Regulation A3.1.6(h) calls out Regulation 4.3. Below is listed the physical design and arrangement related aspects of Regulation 4.3 include:

- A4.3.1(b) *"reasonable precautions to prevent occupational accidents, injuries and diseases on board ship, including measures to reduce and prevent the risk of exposure to harmful levels of ambient factors and chemicals as well as the risk of injury or disease that may arise from the use of equipment and machinery on board ships;"*
- A4.3.2(a) *"take account of relevant international instruments dealing with occupational safety and health protection in general and with specific risks, and address all matters relevant to the prevention of occupational accidents, injuries and diseases that may be applicable to the work of seafarers and particularly those which are specific to maritime employment;"* and
- A4.3.4 *"Compliance with the requirements of applicable international instruments on the acceptable levels of exposure to workplace hazards on board ships and on the development and implementation of ships' occupational safety and health policies and programmes shall be considered as meeting the requirements of this Convention."*

ABS considers compliance with the noise criteria in this Section satisfactory for compliance with the hazardous noise aspects of A3.1.6(h).

The criteria in this Section provide an acceptable level of exposure to noise and methods for assessing noise relating to accommodation areas onboard vessels. The noise criteria have been selected to enhance the seafarers' living conditions. In this instance, "living conditions" means the ability of the seafarer to use a space for its intended purpose with minimal interference or annoyance from noise.

This Section applies to manned accommodation spaces occupied by seafarers for twenty (20) minutes or longer at any one time during normal, routine daily activities. Examples of such spaces include cabins, staterooms, and dining and recreation spaces. Compliance with this Section is a prerequisite for the Accommodation notations (**MLC-ACCOM**, **MLC-ACCOM(SPS)**, and **MLC-ACCOM(WB)**) confirmation.

Enhanced levels of noise criteria intended to improve seafarer habitability, comfort and safety can be found in the following:

- ABS *Guide for Crew Habitability on Ships*
- ABS *Guide for Crew Habitability on Offshore Installations*
- ABS *Guide for Crew Habitability on Workboats*
- ABS *Guide for Crew Habitability on Mobile Offshore Drilling Units*

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 signal or through zero calibration.

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

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

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

4 Associated Documentation

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

- IEC 61672-1: 2004, Electroacoustics – Sound Level Meters – Part 1: Specifications
- IMO Resolution MSC.337(91) (2012): Code on noise levels onboard ships
- ISO 140-3 (2004) – Acoustics – Measurement of sound insulation in buildings and of building elements Part 3: laboratory measurements of airborne sound insulation of building elements
- ISO 2923, (1996): Acoustics – Measurement of noise on board vessels
- ISO 717 (2006): Rating of Sound Insulation for Dwellings
- WMO, 1995, Sea State Code

5 Criteria

5.1 Equivalent Continuous A-weighted Sound Pressure Level

The noise criteria for the Accommodation notation are provided in Section 4, Table 1, "Noise Criteria". Noise levels shall be determined for the test conditions specified in 4/7.3, "Test Conditions" and shall not exceed the maximum acceptable L_{Aeq} levels indicated in Section 4, Table 1, "Noise Criteria" for each type of space or area. The maximum acceptable noise levels given in Section 4, Table 1, "Noise Criteria" are L_{Aeq} levels determined as appropriate to the character of the noise (see 4/7.5, "Measurement Procedures and Recorded Results").

These noise criteria are the same as IMO Resolution MSC.337(91): *Code on noise levels on board ships*. For noise criteria for areas other than the accommodation areas covered by these notations, consult the IMO Resolution MSC.337(91): *Code on noise levels onboard ships*.

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

TABLE 1
Noise Criteria

Space	*Noise Limit dB(A) Maximum (< 10,000 GT)*	*Noise Limit dB(A) Maximum (≥ 10,000 GT)*
Accommodation Spaces		
Cabins and hospitals	60	55
Mess rooms	65	60
Recreation room	65	60
Open recreation areas	75	75
Offices	65	60
Service Spaces		
Galleys, without food processing equipment operating	75	75
Serveries and pantries	75	75

* In any manned space with noise levels above 85 dB(A), hearing protection should be worn in accordance with appropriate IMO regulations.

5.2 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 717-1:1996 as amended (1:2006), part 1:

Cabin to cabin	R_w = 35
Messrooms, recreation rooms, public spaces and entertainment areas to cabins and hospitals	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.

6 Test Plan

As stated in 1/7.3.1, "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:

6.1 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 ABS Surveyor to verify compliance with the criteria set in this Guide.

The Test Plan shall also include the acoustic insulation plan, calculations, and relevant supporting documentation for review and approval. With the Test Plan, the acoustic insulation test results (see 4/5.2, "Acoustic Insulation") shall be submitted for review.

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

6.2 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 Appendix 2, "Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists".

6.3 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*.

6.4 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 4/7.4, "Measurement Locations".

6.5 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 4/7.2, "Data Acquisition and Instruments".

6.6 Data Analysis

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

6.7 Test Schedule

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

7 Test Requirements

7.1 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 Guide, the more stringent requirement shall take precedence.

7.2 Data Acquisition and Instruments

The integrating-averaging sound level meter shall meet the requirements for a Type 1 instrument specified in IEC 61672-1.

7.3 Test Conditions

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

7.3.1 Power Output

i) *Transit.* The propulsion machinery shall run at contractual service conditions.

ii) *Dynamic Positioning.* Devices such as azimuth or tunnel thrusters automatic or manual shall run at contractual service conditions or with at least 40% power on the thrusters.

7.3.2 Equipment Operation

As appropriate for the mode of operation (transit or dynamic positioning), 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

7.3.3 Course and Water Depth

For transit mode of operations, 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.

7.3.4 Rudder Conditions

During transit measurements, rudder action shall be minimized. During dynamic positioning, measurements shall be taken while the vessel is maintaining a position relative to another vessel or fixed point (e.g., offshore installation).

7.3.5 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*.

7.3.6 Loading Conditions

The loading condition shall be as close as possible to normal operating conditions.

7.3.7 Test Interference

During the noise measurements, noise arising from every 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.

7.4 Measurement Locations

7.4.1 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. Measurements shall be taken in all identified worst case locations (e.g., a cabin adjacent to a machinery space).

ii) Where a single instance of one (1) type of manned space exists within the vessel (e.g., 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 of the representative sample for crew cabins and staterooms, if applicable.

iv) 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.

7.4.2 Walkthrough Verification Inspection Locations

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

7.4.3 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 seafarer 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, measure midway between the machinery and an adjacent reflecting surface.

7.5 Measurement Procedures and Recorded Results

7.5.1 Persons Present During Measurements

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

7.5.2 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.

7.5.3 Cyclic Noise

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

7.5.4 Intermittent Noise

If the noise within a space is intermittent, an L_{Aeq} value shall be determined and reported for a period of high-level noise.

7.5.5 HVAC Related Noise

If HVAC system-related noise is a large contributor to the noise level in the space, a noise measurement shall 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.

8 Test Report

As stated in 1/7.3.2, "Test Reports", a Test Report shall be submitted to the ABS 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.

8.1 Test Details

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

i) Loading (mean draft and trim)

ii) Number of seafarers and number of other persons onboard during testing

iii) Bridge confirmation that operating conditions complied with contractual service conditions

iv) Vessel course and speed

v) Average water depth under keel

vi) Sea state

vii) Any indications of abnormal activity during the test that might skew results

viii) Vessel's equipment operated during the test

8.2 Measurement Equipment Details

Details of measuring 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.

8.3 Results

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

i) Measurement positions (i.e., space and location within space)

ii) Measurement conditions (power output, sea states, etc.)

iii) Number of people present in the space at time of measurement

iv) Measurement period

v) Time at start and finish of measurement

vi) Equivalent continuous A-weighted sound pressure level (L_{Aeq})

vii) Note any open doors and windows

viii) Note equipment operating in proximity to the measurement position

ix) Note observed direct sources of noise (such as ventilation devices) and any measurement data collected

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

i) Name and number of space

ii) Walkthrough inspection observations

iii) Measurement results, if necessary

8.4 Deviations

All deviations from the approved Test Plan shall be reported.

8.5 Surveyor Witnessing Documentation

The equipment calibration and data collection process of the noise level tests shall be witnessed by an ABS Surveyor. The ABS Surveyor shall provide documentation stating whether all steps of the noise level testing were completed to their satisfaction. A copy of the witnessing document shall be given to the person conducting the testing, for insertion into the final Noise Test Report. The original shall be retained for ABS' files.

9 Results

The Noise Test Report shall be reviewed by the ABS Surveyor against the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** criteria for notation confirmation.

SECTION 5 Indoor Climate

1 Background

Thermal comfort is defined in ISO 7730 as "…that condition of mind which expresses satisfaction with the thermal environment". The sensation of thermal comfort is therefore largely subjective and will vary from person to person. Due to differences in metabolism and expectations, there are distinct individual differences among people's perception of comfort as a function of temperature, humidity, and other atmospheric characteristics. Acclimatization, habits, and expectations influence perceived comfort. These individual differences make it difficult to specify a single thermal environment that will be satisfactory to everyone. A thermal environment is therefore typically defined to be acceptable to at least 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 temperature, air velocity, 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 facilitate the thermal comfort of the occupants.

2 Scope

The 2006 MLC has Regulations relating to indoor climatic variables levels aboard vessels. They are contained in the following list:

i) Regulation A3.1.6(b) states: *"the accommodations shall be adequately insulated"*

ii) Regulation A3.1.6(h) states: *"accommodation and recreational and catering facilities shall meet the requirements in Regulation 4.3, and the related provisions in the Code, on health and safety protection and accident prevention, with respect to preventing the risk of exposure to hazardous levels of noise and vibration and other* ***ambient factors*** *and chemicals on board ships, and to provide an acceptable occupational and on-board living environment for seafarers."*

iii) MLC Regulation A3.1.6(h) calls out Regulation 4.3. Below is listed the physical design and arrangement related aspects of Regulation 4.3 include:

- 4.3.1(b) *"reasonable precautions to prevent occupational accidents, injuries and diseases on board ship, including measures to reduce and prevent the risk of exposure to* ***harmful levels of ambient factors*** *and chemicals as well as the risk of injury or disease that may arise from the use of equipment and machinery on board ships;"*
- 4.3.2(a) *"take account of relevant international instruments dealing with occupational safety and health protection in general and with specific risks, and address all matters relevant to the prevention of occupational accidents, injuries and diseases that may be applicable to the work of seafarers and particularly those which are specific to maritime employment;"* and
- 4.3.4 *"Compliance with the requirements of applicable international instruments on the acceptable levels of exposure to workplace hazards on board ships and on the development and implementation of ships' occupational safety and health policies and programmes shall be considered as meeting the requirements of this Convention."*

iv) Regulation A3.1.7(a) states: *"Sleeping rooms and mess rooms shall be adequately ventilated"*

v) Regulation A3.1.7(b) states: *"Ships, except those regularly engaged in trade where temperate climatic conditions do not require this, shall be equipped with air conditioning for seafarer accommodation, for any separate radio room and for any centralized machinery control room."*

vi) Regulation A3.1.7(d) states: *"adequate heat through an appropriate heating system shall be provided, except in ships exclusively on voyages in tropical climates"*

vii) Regulation B3.1.2.2(a) states: *"Air-conditioning systems, whether of a centralized or individual unit type, should be designed to maintain the air at a satisfactory temperature and relative humidity as compared to outside air conditions, ensure a sufficiency of air changes in all air conditioned spaces, take account of the particular characteristics of operations at sea and not produce excessive noise or vibrations."*

viii) Regulation B3.1.8.2 states: *"The arrangement of the entrance, berths, lighting, ventilation, heating and water supply should be designed to ensure the comfort and facilitate the treatment of the occupants."*

ABS considers compliance with the indoor climate criteria in this Section satisfactory for compliance with the hazardous indoor climate aspects of A3.1.6, A3.1.6(b), A3.1.7(a), A3.1.7(b), and A3.1.7(d).

This Section provides the assessment criteria, verification, and measurement methodology for indoor climate relating to accommodation areas on vessels to fulfill the indoor climate related MLC requirements.

The thermal environmental variables covered by this Guide include the ambient qualities of air temperature, air velocity, and relative humidity.

The thermal environmental criteria provided in this Guide are for persons wearing typical indoor clothing occupied with light, primarily sedentary activity and resulting in a thermal environment acceptable to at least eighty (80) percent of the occupants.

This Section applies to enclosed manned accommodation spaces occupied by seafarers for twenty (20) minutes or longer at any one time for normal, routine daily activities. Examples of seafarer spaces include accommodation areas, mess spaces, lounges, and hospitals.

Compliance with this Section is a prerequisite for the Accommodation notation (**MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)**) confirmation.

Enhanced levels of indoor climate criteria intended to improve seafarer habitability, comfort and safety can be found in the following:

- ABS *Guide for Crew Habitability on Ships*
- ABS *Guide for Crew Habitability on Offshore Installations*
- ABS *Guide for Crew Habitability on Workboats*
- ABS *Guide for Crew Habitability on Mobile Offshore Drilling Units*

3 Terminology

Air Temperature: 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: That range of environmental conditions in which at least eighty (80) percent of seafarers experience thermal comfort.

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

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

Relative Humidity (RH): The ratio of the amount of vapor contained in the air (absolute humidity) to the maximum amount of vapor the air can hold at a given temperature before 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.

4 Associated Documentation

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

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

5 Criteria

The indoor climate criteria for the Accommodation notation (**MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)**) are provided in Section 5, Table 1, "Summary of Indoor Climate Requirements".

Indoor climate measurements shall be taken only in enclosed manned accommodation spaces. Specific locations are discussed in 5/7.4, "Measurement Locations".

The thermal environmental comfort ranges and conditions shall be achievable, under the test conditions specified in 5/7.3, "Test Conditions", for normal operating conditions, in all manned spaces.

The criteria provide for a range of air temperatures maintained by a temperature controller for each zone and are primarily aimed at HVAC systems that do not make provision for individual adjustment to suit personal preferences and activities within a specific space. If individual adjustment is provided then the adjustable range of air temperatures shall be between Winter: 20 to 25°C (68 to 77°F) and Summer: 22 to 27°C (71.5 to 80°F). *Note:* This is not a requirement for the **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** notations.

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

5.1 Air Temperature

The HVAC system shall be capable of providing air temperatures as noted in Section 5, Table 1, "Summary of Indoor Climate Requirements" to an HVAC zone for a set of habitable spaces. This temperature shall be maintained by a temperature controller. Each zone shall have a thermostat for reheat and dehumidification purposes.

5.2 Relative Humidity

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

5.3 Air Velocity

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

5.4 Air Exchange Rate

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

5.5 Summary

A summary of the indoor climate requirements is presented in Section 5, Table 1, "Summary of Indoor Climate Requirements".

TABLE 1
Summary of Indoor Climate Requirements

Item	*Requirement or Criterion*
Air Temperature	Air temperature between Winter or Summer: 20 to 27°C (68 to 80°F)
Relative Humidity	A range from 30% minimum to 70% maximum
Air Velocity	Not to exceed 30 meters-per-minute or 100 feet-per-minute (0.5 m/s or 1.7 ft/s)
Air Exchange Rate	The rate of air change for enclosed spaces shall be at least six (6) complete changes-per-hour.

6 Test Plan

As stated in 1/7.3.1, "Test Plans", a Test Plan shall be developed to serve as the principal means for submitting design details of the HVAC system for review by ABS Engineering and for verifying the measurements to be performed to verify compliance with indoor climate criteria.

6.1 Documentation

The Test Plan shall identify spaces where measurements shall be taken and include the following documentation and data to enable ABS Engineering to verify compliance to the indoor climate criteria set in this Guide:

i) Appropriate vessel and HVAC system design specifications

ii) Schematics/layout drawings of the HVAC system

iii) General arrangement drawings of the vessel

A report of the total system Testing, Adjusting, and Balancing (TAB) shall be provided to ABS Engineering. The total system 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 standards.

6.2 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 Appendix 2, "Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists".

6.3 Test Conditions

The Test Plan shall detail the conditions under which the tests will be performed. Details about test conditions are given in 5/7.3, "Test Conditions".

6.4 Measurement Locations

The Test Plan shall document, in detail, on appropriate drawings, all manned spaces or areas where measurements will be taken. Details on selecting measurement locations and determining transducer positions are provided in 5/7.4, "Measurement Locations".

6.5 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, response time, calibration, and sensitivity. More details on data acquisition and instruments are provided in 5/7.2, "Data Acquisition and Instruments".

6.6 Data Analysis

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

6.7 Test Schedule

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

7 Test Requirements

7.1 General

Indoor climate measurements shall be in accordance with the requirements of ANSI/ASHRAE 55a and ANSI/ASHRAE 15. When the procedures described in this Guide deviate from those in ANSI/ASHRAE 55a and ANSI/ASHRAE 15, the more stringent requirement shall take precedence.

7.2 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 following quantities 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:

i) Air temperature

ii) Relative humidity

iii) Air velocity

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.

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

The measuring period for determining the average air velocity at any location shall be three (3) minutes.

7.3 Test Conditions

In order to determine the effectiveness of the HVAC system at providing the environmental conditions specified in this Guide, measurements shall be made under the following conditions:

7.3.1 Testing

Testing of identified spaces can be performed in port and at sea, provided the provisions of the required test conditions stated here are in compliance at the time the measurements are made and recorded. In the case where some testing is performed in port, confirmatory testing shall be performed with all normally functioning operations. This testing will consist of a sample of manned accommodation spaces on the weather boundary and will be selected by the ABS Surveyor.

7.3.2 Equipment Operation

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

7.3.3 Doors and Windows

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

7.3.4 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.

7.3.5 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 possible, measurements should be taken with little or no cloud cover.

7.3.6 Test Interference

During the indoor climate measurements, any activity that might affect the indoor climate in the space 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. Any open doors or windows shall be noted in the Indoor Climate 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.

7.4 Measurement Locations

7.4.1 Selection of Spaces where Measurements are to be Conducted

The aim when selecting indoor climate 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

i) Select potential problem areas where the influence of internal conditions or factors may adversely impact the quality of the indoor climate in seafarer accommodation areas, and recreation areas. Internal conditions include space proximity to equipment that radiates or absorbs heat and surfaces with thermal differentials in excess of 10°C (18°F) from the ambient temperature in the space. Accommodation 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 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., officer's mess, gymnasium, library, offices, etc.), that 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 shall be selected for measurement. The worst case locations are to be considered part of the representative sample, if applicable.

If any of the spaces identified for measurement extend or are situated over a large portion of the vessel, measurement locations shall be selected throughout the length of the vessel on each deck. Additionally, attention must be given to selecting a variety of locations port, starboard, amidships, fore, and aft.

7.4.2 Walkthrough Verification Inspection Locations

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

7.4.3 Transducer Measurement Positions

For each space identified in the Test Plan, the transducer locations shall be standardized as follows:

i) Air temperature and relative humidity measuring instrumentation shall be set up approximately 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). These measurements should be taken in the center of the space and only once per testing location.

8 Test Report

As stated in 1/7.3.2, "Test Reports", a Test Report shall be submitted to the ABS Surveyor to determine whether the indoor climate levels meet the criteria and whether this part of the notation requirement has been met. The details listed in the following Paragraphs shall be provided in the Indoor Climate Test Report.

8.1 Test Details

The following details 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 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.

iii) Any indications of abnormal activities or conditions during the test that might skew results

8.2 Transducer Measurement Positions

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

8.3 Measurement Equipment Details

Details of measuring and analysis equipment (e.g., manufacturer, type and serial number, accuracy, sampling frequency, 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.

8.4 Results

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

i) Measurement position

ii) Number of people present in the space at time of measurement

iii) Measurement period

iv) Time at start and end of measurement

v) Air temperature (minimum, maximum, and average) at 100 mm (4 in.) above deck

vi) Air temperature (minimum, maximum, and average) at 1100 mm (43 in.) above deck

vii) Air temperature (minimum, maximum, and average) at 1700 mm (67 in.) above deck

viii) Relative humidity (minimum, maximum, and average) at 1700 mm (67 in.) above deck

ix) Air velocity at 100, 1100, and 1700 mm (4, 43, and 67 in.) above deck at measurement positions

x) Wind speed and direction, ambient outdoor air temperature, outdoor humidity, and barometric pressure corresponding to indoor measurement periods

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

8.5 Deviations

All deviations from the approved Test Plan shall be reported.

8.6 Surveyor Witnessing Documentation

The equipment calibration and data collection process of the indoor climate tests shall be witnessed by an ABS Surveyor. The ABS Surveyor shall provide documentation stating whether all steps of the indoor climate 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 Indoor Climate Test Report. The original shall be retained for ABS' files.

9 Results

The Indoor Climate Test Report and test results shall be reviewed by the ABS Surveyor against the appropriate **MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)** criteria for notation confirmation.

SECTION 6 Lighting

1 Background

The lighting of seafarer spaces should facilitate visual task performance and facilitate the movement of seafarers in the space and aid in the creation of an appropriate visual environment. Lighting design involves integrating these aspects to provide adequate illumination for the safety and well-being of seafarers as well as for the various tasks performed onboard vessels.

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.

Since 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.

2 Scope

The 2006 MLC has Regulations relating to lighting levels aboard vessels. They are contained in the following list:

i) Regulation A3.1.6(d) states*: "in passenger ships, and in special ships constructed in compliance with the IMO Code of Safety for Special Purpose Ships, 1983, and subsequent versions (hereinafter called "special purpose ships"), the competent authority may, on condition that satisfactory arrangements are made for* ***lighting*** *and ventilation, permit the location of sleeping rooms below the load line, but in no case shall they be located immediately beneath working alleyways;"*

ii) Regulation A3.1.6(g) states: *"****proper lighting*** *and sufficient drainage shall be provided"*

iii) Regulation A3.1.8 states: *"With respect to requirements for lighting, subject to such special arrangements as may be permitted in passenger ships, sleeping rooms and mess rooms shall be lit by natural light and provided with* ***adequate artificial light****."*

iv) Regulation B3.1.8.2 states: *"The arrangement of the entrance, berths,* ***lighting****, ventilation, heating and water supply should be designed to ensure the comfort and facilitate the treatment of the occupants."*

ABS considers compliance with the lighting criteria in this Section satisfactory for compliance with the artificial lighting aspects of A3.1.6(d), A3.1.6(g), and A3.1.8.

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 seafarer visual task performance and facilitate seafarer movements and well-being onboard vessels.

Lighting criteria are based on currently available objective standards and research data. Compliance with this Section is a prerequisite for the Accommodation notation (**MLC-ACCOM**, **MLC-ACCOM(SPS)**, or **MLC-ACCOM(WB)**) confirmation.

3 Terminology

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

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

Discomfort Glare: Glare which produces viewer discomfort, but which does not interfere significantly 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*.

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

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

Task Plane: The horizontal, vertical, or inclined plane in which the visual task lies. If no information is available, 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.

4 Associated Documentation

ISO 8995:2000 (CIES 008/E), Lighting of indoor work places

5 Criteria

The lighting criteria for the Accommodation notations are provided in Section 6, Table 1, “Lighting Criteria for Seafarer Accommodation Area Spaces”.

In this Section, general lighting and task lighting requirements are provided for seafarer tasks and spaces normally encountered on vessels. The lighting levels provided in the tables are for new lamps. Emergency lighting is covered in SOLAS and IMO Resolutions and was not considered in the selection of the lighting levels provided in this Guide. For lighting criteria for spaces not covered by this notation, please consult the following:

- ABS *Guide for Crew Habitability on Ships*
- ABS *Guide for Crew Habitability on Offshore Installations*
- ABS *Guide for Crew Habitability on Workboats*
- ABS *Guide for Crew Habitability on Mobile Offshore Drilling Units*

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

5.1 General and Task Lighting

The minimum maintained illuminance levels in Section 6, Table 1, "Lighting Criteria for Seafarer Accommodation Area Spaces" shall be achieved under the test conditions specified in 6/7.3, "Test Conditions", measured with task lighting turned on where provided but with daylight excluded.

TABLE 1
Lighting Criteria

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
Cabins, Staterooms, and Sanitary Spaces			
General Lighting	150	Bath/Showers (General Lighting)	200
Reading and Writing (Desk and/or Bunk Light)	500	All other Areas within Sanitary Space (e.g., Toilets, Change Room)	200
Mirrors (Personal Grooming)	500	Light During Sleep Periods	<30
Dining Spaces			
Mess Room and Cafeteria	300	Snack and Coffee Bar	150
Vending Machine Area	75		
Recreation Spaces			
Lounges	200	Gymnasiums	300
Library (Reading Areas)	500	Bulletin Boards/Display Areas	150
Multimedia Resource Center	300	All other Recreation Spaces (e.g., Game Rooms)	200
TV Room	150	Crew Accommodation Area	500
Medical, Dental and First Aid Center			
Dispensary	500	Wards - General Lighting - Critical Examination - Reading	150 500 300
Medical and Dental Treatment/Examination Room	500		
Medical Waiting Areas	200		
Laboratories	500	Other Medical & Dental Spaces	300

6 Test Plan

As stated in 1/7.3.1, "Test Plans", a Test Plan shall be developed to serve as the principle means for submitting design details of the lighting system for review by ABS Engineering and for verifying the measurements to be performed to verify compliance with lighting criteria. The Test Plan shall include the following:

6.1 Documentation

The Test Plan shall include appropriate design information and layout drawings showing the hull outline, bulkheads, access routes, location of luminaires, outlines of major furniture and equipment, and the space name and number. The drawings shall be to a scale and sized to permit the scaling of measurement locations (required by 6/7.4, "Measurement Locations") and lighting equipment and the recording of luminance and other relevant data.

6.2 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 Appendix 2, "Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists".

6.3 Test Conditions

The Test Plan shall detail the conditions under which the tests will be performed. Details about test conditions are given in 6/7.3, "Test Conditions".

6.4 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 6/7.4, "Measurement Locations".

6.5 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, response time, calibration, and sensitivity. More details on data acquisition and instruments are provided in 6/7.2, "Data Acquisition and Instruments".

6.6 Data Analysis

The Test Plan shall provide information regarding the methods used for data analysis.

6.7 Test Schedule

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

7 Test Requirements

7.1 General

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 ABS Surveyor witnessing the collection of lighting data. These assessments shall be made as a part of the activities discussed in 6/7.4.2, "Walkthrough Verification Inspection Locations".

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 can be blocked out.

7.2 Data Acquisition and Instruments

The illuminance meter (light meter) should meet the requirements specified in ISO 8995. This defines the instrumentation requirements for measuring white light.

7.3 Test Conditions

The test conditions required for Lighting measurements shall be in accordance with the following Subparagraphs:

7.3.1 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, power during testing shall come from the vessel not the port.

7.3.2 Spaces with Windows/Portlights

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

7.3.3 Spaces without Windows/Portlights

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

7.3.4 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.

7.3.5 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.

7.3.6 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 needed to operate any equipment during testing and those carrying out the measurements shall be present in the space.

Doors and windows shall be closed, except where they are normally left open. Any open doors or windows shall be noted in the Lighting Test Report. Spaces shall be furnished with all usual equipment and furnishings normally found in the space.

7.4 Measurement Locations

7.4.1 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 spaces listed in Section 6, Table 1, "Lighting Criteria for Seafarer Accommodation Area 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 problem areas based on the potential for excessive external illumination (daylight) into the space. 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., officer's mess, gymnasium, library, etc.), that location shall be selected for measurement.

iv) Where multiple instances of one (1) type of space exist (e.g., seafarer recreation areas or mess) 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 seafarer 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 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.

7.4.2 Walkthrough Verification Inspection Locations

All normally manned spaces shall be subject to a walkthrough inspection by the ABS Surveyor. The number and locations of the walkthrough inspections will be determined by the ABS Surveyor. The purpose of the walkthrough verification 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 ABS Surveyor, additional measurements or assessments may be required. The Surveyor will determine if any follow-on activity is required for any noted discomfort or disability glare.

7.4.3 General Illuminance Measurement Positions

General lighting levels shall be measured with all lights turned on except supplementary detail 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 shall be 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 Section 6, Table 2, "Distribution of Measurement Positions within Spaces".

TABLE 2
Distribution of Measurement 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(1291–2142 ft^2)	5
Greater than 200 m^2 (2142 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.

7.4.4 Task Lighting Measurement Positions

For task area lighting (such as desktops and meeting tables, and medical stations), a representative set of readings shall be taken over the task surface with the testing specialist in the normal working position. Task lighting shall be measured with both general and supplementary task lighting turned on. Daylight shall be excluded during the measurements.

Measurements of task lighting shall be made on the surface or in the plane of the task (horizontal, vertical, or at an angle). For small task surfaces [smaller than 0.5 m^2 (5 ft^2)], a single measurement shall be taken at the center of the task surface. For larger task surfaces [0.5 m^2 (5 ft^2) or larger], the illuminance shall be measured by dividing the task surface into a grid no larger than 0.5 m^2 (5 ft^2) and averaging the measurements taken at the grid intersections.

Measurements for mirrors shall be taken approximately 400 mm (16 in.) away from the surface of the mirror. For berths and bunks, measurements shall be taken at a point approximately 300 mm (12 in.) above the top of the mattress and 600 mm (24 in.) from the head of the bed.

8 Test Report

As stated in 1/7.3.2, "Test Reports", a Test Report shall be submitted to the ABS 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.

8.1 Test Details

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

i) Power source for lighting during testing and 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?)

8.2 Measurement Positions

Actual measurement locations shall be indicated on appropriate drawings.

8.3 Measurement Equipment Details

Details of all 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.

8.4 Results

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 locations within a space and any follow-up activity requirements

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

8.5 Deviations

All deviations from the approved Test Plan shall be reported.

8.6 Surveyor Witnessing Documentation

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

9 Results

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

APPENDIX 1 References

1 General References

1 American Bureau of Shipping. *Guide for Building and Classing Yachts.* Houston, TX.

2 American Bureau of Shipping. *Rules for Materials and Welding: Aluminum and Fiber Reinforced Plastics.* Houston, TX.

3 American Bureau of Shipping. *Rules for Building and Classing Steel Vessels*. Houston, TX.

4 American Bureau of Shipping. *Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways.* Houston, TX.

5 American Bureau of Shipping. *Rules for Building and Classing Steel Vessels Under 90 Meters (295 Feet) in Length*. Houston, TX.

6 International Labor Organization. Maritime Labour Convention, 2006 Geneva.

2 Accommodation Area References

1 American Society for Testing and Materials. (1996). *Standard practice for human engineering design for marine systems, equipment and facilities* (ASTM F 1166 – 2000). West Conshohocken, PA.

2 Human Factors Society, Inc. (1988). *American national standard for human factors engineering of visual display terminal workstations* (ANSI/HFS Standard No.100-1988). Santa Monica, CA.

3 The ILO Maritime Labour Convention, 2006. Geneva.

4 International Maritime Organization. (1997). *International Convention of the Safety of Life at Sea: Means of escape* (Chapter II-2, Regulation 28). London.

5 International Organization of Masters, Mates, & Pilots. *Contract requirements for both existing and new ship construction*. Linthicum Heights, MD.

6 Sailor's Union of the Pacific. (1996). *Agreement between Sailor's Union of the Pacific and American President Lines, Ltd. In the Offshore and Intercoastal Trades*. San Francisco, CA.

7 Seafarers International Union. *Contract requirements for unlicensed seamen*. Camp Springs, MD.

8 U.S. Maritime Administration: National Maritime Resource and Education Center. (1995). *Guideline specification for merchant ship construction, prepared by the Office of Ship Design*. Washington, DC: U.S. Department of Transport.

9 U.S. Navy. (1995). *Shipboard accommodations design criteria manual* (T9640-AB-DDT-010/MLC-ACCOM). Arlington, VA: Naval Sea Systems Command.

10 Woodson, W.E., Tillman, B., and Tillman, P. (1992). *Human factors design handbook: Information and guidelines for the design of systems, facilities, equipment and products for human use* (2nd ed.). New York: McGraw-Hill, Inc.

3 Whole-body Vibrations References

1 American Bureau of Shipping. *Rules for Building and Classing High-Speed Craft*. Houston, TX.

2 Griffin M. J. (1990). *Handbook of human vibration*. London: Academic Press.

3 International Organization for Standardization. (1984). *Code for the measurement and reporting of local vibration data of ship structures and equipment* (ISO 4867:1984). Geneva.

4 International Organization for Standardization. (1998). *Mechanical mounting of accelerometers for measuring mechanical vibration and shock* (ISO 5348:1998(E)). Geneva.

5 International Organization for Standardization. (2007). *Human response to vibration – Measuring instrumentation Amendment 1* (ISO 8041:2007). Geneva.

6 International Organization for Standardization (2000) *Mechanical vibration – Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships* (ISO 6954:2000)

7 International Organization for Standardization. (2008). *Mechanical Vibration – Measurements of Vibration on Ships – Part 2: Measurement of Structural Vibration* (ISO 20283-2:2008). Geneva.

8 World Meteorological Organization (1995). *International Codes Vol I.1 Part A Alphanumeric Codes*. Boston, MA: American Meteorological Society.

4 Noise References

1 International Electrotechnical Commission. (2002). *Electroacoustics – Sound Level Meters Integrating-averaging sound level meters* (International Standard IEC 64672-1:2002,– Part 1: Specifications). Geneva: IEC Central Office.

2 International Maritime Organization. (2012). *Code on noise levels on board ships* (IMO Resolution MSC.337(91)).

3 International Organization for Standardization (1996). *Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation* (ISO 717-1:1996). Geneva.

4 International Organization for Standardization. (1996). *Acoustics – Measurement of noise on board vessels* (ISO 2923:1996). Geneva.

5 International Organization for Standardization. (1984). *Code for the measurement and reporting of shipboard vibration data* (ISO 4867:1984). Geneva.

6 Kryter, K.D. (1994). *The handbook of hearing and the effects of noise: Physiology, psychology and public health*. San Diego: Academic Press.

7 World Meteorological Organization (1995). *International Codes Vol I.1 Part A Alphanumeric Codes*. Boston, MA: American Meteorological Society.

5 Indoor Climate References

1 American National Standards Institute. (1995). *Thermal environmental conditions for human occupancy* (ANSI/ASHRAE 55a-1995). Atlanta, GA: The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

2 International Organization for Standardization. (1998). *Ergonomics of the thermal environment – Instruments for measuring physical quantities* (ISO 7726:1998 (E)). Geneva.

3 International Organization for Standardization. (1994). *Moderate thermal environments – Determination of the PMV and PPD indices and specification of the conditions for thermal* Comfort (ISO 7730:1994(E)). Geneva.

4 National Environmental Balancing Bureau. (1998). *NEBB Procedural standards for testing, adjusting, balancing of environmental systems*. Gaithersburg, MD.

6 Lighting References

1 Chartered Institution of Building Services. (1984). *CIBS CODE for interior lighting*. London.

2 Illuminating Engineering Society of North America. (1993). *American national standard practice for office lighting* (ANSI/IESNA RP-1-1993). New York.

3 Ryer, A. D. (1997). *Light measurement handbook*. Newburyport, MA: International Light, Inc.

4 U.K. Ministry of Defence. (1997). *Human factors for designers of equipment, Part 6: Vision and lighting* (DEF STAN 00-25 (Part 6)/Issue 2). Glasgow: Ministry of Defence, Directorate of Standardization.

APPENDIX 2 Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists

1 Terminology

ABS Recognized Ambient Environmental Testing Specialists: Companies providing test or measurement services on behalf of the Owner of a vessel or shipyard for the purposes of meeting ABS Accommodation (**MLC-ACCOM, MLC-ACCOM(SPS),** or **MLC-ACCOM(WB)**) notation requirements. Approval of the Testing Specialist for the **MLC-ACCOM, MLC-ACCOM(SPS),** and **MLC-ACCOM(WB)** notations may also allow for testing and measurement services for other ABS Habitability and Comfort notations:

- **HAB**, **HAB+**, **HAB++**
- **HAB(WB)**, **HAB+(WB)**, **HAB++(WB)**
- **HAB(OS)**, **HAB+ (OS)**, **HAB++(OS)**
- **HAB(MODU)**, **HAB+(MODU)**, **HAB++(MODU)**
- **COMF**, **COMF+**
- **COMF(Y)**, **COMF+(Y)**

Note that for **COMF+** and **COMF+(Y),** motion sickness testing is required.

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.

2 Objective

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

3 Application

This procedure applies 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 A2/4.2, “General Requirements”. Specific requirements for the test services listed above are in Subsection A2/8, “Detailed Requirements by Ambient Environmental Aspect”.

4 Procedure for Approval and Certification

4.1 Documentation Requirements

The following documents are to be submitted to ABS for review:

i) An outline of the company (e.g., organization and management structure) including subsidiaries or subcontractors to be included in the approval/certification

ii) A list of company experience in the specific ambient environmental aspect

iii) 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

The following documents will be reviewed during the initial approval audit (See A2/4.3, "Auditing of the Testing Specialist"):

i) A guide for operators of such equipment

ii) Training programs for test personnel

iii) Draft checklists and data recording sheets for recording results of the services referred to in Subsection A2/3, "Application"

iv) Quality Manual and/or documented procedures covering requirements in A2/4.5, "Quality Assurance System"

v) Evidence of approval/acceptance by certifying bodies, if any

vi) Information about other activities which may present a conflict of interest

vii) Record of customer claims and of corrective actions requested by certification bodies for the past year

viii) Where relevant, list and documentation of licenses granted by equipment's manufacturer

ix) Example Test Plan(s) for the ambient environmental quality for which approval is requested

x) Example Test Reports

4.2 General Requirements

4.2.1 Extent of Approval

The Testing Specialist shall demonstrate, as required by A2/4.2.2, "Training of Personnel" through A2/4.2.9, "Reporting", that they have the competence, quality control, and quality assurance needed to perform the test and analysis services for which approval is sought.

4.2.2 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 do not exist, 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.

4.2.3 Supervision

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.

4.2.4 Personnel Records

The Testing Specialist shall keep records of the recognized test personnel. The records shall contain information about formal education, training, and experience for the ambient environmental test services for which they are recognized.

4.2.5 Equipment and Facilities

The Testing Specialist shall have the necessary equipment and facilities for the ambient environmental aspect to be tested. A record of the equipment used for ambient environmental testing shall be kept. The record shall contain information about maintenance and calibration.

4.2.6 Procedures

The Testing Specialist shall have documented work procedures covering all ambient environmental test services supplied.

4.2.7 Subcontractors

The Testing Specialist shall give information of agreements and arrangements if any parts of the services provided are subcontracted. Particular emphasis shall be given to quality management by the Testing Specialist in following-up of such subcontracts. Subcontractors providing anything other than subcontracted personnel or equipment shall also meet the requirements of A2/4.2, "General Requirements" and A2/4.5, "Quality Assurance System".

4.2.8 Verification

The Testing Specialist shall verify that the services provided are carried out in accordance with approved procedures.

4.2.9 Reporting

The report shall be prepared in a form acceptable to ABS as outlined within this Guide. The report shall include a copy of the Certificate of Approval.

4.3 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.

4.4 Certification

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

4.5 Quality Assurance System

The Testing Specialist shall have a documented system covering at least 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.

4.6 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. ABS 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.

5 Certificate of Approval

Upon satisfactory completion of both the audit of the Testing Specialist and practical demonstration, ABS 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 ABS in making decisions affecting optional Accommodation/Comfort classification notations. The Certificate shall clearly state the type and scope of services and any limitations or restrictions imposed. The Testing Specialist shall also be included in ABS' 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 A2/4.6, "Testing Specialist Relations with the Test Equipment Manufacturer".

5.1 Renewal

The Certificate of Approval is subject to renewal or endorsement at intervals not exceeding three (3) years per Testing Specialist procedure. The renewal or endorsement shall be accomplished by verification through audits to verify that approved conditions are maintained.

6 Alterations

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

7 Cancellation of Approval

Approval may be cancelled in the following cases:

i) Where the service was improperly carried out or the results were improperly reported

ii) Where deficiencies are found in the recognized services of the Testing Specialist and appropriate corrective action is not taken

iii) Where the Testing Specialist fails to inform ABS of any alteration, as in Subsection A2/6, "Alterations"

iv) Where a renewal audit, if requested per A2/5.1, "Renewal", has not been carried out

v) Where willful acts or omissions are ascertained

ABS reserves the right to cancel the approval if any of these cases are met.

A Testing Specialist whose approval was cancelled may apply for re-approval provided the nonconformities which resulted in cancellation have been corrected, and that ABS is able to confirm that the corrective action has been effectively implemented.

8 Detailed Requirements by Ambient Environmental Aspect

8.1 Whole-body Vibration

8.1.1 Extent of Engagement

Whole-body vibration measurement Testing Specialists are engaged to conduct vibration measurements and analyses onboard vessels.

8.1.2 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

iii) have a documented history of at least two (2) years supervising vibration testing onboard marine vessels

The supervisor shall have sufficient knowledge of vessel structures and equipment, measurement and analysis of whole-body vibration according to ISO 6954, to verify that test procedures are compliant with the required test conditions.

8.1.3 Test Personnel

The test personnel carrying out the measurements shall:

i) be qualified to Level I according to a recognized national or international Nondestructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or

ii) have a documented history of experience in performing vibration environmental testing onboard marine vessels

iii) have adequate knowledge of vessel structures and equipment.

8.1.4 Equipment

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

8.1.5 Procedures

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

i) Test preparation

ii) Selection and identification of measurement locations

iii) Surface preparation

iv) Calibration checks

v) Testing methods

vi) Equipment handling

vii) Report preparation and content

viii) Method for handling previous results if subsequent calibration shows instruments to be out of tolerance

8.1.6 Reporting

The report shall be based on the instructions given in Subsection 3/8, “Test Report”.

8.2 Noise

8.2.1 Extent of Engagement

Noise measurement Testing Specialists are engaged to conduct noise measurements and analyses onboard vessels.

8.2.2 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

iii) have a documented history of at least two (2) years supervising noise testing onboard marine vessels

The supervisor shall have sufficient knowledge of vessel structures, measuring equipment, ISO 2923, IEC 160651, and IEC 60804, to verify that test procedures are compliant with the required test conditions.

8.2.3 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 noise testing onboard marine vessels

iii) have adequate knowledge of vessel structures and equipment.

8.2.4 Equipment

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

8.2.5 Procedures

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

i) Test preparation

ii) Selection and identification of measurement locations

iii) Surface preparation

iv) Calibration checks

v) Testing methods

vi) Equipment handling

vii) Report preparation and content

viii) Method for handling previous results if subsequent calibration shows instruments to be out of tolerance

8.2.6 Reporting

The report shall be based on the instructions given in Subsection 4/8, “Test Report”.

8.3 Indoor Climate

8.3.1 Extent of Engagement

Indoor climate measurement Testing Specialists are engaged to conduct indoor climate measurements and analyses onboard vessels.

8.3.2 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

iii) have a documented history of at least two (2) years supervising ambient environmental testing onboard marine vessels

The supervisor shall have sufficient knowledge of vessel structures, measuring equipment, ANSI/ASHRAE 15 and 55a and ISO 7726, to verify that test procedures are compliant with the required test conditions.

8.3.3 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 vessels

iii) have adequate knowledge of vessel structures and equipment.

8.3.4 Equipment

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

8.3.5 Procedures

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

i) Test preparation

ii) Selection and identification of measurement locations

iii) Surface preparation, if applicable

iv) Testing methods

v) Equipment handling

vi) Report preparation and content

vii) Method for handling previous results if subsequent calibration shows instruments to be out of tolerance

8.3.6 Reporting

The report shall be based on the instructions given in Subsection 5/8, “Test Report”.

8.4 Lighting

8.4.1 Extent of Engagement

Lighting measurement Testing Specialists are engaged to conduct illuminance measurements and analyses onboard vessels.

8.4.2 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

iii) have a documented history of at least two (2) years supervising ambient environmental testing onboard marine vessels

The supervisor shall have sufficient knowledge of vessel structures and measuring equipment, to verify that test procedures are compliant with the required test conditions.

8.4.3 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 vessels

iii) have adequate knowledge of vessel structures and equipment.

8.4.4 Equipment

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

8.4.5 Procedures

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

i) Test preparation

ii) Selection and identification of measurement locations

iii) Surface preparation

iv) Calibration checks

v) Testing methods

vi) Equipment handling

vii) Report preparation and content

viii) Method for handling previous results if subsequent calibration shows instruments to be out of tolerance

8.4.6 Reporting

The report shall be based on the instructions given in Subsection 6/8, “Test Report”.

APPENDIX 3 Accommodation Area Criteria

Requirement	*Flag Administration's Requirements Reviewed and Included as Appropriate*
Have the flag Administration's requirements related to title 3.1 (if any) been identified and compared to the criteria contained in this Appendix to determine if there are additional requirements?	☐

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "General" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – General		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.6(a)	*There shall be adequate headroom in all seafarer accommodation; the minimum permitted headroom in all seafarer accommodation where full and free movement is necessary shall be not less than 203 centimeters (80 in.); the competent authority may permit some limited reduction in headroom in any space, or part of any space, in such accommodation where it is satisfied that such reduction: is reasonable; and will not result in discomfort to the seafarers;*	☐
A3.1.6(b)	*The accommodations shall be adequately insulated* (insulation relating to noise and indoor climatic variables are addressed in Section 4, "Noise", and Section 5, "Indoor Climate")	☐
A3.1.6(e)	*There shall be no direct openings into sleeping rooms from cargo and machinery spaces or from galleys, storerooms, drying rooms or communal sanitary areas.*	☐
	That part of a bulkhead separating such places from sleeping rooms and external bulkheads shall be efficiently constructed of steel or other approved substance and be watertight and gas-tight.	☐
A3.1.6(f)	*The materials used to construct internal bulkheads, paneling and sheeting, floors and joining shall be suitable for the purpose and conducive to ensuring a healthy environment.*	☐
	Additional Requirements for A3.1.6(f)	
	The bulkhead surfaces and deck heads are to be of material with a surface easily kept clean. No form of construction likely to harbor vermin is to be used. (B3.1.1.3)	☐
	The bulkhead surfaces and deck heads in sleeping rooms and mess rooms shall be capable of being easily kept clean and light in color with a durable, nontoxic finish. (B3.1.1.4)	☐
	The decks in all seafarer accommodation are to be of approved material and construction and shall provide a non-slip surface impervious to damp and easily kept clean. (B3.1.1.5)	☐
	Where the floorings are made of composite materials, the joints with the sides shall be profiled to avoid crevices. (B3.1.1.6)	☐
	Deck coverings (e.g., mats, carpeting, etc.) shall be supplied where slipping is possible due to occasional water, oil, or liquid on the floors.	☐

Accommodation Area Criteria – General		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.6(g)	*Proper lighting* (addressed in Section 6, "Lighting") *and sufficient draining shall be provided.*	☐
	Additional Requirements for A3.1.6(g)	
	Deck drains shall be considered in all food service areas subject to flood type cleaning or where normal operations release or discharge water or other liquid onto the deck.	☐
	Deck drains for food service areas shall be considered in number and location so that complete drainage is possible under normal conditions of list and trim.	☐
	There shall be no deck drains inside provision rooms except the thaw room.	☐
	Deck drains shall be provided in the laundry.	☐
A3.1.6(h)	*Accommodation and recreational and catering facilities shall meet the requirements in Regulation 4.3, and the related provisions in the Code, on health and safety protection and accident prevention, with respect to preventing the risk of exposure to hazardous levels of noise and vibration and other ambient factors and chemicals on board ships, and to provide an acceptable occupational and on-board living environment for seafarers.* (hazardous levels of vibration, noise and the ambient environment qualities of indoor climate and lighting are addressed in Sections 3, "Whole-body Vibration", 4 "Noise", 5 "Indoor Climate", and 6 "Lighting")	☐
A3.1.7(a)	*Sleeping rooms and mess rooms shall be adequately ventilated* (addressed in Section 5, "Indoor Climate")	☐
A3.1.7(b)	*Ships, except those regularly engaged in trade where temperate climatic conditions do not require this, shall be equipped with air conditioning for seafarer accommodation, for any separate radio room and for any centralized machinery control room.* (addressed in Section 5, "Indoor Climate")	☐
A3.1.7(c)	*Adequate heat through an appropriate heating system shall be provided, except in ships exclusively on voyages in tropical climates.* (addressed in Section 5, "Indoor Climate")	☐
A3.1.8	*With respect to requirements for lighting, subject to such special arrangements as may be permitted in passenger ships, sleeping rooms and mess rooms shall be lit by natural light and provided with adequate artificial light."* (artificial light is addressed in Section 6, "Lighting")	☐
A3.1.12	*With respect to requirements for hospital accommodation, ships carrying 15 or more seafarers and engaged in a voyage of more than three days' duration shall provide separate hospital accommodation to be used exclusively for medical purposes; the competent authority may relax this requirement for ships engaged in coastal trade; in approving on-board hospital accommodation, the competent authority shall ensure that the accommodation will, in all weathers, be easy of access, provide comfortable housing for the occupants and be conducive to their receiving prompt and proper attention.*	☐
A3.1.15	*All ships shall be provided with separate offices or a common ship's office for use by deck and engine departments; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the ship owners' and seafarers' organizations concerned.*	☐
A3.1.16	*Ships regularly trading to mosquito-infested ports shall be fitted with appropriate devices as required by the competent authority.*	☐
	Additional Requirements for A3.1.16	
	Suitable screens are to be provided, as appropriate, for side scuttles, ventilators, and doors to the open deck.	☐

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "Cabins" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – Cabins		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.6(c)	*In ships other than passenger ships, as defined in Regulation 2(e) and (f) of the International Convention for the Safety of Life at Sea, 1974, as amended (the "SOLAS Convention"), sleeping rooms shall be situated above the load line amidships or aft, except that in exceptional cases, where the size, type or intended service of the ship renders any other location impracticable, sleeping rooms may be located in the fore part of the ship, but in no case forward of the collision bulkhead.*	☐
A3.1.6(d)	*In passenger ships, and in special ships constructed in compliance with the IMO Code of Safety for Special Purpose Ships, 1983, and subsequent versions (hereinafter called "special purpose ships"), the competent authority may, on condition that satisfactory arrangements are made for lighting and ventilation, permit the location of sleeping rooms below the load line, but in no case shall they be located immediately beneath working alleyways.*	☐
	Additional Requirements for A3.1.6(d)	
	Accommodation 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. (B3.1.12.1)	☐
	The system of ventilation for sleeping rooms and mess rooms shall be controlled so as to maintain the air in a satisfactory condition and to ensure a sufficiency of air movement in all conditions of weather and climate. (B3.1.2.1)	☐
A3.1.9(a)	*In ships other than passenger ships, an individual sleeping room shall be provided for each seafarer; in the case of ships of less than 3,000 gross tonnage or special purpose ships, exemptions from this requirement may be granted by the competent authority after consultation with the ship owners' and seafarers' organizations concerned.*	☐
	Additional Requirements for A3.1.9(a)	
	There shall be adequate berth arrangements on board, making it as comfortable as possible for the seafarer and any partner who may accompany the seafarer. (B3.1.5.1)	☐
A3.1.9(b)	*Separate sleeping rooms shall be provided for men and for women.*	☐
	Additional Requirements for A3.1.9(b)	
	As far as practicable, sleeping rooms of seafarers shall be so arranged that watches are separated and that no seafarers working during the day share a room with watch keepers. (B3.1.5.3)	☐
A3.1.9(c)	*Sleeping rooms shall be of adequate size and properly equipped so as to ensure reasonable comfort and to facilitate tidiness.* (Room size is covered in requirements A3.1.9(f), (g), and (h).)	☐
	Additional Requirements for A3.1.9(c)	
	Space occupied by berths and lockers, chests of drawers and seats shall be included in the measurement of the floor area. Small or irregularly shaped spaces which do not add effectively to the space available for free movement and cannot be used for installing furniture shall be excluded. (B3.1.5.6)	☐
	Outfitting for sleeping rooms shall, in addition to berths and lockers, contain the following: • a table and chair • a mirror with a light • a small cabinet for toilet requisites for each person in the room • a book rack • coat hooks	☐

Accommodation Area Criteria – Cabins		
MLC Requirement	*Requirement*	*Meets Requirements*
	An electric reading light at the head of each berth.	☐
A3.1.9(d), (e)	*A separate berth for each seafarer shall in all circumstances be provided; the minimum inside dimensions of a berth shall be at least 198 centimeters by 80 centimeters.*	☐
	Additional Requirements for A3.1.9(d), (e)	
	The berth shall be at least 300 millimeters above the deck.	☐
	Head clearance above each berth shall be at least 610 millimeters.	☐
	The framework and leeboard of a berth shall be of approved material, hard, smooth, and not likely to corrode or to harbor vermin.	☐
	Berths constructed from tubular frames shall be completely sealed and without perforations which would give access to vermin.	☐
A3.1.9(f)	*In single berth seafarers' sleeping rooms the floor area shall not be less than:* • *4.5 square meters in ships of less than 3,000 gross tonnage;* • *5.5 square meters in ships of 3,000 gross tonnage or over but less than 10,000 gross tonnage;* • *7 square meters in ships of 10,000 gross tonnage or over.*	☐
A3.1.9(g)	*However, in order to provide single berth sleeping rooms on ships of less than 3,000 gross tonnage, passenger ships and special purpose ships, the competent authority may allow a reduced floor area.*	☐
A3.1.9(h)	*In ships of less than 3,000 gross tonnage other than passenger ships and special purpose ships, sleeping rooms may be occupied by a maximum of two seafarers; the floor area of such sleeping rooms shall not be less than 7 square meters.*	☐
A3.1.9(i)	*On passenger ships and special purpose ships the floor area of sleeping rooms for seafarers not performing the duties of ships' officers shall not be less than:* • *7.5 square meters (80.73 square feet) in rooms accommodating two persons;* • *11.5 square meters(123.78 square feet) in rooms accommodating three persons;* • *14.5 square meters (156.08 square feet) in rooms accommodating four persons*	☐
A3.1.9(j)	*On special purpose ships sleeping rooms may accommodate more than four persons; the floor area of such sleeping rooms shall not be less than 3.6 square meters (38.75 square feet) per person.*	☐
A3.1.9(k)	*On ships other than passenger ships and special purpose ships, sleeping rooms for seafarers who perform the duties of ships' officers, where no private sitting room or day room is provided, the floor area per person shall not be less than:* • *7.5 square meters (80.73 square feet) in ships of less than 3,000 gross tonnage;* • *8.5 square meters (91.49 square feet) in ships of 3,000 gross tonnage or over but less than 10,000 gross tonnage;* • *10 square meters (107.64 square feet) in ships of 10,000 gross tonnage or over.*	☐
A3.1.9(l)	*On passenger ships and special purpose ships the floor area for seafarers performing the duties of ships' officers where no private sitting room or day room is provided, the floor area per person for junior officers shall not be less than* • *7.5 square meters (80.73 square feet) and for senior officers* • *not less than 8.5 square meters (91.49 square feet);* • *junior officers are understood to be at the operational level, and senior officers at the management level.*	☐

Accommodation Area Criteria – Cabins		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.9(m)	*The master, the chief engineer and the chief navigating officer shall have, in addition to their sleeping rooms, an adjoining sitting room, day room or equivalent additional space; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the ship owners' and seafarers' organizations concerned.*	☐\
	Additional Requirements for A3.1.9(m)	
	Consideration shall be given to extending the facility referred to in Standard B3.1.5.5.	☐\
A3.1.9(n)	*For each occupant, the furniture shall include a clothes locker of ample space, minimum 475 liters or 0.475 cubic meters (16.77 cubic feet), and a drawer or equivalent space of not less than 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 ensure privacy.*	☐\
A3.1.9(o)	*Each sleeping room shall be provided with a table or desk, which may be of the fixed, drop-leaf or slide-out type, and with comfortable seating accommodation as necessary.*	☐\

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "Food Service" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – Food Service		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.10(a)	*Mess rooms shall be located apart from the sleeping rooms and as close as practicable to the galley; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the ship owners' and seafarers' organizations concerned.*	☐
	Additional Requirements for A3.1.10(a)	
	Mess lines and mess rooms are protected from weather, objectionable sights (such as garbage disposal areas), and objectionable odors (such as from engines, holds, toilets, fire room, etc.).	☐
A3.1.10(b)	*Mess rooms shall be of adequate size and comfort and properly furnished and equipped (including ongoing facilities for refreshment), taking account of the number of seafarers likely to use them at any one time; provision shall be made for separate or common mess room facilities as appropriate.*	☐
	Additional Requirements for A3.1.10(b)	
	Mess room facilities may be either common or separate. The decision in this respect shall be taken after consultation with seafarers' and ship owners' representatives and subject to the approval of the competent authority. Account shall be taken of factors such as the size of the ship and the distinctive cultural, religious and social needs of the seafarers. (B3.1.6.1)	☐
	On ships other than passenger ships, the floor area of mess rooms for seafarers shall be not less than 1.5 square meters per person of the planned seating capacity. (B3.1.6.3)	☐
	There shall be available at all times when seafarers are on board: (B3.1.6.5) • a refrigerator, which shall be conveniently situated and of sufficient capacity for the number of persons using the mess room or mess rooms; • facilities for hot beverages; and • cool water facilities	☐
	Where available pantries are not accessible to mess rooms, adequate lockers for mess utensils and proper facilities for washing utensils shall be provided. (B3.1.6.6)	☐
	Mess rooms have tables and seats sufficient for the number of persons likely to use them at any one time.	☐
	The tops of tables and seating are capable of being easily cleaned.	☐
	Sufficient storage for dry, refrigerated, and frozen food is provided based on the estimated mass and associated volume based on the duration of the voyage or normal food stores replenishment schedules.	☐
	Adequate lockers for mess utensils are provided.	☐
A3.1.7(c)	*All sanitary spaces shall have ventilation to the open air, independently of any other part of the accommodation.*	☐
	Additional Requirements for A3.1.7(c)	
	Sanitary accommodation intended for the use of more than one person shall comply with the following: the accommodation shall be sufficiently lit, heated, and ventilated. (B3.1.7.3(c))	☐
	All toilet spaces shall be ventilated sufficiently to be reasonably free of disagreeable odors and condensation.	☐

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "Sanitary Spaces" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – Sanitary Spaces		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.11(a)	*All seafarers shall have convenient access on the ship to sanitary facilities meeting minimum standards of health and hygiene and reasonable standards of comfort, with separate sanitary facilities being provided for men and for women.*	☐
	Additional Requirements for A3.1.11(a)	
	Toilets shall be situated convenient to, but separate from, sleeping rooms and wash rooms, without direct access from the sleeping rooms or from a passage between sleeping rooms and toilets to which there is no other access; this requirement does not apply where a toilet is located in a compartment between two sleeping rooms having a total of not more than four seafarers; and where there is more than one toilet in a compartment, they shall be sufficiently screened to ensure privacy. (B3.1.7(d))	☐
	Sanitary spaces shall be gender identifiable without entering the space.	☐
	All toilets shall have flush water available at all times and have a hand washing station.	☐
	Water heaters supplying showers shall not support areas that have higher water temperature requirements, such as food service areas. If they do, then anti-scalding devices shall be provided.	☐
	Floors in sanitary spaces shall have a non-slip type deck covering and be easily cleaned.	☐
	Bulkheads in sanitary spaces shall be made of steel or other approved material and be watertight up to 230 millimeters (9 inches) above deck level.	☐
	A public sanitary facility shall be situated convenient to vessel control rooms.	☐
A3.1.11(b)	*There shall be sanitary facilities within easy access of the navigating bridge and the machinery space or near the engine room control centre; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the ship owners' and seafarers' organizations concerned.*	☐
	Additional Requirements for A3.1.11(b)	
	The sanitary facility shall contain a toilet and washbasin having hot and cold running potable water.	☐
	A public sanitary facility shall be situated near the ship's office if it is not conveniently located near the navigation bridge.	☐
A3.1.11(c)	*In all ships a minimum of one toilet, one wash basin and one tub or shower or both for every six persons or less who do not have personal facilities shall be provided at a convenient location.*	☐
A3.1.11(d)	*With the exception of passenger ships, each sleeping room shall be provided with a washbasin having hot and cold running fresh water, except where such a washbasin is situated in the private bathroom provided.*	☐

Accommodation Area Criteria – Sanitary Spaces		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.11(f)	*Hot and cold running fresh water shall be available in all wash places.*	☐
	Additional Requirements for A3.1.11(f)	
	Water heaters supplying washbasins and showers shall not support areas that have higher water temperature requirements, such as food service areas. If they do, then anti-scalding devices shall be provided.	☐

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "Recreation" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – Recreation		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.14	*All ships shall have a space or spaces on open deck to which the seafarers can have access when off duty, which are of adequate area having regard to the size of the ship and the number of seafarers on board*	☐
A3.1.17	*Appropriate seafarers' recreational facilities, amenities and services, as adapted to meet the special needs of seafarers who must live and work on ships, shall be provided on board for the benefit of all seafarers, taking into account Regulation 4.3 and the associated Code provisions on health and safety protection and accident prevention.*	☐
	Additional Requirements for A3.1.17	
	Furnishings for recreational facilities shall as a minimum include a bookcase and facilities for reading, writing and, where practicable, games. (B3.1.11.2)	☐
	Consideration shall also be given to including the following facilities at no cost to the seafarer, where practicable: (B3.1.11.4) • a smoking room; • television viewing and the reception of radio broadcasts; • showing of films, the stock of which shall be adequate for the duration of the voyage and, where necessary, changed at reasonable intervals; • sports equipment including exercise equipment, table games, and deck games; • where possible, facilities for swimming; • a library containing vocational and other books, the stock of which shall be adequate for the duration of the voyage and changed at reasonable intervals; • facilities for recreational handicrafts; • electronic equipment such as a radio, television, video recorders, DVD/CD player, personal computer and software, and cassette recorder/player; • where appropriate, the provision of bars on board for seafarers unless these are contrary to national, religious, or social customs; and • reasonable access to ship-to-shore telephone communications, and email and Internet facilities, where available, with any charges for the use of these services being reasonable in amount.	☐

Instructions: For the **MLC-ACCOM** notation, the requirements under "Meets Requirements" must be met. For the **MLC-ACCOM(SPS)** notation, the requirements under "Meets Requirements" must be met, with consideration given for special purpose ship allowances/exemptions for vessels awarded the ABS Classification Notation of **SPS**. For the **MLC-ACCOM(WB)** notation, the requirements under "Meets Requirements" must be met with consideration given for specific flag State ILO MLC guidance. The "Laundry" accommodation area criteria are applicable to all Title accommodation areas.

Accommodation Area Criteria – Laundry		
MLC Requirement	*Requirement*	*Meets Requirements*
A3.1.13	*Appropriately situated and furnished laundry facilities shall be available.*	☐
	Additional Requirements for A3.1.13	
	The laundry facilities provided for seafarers' use shall include: (B3.1.7.4) • washing machines; • drying machines or adequately heated and ventilated drying rooms; and • irons and ironing boards or their equivalent.	☐
	Facilities exist for washing and drying clothes on a scale appropriate to the size of the crew and the normal duration of the voyage.	☐
	Laundry facilities shall be sufficient to allow seafarers to be provided with clean and dry underwear once per day and clean and dry outerwear and bedding once per five (5) days.	☐
	Washers and dryers (if provided) are placed relative to each other to facilitate the transfer of clothing from the washer to the dryer and their capacities shall be matched.	☐
	Air vents from laundry space shall not re-circulate in the vessel.	☐

APPENDIX 4 Acronyms and Abbreviations

°C	Degrees Celsius
°F	Degrees Fahrenheit
ABS	American Bureau of Shipping
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASNT	American Society of Nondestructive Testing
Avg	Average
a_w	Multi-axis acceleration value
a_{xw}	The weighted root mean square acceleration values measured along the x-axis
a_{yw}	The weighted root mean square acceleration values measured along the y-axis
a_{zw}	The weighted root mean square acceleration values measured along the z-axis
cd/m^2	Candela-per-square meter
CIH	Certified Industrial Hygienist
dB(A)	Decibels measured using the A-weighted scale
DP	Dynamic Positioning
ed.	Edition
EN	European Norms
ft/s	Feet-per-second
fc	Foot-candle
ft	Feet
ft^2	Square feet
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IEC	International Electrotechnical Commission
ILO	International Labor Organization
IMO	International Maritime Organization
in.	Inch
ISO	International Organization for Standardization
L_{Aeq}	Equivalent Continuous A Weighted sound pressure level
lm/m^2	Lumens-per-square meter
lm/ft^2	Lumens-per-square foot
m	Meter
m^2	Square meter
m/s	Meters-per-second
m/s^2	Meter-per-second squared
Max	Maximum
Min	Minimum
MLC	Maritime Labour Convention

MLC-ACCOM	Accommodations notation
MLC-ACCOM(SPS)	Accommodation notation for Special Purpose Ships
MLC-ACCOM(WB)	Accommodation notation for non-SPS vessels (e.g., offshore/platform support vessels, tow boats, anchor handling vessels, etc.) wanting to demonstrate compliance with the ILO MLC considering specific flag state ILO MLC with consideration given to specific flag State ILO MLC guidance, as applicable
Mm	Millimeter
NDT	Nondestructive Testing
NEBB	National Environmental Balancing Bureau
RH	Relative humidity
RMS	Root-mean square
RP	Recommended Practice
SI	International System of Units
SOLAS	Safety Of Life At Sea
TAB	Testing, Adjusting and Balancing
USA	United States of America
W_m	Frequency weighting used to evaluate x, y, and z-axis vibration with respect to comfort.
WMO	World Meteorological Organization

APPENDIX 5 Associated Documentation

Titles listed under the heading of "Associated Documentation" throughout this text can be obtained from the following sources:

ANSI/ASHRAE	www.ansi.org
IEC	www.iec.org
ILO	www.ilo.org
IMO	www.imo.org
ISO	www.iso.org
NEBB	www.NEBB.org